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**A systematic review and meta-analysis of the effectiveness
of behavioural smoking cessation interventions
in selected disadvantaged groups**

Jamie Bryant ¹, Billie Bonevski ¹, Chris Paul ², Patrick Mcelduff ³, John Attia ⁴

¹ Centre for Health Research and Psycho-oncology, Cancer Council NSW, Priority Research Centre for Health Behaviour, School of Medicine and Public Health, University of Newcastle, Hunter Medical Research Institute. Room 230A, Level 2, David Maddison Building, Callaghan, NSW 2308, Australia

² Health Behaviour Research Group, Priority Research Centre for Health Behaviour, School of Medicine and Public Health, University of Newcastle, Hunter Medical Research Institute. Room 268, Level 2, David Maddison Building, Callaghan, NSW 2308, Australia

³ Hunter Medical Research Institute and School of Medicine and Public Health, University of Newcastle, Callaghan, NSW 2308, Australia

⁴ University of Newcastle and Hunter Medical Research Institute, John Hunter Hospital, Locked Bag 1, Hunter Region Mail Centre, Newcastle, NSW 2310, Australia

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Abstract

Background: A systematic review and meta-analysis was conducted to assess the methodological quality and effectiveness of behavioural smoking cessation interventions targeted at six disadvantaged groups: the homeless, prisoners, Indigenous populations, at-risk youth, individuals with low socio-economic status and individuals with mental illness.

Methods: Medline, Embase, the Cochrane Library and PsycInfo databases were searched using MeSH and keywords for studies conducted in developed countries prior to October 2010. Included studies were assessed for methodological quality. A DerSimonian and Laird random effects meta-analysis was conducted, where possible, to explore the effectiveness of interventions for the different sub-groups. A narrative review was conducted for studies unable to be included in meta-analysis. Outcomes examined were abstinence rates at short-term (up to 3 months) and long-term (6 months or the longest) follow-up.

Results: Thirty-two relevant studies were identified. The majority ($N=20$) were rated low in methodological quality. Results of the meta-analysis showed significant increases in cessation for behavioural support interventions targeted at low-income female smokers at short-term follow-up (RR 1.68, CI 1.21-2.33) and for behavioural support interventions targeted at individuals with mental illness at long-term follow-up (RR 1.35, CI 1.01-1.81). Results of the narrative review showed several promising interventions that increased cessation rates at 6 months or longer follow-up.

Conclusions: Few well-controlled trials have examined the most effective smoking cessation strategies for highly disadvantaged groups, especially among the homeless, Indigenous people and prisoners. The use of behavioural smoking cessation interventions for some socially disadvantaged groups appears promising. However, overall findings are

inconsistent. Further research is needed to establish the most effective interventions for vulnerable high-risk groups. Special attention should be given to increasing sample size and power, and to sound evaluation methodology to overcome methodological limitations of conducting research with these high-risk groups.

Introduction

Compared with recent estimates of population smoking prevalence of about 20% in most developed countries ^{1,2}, markedly higher smoking rates have been reported for disadvantaged groups. For example, rates of 26% to 30% have been found among individuals with low-income ^{2,3}, rates of 32% to 50% have been found for Indigenous groups ^{3,4}, rates of 69% to 70% have been found for homeless individuals ^{5,6}, rates of 35% to 90% have been found for individuals with mental illness ⁷⁻⁹ and rates of 72% to 79% have been found among prisoner populations ¹⁰⁻¹².

Some studies have found that although smokers from disadvantaged groups are interested in quitting and attempt to quit at rates similar to those of other smokers, they are less likely to succeed ¹³⁻¹⁵. Smokers from disadvantaged groups face unique barriers to quitting, including high levels of dependence ¹⁶, high levels of stress, and pro-smoking community norms which both increase social pressure to smoke and increase exposure to triggers for smoking ¹⁷. As a result, the need for targeted efforts to increase cessation among highly disadvantaged groups has been identified as a public health priority in many countries ^{18, 19, 20}.

While the effectiveness of behavioural strategies for smoking cessation has been repeatedly and rigorously evaluated for the general population ²¹, limited attention has been given to determining the effectiveness of behavioural counselling interventions at achieving cessation with disadvantaged groups ²². Six reviews have synthesised the evidence related to smoking cessation in special populations, including some disadvantaged populations ²³⁻²⁸. Two reviews of population-based approaches found mixed results ^{27, 28}. Other reviews have highlighted difficulties disadvantaged groups have in accessing existing cessation support ²³, and have made recommendations about future research needs ²⁴⁻²⁶. No reviews have examined the effectiveness of behavioral counselling interventions among disadvantaged groups and, as a

result, few evidence-based recommendations for achieving cessation among disadvantaged groups exist. Additionally, few studies have examined the methodological quality of the evidence base in this area. Given that poor methodological quality has been associated with bias in estimates of treatment effect ²⁹ and that research with disadvantaged populations can be methodologically challenging ³⁰, it is critical that an assessment of quality be conducted.

This paper aimed to review the literature reporting the effectiveness of behavioural smoking cessation interventions among six disadvantaged groups known to have high smoking rates: 1) individuals who are homeless, 2) prisoners, 3) Indigenous populations, 4) at-risk youth (defined as young people and adolescents at higher risk of harm), 5) individuals with low incomes and 6) individuals with mental illness. Specifically, this review aimed to:

1. Assess the methodological quality of studies targeted at smoking cessation for disadvantaged groups using a methodological rating tool with demonstrated validity ³¹
2. Conduct a meta-analysis or, if not possible, a narrative review, to examine the effectiveness of behavioural cessation interventions in the selected disadvantaged groups.

Method

Literature search

Medline, The Cochrane Library, Embase and PsycInfo databases were searched for relevant studies published prior to October 2010. The MeSH terms [smoking OR smoking cessation] were combined with the following groups of words using the AND command: [vulnerable populations OR minority groups OR poverty OR socioeconomic factors OR homeless persons OR Oceanic Ancestry Group OR Central American Indians OR North American Indians OR Inuits OR First Nations OR mentally ill persons OR mental health OR schizophrenia OR anxiety OR

depression OR prison OR prisoner OR adolescent behaviour OR juvenile delinquency]. Tables of contents of relevant journals, *Tobacco Control*, *Nicotine and Tobacco Research* and the *Journal of Public Health*, were manually searched between 2005 and 2010. Previous reviews of relevant literature, the grey literature databases, GreyNet and OpenSIGLE, and the reference lists of retrieved articles were also searched. Several researchers known to be working in the areas of interest were also contacted to identify eligible studies.

Inclusion and exclusion criteria

Randomised controlled trials (RCTs) and clinical controlled trials (CCTs) that described evaluations of behavioural smoking cessation interventions published prior to October 2010 were included. To limit the scope of the review and minimise heterogeneity, only studies conducted in developed countries (i.e. United States, Canada, Australia, New Zealand, the United Kingdom and Western Europe) and reporting smoking cessation as an outcome measure 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 only when pharmacotherapy was not being tested for effectiveness. Studies that were not published in English, that were case reports or cross-sectional studies, or studies that reported on population-level public health campaigns or pharmacotherapies alone were excluded. Multiple risk factor interventions where smoking cessation was one of a number of health-related outcomes were excluded because of the inability to distinguish the impact of the smoking intervention alone.

Data extraction

The titles and abstracts of all identified papers were assessed for relevance by one reviewer (JB) and were rejected on initial screening if the reviewer could determine from the title and

abstract that the study did not meet inclusion criteria. Remaining studies were assessed against the inclusion and exclusion criteria by two reviewers (JB 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 examined.

Assessment of methodological quality

Studies included in the review were assessed for methodological quality using the Effective Public Health Practice Project Quality Assessment Tool for quantitative studies³¹⁻³³ [Appendices 4.2 and 4.3]. Study quality was assessed by one author (JB) and an independent second reviewer, and disagreement resolved through discussion. Studies were assessed on six domains: selection bias (the likelihood that participants were representative of the target population as well as the consent rate achieved in the study); study design; control of confounders; blinding (whether assessors were blind to participant condition and whether participants were blind to the research question); data collection methods (whether the data collection tools were both valid and reliable); and withdrawals and drop-outs (whether the reasons for attrition and final follow-up numbers were reported). Each study was given a rating of “strong”, “moderate” or “weak” in methodological quality for each domain, according to pre-defined criteria (see <http://www.ehphp.ca/Tools.html>), and then given an overall global rating; those with no weak ratings were given a rating of “strong”, those with one weak rating were given a rating of “moderate”, and those with two or more weak ratings across the six domains were given a rating of “weak”.

Classification of interventions

Cochrane reviews of smoking cessation interventions provided a framework for the classification of studies by the type of interventions used (see Table 5.1).

Table 5.1: *Criteria for classification of interventions included in meta-analysis*

Intervention type	Description	Number of studies; References
Brief advice	Verbal advice with a “Stop smoking” message	N=2 34, 35
Incentives for quitting	Incentive schemes (such as contingent reinforcement) for quitting	N=1 36
Self-help intervention	Any manual or program to be used by individuals to assist a quit attempt not aided by health professionals, counsellors or group support	N=2 37, 38
Behavioural support	Includes: 1) interventions based on identified motivational interviewing (MI) principles ³⁹ making explicit reference to exploring ambivalence, decision balance, assessment of motivation and confidence to quit, or motivational enhancement therapy; 2) behavioural counselling, including the provision of information, advice, support or encouragement, skills training, cognitive behavioural therapy or other counselling provided for smoking cessation	N=29 40-68

Meta-analysis

Given the potential statistical heterogeneity among studies, an estimate of the pooled effect size for each disadvantaged group using a defined intervention was calculated using a DerSimonian and Laird random effects model. Risk ratios, 95% confidence intervals and a statistical measure of heterogeneity (I^2) was calculated for each analysis using Revman⁶⁹. Three studies were not eligible to be included in meta-analysis because they did not report sufficient data or outcomes in a format suitable for inclusion in meta-analysis^{54, 61, 70}. The results of these studies are instead reported narratively.

