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# Incentives for smoking cessation (Review)

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[Intervention Review]

# Incentives for smoking cessation

Caitlin Notley[1], Sarah Gentry[1], Jonathan Livingstone-Banks[2], Linda Bauld[3], Rafael Perera[2], Monserrat Conde[2], Jamie Hartmann-Boyce[2,4]

[1]Norwich Medical School, University of East Anglia, Norwich, UK. [2]Nuffield Department of Primary Care Health Sciences, University of Oxford, Oxford, UK. [3]Usher Institute and Behavioural Research UK, College of Medicine and Veterinary Medicine, University of Edinburgh, Edinburgh, UK. [4]Health Promotion and Policy, University of Massachusetts Amherst, Amherst, MA, USA

**Contact:** Caitlin Notley, c.notley@uea.ac.uk.

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## ABSTRACT

### Background

Financial incentives (money, vouchers, or self-deposits) can be used to positively reinforce smoking cessation. They may be used as one-off rewards, or in various schedules to reward steps towards sustained smoking abstinence (known as contingency management). They have been used in workplaces, clinics, hospitals, and community settings, and to target particular populations. This is a review update. The previous version was published in 2019.

### Objectives

#### Primary

To assess the long-term effects of incentives and contingency management programmes for smoking cessation in mixed and pregnant populations.

#### Secondary

To assess the long-term effects of incentives and contingency management programmes for smoking cessation in mixed populations, considering whether incentives were offered at the final follow-up point.

To assess the difference in outcomes for pregnant populations, considering whether rewards were contingent on abstinence or guaranteed.

### Search methods

For this update, we searched CENTRAL, MEDLINE, Embase, PsycINFO, and two trials registers on 2 November 2023, and the Cochrane Tobacco Addiction Group Specialised Register on March 2023, together with reference checking, citation searching, and contact with study authors to identify additional studies.

### Selection criteria

We considered only randomised controlled trials (RCTs), allocating individuals, workplaces, groups within workplaces, or communities to smoking cessation incentive schemes or control conditions. We included studies in a mixed-population setting (e.g. community-, work-, clinic- or institution-based), studies with specific populations (e.g. those with diagnosed mental health conditions), and studies in pregnant people who smoke.

**Data collection and analysis**

We used standard Cochrane methods. The primary outcome measure in the mixed-population studies was abstinence from smoking at longest follow-up (at least six months from the start of the intervention). In the trials of pregnant people, we used abstinence from smoking measured at the longest follow-up, and at least to the end of the pregnancy. Where available, we pooled outcome data using a Mantel-Haenszel random-effects model, with results reported as risk ratios (RRs) and 95% confidence intervals (CIs), using adjusted estimates for cluster-randomised trials. We analysed studies carried out in mixed populations separately from those carried out in pregnant populations.

**Main results**

Forty-eight mixed-population studies met our inclusion criteria, recruiting more than 21,924 participants; 15 of these are new to this version of the review. Studies were set in varying locations, including community settings, clinics or health centres, workplaces, and outpatient drug clinics. We judged eight studies to be at low risk of bias, and 16 to be at high risk of bias, with the remaining 24 studies at unclear risk. Thirty-three of the trials were run in the USA, two in Thailand, one in the Philippines, one in Hong Kong, and one in South Africa. The rest were European. Incentives offered included cash payments, self-deposits, or vouchers for goods and groceries, offered directly or collected and redeemable online. The pooled RR for quitting with incentives at longest follow-up (six months or more) compared with controls was 1.52 (95% CI 1.33 to 1.74; $I^2$ = 23%; 39 studies, 18,303 participants; high-certainty evidence). Results were not sensitive to the exclusion of seven studies that offered an incentive for cessation at long-term follow-up (result excluding those studies: RR 1.46, 95% CI 1.23 to 1.73; $I^2$ = 26%; 32 studies, 15,082 participants), suggesting the impact of incentives continues for at least some time after incentives cease (at least six months). For this update, we included an adjusted analysis incorporating three cluster-RCTs. The pooled odds ratio was 1.57 (95% CI 1.37 to 1.79; $I^2$ = 30%; 43 studies, 23,960 participants; high-certainty evidence).

Although not always clearly reported, the total financial amount of incentives varied considerably between trials, from zero (self-deposits), to a range of between 45 US dollars (USD) and USD 1185. There was no clear difference in effect between trials offering low or high total value of incentives, nor those encouraging redeemable self-deposits. We ran an updated exploratory meta-regression and found no significant association between the outcome and the total value of the financial incentive (P = 0.963). Any such indirect comparison is particularly crude in this context, due to differences in the cultural significance of financial amounts (e.g. USD 50 might have different significance in different contexts).

We included 14 studies of 4314 pregnant people (11 conducted in the USA, one in France, and two in the UK). We judged four studies to be at low risk of bias, two at high risk of bias, and eight at unclear risk. When pooled, the 13 trials with usable data delivered a risk ratio at longest follow-up (up to 48 weeks postpartum) of 2.13 (95% CI 1.58 to 2.86; $I^2$ = 31%; 13 studies, 3942 participants; high-certainty evidence), in favour of incentives.

**Authors' conclusions**

Overall, our conclusion from this latest review update remains that there is high-certainty evidence that incentives improve smoking cessation rates at long-term follow-up in mixed population studies. The evidence demonstrates that the effectiveness of incentives is sustained even when the last follow-up occurs after the withdrawal of incentives. There is also now high-certainty evidence that incentive schemes conducted amongst pregnant people who smoke improve smoking cessation rates, both at the end of pregnancy and postpartum. This represents a change from the previous update in which we rated this evidence as moderate certainty. Current and future research might more precisely explore differences between trials offering low or high cash incentives and self-incentives (deposits), within a variety of smoking populations, focusing on low- and middle-income countries where the burden of tobacco use remains high.

## PLAIN LANGUAGE SUMMARY

### Can rewards help people quit smoking, and do they work in the long term?

**Key messages**

• Smoking is the leading preventable cause of ill health and early death worldwide. Quitting smoking is vitally important to help people live in good health for longer.

• Rewards help people to quit smoking for at least six months.

• This effect continues after rewards have ended, suggesting long-term benefits.

• Rewards also help pregnant people who smoke to quit smoking. This effect continues after the baby has been born.

**What are rewards?**

Incentives, such as money, vouchers or deposits, can be used to encourage people to quit smoking, and to reward them if they remain non-smoking. Such schemes can be run in workplaces, in clinics, and sometimes as community programmes.

**What did we want to find out?**

We wanted to find out if giving people rewards helps them to quit smoking in the long term.

**What did we do?**

We searched for studies that investigated offering rewards to adults to help them quit smoking. People in the studies had to be chosen at random to receive incentives or a control condition (usual care, or another smoking cessation intervention). We included people from mixed populations and also pregnant people.

**What did we find?**

We found 48 studies that tested different reward schemes to help people who smoke to quit. Five studies included people from mental health clinics, four from primary care clinics, two from head-and-neck cancer treatment clinics, three from colleges or universities, one recruited veterans, and two recruited people living in Thai villages. Rewards were cash payments, vouchers, or the return of money deposited by those taking part.

*Pregnancy studies:* we looked at studies involving pregnant people separately. We found 14 studies: 11 based in the USA, two in the UK, and one in France. The rewards used were vouchers that were sometimes increased in value, depending on how long the person managed to abstain from smoking.

Quality of the studies: some of the studies did not provide enough data for us to fully assess their quality. Taking out the lowest-quality trials from the analysis did not change the results.

**Main results**

We found that people receiving rewards were more likely to have stopped smoking than those in the control groups six months or more after the beginning of the study (39 studies, 18,303 people). For every 100 people who received financial incentives, 10 people were likely to successfully quit smoking at six months or longer, compared to 7 in 100 people who did not receive financial incentives. Success rates continued beyond when the incentives had ended. Studies varied in the total amounts of rewards that were paid. There was no noticeable difference between studies paying smaller amounts (less than USD 100 (US dollars)) compared to those paying larger amounts (more than USD 700).

*Pregnancy trials:* people who were pregnant and received rewards were much more likely to stop smoking than those in the control groups, both at the end of the pregnancy and after the birth of the baby (13 studies, 3942 people). For every 100 pregnant people who received financial incentives, 13 people were likely to successfully quit smoking at six months or longer, compared to 6 in 100 people who did not receive financial incentives.

**What are the limitations of the evidence?**

The evidence for our results is very reliable. We are very confident that incentives help people, and pregnant people, to quit smoking better than not offering incentives. We did not have enough evidence to find out if offering different value rewards had an impact on quitting smoking.

**How current is the evidence?**

The evidence is current to November 2023.

## SUMMARY OF FINDINGS

### Summary of findings 1. Incentives versus no incentives for smoking cessation in mixed populations at longest follow-up

**Smoking cessation: incentives compared to no incentives in mixed populations**

**Patient or population:** adults who smoke tobacco
**Setting:** mixed
**Intervention:** incentives for smoking cessation
**Comparison:** no incentives

| Outcomes | Anticipated absolute effects* (95% CI) | | Relative effect (95% CI) | № of participants (studies) | Certainty of the evidence (GRADE) | Comments |
|---|---|---|---|---|---|---|
| | Risk with control | Risk with incentives: mixed populations | | | | |
| **Smoking cessation in mixed populations at longest follow-up**<br><br>Follow-up: 6 months to 24 months | 71 per 1000 | 108 per 1000 (94 to 123) | RR 1.52 (1.33 to 1.74)<br><br>Pooled OR 1.57 (1.37 to 1.79) | 18,303 (39 RCTs)<br><br>23,960 (43 studies) | ⊕⊕⊕⊕ **High**[a] | We undertook a separate analysis (Analysis 1.3) of 43 studies, incorporating 3 new cluster-RCTs and a study which only reported an OR, as a pooled odds ratio. For 1 included study, extractable data were available, but it was not possible to include anything in the analysis as no events (episodes of smoking cessation) occurred in either arm. We excluded a further two studies from the formal analysis since no extractable data were available on programme participants at follow-up, and another study which compared two incentives and no control. |

***The risk in the intervention group** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).
**CI:** confidence interval; **OR:** odds ratio; **RCT:** randomised controlled trial; **RR:** risk ratio

**GRADE Working Group grades of evidence**
**High certainty:** we are very confident that the true effect lies close to that of the estimate of the effect.
**Moderate certainty:** we are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
**Low certainty:** our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect.
**Very low certainty:** we have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

[a]Overall, we rate the certainty of the evidence as high, despite some of the included studies being considered at high risk of bias. This is because when we restricted the analyses to only those studies at overall low risk of bias, there was still a statistically and clinically significant effect in favour of the intervention. Similarly, when we removed studies at

high risk of bias from analyses, leaving only those at low and unclear risk of bias, there remained an effect estimate clearly in favour of the intervention. We are therefore very confident that the true effect lies close to that of the estimate of the effect.

**Summary of findings 2. Incentives versus no incentives for smoking cessation in pregnant people at longest follow-up**

**Smoking cessation: incentives compared to no incentives in pregnant people**

**Patient or population:** pregnant people who smoke tobacco
**Setting:** antenatal clinics
**Intervention:** incentives for smoking cessation

**Comparison:** no incentives

| Outcomes | Anticipated absolute effects* (95% CI) | | Relative effect (95% CI) | № of participants (studies) | Certainty of the evidence (GRADE) | Comments |
|---|---|---|---|---|---|---|
| | Risk with control | Risk with incentives: pregnancy | | | | |
| **Smoking cessation in pregnancy at longest follow-up**<br><br>Follow-up: 10 to 24 weeks postpartum | 62 per 1000 | 133 per 1000 (98 to 178) | RR 2.13 (1.58 to 2.86) | 3942 (13 RCTs) | ⊕⊕⊕⊕ **High**[a] | 1 included study did not contribute to the analysis because of lack of usable data |

*__The risk in the intervention group__ (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).
**CI:** confidence interval; **RCT:** randomised controlled trial; **RR:** risk ratio

**GRADE Working Group grades of evidence**
**High certainty:** we are very confident that the true effect lies close to that of the estimate of the effect.
**Moderate certainty:** we are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
**Low certainty:** our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect.
**Very low certainty:** we have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

[a]Overall, we rate the certainty of the evidence as high, despite some of the included studies being considered at high risk of bias. In the previous version of the review, two of the included studies were judged as having a low risk of bias. Four new studies have been included in this update, and two of these are also at low risk of bias. Therefore, the GRADE rating is now high certainty, whereas in the previous update it was moderate certainty. Findings were not sensitive to the removal of the two studies at high risk of bias.