Outcome measures

The primary outcome measure was smoking abstinence 6 months after the start of the intervention, or longer when data from longer follow-up points were available. Short-term abstinence at 3 months or less was also assessed. Biochemically validated quit rates were preferred over self-reported quit rates, and cotinine-confirmed measures were preferred over carbon monoxide (CO) measures. Self-reported quit rates were included where this was the only information available. For consistency, seven-day point prevalence abstinence rates were the preferred outcome measure, although continuous abstinence rates were used where this was the only outcome measure reported. An intention-to-treat approach was adopted where possible. Where studies had more than two experimental groups and these were similar^{49, 59}, the average effect of the two treatment groups was calculated and compared with the control group. For one four-arm trial, the most intensive condition was compared with the control group⁵⁶. Three studies were cluster-randomised trials^{44, 46, 47, 70}. One of these studies was not included in meta-analysis³⁷. We have adjusted for the study design of the two cluster-randomised trials included in meta-analysis^{44, 46, 47} by dividing the number of participants in each arm of the trial by the design effects of 3.98 and 1.26 respectively, which were estimates based on the intra-cluster correlation coefficient reported in Okuyemi et al⁴⁴.

Results

Search results

The initial search yielded 12,448 citations, of which 237 relevant articles were retained for further review. A flow chart describing article retrieval is provided in Figure 5.1. In total, 32 studies reported in 34 papers are included in the review. One study targeted homeless smokers⁴⁰, one study targeted prisoners⁵¹, two studies targeted Indigenous smokers^{62, 64}, six studies targeted at-risk adolescent smokers^{42, 43, 52, 54, 66, 70}, 12 studies targeted low-income smokers^{35, 37, 38, 41, 44-47, 56-59, 63, 65}, and ten studies targeted smokers with mental illness^{34, 36, 49, 50, 53, 55, 60, 61, 67, 68}.

Description of included studies

A detailed description of included studies is provided in Table 5.2. Included studies were published between 1997 and 2010. Thirteen RCTs^{37, 38, 44, 45, 50, 51, 53-57, 64, 65, 67}, sixteen CCTs^{34-36, 41-43, 49, 52, 58-63, 66, 68} (RCTs where the method of randomisation was not described) and three cluster RCTs were identified^{44, 46, 47, 70}. Studies were primarily conducted in primary and community healthcare clinics. Thirteen studies incorporated nicotine replacement therapy (NRT)^{35-38, 40, 43, 44, 50, 51, 55, 57, 60, 63, 68}. The majority of studies (91%) were conducted in the United States (US), with one study each conducted in Australia⁶⁸, New Zealand⁶⁴ and the United Kingdom (UK)^{37, 38}.

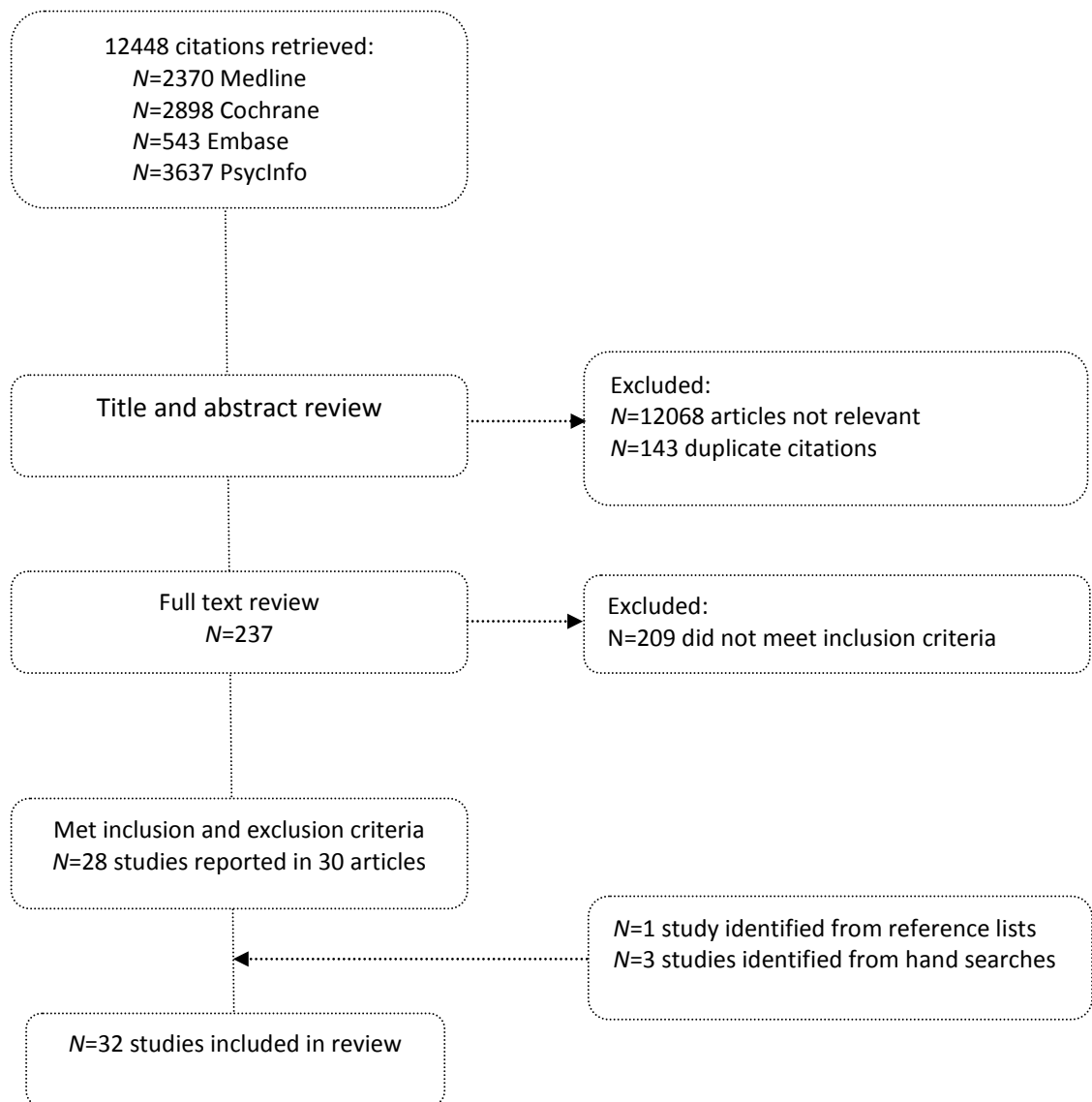


Figure 5.1: *Flow chart of search strategy and study selection*

Table 5.2: Study characteristics by population group

Study; Country	Design; Intervention setting	Participant group; N; Gender; Age	Intervention	Primary outcome measure; Follow-up	Results
Homeless					
Okuyemi et al, 2006 ⁴⁰ ; US	RCT; Homeless service facilities	Homeless smokers; N=46; 56.3% male smoking only group, 65.2% male smoking plus group; M=43.8 years (SD=9.4) (smoking only group), M=43.7 years (SD=9.8) (smoking plus group)	<p><u>Smoking only:</u> N=23; 5 individual MI sessions focusing exclusively on smoking behaviours, 6 group educational support sessions, group outings, 8-week course, NRT</p> <p><u>Smoking plus:</u> N=23; as above, plus individual MI sessions focused on smoking behaviours and other barriers to quitting (e.g. other addictions)</p>	7-day PPA; 8 and 26 weeks	ITT 7-day PPA: 17.4% smoking plus vs. 13% smoking only at 8 week follow-up (n.s.); 17.4% smoking plus and 8.7% smoking only at 26 week follow-up (n.s.)

Indigenous					
Bramley et al, 2005 ⁶⁴ ; New Zealand	RCT; Text message intervention	Maori and non-Maori smokers; N=1705 (355 Maori, 1350 non-Maori); 41.5% male; Median 22 years (inter-quartile range 19-30)	<u>Intervention</u> N=176 Maori, N=676 non-Maori; supportive text messages (tailored for Maori clients); 5 messages per day in first 6 weeks, 3 per week until 26 week follow-up <u>Control</u> : N=179 Maori, N=674 non-Maori, one fortnightly message not related to smoking (tailored for Maori participants)	7-day PPA; 6, 12 and 26 weeks	For Maori clients, ITT-verified quit rates: 26.1% (I) vs. 11.2% (C) at 6 week follow-up ($p<.01$); 26.7% (I) vs. 19.6% (C) at 12 week follow-up ($p=.11$); 21.6% (I) vs. 18.4% (C) at 26 week follow-up ($p=.46$)
Patten et al, 2010 ⁶² ; US	CCT; Prenatal and WIC clinic	Pregnant native Alaskan women; N=35; 100% female; M=25.4 years (SD=4.2) (I), M=24.8 years (SD=5) (C)	<u>Intervention</u> : N=17; 15-25 minutes of face-to-face counselling, four 10-15 minute telephone calls at 1, 2, 4 and 6 weeks, private viewing of video highlighting cessation stories, culturally sensitive cessation guide <u>2) Control</u> : N=18; Brief 5-minute face-to-face counselling	7-day PPA; Baseline and >60 days post-randomisation (average 82 days post-randomisation controls and 108 days intervention	ITT 7-day PPA-verified quit rates: 6% (I) vs. 0% (C) (n.s.)

using the 5 As approach at the participants)
 first visit and four visits during pregnancy, and culturally-specific information brochures

Prisoners

Cropsey et al, 2008 ⁵¹ ; US	RCT; Prison	Female prisoners; N=539; 100% female; M=33.8 years (SD=9)	<u>Intervention</u> : N=250; 10-session group intervention based on mood management, combined with NRT <u>Control</u> : N=289, no-advice wait-list control group	7-day PPA; Each weekly session and 3, 6 and 12 months	ITT 7-day PPA: 18.4% (I) at end of treatment; 16.8% (I) at 3-month follow-up; 14% (I) vs. 2.8% (C) at 6 month follow-up (<i>p</i> <.001) At 12 month follow-up, there was no control group but 11.6% (I) remained abstinent.
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At-risk youth

Albrecht et al, 1998 ⁵² ; US	CCT; Not reported	Pregnant teenage smokers; N=84; 100% female; Not reported	<u>TFS-B</u> : N=26; 8-week Teen FreshStart CBT group program with “buddy” support person <u>TFS</u> : N=29; 8-week Teen FreshStart CBT group program <u>Usual care</u> : N=29; 30-minute	Self-reported smoking; 4-6 weeks post-baseline	ITT-verified quit rates (TFS and UC groups were combined for analysis): Abstinence rates were 18.7% TFSB vs. 16.6% TFS and UC groups (n.s.)
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			individual education session with a nurse, and written materials		
Albrecht et al, 2006 ⁵⁴ ; US	RCT; Not reported	Pregnant teenage smokers; N=142; 100% female; M=17 years (SD=1.3)	<u>TFS-B</u> : N=45; 8-week Teen FreshStart CBT group program with “buddy” support person <u>TFS</u> : N=47, 8-week Teen FreshStart CBT group program <u>Usual care</u> : N=50, educational materials	Self-reported smoking; 8 weeks and 1 year	Self-reported abstinence: At 8-week follow-up, greater abstinence in the TFS-B group than the UC group (<i>p</i> =.01). No differences between any of the three groups at 1 year follow-up
Brown et al, 2003 ⁴³ ; US	CCT; University psychiatric hospital	Adolescent smokers with psychiatric disorders; N=191; 37.7% male; M=15.4 years	<u>Intervention</u> : N=116; two 45- minute individual MI sessions, relapse prevention manual, “I Quit” self-help pamphlet, 8 weeks’ free nicotine patches, 6 telephone calls over 6 months to clients. Parents were also able to utilise 4 telephone calls over the same period. <u>Control</u> : N=75; 5-10 minute brief advice from study	7-day PPA; Baseline, 1, 3, 6, 9 and 12 months	Non-ITT-verified 7-day PPA: 11% (I) vs. 11% (C) at 1 month follow-up (n.s.); 13.3% (I) vs. 8.5% (C) at 6 month follow-up (n.s.); 14% (I) vs. 9.9% (C) at 12 month follow-up (n.s.)

			therapist and the “I Quit” self-help manual		
Helstrom et al, 2007 ⁴² ; US	CCT; Not reported	High-risk adolescent smokers; <i>N</i> =81; 58% male; <i>M</i> =15.98 years (<i>SD</i> =1.30) (I), <i>M</i> =15.97 years (<i>SD</i> =1.36) (C)	<u>Intervention</u> : <i>N</i> =45; 1 session of motivational enhancement therapy <u>Control</u> : <i>N</i> =36; 1 session of tobacco education based on American Cancer Society self-help pamphlet	Salivary-confirmed abstinence; 1 and 6 months	Non-ITT-verified quit rates: 10.5% (I) vs. 6.8% (C) at 1 month follow-up (n.s.); 9.5% (I) vs. 7.4% (C) at 6 month follow-up (n.s.)
Myers et al, 2005 ⁶⁶ ; US	CCT; Out-patient substance abuse centres	Adolescents in substance abuse treatment; <i>N</i> =54; 78% male; <i>M</i> =16.1 years	<u>Intervention</u> : <i>N</i> =26; 6 weekly 1-hour counselling sessions incorporating motivational enhancement, stimulus control, barriers to change, social support for quitting, and planning for quitting and relapse <u>Control</u> : <i>N</i> =28; wait-list control group	7-day PPA; end of treatment and 3 and 6 months	ITT-verified 7-day PPA: 19.2% (I) vs. 3.6% (C) at end of treatment (<i>p</i> =.012); 30.8% (I) vs. 3.6% (C) at 3 month follow-up (<i>p</i> =.004); 15.4% (I) vs. 3.6% (C) at 6 month follow-up (n.s.)
Prokhorov et al, 2008 ⁷⁰ ;	CCT; Not reported	10 th grade high school students from schools	<u>Intervention</u> : <i>N</i> =573; Interactive computer program	7-day self-reported PPA;	Non-ITT: 60.7% (I) vs. 61.8% (C) (n.s.)

US	located in ethnically diverse, socio-economically disadvantaged communities; N=1574. A small sub-sample of students (N=62) were smokers. 58.5% female; M=15.7 years (SD=.90)	of 5 weekly sessions in one semester and 2 booster sessions in following semester. Sessions 30 minutes in duration	Control: N=501; National Cancer Institute's "Clearing the Air" self-help booklet	18 months
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Low income

Bullock et al, 2009 ⁵⁶ ; US	RCT; 21 rural WIC Nutritional Supplement clinics in a US mid-west state	Low-income rural pregnant women; N=530; 100% female; M=22 years (SD=4.6)	<u>Social support plus booklet:</u> N=129; scheduled weekly telephone call with nurse plus "Stop smoking! A Special Program for Pregnant Women" booklet, plus 24/7 access to nurse <i>via</i> telephone <u>Social support without booklet:</u> N=132; scheduled weekly telephone call with nurse plus	PPA; Baseline (T1), 8 th month of pregnancy (T2) and 6 weeks <i>post partum</i> (T3)	ITT-verified abstinence: At T2, 17% in social support plus booklet group vs. 22% in social support alone group vs. 19.2% booklet alone vs. 17.2% control group were abstinent (all differences n.s.). At T3, 12.4% in social support plus booklet group vs. 11.4%
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			24/7 access to nurse via telephone <u>Booklet only:</u> N=141; 8 serialised “Quit Smoking for Good” booklets from American Heart Association <u>Usual care control group:</u> N=128; usual care plus a quit booklet		social support alone group vs. 13.5% in the booklet alone group vs. 13.3% in the control group were abstinent (all differences n.s.).
Curry et al, 2003 ⁴⁵ ; US	RCT; Four paediatric clinics serving low-income and ethnically diverse families	Low-income women; N=303; 100% female; M=34.2 years (SD=8.8) (I), M=33.6 years (SD=9.5) (C)	<u>Intervention:</u> N=156; brief motivational message from the child’s clinician, self-help guide to quitting, 10-minute motivational interview with nurse or research assistant and up to 3 outreach telephone calls <u>Control:</u> N=147; usual care	7-day self-reported PPA, sustained abstinence; 3 and 12 months	ITT 7-day PPA: 8% (I) vs. 3% (C) at 3 months (adjusted OR=2.4, n.s.); 14% (I) vs. 7% (C) at 12 months (adjusted OR=2.77, sig.)
Froelicher et al, 2010 ⁵⁷ ; US	RCT; Public health centre located in a	African-American smokers residing in a low-income area;	<u>Intervention:</u> N=26; Industry and media intervention program. 1-hour pre-class	7-day PPA; Baseline, 6 months and 12	ITT-verified analyses: 13.6% (I) vs. 11.5% (C) at 6 month follow-up (n.s.);

	low-income area	N=60; 80.8% female (I), 64.7% female (C); M=46.5 years (I), M=46.7 years (C)	orientation, 5 weekly standard smoking cessation intervention sessions. NRT offered to those who requested it and to highly addicted smokers (defined as those reporting withdrawal and smoking ≥25 cigarettes per day) <u>Control:</u> N=34; 1-hour pre-class orientation session, 5 weekly group smoking cessation intervention sessions which included education and CBT strategies, plus NRT (as defined above) and edited smoking cessation guide	months	15.8% (I) vs. 5.3% (C) at 12 month follow-up (n.s.)
Gielen et al, 1997 ⁵⁸ ; US	CCT; Public prenatal clinic servicing predominately low-income African-American	Pregnant smokers, predominantly African-American with less than high school education; N=391;	<u>Intervention:</u> N=193; educational materials, 15- minute individual counselling and clinic reinforcement (written agreement to quit, two letters of encouragement	7-day PPA; 28 weeks gestation, 6 months <i>post</i> <i>partum</i>	Non-ITT-verified 7-day PPA: 6.2% (I) vs. 5.6% (C) (sig. not reported) at 28 weeks gestation. At 6 months <i>post partum</i> , 15% (I) vs. 4% (C) (sig .not

	smokers	100% female; M=23.3 years (I), M=24.1 years (C)	and brief advice from clinic nurse) <u>Control:</u> N=198; usual brief advice		reported), although only a small number of participants (27%) were followed up at this point
Glasgow et al, 2000 ⁶⁵ ; US	RCT; Four planned parenthood clinics	Low-income female smokers; N =1154; 100% female; M=24 years (SD=5)	<u>Intervention:</u> N=578; generic stop-smoking pamphlet, brief advice, educational video, 15-minute consultation with nurse, 2 follow-up telephone calls <u>Control:</u> N=576; generic stop-smoking brochure and brief advice	7-day PPA; 6 weeks and 6 months	ITT-verified 7-day PPA: 10.2% (I) vs. 6.9% (C) at 6 week follow-up (p<.05); 18.3% (I) vs. 14.9% (C) at 6 month follow-up (n.s.)
Gordon et al, 2010 ³⁵ ; US	CCT; 14 federally funded public health dental clinics serving diverse racial/ethnic groups	Low-income individuals (at or below 200% of the federal poverty threshold) attending public dental health clinics; N=2637; 57.2% female;	<u>Intervention:</u> N=1434; practitioners provided 5 As, printed self-help materials and NRT <u>Control:</u> N=1203; usual care	7-day PPA abstinence at the 7.5 month follow-up; 6 weeks and 7.5 months post- enrolment	Non-ITT 7-day PPA: 11.3% (I) vs. 6.8% (C) (p<.05)