# BACKGROUND

## Description of the condition

Smoking is one of the leading causes of preventable death and disease worldwide (WHO 2023). Most adults who smoke wish to quit (ASH 2020), but quitting is challenging. Despite the availability of effective evidence-based cessation methods, quit rates remain low (Pierce 2022). Quitting smoking can lead to substantial health gains, even later in life (WHO 2020). Smoking cessation improves physical *and* mental health (Taylor 2021). The earlier someone quits smoking, the more they reduce their risk of developing smoking-related diseases (WHO 2018). Tobacco smoking is unevenly distributed in populations. Smoking prevalence is highest in low- and middle-income countries (ASH 2019). In high-income countries, people on the lowest incomes are more likely to be tobacco smokers (ONS 2023), suggesting that smoking is a key driver of health inequalities.

## Description of the intervention

Incentives for smoking cessation are used as rewards for achieving abstinence. These can be financial rewards – money, vouchers, gifts, or self-deposits – that are used to encourage, reward, and promote continued engagement in achieving smoking abstinence.

There has been interest and support for incentive-based programmes to change unhealthy behaviours, including smoking, weight loss (e.g. Dombrowski 2020), alcohol and substance use (de Walque 2020), and to increase levels of physical activity (Giles 2014; Heise 2021). However, financial incentives to promote behaviour change are controversial. Qualitative research demonstrates that public acceptability of incentives varies (Giles 2015), perhaps due to misinformation or a lack of education (Robertson 2018), and a concern about commissioning (funding of) incentive-based schemes. There has also been a concern that incentive schemes may only be effective for the duration of time that incentives are offered. There may be cultural variation in acceptability, such that implementation of incentive-based programmes may prove more difficult in some settings (Berlin 2018).

Many developing countries, particularly in Latin America, operate conditional national or regional cash transfer programmes of monetary rewards for behaviour change or compliance, often targeting improvements in child and maternal health (Lagarde 2009; Paes-Sousa 2011; Powell-Jackson 2011). In the United Kingdom (UK), incentive schemes often focus on encouraging pregnant people to quit smoking, with well-established programmes such as 'Give It Up For Baby' providing early evidence (Ballard 2009). A series of studies, conducted in the USA, included in the last update of this review (Donatelle 2000a; Donatelle 2000b; Donatelle 2002; Heil 2008; Higgins 2004; Higgins 2014), and a large randomised trial in the UK (Tappin 2015), contributed the majority of the evidence to underpin the conclusions in the last update of this Cochrane review, which was instrumental in the UK Government's recommendation in April 2023 to implement financial incentive schemes for smoking cessation in pregnancy (DHSC 2023a).

## How the intervention might work

Incentives and rewards (terms used interchangeably in studies contributing to this review) routinely feature in smoking cessation programmes. Theory suggests they might work according to behavioural processes of operant conditioning (positively rewarding the desired behaviour), or by providing short-term gain for behaviour change that ultimately results in long-term gain, but is perceived as less proximal to the individual (delay discounting) (Gneezy 2011; Miglin 2017). Siersbaek 2024 suggests that incentives can be particularly beneficial for low-income groups because they offer an opportunity to meet financial needs, give a sense of autonomy due to having extra financial resources, and engender feelings of esteem. Incentives can be used to encourage recruitment into the programme, to reward compliance with the process, to reward steps towards cessation (shaping), and to reward cessation achieved at predefined stages, usually contingent on production of a biochemically-confirmed cessation outcome. A variety of rewards have been used for these purposes, including cash payments, vouchers exchangeable for goods (excluding alcohol and cigarettes) or leisure activities, salary bonuses, promotional items such as T-shirts, pens and bags, or 'self-deposits', where individuals contribute their own money and are rewarded back with the savings accrued for having achieved abstinence.

Rewards can be given for attendance at the programme and at follow-up appointments, irrespective of subsequent smoking status (i.e. guaranteed or non-contingent), or can be paid and scaled relative to the participant's success in smoking cessation (i.e. contingent) (Higgins 2002). Recent trials and systematic reviews have explored variations in the type, scale, and the scheduling of rewards (Adams 2014; Crossland 2015; Giles 2014; Jochelson 2007; Leeks 2010; Sigmon 2012b), and in their acceptability as a mechanism for behaviour change (Hoddinott 2014; Thomson 2014). This review focuses on rewards for abstinence (as opposed to attendance, shaping, etc.).

## Why it is important to do this review

This review is an updated version of our previous reviews (most recently, Cahill 2015; Notley 2019). Over the 23-year lifetime of this review, the debate about incentive-based smoking cessation programmes has shifted from their feasibility (i.e. can they work?) to their effectiveness (i.e. do they work?), the relative success or limitations of the mechanisms deployed (Higgins 2012; Promberger 2012), the merits of rewards ('carrots') versus penalties ('sticks') (Adams 2014; Lynagh 2013; Volpp 2014), the extent to which achieved changes can be maintained (Jochelson 2007; Strickland 2014), the possibilities of unintended consequences (Marteau 2009; Thomson 2014), and the acceptability and implementation of incentive-based programmes (Berlin 2018). Although many of the older included studies may not address these issues, our review contributes to a growing evidence base that defines the rationale for incentive-based programmes and identifies areas for further investigation. In this review, we also explore the use of incentives in subpopulations of participants, consider the longevity of effects of incentives, the types of incentives offered, and the cumulative value of incentives optimal for cessation outcomes.

# OBJECTIVES

### Primary

To assess the long-term effects of incentives and contingency management programmes for smoking cessation in mixed and pregnant populations.

**Secondary**

To assess the long-term effects of incentives and contingency management programmes for smoking cessation in mixed populations, considering whether incentives were offered at the final follow-up point.

To assess the difference in outcomes for pregnant populations, considering whether rewards were contingent on abstinence or guaranteed.

# METHODS

## Criteria for considering studies for this review

### Types of studies

Randomised controlled trials (RCTs) or cluster-RCTs allocating individuals, communities, workplaces or groups within workplaces to intervention or to control conditions.

### Types of participants

Adults who smoke tobacco, of any gender, in any setting, including trials conducted in pregnant people who smoke. We have not included trials aimed exclusively at people aged less than 18 years, as they are covered by a separate Cochrane review (Fanshawe 2017).

We used the definitions of smoking tobacco as provided by the study authors. Typically, this would mean smoking tobacco cigarettes (as the most commonly used form of combustible tobacco), but in some cases this may have included other forms of combustible tobacco (e.g. cigarillos, cigars). This was not clearly reported across all studies, but where studies were of tobacco smoking cessation, we included them.

### Types of interventions

Incentive schemes to reward participants for validated cessation and abstinence in smoking cessation programmes. We have not included reports of the effectiveness of incentives or rewards to healthcare workers (physicians, nurses) for the delivery of smoking cessation interventions, or of reimbursement to participants for smoking cessation treatment costs, as these are covered in another Cochrane review (Van den Brand 2017). We include in this review studies which offered entry into prize draws alongside other guaranteed incentives, but studies which offered only non-guaranteed rewards (e.g. raffle only) are covered by a separate review of 'Competitions for smoking cessation' (Fanshawe 2019). Some included studies also offered incentives for behaviours that were thought to promote cessation, such as clinic visit attendance, in addition to the incentives for smoking cessation outcomes.

Control groups could be usual care or a smoking cessation intervention similar to that provided in the experimental group, but without incentives. Studies comparing two interventions providing incentives, but which varied by the amount or type of incentive, were also eligible.

### Types of outcome measures

The primary outcome for this review is long-term smoking cessation. This could be measured as point prevalence, sustained or continuous abstinence. However, where multiple measures were used in one study, we took the most stringent measure. For trials in mixed populations, abstinence had to be assessed at a minimum of six months from the start of the intervention. For trials in pregnant people, we extracted smoking cessation outcomes at the closest follow-up to end of pregnancy, and also at longest follow-up postpartum, if reported. We did not require the minimum six-month follow-up period for pregnant people because of the time-limited nature of pregnancy. Abstinence could be self-reported or biochemically validated, but we preferred biochemically validated over self-reported rates.

We also looked at negative impacts and costs, where reported.

#### *Primary outcomes*

Long-term smoking cessation (abstinence)

#### *Secondary outcomes*

Other measures of smoking cessation and reduction; costs; and negative impacts, including adverse events and serious adverse events

## Search methods for identification of studies

### Electronic searches

Previous versions of this review used searches of the Cochrane Tobacco Addiction Group Specialised Register. However, for this update, we did not search this register beyond 2 March 2023 as it ceased to be maintained. Beyond this point, we conducted equivalent searches in the constituent databases. At the time of the last search, the Register included the results of searches of MEDLINE (via Ovid) to update 20221222; Embase (via Ovid) to week 202251; PsycINFO (via Ovid) to update 20221219. See the Tobacco Addiction Group website for full search strategies and a list of other resources searched.

This update includes results from searches of the following databases, last conducted on 2 November 2023:

- Cochrane Tobacco Addiction Group Specialised Register (CRS-Web up to 2 March 2023);
- Cochrane Central Register of Controlled Trials (CENTRAL 2023; Issue 10) via CRS-Web;
- MEDLINE (Ovid SP; 1 January 2022 to 2 November 2023);
- Embase (Ovid SP; 1 January 2022 to 2 November 2023);
- PsycINFO (Ovid SP; 1 January 2022 to 2 November 2023);
- ClinicalTrials.gov (via CENTRAL 2023; Issue 10);
- World Health Organization (WHO) International Clinical Trials Registry Platform (ICTRP: www.who.int/ictrp/en/, via CENTRAL 2023; Issue 10).

Records of all search strategies can be found in Appendix 1.

### Searching other resources

We checked reference lists of eligible papers, and consulted with experts in the field to identify any relevant forthcoming or unpublished research. We have contacted the authors of ongoing and included studies where necessary, and have recorded their co-operation in the Acknowledgements section.

## Data collection and analysis

### Selection of studies

For this version of the review, two review authors (CN and SG) independently screened all search results (titles and abstracts) for possible inclusion, resolving any discrepancies through discussion. The same two review authors then independently assessed the full texts of potentially relevant studies, again resolving discrepancies through discussion. We noted reasons for the non-inclusion of key studies, and report these in the Excluded studies section.

### Data extraction and management

Two review authors independently extracted and summarised study data for each study, using a tailored and pre-piloted data extraction form (for this version of the review, CN and SG). We resolved any discrepancies through discussion. Where available, we recorded the following information in the Characteristics of included studies section.

- Methods: study design, country, study setting.
- Participants: N (intervention/control), specific demographic characteristics (e.g. age, gender), mean cigarettes per day, mean Fagerström Test for Nicotine Dependence (FTND), inclusion criteria, and any relevant exclusion criteria.
- Interventions: description of intervention(s) (treatment, dosage, regimen, behavioural support, duration of intervention, monetary value of incentives), description of control (treatment, dosage, regimen, behavioural support); what comparisons were constructed between which groups, and any concomitant interventions received by intervention and control groups.
- Outcomes: primary outcome; long-term smoking cessation (abstinence, strictest measure); and secondary outcomes; other measures of smoking cessation and reduction, costs, and negative impacts, including adverse events and serious adverse events.
- Notes: we recorded trial funding and declarations of interest of trial authors where reported.

### Assessment of risk of bias in included studies

We evaluated each included study for risks of bias, using the methods described in the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2011). The domains examined for this review include:

- random sequence generation (selection bias);
- allocation concealment (selection bias);
- blinding of outcome assessment (detection bias);
- incomplete outcome data (attrition bias);
- other potential risks of bias.

Two review authors (for this version of the review, CN and SG) independently rated each domain as being at low, unclear, or high risk of bias, with quotations from the study report and reasons to justify our judgements. We have summarised the consensus-agreed risk of bias judgements across different studies for each of the domains listed, and display the summary results in a risk of bias figure (Figure 1). As blinding of participants is not feasible due to the nature of intervention, we do not assess performance bias, as in the standard methods of the Cochrane Tobacco Addiction Review Group (Hartmann-Boyce 2023). We did not assess reporting bias, in line with previous versions of this review.