		M=40.5 years (SD=12.6)			
Lipkus et al, 1999 ⁵⁹ ; US	CCT; Community health centre	Low-income African American smokers; N=266 (160 completed final follow-up); 54% male; 56% aged <49 years	<u>Provider intervention</u> : N=53; computer-prompted provider advice <u>Provider intervention + tailored print</u> : N=55; as above, plus a tailored birthday card and newsletter <u>Provider intervention + tailored print + telephone counselling</u> : N=52; as above, plus one (for males) or two (for females) telephone counselling calls	7-day PPA; 16 months	ITT self-reported 7-day PPA: those receiving the provider intervention and tailored print communication sig. more likely to be abstinent (32.7%), compared with those receiving provider intervention alone (13.2%) or all three levels of the intervention (19.2%; <i>p</i> <.05)
Manfredi et al, 1999, 2004 ^{46,47} ; US	CCT; 33 prenatal, family planning and paediatric services within 12 public health clinics	Low-income female smokers; N=1068; 100% female; Not reported	<u>Intervention</u> : N=527; video segment and posters in clinic waiting rooms, provider advice, motivational self-help booklet, patient-provider agreement form, provider reminder letter, one-off 15-minute motivational telephone call	7-day PPA; 2, 6, 12 and 18 months	Non-ITT self-reported 7-day PPA: 14.5% (I) vs. 7.68% (C) at 2 month follow-up (<i>p</i> <.001); 20.15% (I) vs. 11.49% (C) at 6 month follow-up (<i>p</i> <.001); 21.5% (I) vs. 17.73% (C) at 12 month follow-up (n.s.);

			<u>Control</u> : N=541; no intervention		26.11% (I) vs. 24.21% (C) at 18 month follow-up (n.s.)
Okuyemi et al, 2007 ⁴⁴ ; US	RCT; 20 low-income public housing developments	Low-income smokers; N=173; 30% male; M=43 years (SD=14.3) (I), M=48 years (SD=13.1) (C)	<u>Intervention</u> : N=66; educational materials, 8-week course of nicotine gum, 5 MI sessions on quitting smoking <u>Comparison</u> : N=107; educational materials and 5 MI sessions addressing fruit and vegetable consumption	7-day PPA; 8 weeks and 26 weeks	ITT-verified 7-day PPA quit rates: 6.1% (I) vs. 5.6% (C) at 8 week follow-up (n.s.); 7.6% (I) vs. 9.3% (C) at 26 week follow-up (n.s.)
Ruger et al, 2008 ⁴¹ ; US	CCT; Obstetric clinics	Low-income pregnant women; N=302; 100% female; M=25.6 years (I), M=25.7 years (C)	<u>Intervention</u> : N=156; 3 home visits providing individual MI sessions, feedback about household nicotine levels, and self-help materials. Visits lasted an average of 1 hour and were tailored to stage of change. <u>Control</u> : N=146; 5-minute brief intervention at clinic, and self-help materials	30-day PPA; 1 month post-intervention and 6 months <i>post partum</i>	Non-I TT self-reported 30-day point prevalence quit rates: 6.3% (I) vs. 8% (C) at 6 month follow-up (n.s.)
Sykes et al, 2001 ³⁸ ; Marks et	RCT; Smoking cessation	Smokers from deprived area of	<u>Intervention</u> : N=131; 3-month self-help CBT cessation and	7-day PPA; 6 and 12 months	Non-ITT verified PPA: 17.2% (I) vs. 5.6% (C) at 6

al, 2002 ³⁷ ; UK	clinic	London; N=260; 36.2% male; Not reported	relapse prevention program ("Quit for Life") with optional NRT <u>Control</u> : N=129; Educational materials ("Stop Smoking Made Easier" program)		month follow-up (<.0001); 19.8% (I) vs. 5.7% (C) at 12 month follow-up (sig. not reported)
Wadland et al, 2001 ⁶³ ; US	CCT; Community health centres	Low-income smokers; N=238; 30% male; M=44 years (I), M=38.7 years (C)	<u>Intervention</u> : N=110; brief physician advice, 8 weeks' transdermal NRT; 6 telephone counselling sessions <u>Control</u> : N=123; brief physician advice, 8 weeks' transdermal NRT	7- day PPA; 3 months	ITT-verified 7-day PPA: 8.1% (C) vs. 21% (I)($p<.01$) at 3 month follow-up
Mentally ill					
Baker et al, 2006; 2010 ⁶⁸ ; Australia	CCT; Research centre, community clinic or participants' homes	Smokers with non- acute psychotic disorder; N=298; 52.3% male; M=37.24 years (SD=11.09)	<u>Intervention</u> : N=147; 8 x 1-hour sessions (6 weekly sessions plus a booster at weeks 8 and 10) of MI and CBT, plus NRT and usual care (self-help pamphlets) <u>Control</u> : N=151; self-help pamphlets	7-day PPA; 3 months, 6 months, 12 months and 4 years	ITT-verified 7-day PPA: 15% (I) vs. 6% (C) at 3 month follow-up (n.s.); 9.5% (I) vs. 4% (C) at 6 month follow-up (n.s.); 10.9% (I) vs. 6.6% (C) at 12 month follow-up (n.s.) Among a subsample

					completing follow-up at 4 years (n=164), there were no differences in 7-day PPA: 21% (C) vs. 15.7% (I).
Brown et al, 2001 ⁵³ ; US	RCT; Research centre	Smokers with a history of major depressive disorder; N=179; 40.2% male; M=45.1 years (SD=9.3)	<u>Intervention</u> : N=86; 8 sessions of CBT for depression, combined with homework assignments <u>Control</u> : N=93; 8 sessions of standard CBT, combined with homework assignments	7-day PPA; End of treatment and 1, 6 and 12 months	ITT-verified 7-day PPA: 37.6% (I) vs. 33.3% (C) at end of treatment (n.s.); 39.5% (I) vs. 30.1% (C) at 1 month follow-up (sig. level not reported); 24.4% (I) vs. 24.7% (C) at 6 month follow-up (n.s.); 32.5% (I) vs. 24.7% (C) at 12 month follow-up (n.s.)
Dixon et al, 2009 ³⁴ ; US	CCT; Out-patient mental health clinics	Smokers with a diagnosis of schizophrenia or affective and other psychoses; N=304; 47.7% female; M=44.28 years (SD=9)	<u>Intervention</u> : N=156; 5As for smoking cessation implemented at every patient visit for 12 months <u>Control</u> : N=148; Delayed control; physicians delivered 5 As for 6 months after a 6-month delay control period	7-day PPA. Recent abstinence from smoking confirmed with CO; 6 and 12 months	Non-ITT 7-day PPA: At 6 month follow-up, 3.9% (I) vs. 1.6% (C) (n.s.)

Gallagher et al, 2007 ³⁶ ; US	CCT; Community healthcare organisation	Smokers with Schizophrenia; N=180 52% male; M=42.55 years (SD=0.43) (CR), M=43.55 years (SD=9.82 (CR + NRT)), M=42.45 years (SD=10.35) (CI)	<u>CR</u> : N=60; financial incentive for abstinence <u>CR + NRT</u> : N=60; financial incentive for abstinence, plus 16 weeks of NRT <u>Control</u> : N=60; clients encouraged to use available community resources	“Abstinence”; 20 and 36 weeks	Cotinine-confirmed abstinence: 7% in CR, 0% in CR + NRT and 2% in Control at 20 week follow-up (n.s.); 7% in CR, 2% in CR + NRT and 5% in Control at 36 week follow-up (n.s.)
Gulliver, 2008 ⁴⁹ ; US	CCT; Not reported	Military veterans with variety of psychiatric diagnoses; N=208; 97% male; M=49.16 years (MI alone), M=49.6 years (MI/BI), M=47.5 years (MI/IS)	<u>MI alone</u> : N=67; single MI session 40-50 minutes in duration <u>MI/BI</u> : N=67; MI as above, plus instruction in deep breathing <u>MI/IS</u> : N=74; MI as above, plus instruction in the use of an incentive spirometer for practice in breath/diaphragmatic control	Self-reported smoking abstinence on day of assessment; 1, 2, 3, 4, 5 and 6 months	ITT self-reported abstinence: MI alone: 0% 1 month, 0% 2 months, 4.5% 3 months, 4.5% 4 months, 3% 5 months, 6% 6 months MI/BI: 5.4% 1 month, 4% 2 months, 6.8% 3 months, 6.8% 4 months, 6.8% 5 months, 6.8% 6 months MI/IS: 3% 1 month, 3% 2 months, 4.5% 3 months, 4.5% 4 months, 6% 5

					months, 4.5% 6 months
Hall et al, 2006 ⁵⁵ ; US	RCT; University-based clinic	Smokers with current diagnosis of unipolar depression; N=322; 30.4% male; M=41.5 years (I), M=42.2 years (C)	<u>Intervention</u> : N=163; staged care intervention: individualised feedback on quitting smoking based on stages of change, 6 counselling sessions for clients who had reached contemplation, 10-week course of NRT <u>Control</u> : N=159; brief-contact control: list of smoking cessation programs, no other contact	7-day PPA, number of 24-hour quit attempts; Baseline, 3, 6, 12 and 18 months	ITT 7-day verified quit rates: 13.5% (I) vs. 9.34% (C) at 3 month follow-up (n.s.); 14.11% (I) vs. 15.73% (C) at 6 month follow-up (n.s.); 14.11% (I) vs. 9.43% (C) at 12 month follow-up (n.s.); 18.4% (I) vs. 13.21% (C) at 18 month follow-up (n.s.)
MacPherson, 2010 ⁶⁰ ; US	CCT; Not reported	Smokers with mildly elevated depressive symptoms (score ≥10 on Beck Depression Inventory-II); N=68; 48.6% female (I), 48.5% female (C); M=45.0 years	<u>Intervention</u> N=35; 8 1-hour weekly group sessions. Intervention included 30 minutes of standard treatment and 30 minutes of Behavioural Activation Treatment for Smoking. NRT began on scheduled quit date (21mg for 4 weeks, 14mg for 4 weeks and	7-day PPA; 1 week, 4 weeks, 16 weeks and 26 weeks post quit date	ITT: 1 week 9.1% (C) vs. 28.6% (I); 4 weeks 9.1% (C) vs. 17.1% (I); 16 weeks 3% (C) vs. 11.4% (I); 26 weeks 0% (C) vs. 14.3% (I) Interaction between treatment condition and

		(SD=12.2) (I), M=42.6 years (SD=11.5) (C)	7mg for 2 weeks) <u>Control</u> : N=33; 8 1-hour weekly group sessions including only standard treatment. NRT offered on same schedule as intervention group		time was non-significant (OR 16.4, $p=.24$).
McFall et al, 2005 ⁶¹ ; US	CCT; Outpatient PTSD clinic	Smokers with a diagnosis of PTSD; N=66; 92% male; M=52.9 years (I), M=52.3 years (C)	<u>Intervention</u> : N=33; 5 individual behavioural counselling sessions related to smoking, delivered by mental health providers along with PTSD care <u>Comparison</u> : N=33; PTSD care from normal providers, referred to external clinic for usual behavioural therapy	7-day PPA, repeated 7-day PPA; 2, 4, 6 and 9 month follow-up	ITT-verified 7-day repeated abstinence: 12% (I) vs. 3% (C) ($p=.20$) 7-day point prevalence abstinence: 18% (I) vs. 7% (C) (sig. not reported) At each assessment interval, odds of not smoking were 5.23 times greater for clients in the intervention group than for clients in the control group ($p<.002$).
Vickers et al, 2009 ⁶⁷ ; US	RCT; Not reported	Depressed female smokers (score ≥ 16 on CES-D);	<u>Intervention</u> : N=30; 10 weekly individually tailored exercise counselling sessions designed	7-day PPA; 10 weeks and 24 weeks	Non-ITT-verified 7-day PPA: 17% (I) vs. 23% (C) at 10 week follow-up ($p=.75$);

		<p><i>N</i>=60; 100% female; <i>M</i>=41.8 years (<i>SD</i>=12.1) (I), <i>M</i>=40.9 years (<i>SD</i>=11.8) (C)</p>	<p>to motivate increased regular physical activity and short bouts of exercise in response to urges to smoke <u>Control</u>: <i>N</i>=30; information on health topics including sleep, hygiene, nutrition and health screening tests for women; brief interventions of approximately 10 minutes at each visit</p>		<p>6.3% (I) vs. 6.70% (C) at 24 week follow-up (<i>p</i>=1.0)</p>
Williams et al, 2010 ⁵⁰ ; US	RCT; Outpatient mental health facilities	<p>Individuals who met DSM-IV criteria for schizophrenia or schizo-affective disorder; <i>N</i>=87; 35.6% female (I), 38.1% female (C); <i>M</i>=43.5 years (<i>SD</i>=12.1) (I), <i>M</i>=47.1 years (<i>SD</i>=10.5) (C)</p>	<p><u>Intervention</u>: <i>N</i>=45; high- intensity “Treatment of Addiction to Nicotine in Schizophrenia” intervention. 24 45-minute sessions over 26 weeks incorporating MI, social skills training, use of NRT, relapse prevention techniques and nicotine patch use for 16 weeks beginning on the quit date</p>	<p>Continuous abstinence (self- reported abstinence after the target quit date), 7-day PPA; 3, 6 and 12 months</p>	<p>ITT 7-day PPA: quit rates for both groups not reported; however, difference reported as not significant at 12 week follow- up ITT continuous abstinence: 15.6% (I) vs. 26.2% (C) at 12 weeks (n.s.) No differences at 6 or 12 month follow-up</p>

Comparison: *N*=42; moderate-intensity “Medication Management” intervention. 9 20-minute sessions over 26 weeks. Sessions focused on medication compliance, education about NRT and nicotine patch use for 16 weeks beginning on the quit date

Note: C: control; CBT: cognitive-behavioural therapy; CCT: clinical controlled trial; CES-D: Center for Epidemiologic Studies Depression Scale; CO: carbon monoxide; CR: contingent reinforcement; I: intervention; ITT: intention-to-treat; MI: motivational interviewing; MI/BI: motivational interviewing plus breathing instruction; MI/IS: motivational interviewing plus incentive spirometry; NRT: nicotine replacement; n.s. not significant; PPA: point prevalence abstinence; PTSD: post-traumatic stress disorder; RCT: randomised controlled trial; SD: standard deviation; TFS: Teen FreshStart; TFS-B: Teen FreshStart with “buddy”; WIC: Women, infants and children; 5 A’s: Ask, Assess, Advise, Assist, Arrange.

Methodological quality assessment

Individual ratings for each study against the six methodological criteria and the assigned global rating are reported in Table 5.3. Overall, two studies received a methodological rating of strong^{65, 66}, ten studies received a rating of moderate^{34, 35, 41, 43, 45, 50, 56, 61, 62, 68} and 20 studies received a rating of weak^{36-38, 40, 42, 44, 46, 47, 49, 51-55, 57-60, 63, 64, 67, 70}. Unrepresentative samples, non-reporting of consent rates, non-reporting of blinding of participants and outcome assessors, and high attrition rates were common issues across all studies. Four studies relied solely on self-reported smoking status^{35, 46, 47, 59, 70}. Twelve studies used CO to confirm smoking status^{34, 37, 38, 45, 49-52, 55, 61, 63, 67, 68}, nine used cotinine in saliva or urine^{41, 42, 54, 56-58, 62, 64, 65} and seven studies used a combination of CO and cotinine^{36, 40, 43, 44, 53, 60, 66}. Where reported, attrition rates varied from 8% to 77% at the longest follow-up point.

Narrative review and meta-analysis

Homeless smokers

Only one trial examined the effectiveness of a behavioural smoking cessation intervention targeted at homeless smokers⁴⁰. Okuyemi et al⁴⁰ examined the effectiveness of five individual motivational interviewing (MI) sessions focusing on smoking behaviours and barriers to quitting, combined with group educational support sessions, supportive group outings and an eight-week course of NRT, with a similar intervention where MI sessions focused only on smoking behaviours (and not barriers to quitting). No significant differences were found between the two interventions at 8 week (17.4% smoking plus vs. 13% smoking only) or 26 week follow-up (17.4% smoking plus vs. 8.7% smoking only).

Table 5.3: *Ratings of methodological quality: Strong, Moderate and Weak*

	Selection bias	Study design	Confounders	Blinding	Data collection	Withdrawals	Global rating
Okuyemi et al., 2006 ⁴⁰	W	S	W	W	S	M	W
Bramley et al., 2005 ⁶⁴	W	S	W	M	S	M	W
Patten et al., 2010 ⁶²	W	S	S	M	S	S	M
Cropsey, 2008 ⁵¹	W	S	S	M	S	W	W
Albrecht et al., 1998 ⁵²	W	S	W	M	S	W	W
Albrecht et al., 2006 ⁵⁴	M	S	W	M	S	W	W
Brown et al., 2003 ⁴³	W	S	S	M	S	S	M
Helstrom et al., 2007 ⁴²	W	S	W	M	S	S	W
Myers et al., 2005 ⁶⁶	M	S	S	M	S	M	S
Prokhorov et al., 2008 ⁷⁰	W	S	W	M	W	M	W
Bullock et al., 2009 ⁵⁶	M	S	W	M	S	S	M
Curry et al., 2003 ⁴⁵	W	S	S	M	S	S	M
Froelicher et al., 2010 ⁵⁷	W	S	W	M	S	M	W
Gielen et al., 1997 ⁵⁸	M	S	W	M	S	W	W
Glasgow et al., 2000. ⁶⁵	M	S	S	M	S	S	S
Gordon et al., 2010 ³⁵	M	S	S	M	W	M	M
Lipkus et al., 1999 ⁵⁹	M	S	W	M	W	M	W

	Selection bias	Study design	Confounders	Blinding	Data collection	Withdrawals	Global rating
Manfredi et al., 1999; 2004 ^{46, 47}	M	S	W	M	W	W	W
Okuyemi et al., 2007 ⁴⁴	W	S	W	M	S	M	W
Ruger et al., 2008 ⁴¹	M	S	W	M	S	M	M
Skyles et al., 2001; Marks 2002 ^{37, 38}	W	S	W	M	S	S	W
Wadland et al., 2001 ⁶³	W	S	W	M	S	M	W
Baker et al., 2006 ⁶⁸	M	S	W	M	S	S	M
Brown et al., 2001 ⁵³	W	S	W	M	S	S	W
Dixon et al., 2009 ³⁴	M	S	W	M	S	M	M
Gallagher et al., 2007 ³⁶	W	S	S	M	S	W	W
Gulliver et al., 2008 ⁴⁹	W	S	S	M	S	W	W
Hall et al., 2006 ⁵⁵	W	S	W	M	S	M	W
MacPherson et al., 2010 ⁶⁰	W	S	S	S	S	W	W
McFall et al., 2005 ⁶¹	W	S	S	M	S	S	M
Vickers et al., 2009 ⁶⁷	W	S	S	M	S	W	W
Williams et al., 2010 ⁵⁰	M	S	S	W	S	M	M