**Figure 1. Risk of bias summary: review authors' judgements about each risk of bias item for each included study.**

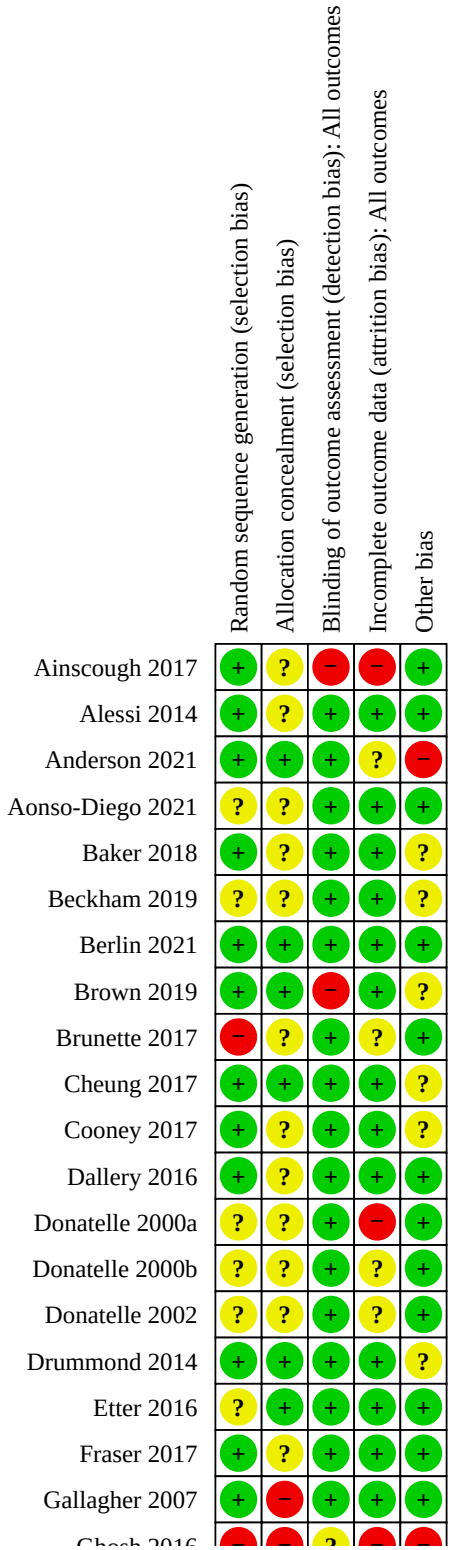


**Figure 1. (Continued)**

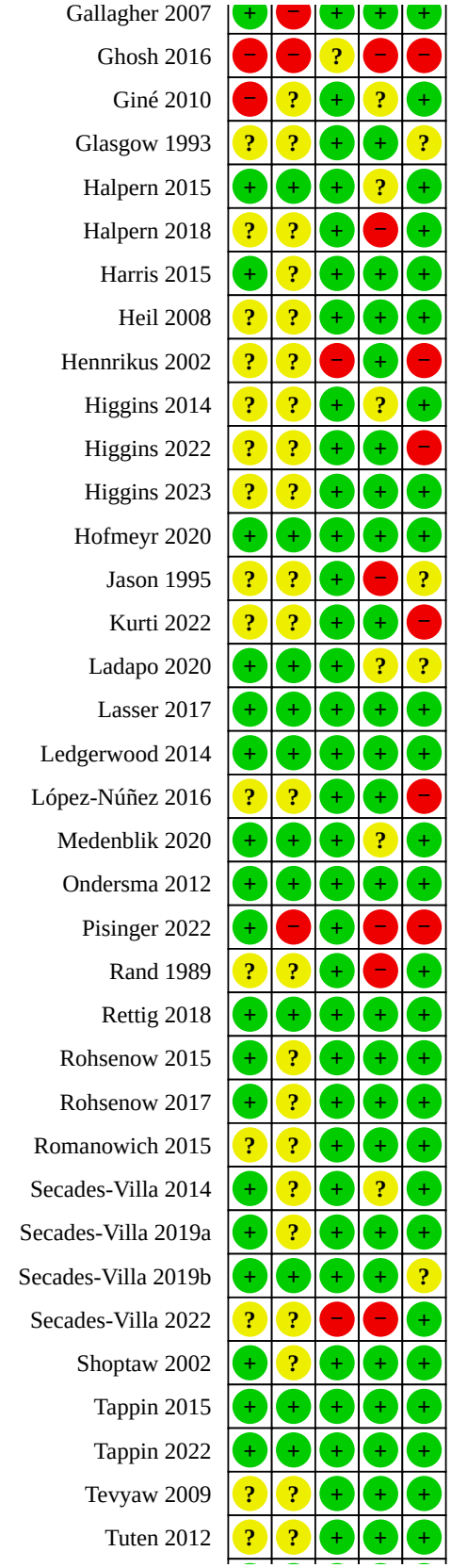
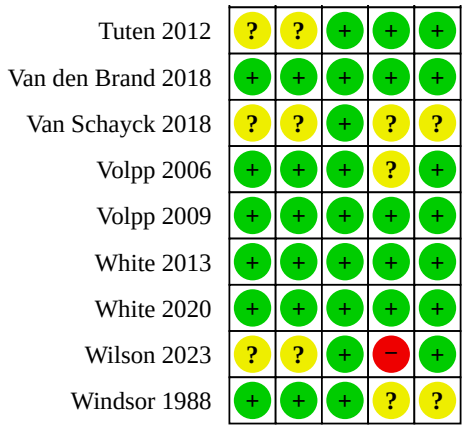


**Figure 1. (Continued)**




### Measures of treatment effect

We report results as risk ratios (RRs) with 95% confidence intervals (CIs), calculated as (number quit in intervention group/number randomised to intervention group)/(number quit in control group/number randomised to control group) where possible. For analysis of cluster-RCTs, we report odds ratios (ORs) with 95% confidence intervals.

### Unit of analysis issues

Several mixed-population studies were cluster-randomised; that is, allocated by group, community, or workplace. In previous versions of the review, we used the intraclass correlation coefficient (ICC) reported by Martinson 1999 (unadjusted ICC for percentage quit smoking in a worksite) to obtain an adjusted estimate of the effect size for the studies that were cluster-randomised and that contributed to our analyses. In this version of the review, where available, we extracted fully adjusted odds ratios with 95% confidence intervals and entered these directly into the review and analyses, in accordance with guidance in the *Cochrane Handbook* (Higgins 2023). If these data were not available, we used the ICC reported by Martinson 1999 to obtain an adjusted estimate.

### Dealing with missing data

We contacted investigators or study sponsors in order to verify key study characteristics and to obtain missing numerical outcome data where possible (e.g. when a study was reported as abstract only).

Where possible, we conducted an intention-to-treat analysis, including all participants randomised. Where possible, we have treated participants who dropped out or who were lost to follow-up after randomisation as continuing to smoke. We note the proportion of participants for whom the outcome was imputed in this way, and whether there was either high or differential loss to follow-up between the groups.

In trials of pregnant people, we have followed the convention observed in most of the trials, and not included in the denominator people whose pregnancies were uncompleted because of termination or foetal death.

### Assessment of heterogeneity

To investigate heterogeneity, we used the $I^2$ statistic, given by the formula $[(Q - df)/Q] \times 100\%$, where Q is the $Chi^2$ statistic and df is its degrees of freedom (Higgins 2003). This describes the percentage of variability in effect estimates that is due to heterogeneity rather than to sampling error (chance). We interpreted the $I^2$ result using the following overlapping bands (Deeks 2023):

- 0% to 40%: might not be important;
- 30% to 60%: may represent moderate heterogeneity;
- 50% to 90%: may represent substantial heterogeneity;
- 75% to 100%: considerable heterogeneity.

Where we found moderate to substantial heterogeneity, we investigated further using subgroup analyses based on study characteristics decided upon through review author consensus. In the event of considerable unexplained statistical heterogeneity (i.e. $I^2$ = 75% or higher), we would have evaluated whether it was still appropriate to report a pooled result (Deeks 2023).

### Assessment of reporting biases

As there are a sufficient number of included studies (10 or more contributing to the primary outcome of long-term smoking cessation), we have created funnel plots for the analyses in studies involving mixed populations (Figure 2) and pregnant people (Figure 3) to assist in identifying possible publication bias, methodological flaws, or small-study effects. We have searched for and reported on studies we know to have been completed, but for which results are unavailable.

**Figure 2. Funnel plot of comparison: 1 Incentives in mixed populations, outcome: 1.1 Smoking cessation (subgrouped by when incentives were provided).**

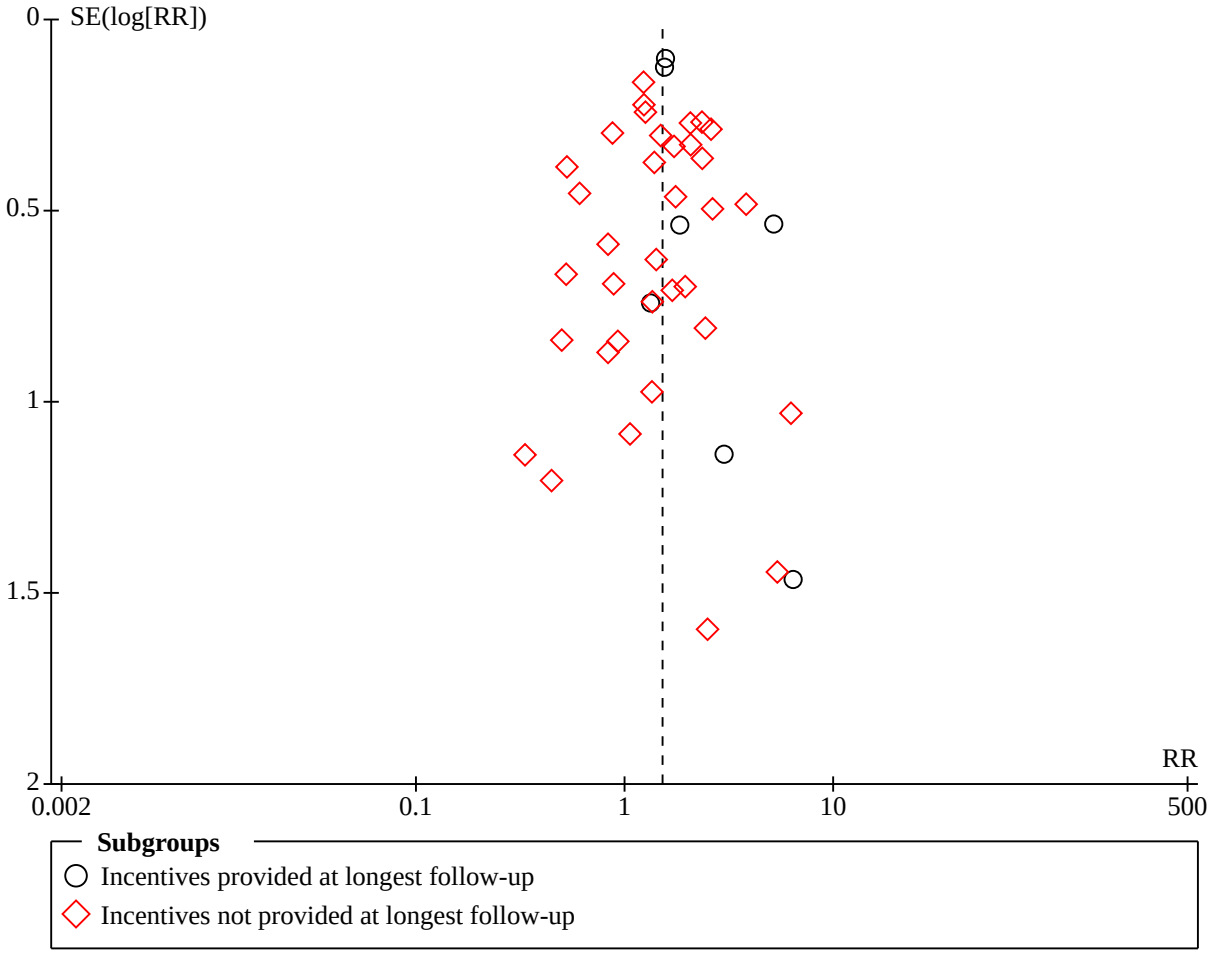
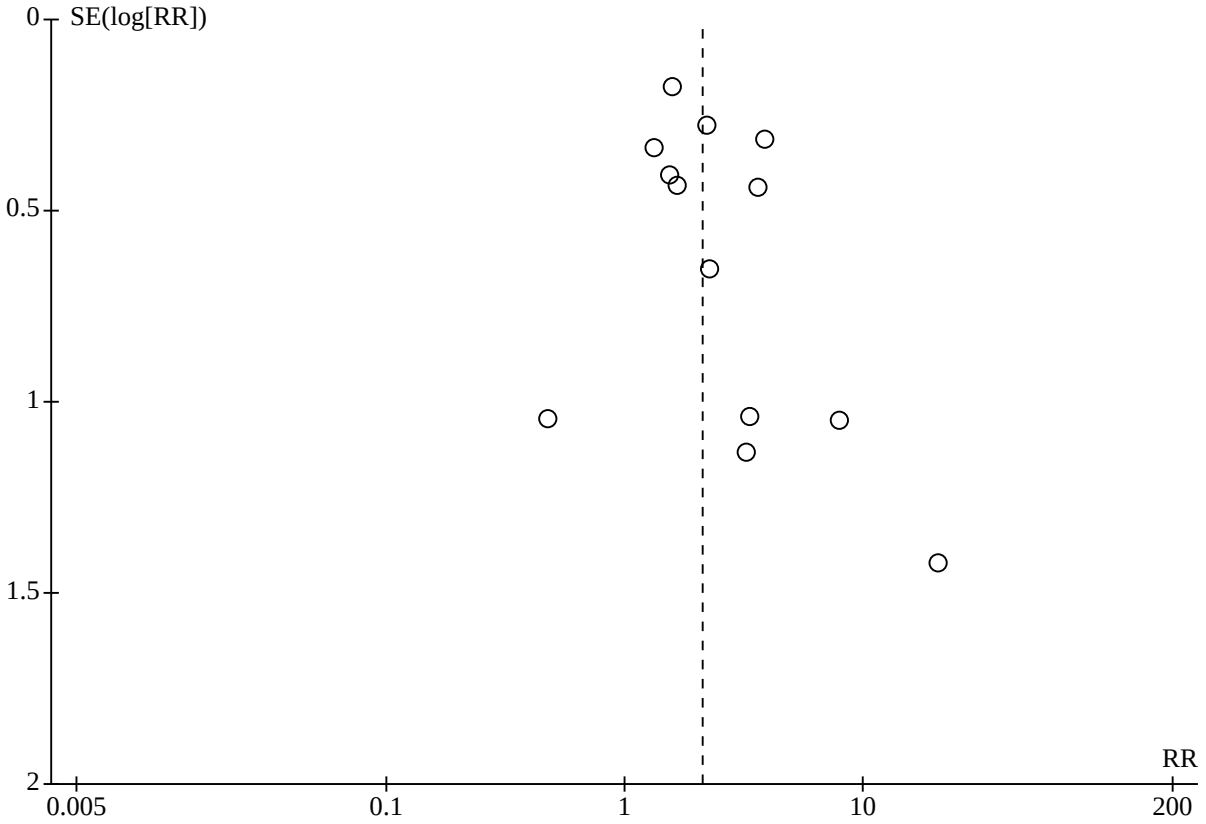