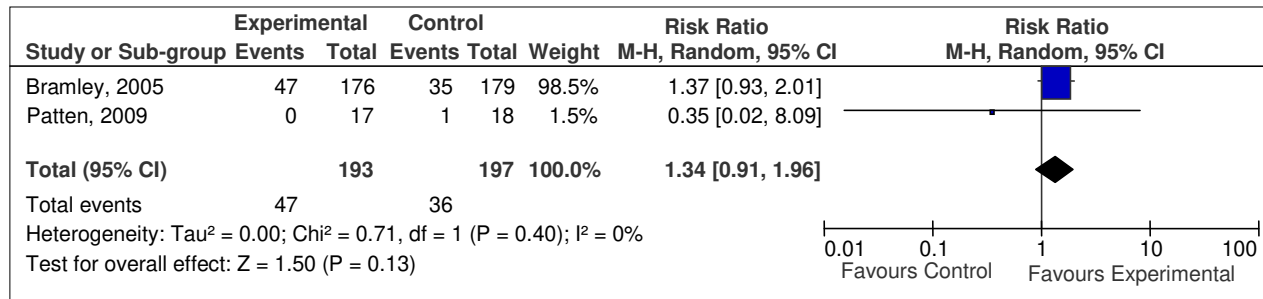
Indigenous smokers

Two trials examined cessation interventions targeted at Indigenous populations^{62, 64}. Bramley et al⁶⁴ examined the effectiveness of supportive quit smoking text messages compared with text messages not related to smoking among 355 Maori smokers over a six-month period (this study also examined the effectiveness for non-Maori smokers, but these results will not be reported here). Patten et al⁶² examined the effectiveness of a multi-component intervention consisting of face-to-face counselling, four telephone calls, a video highlighting personal stories of cessation, and a cessation guide on abstinence among pregnant Alaskan native women. Both studies were combined at short-term follow-up for meta-analysis. A non-significant effect was found (RR 1.34, CI 0.91-1.96, $I^2=0\%$) (See Figure 5.2a). Bramley⁶⁴ also assessed outcomes at six month follow-up and found no significant differences between those receiving smoking-related text messages and those receiving non-smoking-related messages.

Prisoners

One trial examined the effectiveness of a group behavioural mood management intervention among 250 female prisoners. Cropsey et al⁵¹ randomly assigned participants to a 10-week group mood management intervention incorporating transdermal nicotine or to a waiting-list control group. At six month follow-up, 14% of prisoners receiving the mood management intervention were abstinent, compared with 2.8% of control participants ($p<.001$). At 12 month follow-up there was no longer a comparison condition (as the waiting-list control group had crossed over to the active intervention condition). However, 11.6% of intervention participants maintained abstinence.

a) *Indigenous - Behavioural support - Short term*



b) *At-risk youth - Behavioural support - Short-term*

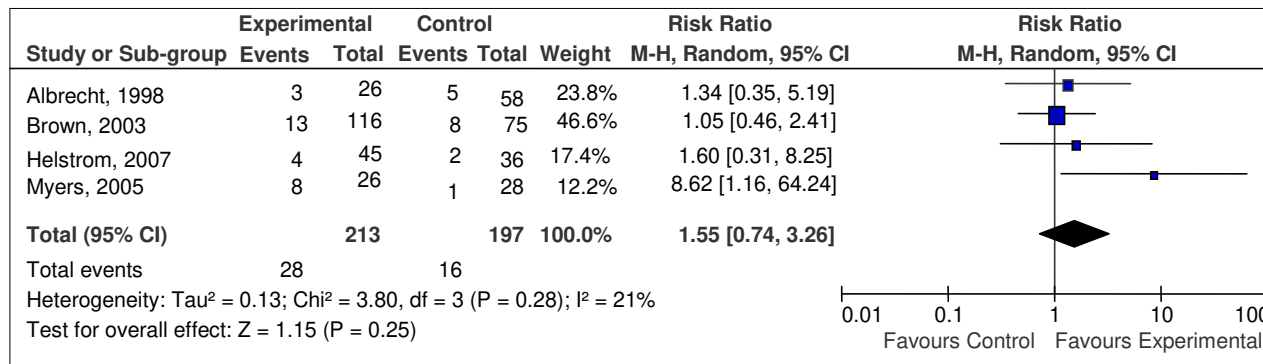
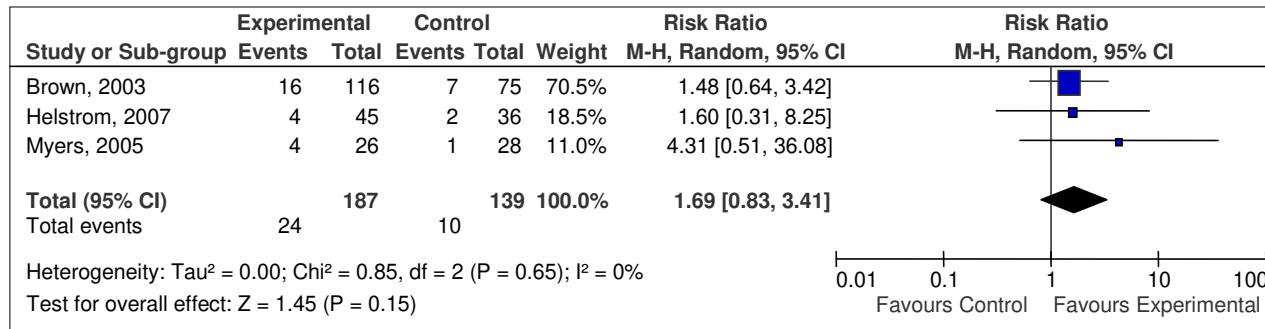


Figure 5.2 (a, b): Forrest Plots: Intervention effectiveness at short- and long-term follow-up

c) *At-risk youth - Behavioural support - Long-term*



d) *Low-income female - Behavioural support - Short-term*

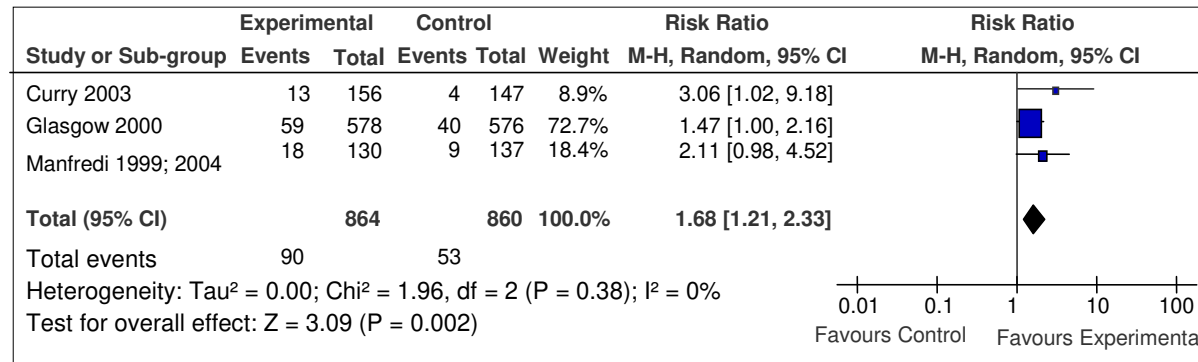
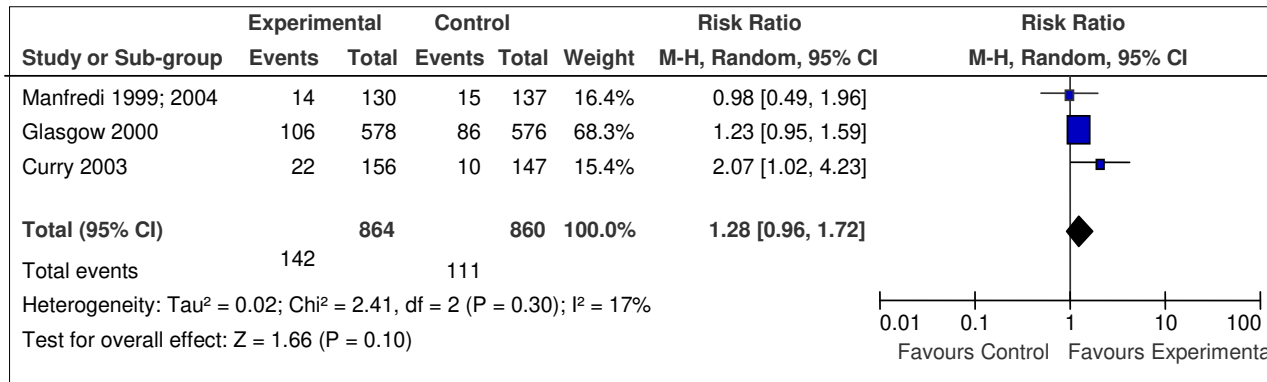


Figure 5.2 (c, d): Forrest Plots: Intervention effectiveness at short- and long-term follow-up

e) Low-income female - Behavioural support - Long-term



f) Pregnant women - Behavioural support - Third trimester

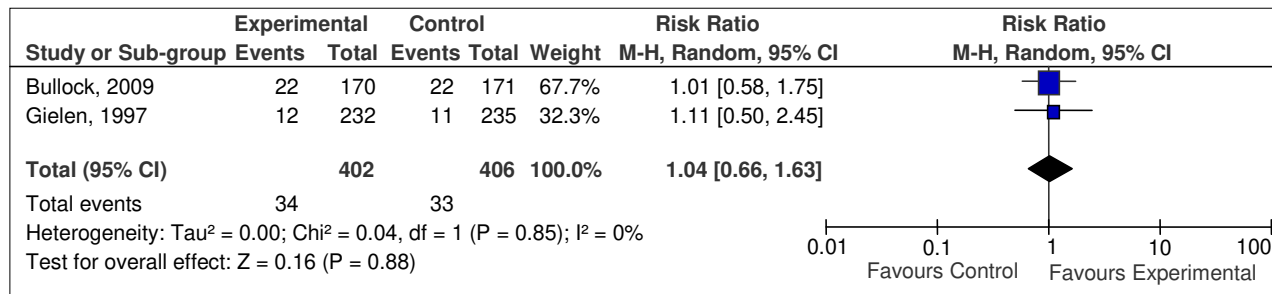
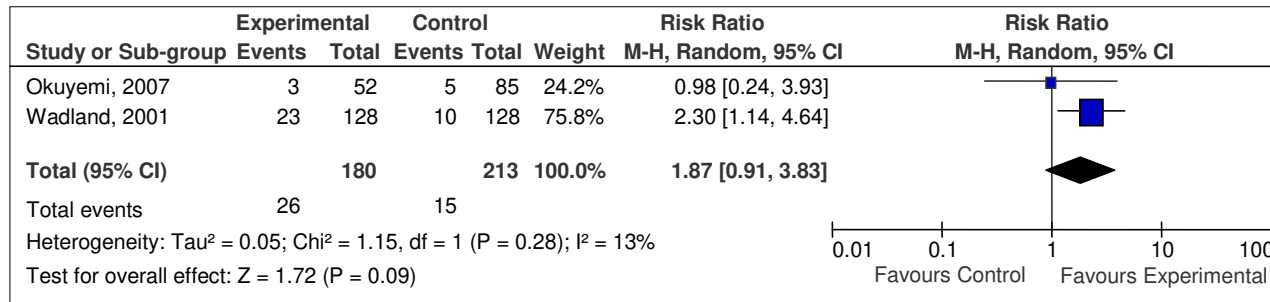


Figure 5.2 (e, f): Forrest Plots: Intervention effectiveness at short- and long-term follow-up

g) Low-income individual living in deprived area - Behavioural support - Short-term



h) Low-income individual living in deprived area - Behavioural support - Long-term

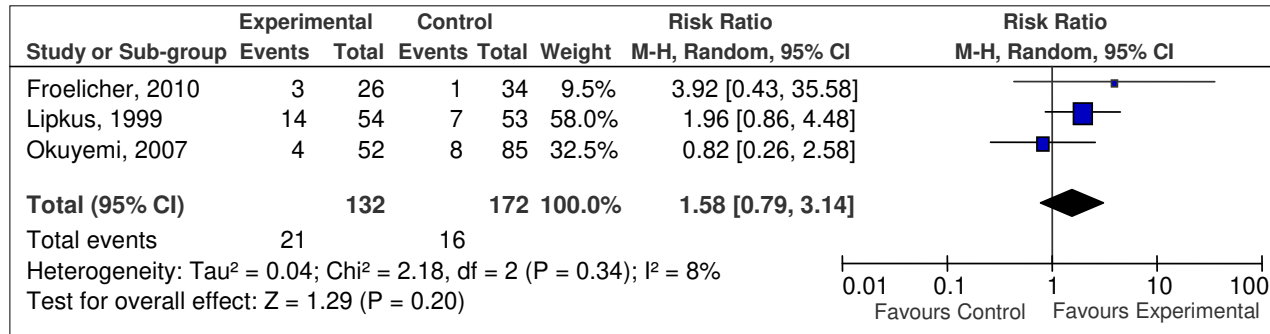
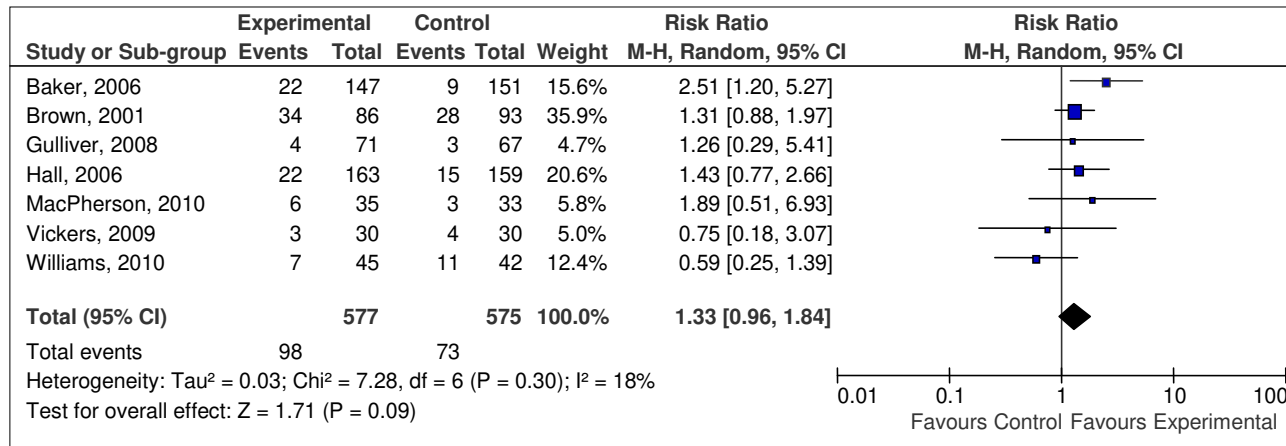


Figure 5.2 (g, h): Forrest Plots: Intervention effectiveness at short- and long-term follow-up

i) Mentally ill - Behavioural support - Short-term



j) Mentally ill - Behavioural support - Long-term

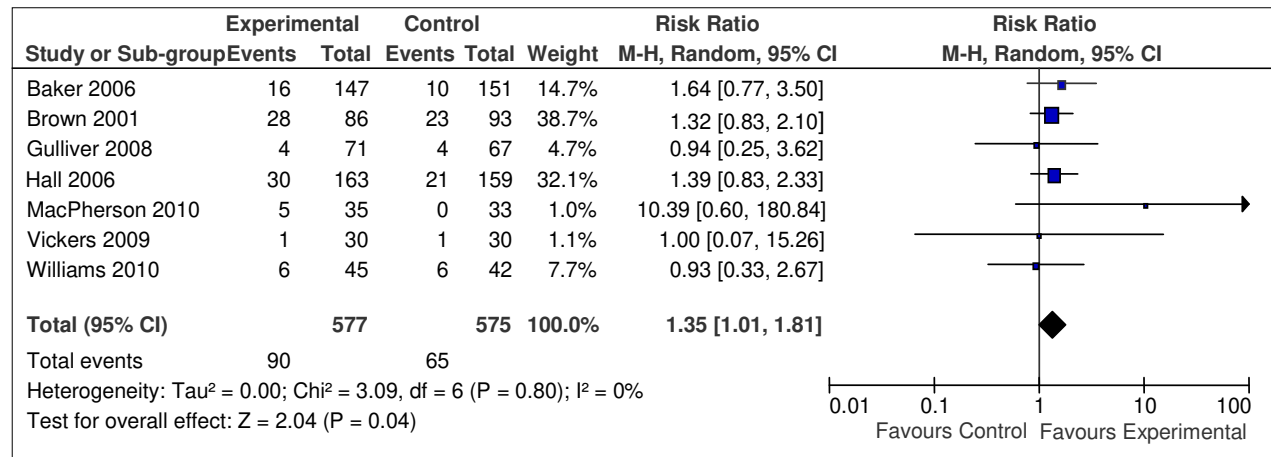


Figure 5.2 (I, j): Forrest Plots: Intervention effectiveness at short- and long-term follow-up

Youth

Six studies examined the effectiveness of cessation interventions for at-risk youth^{42, 43, 52, 54, 66, 70}. Four studies that used a behavioural support intervention were combined for meta-analysis^{42, 43, 52, 66}. At short-term follow-up a non-significant effect was found (RR 1.55, CI 0.74-3.26, $I^2=21\%$) (Figure 5.2b). Three studies pooled at long-term follow-up^{42, 43, 66} also showed a non-significant effect (RR 1.69, CI 0.83-3.41, $I^2=0\%$) (Figure 5.2c). Two studies also used a behavioural support intervention but could not be included in meta-analysis due to the methods for reporting results. Albrecht et al⁵⁴ examined the effectiveness of an eight-week group CBT group program for pregnant adolescents incorporating NRT and buddy support, compared with a CBT program alone and usual care. It appeared that the addition of a support person was of modest benefit, with a significant difference found at eight week follow-up ($p=.01$). No differences were found at one year follow-up. Prokhorov⁷⁰ examined the effectiveness of a computer-based smoking prevention and cessation program among disadvantaged high school students. No significant effects were found among a small subsample of adolescent smokers at 18 month follow-up⁷⁰.

Low-income smokers

Studies targeting low-income smokers were categorised as those targeting low-income women attending paediatric or planned parenthood clinics (three studies^{45-47, 65}), those targeting low-income pregnant women (three studies^{41, 56, 58}) and those targeting individuals from low-income areas (six studies^{35, 37, 38, 44, 57, 59, 63}).

Three studies compared a multi-component MI intervention with either usual care or brief advice among low-income female smokers accessing paediatric or planned parenthood clinics, and were combined for meta-analysis^{45-47, 65}. Combining the three studies at their shortest follow-up point (6-12 weeks) resulted in a significant effect (RR 1.68, CI 1.21-2.33, $I^2=0\%$)

(Figure 5.2d). At the longest follow-up point, a non-significant effect was found (RR 1.28, CI 0.96-1.72, $I^2=17\%$) (Figure 5.2e), although it should be noted that one study⁶⁵ was given the majority of the weight (68.3%) in the meta-analysis.

Three interventions targeted pregnant women^{41, 56, 58}: Gielen et al⁵⁸ examined the provision of educational materials, 15 minutes of individual counselling, verbal support from clinic staff and letters of encouragement, compared with brief advice; Bullock et al⁵⁶ tested intensive social support plus a cessation guide, compared with a cessation booklet alone, social support alone or usual care (only the comparison between social support and booklet compared with control is reported here); and Ruger et al⁴¹ tested the effectiveness of three home visits providing MI, feedback about household nicotine levels, and self-help materials, compared with a five-minute brief intervention and self-help materials provided at the prenatal clinic. Two studies were combined at the third trimester follow-up point^{56, 58}. No effect was found (RR 1.04, CI 0.66-1.63, $I^2=0\%$) (Figure 5.2f). Two studies^{41, 58} reporting 6 month *post partum* follow-up could not be combined due to heterogeneity ($I^2= 61\%$). Both found no significant differences at the 6 month *post partum* follow-up. Bullock et al⁵⁶ also found no significant differences at 6 weeks *post partum*.