**Figure 3. Funnel plot of comparison: 2. Incentives in pregnant people, outcome: 2.1 Smoking cessation at longest follow-up**




### Data synthesis

For our primary outcome of smoking cessation, we have combined eligible studies using a Mantel-Haenszel random-effects model. We have combined studies carried out in mixed populations separately from those carried out in pregnant people. In both cases, we include an analysis with smoking cessation at longest follow-up as the outcome. For the pregnancy studies, we also include an analysis with smoking cessation at end of pregnancy as an outcome.

We have not combined data on costs or negative impacts, as this information was sparsely and heterogeneously reported. Where reported, we summarise results narratively in the text.

### Subgroup analysis and investigation of heterogeneity

As noted above (Assessment of heterogeneity), we have used the $I^2$ statistic to assess statistical heterogeneity. An $I^2$ value greater than 50% may be considered to indicate substantial heterogeneity.

Ten included studies involved participants who misused substances (nine with sufficient data to be included in analyses). We included this group in the mixed-population analyses, but we also investigated them separately through subgroup analysis as they have been shown to have different barriers and facilitators to smoking cessation from the general population (Gentry 2017).

We also conducted a subgroup analysis to investigate differences between studies providing incentives at longest follow-up and those not.

We analysed 13 pregnancy trials separately (one was excluded from analysis due to insufficient data) from the studies in mixed populations due to different outcome data. These analyses did not require six-month follow-up and explored smoking cessation at longest follow-up, and at least until the end of pregnancy.

We conducted a separate analysis including three new cluster-randomised controlled trials, for our primary outcome smoking cessation at longest follow up in mixed-populations, and where incentives were not provided at longest follow-up. We used the generic inverse-variance random-effects model with the odds ratio (OR) as the summary statistic.

We also ran an exploratory meta-regression to estimate the impact that the incentive amount (converted to equivalent US dollars (USD)) had on the effect estimate (transformed to the logOR) in Stata (Stata/SE 16.1 for Mac) using the 'meta regress' command.

### Sensitivity analysis

We conducted sensitivity analyses testing the effect of removing studies we judged to be at high risk of bias (high risk in at least one domain) and unclear risk of bias (unclear risk in at least one domain) to see if those studies affected the overall result.

### Summary of findings and assessment of the certainty of the evidence

We have created two summary of findings tables to present the following outcomes.

- Mixed-population studies: smoking cessation at longest follow-up (Summary of findings 1).
- Pregnancy trials: smoking cessation at longest follow-up (postpartum where available) (Summary of findings 2).

We (SG and CN) used the five GRADE considerations (study limitations, consistency of effect, imprecision, indirectness, and publication bias) to assess the certainty of the body of evidence as it relates to the studies which contribute data to the prespecified outcomes. We have used methods and recommendations described in the *Cochrane Handbook* (Higgins 2023), using GRADEpro software. We have made comments to aid readers' understanding of the review where necessary.

## RESULTS

### Description of studies

We included RCTs that allocated individuals, workplaces, groups within workplaces, or communities to experimental or control conditions. Included trials recruited from diverse populations, internationally, using a broad range of incentive interventions, from self-incentives/deposits to modest or large-value financial incentives.

#### Results of the search

For this update, we screened the titles/abstracts of 1030 records, and 158 full-text articles. We excluded 105 studies at full-text stage, 49 of which are listed in the Characteristics of excluded studies section. We included 19 new studies in this update, for a total of 62 included studies, across all populations. We identified 34 ongoing trials. The flow of studies for this update is recorded in Figure 4. Where necessary, we contacted study authors for clarification and to request additional information. We contacted five authors and received three replies.

**Figure 4. Study flow diagram, detailing 2024 update**

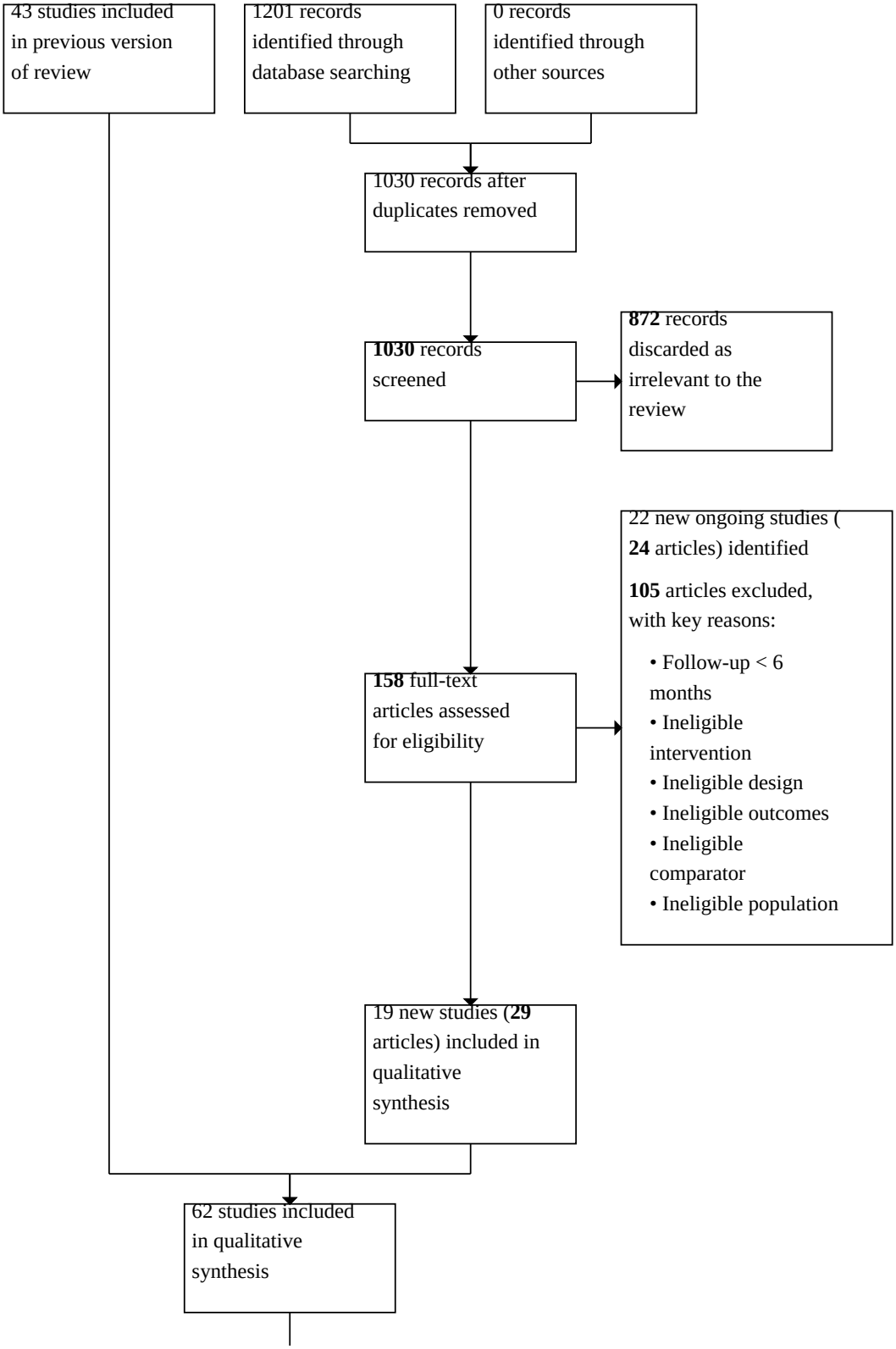
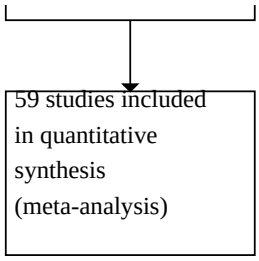


**Figure 4. (Continued)**




## Included studies

### *Interventions in mixed populations*

We retained 33 studies which met our inclusion criteria and were included in the 2019 version of this review (Notley 2019). From our latest searches, we included 15 new trials recruiting mixed populations (different specific participant groups across trials). These include four community-based studies (Brown 2019; Higgins 2023; Pisinger 2022; Secades-Villa 2019b); two trials recruiting from substance-misusing populations (Aonso-Diego 2021; Secades-Villa 2022); two recruiting people with serious mental illness (Medenblik 2020; Secades-Villa 2019a); one workplace-based studies (Van Schayck 2018); one study recruiting motivated people attending a stop smoking clinic (Anderson 2021); one study recruiting university students (Hofmeyr 2020); one study recruiting hospital inpatients (Ladapo 2020); and two studies recruiting veterans (Beckham 2019; Wilson 2023). White 2020 was included in the previous version of the review as White 2018, using unpublished data supplied by the authors. The published version was available for this update. In total, we included 48 mixed-population studies in this update, recruiting more than 21,924 participants.

#### Settings

Ten studies were set in community settings (Beckham 2019; Brown 2019; Cheung 2017; Dallery 2016; Etter 2016; Fraser 2017; Giné 2010; Higgins 2023; Pisinger 2022; White 2013). Seven studies delivered smoking cessation support in clinics (smoking cessation, mental health, head and neck cancer, or primary care) (Anderson 2021; Brunette 2017; Gallagher 2007; Ghosh 2016; Lasser 2017; Rettig 2018; Volpp 2006), and 10 delivered interventions in substance misuse clinics, representing a large subgroup (Ainscough 2017; Alessi 2014; Aonso-Diego 2021; Cooney 2017; Drummond 2014; Rohsenow 2015; Rohsenow 2017; Secades-Villa 2014; Shoptaw 2002; Secades-Villa 2022). The type of substance misuse was mixed, where specified. Four studies delivered the intervention in an academic institution (Hofmeyr 2020; Ledgerwood 2014; Tevyaw 2009; Windsor 1988), and the rest were delivered in worksites, including White 2020 and Van Schayck 2018. Thirty-three of the trials were run in the USA, two in Thailand (White 2013; White 2020), one in the Philippines (Giné 2010), one in Hong Kong (Cheung 2017), and one in South Africa (Hofmeyr 2020). The rest were European.

#### Incentives

Approximately half of studies (22 in total) offered cash for abstinence (contingent rewards), or monetary incentives in the form of vouchers (17 studies). Four studies used entry into a prize draw alongside a guaranteed reward (Cheung 2017; Glasgow 1993; Hennrikus 2002; Ledgerwood 2014). Three studies used self-deposited money as the reward incentive (Brown 2019; Dallery 2016; Giné 2010), and a further four studies used a combination of deposit arms with cash rewards or mixed-rewards arms for abstinence at fixed time points (Halpern 2015; Halpern 2018; White 2013; White 2020). One study used a points system, with points earned being converted to cash (Secades-Villa 2022). Eight further studies included more complex payment schedules, especially with a 'reset' option, meaning that a non-abstinent biochemically-confirmed outcome at any time point would reset the escalating schedule of reinforcement to a lower level, thus reinforcing continued abstinence (Ainscough 2017; Cooney 2017; Drummond 2014; Rohsenow 2017; Secades-Villa 2014; Shoptaw 2002; Tevyaw 2009; White 2020). One new study for this update used mobile phone technology to deliver cash incentives directly to participants' bank accounts (Wilson 2023).

Most of the studies compared the incentive intervention arm to 'usual care', or to another intervention arm with different support options (non-incentives) (Ainscough 2017; Alessi 2014; Anderson 2021; Aonso-Diego 2021; Beckham 2019; Berlin 2021; Brown 2019; Cooney 2017; Drummond 2014; Etter 2016; Gallagher 2007; Ghosh 2016; Giné 2010; Glasgow 1993; Hennrikus 2002; Higgins 2022; Higgins 2023; Hofmeyr 2020; Jason 1995; Kurti 2022; Ladapo 2020; Lasser 2017; Medenblik 2020; Pisinger 2022; Rettig 2018; Secades-Villa 2014; Secades-Villa 2019a; Secades-Villa 2019b; Secades-Villa 2022; Shoptaw 2002; Tappin 2022; Van den Brand 2018; Van Schayck 2018; Volpp 2006; Wilson 2023; Windsor 1988). We combined these controls in our analyses. White 2013 and White 2020 examined different arms offering deposits and varying schedules of bonus payments (individual and team bonuses).

Brunette 2017 compared 'usual care' to quitline support or cognitive behavioural therapy (CBT). Approximately half of participants within each experimental group received incentives. As exact numbers could not be calculated from reported results, we excluded this study from our analysis. We also excluded Secades-Villa 2019b from our analysis as the comparison groups compared two different types of interventions (for shaping cessation versus for abstinence).

Nine studies compared non-contingent incentives to contingent (outcome-related) incentives (Dallery 2016; Fraser 2017; Ledgerwood 2014; Rand 1989; Rohsenow 2015; Rohsenow 2017; Romanowich 2015; Tevyaw 2009; Volpp 2009).

Cheung 2017 compared 'usual care' with two incentive groups – those who were 'early informed' about the incentive intervention,

and those who were 'late informed', so were not initially aware they would receive rewards for abstinence.

Halpern 2015 compared 'usual care', including non-contingent rewards, to individual rewards, as well as to collaborative awards (where rewards were given for peer/buddy abstinence in addition to individual abstinence) and to deposits and team deposits. Halpern 2018 compared 'usual care' and text message support to rewards and redeemable deposits.

#### Cessation methods

Only one trial did not deploy any kind of cessation support programme alongside incentives being offered (Glasgow 1993). Most of the trials included self-help support of brief advice at a minimum for the usual-care control group. Sixteen trials included nicotine replacement therapy or pharmacotherapy to support their participants (Ainscough 2017; Anderson 2021; Beckham 2019; Brown 2019; Brunette 2017; Cooney 2017; Gallagher 2007; Halpern 2015; Halpern 2018; Higgins 2023; Ladapo 2020; Medenblik 2020; Rohsenow 2015; Rohsenow 2017; Romanowich 2015; Shoptaw 2002; Volpp 2006; Wilson 2023). Halpern 2018 also offered an electronic cigarette option to some participants as part of the smoking cessation intervention.

Most of the included studies used some form of multicomponent support programme, by combining, for example, self-help and brief advice, with pharmacotherapy. Dallery 2016 and Etter 2016 offered online support, and Halpern 2018 used motivational text messages to offer digital support to trial participants. Jason 1995 combined self-help with a buddy system. Drummond 2014 provided motivational feedback on 'lung age' to promote cessation. Brown 2019, Pisinger 2022, and Wilson 2023 referred participants to recommended support from stop-smoking services, and Higgins 2023 referred participants to 'best practice' routine support. Van den Brand 2018, Van Schayck 2018, White 2013, and White 2020, which were workplace or community-based studies, used group interventions, including group-based 'pledges' for abstinence or peer pairing, thus employing peer pressure/motivation as part of the intervention. However, White 2020 reported that the size of the worksites did not lend itself to the strategy for pairing teammates. Many teammates did not know each other, and did not interact during the study period.

#### Outcomes

All the included studies rewarded smoking cessation, either alone or in combination with recruitment, participation, or both (see the Characteristics of included studies table for full details).

For this update, we found the newly included trials to be more clearly reported than older trials. Twenty-four trials followed participants for a maximum of six months (Ainscough 2017; Alessi 2014; Anderson 2021; Aonso-Diego 2021; Beckham 2019; Brown 2019; Cheung 2017; Cooney 2017; Dallery 2016; Drummond 2014; Fraser 2017; Ghosh 2016; Hofmeyr 2020; Ladapo 2020; Ledgerwood 2014; Medenblik 2020; Rand 1989; Romanowich 2015; Secades-Villa 2014; Secades-Villa 2019a; Tevyaw 2009; Van Schayck 2018; Volpp 2006; White 2013), one for nine months (Gallagher 2007), 18 for twelve months (Brunette 2017; Giné 2010; Halpern 2015; Halpern 2018; Higgins 2023; Lasser 2017; Pisinger 2022; Rettig 2018; Rohsenow 2015; Rohsenow 2017; Secades-Villa 2019b; Secades-Villa 2022; Shoptaw 2002; Van den Brand 2018; Windsor 1988; White 2020; White 2020; Wilson 2023), two for 18 months (Etter 2016; Volpp 2009), and three for 24 months (Glasgow 1993; Hennrikus 2002; Jason 1995). Most of the more recent studies included 12-month follow-up as the standard primary outcome time point.

Few studies formally reported on harms or costs; where reported, we present them narratively below.

### *Interventions in pregnancy*

As in previous versions of this review, we included trials conducted in pregnant people as a separate group. We retained 10 trials included in the last update (Notley 2019). In our updated searches, we found four new completed pregnancy trials that met our inclusion criteria (Berlin 2021; Higgins 2022; Kurti 2022; Tappin 2022). Baker 2018 remains the largest trial investigating incentives for smoking cessation in pregnancy yet reported, recruiting 1014 pregnant women in the USA, and so contributes considerably to the growing evidence base. Two newly included studies were also large studies, conducted in France (Berlin 2021) and the UK (Tappin 2022), respectively. Thus, in this update, we have included a total of 14 trials (4016 participants) recruiting pregnant people who smoke.

#### Settings

Eleven studies were conducted in the USA, mostly in public or private antenatal clinics, obstetric practices, and community antenatal programmes. One of the new trials was conducted remotely, using an app for intervention delivery and verifying abstinence remotely (Kurti 2022). One newly included trial was conducted in France (Berlin 2021 – the first non-UK European trial to be reported for this population). Tappin 2022 was a large, phase 3 implementation trial embedded within English and Scottish stop-smoking services, following the earlier UK trial (Tappin 2015).

#### Incentives

The largest pregnancy trial provided cash payments as the incentive (Baker 2018), and the recent Kurti 2022 trial gave cash payments via a mobile phone app. In all other cases, the rewards were vouchers for goods or services. Three trials delivered monthly rewards contingent upon proven abstinence (Donatelle 2000a; Donatelle 2000b; Donatelle 2002). Five trials evaluated the allocation of incremental rewards, with the voucher reset to baseline value in the case of relapse or missed visits, but restored to previous levels if abstinence was re-established (Harris 2015; Heil 2008; Higgins 2014; Higgins 2022; Tuten 2012). Higgins 2022 also offered up to USD 65 in incentives for completing calls, in addition to incentives for abstinence. Berlin 2021 offered a similar escalating schedule of incentive vouchers for confirmed abstinence, but without the reset. Berlin 2021, Baker 2018, and Fraser 2017 also gave vouchers to both trial groups for visit attendance, aside from abstinence verification. Ondersma 2012, using a computer-based intervention, shifted the onus of testing to the participants, who could present themselves as often as they wished for verification of abstinence, and could win up to five USD 50 gift cards over the course of the programme. Harris 2015 also offered the option of web-based confirmation of biochemical validation of abstinence, and Kurti 2022 included remote abstinence verification. Tappin 2015 awarded vouchers up to a value of GBP 350 (pounds sterling) for achieving staged cessation targets, and a further GBP 50 for engaging with the programme and setting a quit date. Similarly, the more recent Tappin 2022 trial gave incentives at fixed time points throughout pregnancy, with the final voucher payment in late pregnancy. Donatelle 2000a also rewarded a social supporter,

in tandem with the participant smoker. Non-contingent rewards, roughly equivalent to the value available to the intervention group, were given to control participants in three of the older trials (Baker 2018; Heil 2008; Higgins 2014), while Tuten 2012 incorporated a group on a schedule of non-contingent rewards generated from an earlier pilot study. Donatelle 2000a gave a USD 5 voucher to all participants for each of three attendances during the trial.

#### Cessation methods

All the trials (apart from Glasgow 1993) offered a programme of practical cessation support, in addition to the routine care delivered by the host clinics or in community services. Three trials used the 5As approach (Ask, Advise, Assess, Assist, Arange) (Donatelle 2000b; Donatelle 2002; Ondersma 2012), while five trials offered self-help materials. Tuten 2012 also included a brief motivational interviewing feedback session for all participants. Higgins 2022 and Kurti 2022 referred all participants to 'best practice' services, which included a maximum of five brief phone calls with a quit coach antepartum and four postpartum. Women were eligible for free nicotine replacement if their medical provider agreed. Harris 2015 offered a web-based smoking cessation programme in addition to telephone support. The UK trials referred all participants to UK stop-smoking services (Tappin 2015; Tappin 2022), which routinely conducted a one-hour cessation session, four weekly phone calls, and provided free NRT if the women chose to use it.

#### Outcomes

All the included studies reported abstinence at the end of pregnancy, with nine of the 14 tracking participants into the postpartum stage. Two trials referred simply to "abstinence", without further definition of the type or duration (Donatelle 2000b; Donatelle 2002). In all cases, rewards were available only for biochemically-verified abstinence. Two trials rewarded smoking reduction as well as complete abstinence, with Tuten 2012 setting percentage reduction targets to be met for rewards, while Higgins 2014 allocated higher-value vouchers for breath samples below 4 parts per million (ppm) rather than 6 ppm in the early stages of the trial. Our primary outcome of interest for this group is abstinence at the longest available assessment point (which allows us to be the most inclusive in terms of studies included in the analysis); we also report abstinence rates at or around the end of pregnancy for all the trials which had these data.