Six studies targeted low-income individuals living in deprived neighbourhoods or attending public health clinics^{35, 37, 38, 44, 57, 59, 63}. Four which provided a behavioural support intervention were combined for meta-analysis^{44, 57, 59, 63}. Combining two studies reporting short-term outcomes^{44, 63} and three studies reporting long-term outcomes^{44, 57, 59} showed no significant effects (RR 1.87, CI 0.91-3.83, $I^2=13\%$ and RR 1.58, CI 0.79-3.14, $I^2=8\%$ respectively) (Figures 5.2g and 5.2h respectively). Two additional studies targeting low-income individuals found significant effects: Sykes et al^{37, 38} found a self-help CBT cessation program was significantly more effective among smokers living in a deprived area of London, compared with educational

materials, at both 6 month follow-up (17.2% self-help program vs. 5.6% control; <.0001) and 12 month follow-up (19.8% self-help program vs. 5.7% control; $p < .0001$). However, an “intention to treat” approach to analysis was not adopted in this study. Gordon et al³⁵ conducted a large trial to examine the effectiveness of dental practitioner brief advice using the 5 As approach (Assess, Advise, Agree, Assist, Arrange) and NRT, compared with usual care, among 2637 low-income smokers attending a public dental clinic. Significant differences were found at the 7.5 month follow-up (11.3% intervention compared with 6.8% control, $p < .05$).

Individuals with mental illness

Of the ten studies identified, three targeted smokers with schizophrenia or schizo-affective disorders^{34, 36, 71}, four targeted smokers with depression^{53, 55, 60, 67}, two studies included smokers with a variety of psychotic disorders^{49, 68} and one study targeted smokers with post-traumatic stress disorder⁶¹.

Seven studies^{49, 50, 53, 55, 60, 67, 68} which examined the effectiveness of behavioural support interventions were combined for meta-analysis. At short-term follow-up a non-significant effect was found (RR 1.33, CI 0.96-1.84, $I^2 = 18\%$) (Figure 5.2i). However, a significant effect was found at long-term follow-up (RR 1.35, CI 1.01-1.81, $I^2 = 0\%$) (Figure 5.2j). It should be noted that two studies^{60, 67} had extremely wide confidence intervals in the long-term analysis and only contributed 1% and 1.5% weight respectively to the meta-analysis. Two studies^{53, 60} also had moderately intensive control conditions, thus possibly reducing the effect size found.

One study targeting smokers with mental illness could not be included in meta-analysis due to the method of reporting of results. McFall et al⁶¹ found that integrating smoking care with PTSD treatment for smokers with a diagnosis of PTSD was more than five times more effective than referring smokers to external clinics to receive smoking care ($p < .002$). Dixon³⁴ found that

repeated brief advice (5 As) in an out-patient mental health clinic setting had no impact on abstinence rates compared with usual care. Gallagher et al³⁶ examined the use of contingent reinforcement for cessation, both with and without NRT, compared with a control group, in male smokers with schizophrenia. Smokers allocated to either of the contingent reinforcement conditions earned progressively larger cash rewards for abstinence, ranging between \$20 and \$80 per visit. There were no significant differences between conditions at 20 week or 36 week follow-up.

Discussion

The results of this review suggest that behavioural interventions may be effective among some disadvantaged groups. Meta-analysis showed promising point estimates for the effects of behavioural support interventions on abstinence among at-risk youth, but did not reach statistical significance due to small sample sizes and the small number of well-controlled RCTs pooled for analysis. A significant effect was found for behavioural support interventions targeted at low-income female smokers at short-term follow-up (RR 1.68, CI 1.21-2.33). While this comparison pooled only a small number of studies and gave the majority of weight in the meta-analysis to one large study, all three studies provided a similar multi-component clinic-based intervention to low socio-economic status women attending prenatal and paediatric clinics. Despite a reduced effect size and non-significant result at long-term follow-up, the significant short-term finding supports the implementation of evidence-based smoking cessation support in routine prenatal care. Behavioural support interventions targeted at individuals with mental illness at long-term follow-up also showed a significant effect (RR 1.35, CI 1.01-1.81).

The studies included in this meta-analysis incorporated a wide range of behavioural interventions and a varying number of intervention components, and the duration of

intervention delivery varied from one single session to high-intensity treatment of 24 sessions over 26 weeks. These findings must, therefore, be interpreted with caution. While further research that addresses barriers to quitting among individuals with mental illness is needed, this significant long-term finding provides support for research which shows that cessation interventions can assist individuals with mental illness to quit smoking⁷². These two significant findings are, however, notable given that Cochrane reviews of counselling interventions in mainstream population groups show similar effect sizes for both individual and group behavioural counselling interventions of RR 1.39 and RR 1.98 respectively^{73, 74}.

Of studies not included in meta-analysis, some showed promising results. Studies targeting low-income individuals from deprived areas showed the most success, with two different approaches (a self-help CBT program and brief advice integrated in dental care) demonstrating significant increases in smoking abstinence rates. Of particular note, of the six studies included in the review that specifically targeted pregnant smokers^{41, 52, 54, 56, 58, 62}, only one study showed a significant impact on *post partum* abstinence rates. Studies targeting low-income pregnant women tended to focus on providing increased advice and support, both during the women's visits with healthcare providers and in their homes. None included NRT. A recent Cochrane review has shown that cessation interventions can reduce smoking during pregnancy by approximately 6%⁷⁵. Given the high rates of smoking among disadvantaged pregnant women and the high risk of harm, it is crucial that increased efforts are given to reducing smoking among this high-risk group. The addition of NRT to behavioural support for pregnant smokers who smoke more than five cigarettes per day may increase cessation rates⁷⁶.

A small number of studies targeted homeless smokers, Indigenous smokers or prisoners. Point estimates suggest that effective interventions exist for Indigenous smokers, but both of the included trials showed wide confidence intervals due to low power. Promising results were

found for a group mood management intervention delivered to female prisoners⁵¹. Given the small number of studies, it appears efforts to promote cessation in these highly vulnerable groups have so far been relatively limited.

Methodological quality

The majority of studies included in the review performed poorly on ratings of methodological quality. Recurring methodological limitations included small sample sizes, high rates of attrition, and failure to report blinding of participants, clinical staff and outcome assessors. Intervening with hard-to-reach smokers and undertaking rigorously designed cessation interventions is challenging⁷⁷. Trialling strategies to both recruit and retain representative samples of smokers is of critical importance, both to improve the quality of studies and to engage disadvantaged smokers with cessation trials. Robust methodologies which are culturally and politically sensitive to the needs of these populations are required. Extensive formative research would aid the development of stronger trials that can take account of methodological issues⁷⁸.

Implications for research and practice

Some have argued that individuals from disadvantaged groups are more likely to be “hard core” smokers⁷⁹, and therefore that special considerations for intervening with these groups are needed. While Cochrane reviews have shown that cessation interventions, including individual and group behavioural counselling^{73,74}, telephone counselling⁸⁰ and physician advice⁸¹, increase smoking cessation among mainstream population groups, there is less evidence about the effectiveness of behavioural interventions among disadvantaged groups. This meta-analysis found effect sizes broadly similar to those found with other populations, but in most cases the effects were not significant. There were notable exceptions, however,

with targeted behavioural interventions provided to low-income female smokers and individuals with mental illness showing significant effects in meta-analysis.

Additional large-scale RCTs should further examine the differential benefit of behavioural cessation interventions for disadvantaged groups. Such research is difficult to undertake and needs to be adequately resourced to ensure that sample sizes can yield adequate power to detect clinically meaningful effect sizes. There is also a clear need for further research using interventions that have so far received little attention. For example, while there have been recent calls for the use of financial incentives with disadvantaged groups^{82,83}, few studies that examined the effectiveness of this strategy were identified. Where financial incentives were used, wide confidence intervals were found, indicating the need for larger trials³⁶.

Attention should also be given to identifying novel settings for delivering cessation interventions to disadvantaged groups. Of the 32 studies included in this review, the majority were conducted in healthcare settings. Given evidence that disadvantaged groups are less likely to access healthcare and receive preventive advice⁸⁴, further research should explore the effectiveness of providing cessation support in settings familiar to and trusted by disadvantaged individuals, such as community social services^{85,86}.

Limitations

This review is limited by the small number of studies eligible for inclusion in the review and the small number of studies included in meta-analysis. It was not possible to compare interventions on the basis of intensity, duration or format of intervention delivery, and it is important that future reviews examine these constructs where possible. We were also unable to determine whether combining behavioural intervention with NRT increased smoking cessation above behavioural intervention alone. While a significant attempt was made to

identify all published studies by using comprehensive *a priori* search strategies, it is possible that relevant studies were not located. While a significant attempt was made to compare consistent outcome measures, due to the nature of the studies, a mix of validated and self-reported quit rates, seven-day point prevalence and continuous abstinence rates are included. Because only studies conducted in developed countries were included, results are not generalisable to developing countries. Finally, methodological quality was not used as an exclusion criterion for meta-analysis. Although there are conflicting views on how to deal with assessments of study quality^{87,88}, including poor quality studies in meta-analysis means that there is a risk that bias has been introduced.

Conclusions

Increasing rates of cessation among disadvantaged groups will make a significant contribution to reducing tobacco-related health inequalities⁸⁹. The results of this review indicate that behavioural interventions do show some benefit among disadvantaged and vulnerable subgroups. This is an important finding as it suggests that achieving cessation with disadvantaged groups is within reach. Further research that is adequately resourced and powered is needed to establish the most effective cessation interventions for vulnerable high-risk groups.

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