Few studies formally reported on harms or costs; where reported, we describe these below.

### Excluded studies

We list 49 excluded studies in the Characteristics of excluded studies table. The main reasons for exclusion were: ineligible study design; not following participants for at least six months; and for testing an intervention where the effect of the incentive component could not be separately evaluated.

### Ongoing studies

In this update, we have identified a total of 34 ongoing studies from published protocols and trials registries.

## Risk of bias in included studies

Overall, we judged 12 studies to be at low risk of bias (rated as 'low risk' across all domains), and 18 to be at high risk of bias (rated as 'high risk' in at least one domain), with the rest at unclear risk. Assessments of the risk of bias domains for each study are shown in Figure 1.

### Mixed-population studies

In the mixed population studies, we judged eight studies to be at low risk of bias, and 16 to be at high risk of bias, with the rest at unclear risk.

### Pregnancy studies

In the pregnancy studies, we judged four studies to be at low risk of bias, two at high risk of bias, and eight at unclear risk of bias.

### Allocation

Of the 48 mixed-population studies, we judged 22 to be at low risk of selection bias (low risk for both random sequence generation and allocation concealment). We judged five to be at high risk of selection bias, due to issues with either random sequence generation, allocation concealment, or both (Brunette 2017; Gallagher 2007; Ghosh 2016; Giné 2010; Pisinger 2022). We judged the remainder to be at unclear risk of selection bias, due to insufficient information on which to judge.

Of the pregnancy studies, we judged two to be at low risk of selection bias (low risk for both random sequence generation and allocation concealment). We judged the remainder to be at unclear risk due to insufficient detail reported.

### Blinding

Of the mixed-population studies, we rated most to be at low risk of detection bias, because biochemical measures were used to verify abstinence. Because of the explicit mechanism of rewards, most of the reported trials did not attempt to blind participants, trialists, or assessors. In Ainscough 2017, major study problems were encountered, and investigators did not follow up any participants at the primary endpoint. Hennrikus 2002 and Brown 2019 did not validate the abstinence of all participants claiming abstinence, and Secades-Villa 2022 was not able to gain biochemically-validated outcomes due to the coronavirus pandemic. We therefore judged these three trials to be at high risk of bias for this domain. We judged Ghosh 2016 to be at unclear risk, as authors provided limited detail on the method of validation used.

We judged all the studies in pregnant people to be at low risk of detection bias, because each study used biochemical validation of abstinence.

### Incomplete outcome data

In our analysis of all included studies, we treated programme dropouts and losses to follow-up as continuing smokers, whether or not the trial reported results in this way. We conducted the analyses on an intention-to-treat basis; that is, the denominator included all persons randomised at the start of the trial in their original groups. Of the mixed-population studies, we considered 30 trials to be at low risk of bias for this domain.

In accordance with standard Cochrane Tobacco Addiction Group methods for assessing attrition bias, we rated eight studies at high risk of bias in this domain, due to high or differential rates of dropout (Ainscough 2017; Ghosh 2016; Halpern 2018; Jason 1995; Pisinger 2022; Rand 1989; Secades-Villa 2022; Wilson 2023, and 10 as unclear, as there were insufficient details available on which to make a judgement for this domain.

Of the included pregnancy studies, we rated 10 at low risk of bias for incomplete outcome data. Three were unclear due to insufficient detail. We ranked Donatelle 2000a at high risk of attrition bias, as it had lost 36% of the intervention group by two months postpartum, and 52% of the control group, although the authors report that this level of depletion was not unusual for the antenatal clinic in question.

Although we routinely prefer to conduct an intention-to-treat analysis (including all participants randomised), for these trials we have excluded from the denominators any predefined withdrawals due to termination or foetal demise, where these were reported. Tappin 2015 excluded three control participants from the denominator, as they had withdrawn immediately after randomisation and had withheld their data from inclusion in analyses; we have adjusted our calculations accordingly.

### Selective reporting

We did not assess reporting bias, in line with previous versions of this review.

### Other potential sources of bias

We judged five mixed population studies to be at high risk of other biases. Anderson 2021 did not report outcomes aside from odds ratios. We rated Ghosh 2016 at high risk of bias due to inconsistent reporting of length of follow-up, and Hennrikus 2002 at high risk of bias as group dropouts were not followed up. We assessed Pisinger 2022 as being at high risk of bias due to the attrition rate exceeding 50%, with a higher rate in the control group than in the intervention group, and López-Núñez 2016 did not report outcome data for extraction.

In order to test the robustness of the cessation interventions, we have included in our review only those studies which followed up participants for at least six months from the beginning of the intervention. However, seven of the trials delivered their final cessation rewards at the same time point as the end of the designated follow-up period, thereby potentially confounding the intervention rewards with testing at the longest follow-up (Drummond 2014; Fraser 2017; Gallagher 2007; Ghosh 2016; Ladapo 2020; Lasser 2017; Van den Brand 2018). A sensitivity analysis considering these trials separately made no relevant difference to the overall combined outcomes.

In the included pregnancy studies, we judged Kurti 2022 to be at high risk of other bias as the study was underpowered due to a lower sample size than reported in the protocol. We also judged Higgins 2022 to be at high risk of other potential bias as they did not report absolute numbers in the study paper; we extracted the percentages who quit from a graph.

## Effects of interventions

See: **Summary of findings 1** Incentives versus no incentives for smoking cessation in mixed populations at longest follow-up; **Summary of findings 2** Incentives versus no incentives for smoking cessation in pregnant people at longest follow-up

### Mixed-population studies

#### *Cessation*

Details of the results for the 48 mixed-population studies included in this review are tabulated in Table 1, and are displayed graphically for the 39 RCTs with available data in Analysis 1.1. For five multi-armed studies in this comparison, we combined two intervention/incentive group arms and compared their results to a control arm (Brown 2019; Cheung 2017; Halpern 2018; Higgins 2023; Romanowich 2015). For further details, see individual study tables (Characteristics of included studies).

We conducted a meta-analysis of 39 included studies for which there were sufficient data (Analysis 1.1). We excluded Ainscough 2017, Brunette 2017, and Hennrikus 2002 from formal analyses because no extractable data were available on programme participants at follow-up. We also excluded Secades-Villa 2019b as the trial compared two incentive interventions with no comparator group.

The primary result at longest follow-up (six months or more) gave a risk ratio (RR) for quitting with incentives compared with controls of 1.52 (95% confidence interval (CI) 1.33 to 1.74; $I^2$ = 23%; 39 studies, 18,303 participants; high-certainty evidence; Analysis 1.1). We also present this analysis in Summary of findings 1, with a grading of the certainty of the evidence as high.

To explore the effect of incentives offered up until the long-term follow-up point (six months or more) compared to those where the longest follow-up occurred after the incentive schedule had ended, we carried out a subgroup analysis. There was no significant difference in the results found between groups (P = 0.36, $I^2$ = 0%; Analysis 1.1). Restricting results to only those studies which followed up beyond the provision of incentives yielded a statistically and clinically significant effect in favour of the intervention (RR 1.46, 95% CI 1.23 to 1.73; $I^2$ = 26%; 32 studies, 15,082 participants; Analysis 1.1.2), suggesting that the impact of incentives continues for at least some time after incentives are no longer provided. In the group of studies where incentives were provided at longest follow-up (all at six months, apart from Lasser 2017 who provided incentives for up to 12 months), the result was similar (RR 1.63, 95% CI 1.38 to 1.93; $I^2$ = 5%; 7 studies, 3221 participants; Analysis 1.1.1).

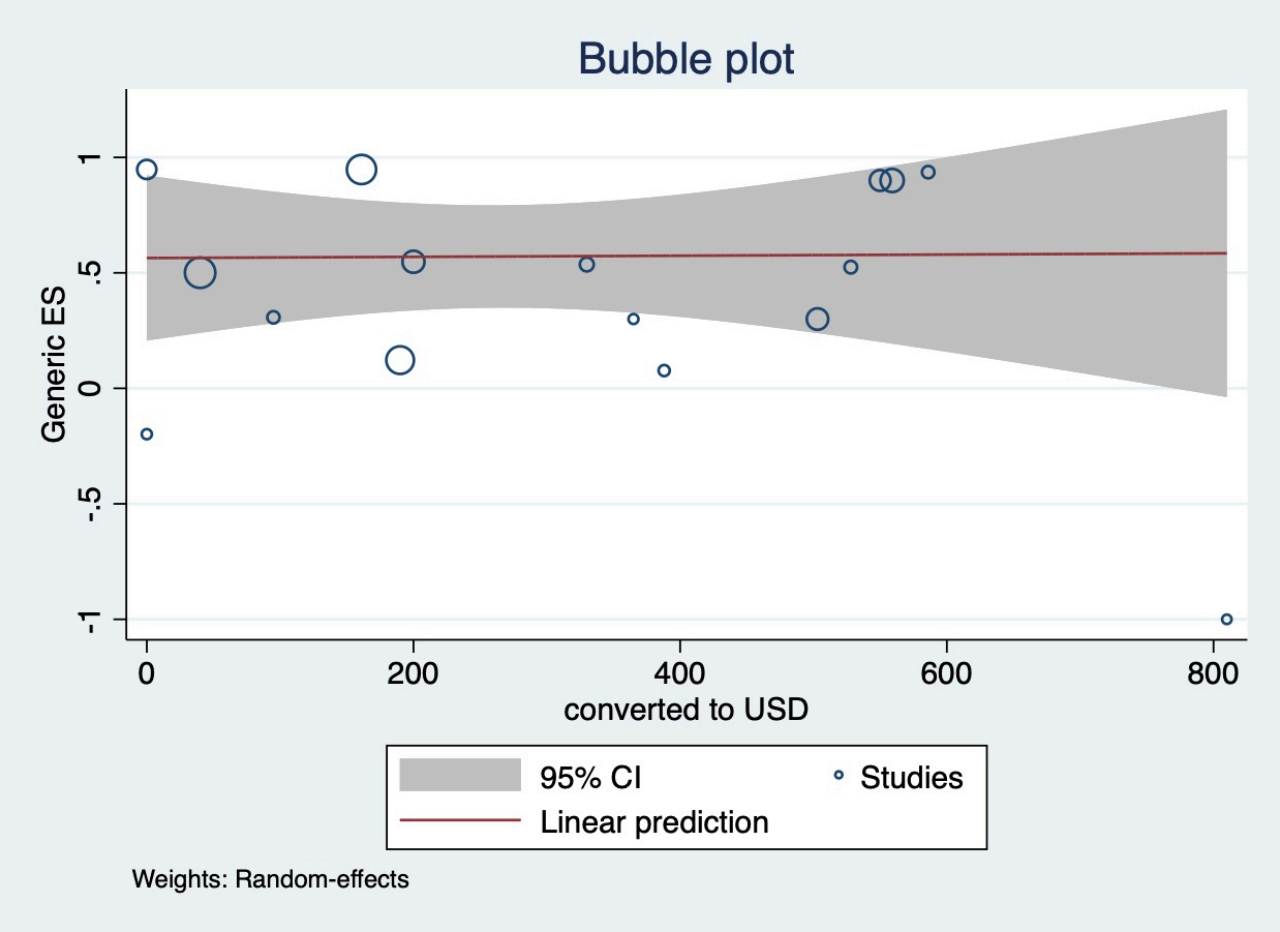
In a subgroup analysis of trials recruiting participants in substance misuse treatment, results also suggested a favourable benefit of incentives for smoking cessation at longest follow-up (no significant subgroup difference (P = 0.25, $I^2$ = 24.6%)) (RR in substance misuse subgroup 1.22, 95% CI 0.82 to 1.82; $I^2$ = 0%; 9 studies, 1152 participants; Analysis 1.2). Although confidence intervals are wide, reflecting the smaller number of studies and participants in this group, the point estimate was consistent with the overall meta-analysis, which found a beneficial effect of the intervention.

We conducted a separate analysis including three new cluster-RCTs (Pisinger 2022; Van Schayck 2018; White 2020), and one study which only reported an odds ratio (Anderson 2021). The pooled odds

ratio was 1.57 (95% CI 1.37 to 1.79; $I^2$ = 30%; 43 studies, 23,960 participants; Analysis 1.3).

Although not always clearly reported, the financial amounts of incentives varied between trials, from zero (self-deposits, from participants' own resources) to a range between USD 45 up to USD 1185 (from study funds). In our last review update (Notley 2019), we found no clear difference between trials offering low or high total amounts of incentives. A meta-analysis and meta-regression was conducted including all the newly identified studies for which there were sufficient data (n = 16). We found no significant association between the estimate of effect and the total value of the financial incentive (Figure 5). There was little heterogeneity in the estimates for these studies, so it was difficult for the incentive amount variable to help explain the differences between the studies, which showed no significant association (P = 0.963). Any such indirect comparison is particularly crude in this context, due to differences in the cultural significance of financial amounts (e.g. USD 50 might have different significance in different contexts). Outcomes were also similar for the three trials using self-deposits as the incentive reward (Brown 2019; Dallery 2016; Giné 2010).

**Figure 5. Exploratory meta-regression testing association between incentive amount and effect estimate**




Cheung 2017, a large trial recruiting from a community sample in Hong Kong as part of the 'Quit to win' contests, specifically examined the effect of small-value financial incentives. They tested incentives where participants were 'early informed' against a group of participants who were 'late informed' about the incentive offer. There was no statistically significant difference in biochemically-validated abstinence rates between the early-informed and late-informed groups. Overall, there was a beneficial effect of the small financial incentive offer across both intervention groups when compared to a control group who were not offered an incentive.

The two largest trials included in this review update specifically evaluated financial incentives against deposit-based incentives. Halpern 2018 found both deposits and incentives to be effective for long-term smoking cessation, but no significant differences between the two forms of incentivisation (2% in the rewards group (95% CI 1.2 to 2.8) versus 2.9% in the redeemable deposit group (95% CI 2.0 to 3.8)) and a very high loss to follow-up. Similarly, White 2020 found that both were effective and reported that "Deposit programs had a negligible effect on abstinence compared with no-deposit programs (0.8 points, 95% confidence interval -0.27 to 4.3, P=0.65)".

By far the largest trial amongst the included studies is White 2020, a nine-arm cluster-RCT recruiting 4190 participants drawn from employees at large workplaces in the Bangkok metropolitan area (101 worksites from 84 Bangkok-area companies). The interventions were individual bonuses, team bonuses, self-deposits, and deposits plus bonuses (individual and team). The total incentive available varied by arm, and was equivalent to

USD 20 (TBH 600 (Thai baht)) in arms that offered a smaller bonus (including the arm that combined a smaller bonus with deposits), and USD 40 (THB 1200) in the arms that offered a larger bonus (including the arm that combined a larger bonus with deposits and the arms with a team bonus). Bearing in mind that Thailand is a middle-income country, the amounts given were relatively small compared to some of the other studies. Incentives were provided up until the end of the three-month intervention period. All incentive arms did significantly better than the usual-care control group at the study's 12-month primary endpoint of validated sustained abstinence. As there were no significant differences between the individual- and group-based arms and no significant differences between deposit- or reward-based arms, we used the reported combined effect of the eight intervention arms as a single group compared against the single control (incentives versus control) for our analyses.

We conducted a sensitivity analysis removing studies at high risk of bias (high risk in at least one domain) from the overall meta-analysis for mixed populations. This resulted in an RR of 1.51 (95% CI 1.28 to 1.78; $I^2$ = 29%; 30 studies, 11,863 participants), which still clearly favours incentives. Removing both those studies at high and at unclear risk (unclear in at least one domain) also yielded a statistically significant benefit in favour of the intervention (RR 2.12, 95% CI 1.50 to 3.37; $I^2$ = 35%; 7 studies, 2199 participants).

We constructed exploratory funnel plots for the main meta-analysis for mixed-populations (Figure 2; Analysis 1.1, abstinence at longest follow-up) and pregnant people (Figure 3; Analysis 2.1, abstinence at longest follow-up), with no clear evidence of publication bias.

### *Costs*

Few studies reported on costs. Amongst all participants in Halpern 2015 achieving sustained abstinence at six months, the average cost per quitter ranged from USD 800 to USD 890. The trialists compared this outlay, even without any deposit contribution from the participant, to the estimated USD 5816 additional cost to employers of hiring someone who smokes rather than a non-smoker in the USA (Berman 2014), and rated the intervention highly cost-effective. Volpp 2009 offered no comment on potential cost benefits of incentive programmes, other than to report an estimate of savings per quitter to an employer (USD 3400 per year, MMWR 2002). White 2013 reported that the intervention, if rolled out to the smoking population in the study area, could translate to a decrease in smoking prevalence of 2% to 5%, and offered an incremental cost-effectiveness analysis. The authors estimate that the cost per quitter from the intervention was USD 281 (95% CI USD 187 to USD 562), compared with quitting with nicotine gum USD 1780 (95% CI USD 1414 to USD 2401) or with varenicline USD 2073 (95% CI USD 1357 to USD 4388) in Thailand. The authors note that the intervention complies with the World Health Organization's ranking of "very cost-effective" in Thailand; that is, less than gross domestic product (USD 8600, purchasing power parity-adjusted in 2011; World Bank 2012). Fraser 2017 reported that the overall cost per quitter for control group participants was on average USD 4268.26 while incentive group participants averaged USD 3601.37 per quit. In a linked cost-effectiveness study (Mundt 2019), the incremental cost-effectiveness ratio (ICER) was USD 2316, comparing favourably with other smoking cessation interventions. Halpern 2018 reported the cost per successful quitter to be USD 7797.52 where free cessation aids were provided, compared to USD 3623.13 per quitter for the incentive group participants, and USD 3461.47 for the redeemable deposit group. Rettig 2018 did not report formal cost-effectiveness data, but reported that “Over-the-counter nicotine replacement therapy was provided for free (estimated cost per participant USD240)” compared with low-cost overall incentives (exact cost not reported). Wilson 2023 reported the overall cost for each person in the incentive group to be USD 618, compared to USD 226 for standard care, which was estimated to cost an additional USD 1133 per quality-adjusted life-years (QALY) saved.

### *Harms, negative impacts*

Few studies formally evaluated harms or negative impacts of incentives specifically. Potential harms evaluated were attributable to smoking cessation itself or judged not attributable to the intervention. Gallagher 2007, reporting on an intervention in 180 people with schizophrenia or other serious mental illness, briefly considered whether smoking cessation may have worsened the participants' psychiatric symptoms, but found no evidence for this at the end of the intervention or at 36-week follow-up, using the Brief Symptom Inventory. However, the authors caution against placing too much weight on this finding, because of low power within the study to detect such differences. Alessi 2014 reported one participant was hospitalised for alcohol-related heart, liver, and lung problems, considered by the trialists not to be associated with the intervention programme. Brunette 2017, recruiting from a community mental health clinic, reported that 25 participants (4%) experienced a serious adverse event: 16 were hospitalised for psychiatric exacerbations, seven were hospitalised for medical reasons (pneumonia, lung cancer, and heart attack), and five study participants died. However, it is not clear whether these events were related in any way to the intervention. Cheung 2017 speculated that incentive-based interventions leading to 'cheating' or 'gaming' by participants may have occurred, in an attempt to 'play the system' to receive financial rewards. They suggest that 'loose' inclusion criteria for the study might have led to the inclusion of low-rate/non-daily/light smokers who might simply stop smoking for a day in order to win. Such 'cheating' was possible, but was not evaluated. Secades-Villa 2022 recruited participants in treatment for substance misuse. They reported no negative consequences of tobacco smoking abstinence on substance misuse abstinence, suggesting that tobacco smoking abstinence also had a positive impact on substance use abstinence outcomes. None of the other included studies reported on any harms, unintended consequences, or adverse events associated with the interventions. However, we consider in the Discussion section the implications of systematic deception in participants seeking to obtain unmerited rewards for abstinence, and other potential negative impacts of incentive-based interventions.

## Pregnancy studies

### *Cessation*

Table 2 presents results at longest follow-up (up to 48 weeks postpartum) for 13 of 14 included pregnancy studies. Eleven studies were conducted in the USA, one in France, and two in the UK. These results are displayed graphically where data were available in Analysis 2.1 and Figure 3. One trial could not be included in the meta-analysis: the MISS Project reported interim results only; that is, for 298 women from a projected total of 600 (Donatelle 2002). We were unable to obtain further information on final numbers, or on quit rates achieved at any point.

The trials demonstrated a clear benefit for the incentives groups over the controls. Taken together, the 13 trials with usable data delivered a risk ratio at longest follow-up of 2.13 (95% CI 1.58 to 2.86; $I^2$ = 31%; 13 studies, 3942 participants; high-certainty evidence; Analysis 2.1), in favour of incentives. This effect persisted in a sensitivity analysis removing three studies at high risk of bias (Donatelle 2000a; Higgins 2022; Kurti 2022) (RR 2.02, 95% CI 1.46 to 2.81; $I^2$ = 32%; 10 studies, 3469 participants).

Analysis of follow-up to the end of pregnancy only suggested a stronger effect of incentives for smoking cessation. Ten included trials measuring cessation at this time point delivered a risk ratio at end of pregnancy of 2.78 (95% CI 2.20 to 3.50; $I^2$ = 0%; 10 studies, 1965 participants; Analysis 2.2).

We were unable to ascertain with any certainty whether the size of the rewards made a difference to outcomes, due to a paucity of relevant data. Three trials addressed whether contingent rewards were more effective than non-contingent fixed payments (Heil 2008; Higgins 2014; Tuten 2012). In these trials, scaled payments were given only as a reward for validated abstinence (contingent), while fixed payments were guaranteed, provided that the participant attended and gave a biological sample, irrespective of her smoking status. All three trials favoured conditional over non-conditional payments, with an RR of 3.33 (95% CI 0.97 to 11.38; $I^2$ = 18%; 3 studies, 225 participants; Analysis 2.3). None of the included trials compared an incremental with a fixed schedule, where both were payable only for validated abstinence; in other words, testing the role of variable rewards rather than contingency.

#### *Costs*

Whilst confirming that they had not conducted a cost-benefit analysis, Heil 2008 reported that the average cost of the incentives per participant was USD 334. Tappin 2015 reported that the short-term incremental cost per quitter was GBP 1127, with an incremental cost per quality-adjusted life-year of GBP 482. The National Health Service (NHS) lower threshold is GBP 20,000, designated by the National Institute for Health and Care Excellence (NICE 2018) as an indicator of cost-effectiveness (Tappin 2015), suggesting that "financial incentives for smoking cessation in pregnancy are highly cost-effective" (Boyd 2016). A recent cost-effectiveness analysis of the later Tappin 2022 trial found financial incentives to be cost-saving and improve health outcomes, with an incremental cost per quitter of GBP 4400 and cost per QALY of GBP 150,000 (McKeekin 2023). Similarly, a cost-effectiveness analysis of Baker 2018 reported incremental cost-effectiveness of incentives to be USD 3399 per pregnant person who quits smoking (Mundt 2021). The remaining included studies in pregnant people did not report on costs.

#### *Harms, negative impacts*

None of the included pregnancy trials reported on harms or unintended consequences of the interventions, although Tappin 2015 offered some evidence on the likelihood of the participants 'gaming' to receive unmerited rewards. We consider this further in the Discussion section below.

## DISCUSSION

### Summary of main results

Overall, there is high-certainty evidence that incentives improve smoking cessation rates at the longest follow-up in mixed-population studies (Summary of findings 1). With this update, the evidence available for the pregnancy trials is now of high certainty, confirming the efficacy of incentives at longest follow-up, at or around the end of pregnancy (Summary of findings 2). This is a change from the previous version of the review (Notley 2019), in which the evidence for pregnancy studies was of moderate certainty.

Previous reviews of incentive-based interventions for smoking cessation have expressed concerns that the effect of incentives may be time-limited. This would conform to a simplistic learning theory-based explanation, that rewards are effective when consistently offered, but that the effect of the reward may be 'extinguished' when rewards cease. With regard to smoking cessation, where individuals may initially find quitting difficult but may adapt over time to this change, offering rewards that can initiate cessation seems to suggest that the long-term effect overall may be maintained. This is plausible, because the incentives serve to support the initial, most difficult weeks (or months) of a quit attempt and the risk of relapse reduces over time. Findings from our meta-analysis in mixed populations suggest that incentives continue to have a significant impact on sustained smoking cessation, even after they have finished.

In our updated searches, we identified two new trials that recruited people who misused substances (Aonso-Diego 2021; Secades-Villa 2022), and three new trials recruiting people with serious mental illness (Medenblik 2020; Secades-Villa 2019a; Secades-Villa 2019b). This suggests that there is increasing focus and attention being paid to the importance of smoking cessation for these populations, and incentives may offer a promising intervention strategy for these groups, amongst whom smoking rates remain high (Gentry 2017). Our subgroup analysis combining results from all studies in people receiving substance misuse treatment suggested a positive benefit of incentives (Analysis 1.2.1): confidence intervals were wide, but results were consistent with the overall finding of a positive effect. One recent trial also recruited homeless veterans (Beckham 2019). The incentives approach may be important for people experiencing homelessness, for whom financial rewards may be especially meaningful.

We narratively explored the value of incentives offered across studies. We considered undertaking subgroup analysis but concluded that this would not be possible. The amounts offered varied considerably, and it was not possible to group trials broadly into 'low value' or 'high value' incentive categories, because of the studies' diverse cultural settings and because it was not possible to establish the 'meaning' of the total amount of incentives offered to participants. We did conduct a meta-regression including all the newly identified studies, which found no significant association between outcome and the total value of financial incentives. However, any such direct comparison is crude, given the varying cultural contexts. Even a small financial incentive offered to a factory worker in rural Thailand may be highly valuable and meaningful to individual participants. From the available evidence, we cannot conclude whether the value of the financial incentive has a discernible impact on the effectiveness of the intervention; this

is therefore a question that future iterations of this review might seek to explore further. A possible approach would be to evaluate incentive size as a percentage of mean study participant income, but the most valuable data would come from studies directly comparing different incentive amounts, as then the population would not be a confounder.

The deposit-refund trials merit particular attention, in light of the discussions that have emerged from the Volpp 2009 study about whether the programme could be implemented in a real-world setting. If implementation of an incentives programme is compromised by the costs incurred, then the model of participants depositing and forfeiting their own money is likely to be more attractive to employers and institutions seeking affordable behaviour change interventions. Although effect estimates appear to be consistent between deposit-based and traditional reward schemes, low uptake rates in deposit-based schemes compared with reward-based interventions may limit the appeal and efficacy of such programmes (Volpp 2014). Both White 2013 and Giné 2010 report a low participation rate among eligible smokers. However, a recent UK trial reported a much improved participation rate, with nearly 50% of those screened for eligibility taking part in the trial (Brown 2019), demonstrating that, for motivated populations, self-incentives are an effective smoking cessation intervention. Halpern 2015 directly compared interventions funded entirely from trial resources to those funded partly by the participants themselves. As discussed above, uptake rates proved to be a barrier: most of those offered rewards accepted the intervention compared to only approximately one in 10 of those required to put up a deposit. This obliged the trialists to develop an adaptive model of randomisation in order to populate the deposit-based arms. On an intention-to-treat basis, the rewards arms consistently delivered significantly more quitters than the deposit arms at all time points. However, in an instrumental variable analysis which accounts for different rates of uptake (equivalent to a per-protocol analysis), amongst participants prepared to accept either intervention, the deposit arms significantly outperformed the rewards arms.

White 2013 used community-based health workers to support people attempting to quit in a region of Thai villages, using a deposit-refund intervention. The six-month success rates were impressive, being more than double for the intervention group compared to controls. However, the unusually high quit rate for the control group suggests that this population may have represented 'low-hanging fruit' (easy quitters who may never have received support to stop smoking before), and that these findings are not readily generalisable to areas with longstanding and established tobacco control programmes. The two largest trials included in this review update specifically evaluated financial incentives against deposit-based incentives. White 2020 and Halpern 2018 found both deposits and incentives to be effective for long-term smoking cessation, but no significant differences between the two forms of incentivisation. This suggests that although it may be more difficult to recruit people who smoke into deposit-based programmes, once they are in, they appear to be strongly committed to the process and can achieve high quit rates equivalent to those observed in voucher- or cash-based incentives trials.

The findings of this review are encouraging and supportive of recent advances in smoking cessation support. In 2023, the UK Government pledged GBP 10 million to support incentive-based smoking cessation schemes for pregnant people who smoke (DHSC 2023b). Although there may be barriers to implementing incentives in routine care or as part of mainstream services, the findings of this review also suggest that the approach may be particularly beneficial to support specific populations – including those in treatment for substance misuse, experiencing homelessness, or with serious mental illness – to quit smoking. Historically, public opinion regarding incentives has been negative (Berlin 2018; Giles 2015; Hoddinott 2014), with incentives seen as 'rewarding' behaviour change for a 'habit' that is perceived as self-inflicted (smoking). An additional challenge is resource constraints. Real-world implementation requires funders (such as the NHS or local government in the UK, which fund smoking cessation services) to prioritise these schemes over other approaches to smoking cessation. In some countries, models of health care have enabled and facilitated incentive-based programmes to become more commonplace, being sponsored by private insurers, health systems, and government agencies. In the USA, the Affordable Care Act permits the introduction of incentives for healthy behaviours that are potentially worth up to half of total insurance premiums (Lowenstein 2013). For further consideration, though, are the possible harms and negative impacts of incentives schemes. However, evidence suggests that the approach is highly cost-effective in light of the improved health and social care outcomes for people who manage to sustain smoking abstinence (McKeekin 2023).

**Deception**

Only nine of the included trials tested for smoking status at baseline, with cotinine or exhaled carbon monoxide (CO) (Baker 2018; Brunette 2017; Cheung 2017; Etter 2016; Fraser 2017; Halpern 2015; Harris 2015; Hofmeyr 2020; Romanowich 2015). Halpern 2015 only tested eligibility in a 5% sample of enroled participants, who were paid USD 100 for supplying a cotinine assay. Of those asked to submit a baseline sample, nine (6%) returned a negative assay and 21 (14%) did not return a sample, suggesting that up to 20% of participants could have been non-smokers. However, as the rates were comparable across all arms of the trial, and sensitivity analyses adjusting for this possible level of deception made no difference to effect estimates, we conclude that biochemical validation of smoking status at baseline may not affect overall trial outcomes, since deception about baseline smoking status is likely to be equally distributed through randomisation.

It was a condition for inclusion in this review that studies used some form of biochemical verification to confirm the smoking status of those claiming abstinence when rewards were due. This procedure is the recommended gold standard for good trial design in smoking cessation studies (SRNT 2002). However, Hennrikus 2002 and Brown 2019 did not validate the abstinence of all participants claiming abstinence, and Secades-Villa 2022 was not able to gain biochemically-validated outcomes due to the coronavirus pandemic. It may be particularly important that quitters in an incentives-based trial are shown to be truly abstinent at the evaluation points, since deception may be a justifiable critique to be directed at incentive-based interventions. Volpp and colleagues addressed the likelihood of participants modifying their smoking behaviour in anticipation of being contacted for follow-up assessment and cotinine testing (Volpp 2006). They concluded that this was unlikely, since although participants knew that they would be biologically tested, they were unaware of how long nicotine metabolites would be detectable or the exact date on which they would be checked. Where reported, most included

studies demonstrated good correspondence between self-reported claims of abstinence and biochemical verification. As incentives were contingent upon biochemically-confirmed abstinence, and our review outcome of longest follow-up was robust to the removal of studies without biochemical verification at longest follow-up (e.g. studies at high risk of detection bias), it is unlikely that deception affected our findings.

Work on incentives for pregnant smokers trying to quit has been concerned with directing attention to the risks of deception or 'gaming', particularly the likelihood of delaying a quit attempt to coincide with a rewards programme, and the likelihood of misrepresenting smoking status, either to gain admission to an incentive programme or to receive unmerited rewards for abstinence (Marteau 2013). Ierfino 2015, in a longitudinal cohort study of 239 pregnant smokers, found no evidence of gaming to enter an incentives programme, but detected a 4% level of deception to win vouchers for abstinence (e.g. falsely reporting abstinence). Tappin 2015 used residual routine blood samples (i.e. taken for non-study-related purposes) collected from the final 200 women enroling in their study, to cross-check the smoking status of self-reporting quitters. Residual blood samples were available for 18 of the 69 intervention women who self-reported abstinence at 34/38 weeks, and had this confirmed by saliva or urinary cotinine; 78% of these samples (14/18) confirmed their non-smoking status. Similarly, five residual samples for the 26 control participants with confirmed abstinence at 34/38 weeks corroborated 80% (4/5) of the results. While this suggests some overestimation of the true quit rates, the level of 'deception' appeared to be similar across both groups, and confirmed the veracity of 80% of the self-reported quitters. A large pregnancy trial reported that "It is possible that some participants quit or reduced their smoking just prior to the 6-month visit. Breath CO, which was used in this trial, has a relatively brief half-life; serum cotinine might have been more sensitive to detecting temporally remote smoking" (Baker 2018). A much smaller pregnancy trial more robustly combined both CO and urinary cotinine testing to confirm abstinence (Harris 2015). Taken together, these results suggest that the likelihood of deception in the pregnancy incentives trials is also low.

### Overall completeness and applicability of evidence

This review update includes a number of studies from increasingly diverse cultural settings (White 2020 recruited from worksites in Bangkok; Giné 2010 approached people smoking in the street in cities in the Philippines; Hofmeyr 2020 recruited from university students in South Africa; Van den Brand 2018 recruited from workplaces in the Netherlands; Etter 2016 recruited a community sample in Switzerland; Pisinger 2022 recruited a community-based sample in Denmark; Secades-Villa 2019a recruited from clinics in Spain; and Fraser 2017 contributed evidence from 1900 community-based smokers in the USA), suggesting that the impact of incentives can be considered to be generalisable across populations, including some low- and middle-income countries. Future reviews might consider analysis of outcomes by population setting. Comparison of clinical versus community-based populations may be meaningful, as different populations may be more or less motivated to quit, and have different access to adjunctive support. Population setting may also be relevant to the scalability of incentive-based interventions.

We have followed standard Cochrane methods to identify and evaluate the studies contributing to this review, and are confident that we have not missed any significant published trials within our search date limitations. We have sought missing or incomplete data, and have contacted authors where possible to clarify our interpretation of their work. The increased diversity of populations included within this review, from diverse cultural settings, across different healthcare systems, and including unique populations (such as pregnant women, those in treatment for substance misuse and serious mental illness, and other distinct clinical populations), has extended the applicability and generalisability of this review, in line with recent trends in public health approaches to incentivising behaviour change.

### Certainty of the evidence

We rated the overall certainty of the evidence in the mixed-population group of trials as high (see Summary of findings 1). Although there were concerns about risks of bias, particularly in older trials, our sensitivity analyses excluding trials at (1) overall high risk of bias and (2) overall high or unclear risk of bias did not change the positive effect of incentives on abstinence rates.

For the first time, in this update, the certainty of the evidence from the pregnancy trials is high (it was moderate certainty in the previous version). We have increased confidence in our reported findings and the estimate of effect (Summary of findings 2). The recent inclusion of four large, high-quality trials of pregnant people from European and US settings (Berlin 2021; Higgins 2022; Kurti 2022; Tappin 2022), led to the change from moderate to high certainty.

### Potential biases in the review process

We followed standard Cochrane methods which are designed to reduce risks of bias. Our funnel plot for the main analysis in mixed populations did not suggest evidence of asymmetry.

We searched clinical trials registries, but we cannot rule out the possibility that we may have missed unpublished, unregistered studies.

One aspect of reporting that we found challenging to synthesise was the reporting of potential negative impacts or adverse effects. These were rarely reported or considered in study reporting. Incentive-based programmes involve financial outlay from commissioners and require public support to be implemented in practice. Thus, it is possible that the potential negative impact of these programmes being publicly unacceptable represents a wider adverse effect that was not captured or quantified. Within trials, relapse rates are not routinely reported. Within-person relapse (trajectories) are an important aspect that future trials should consider, as mapping individual outcomes following completion or removal of an incentives-based programme is an important real-world adverse outcome that is of interest.

A noted limitation is that studies were not always consistent with definitions of smoked tobacco use. Although most of the included studies were explicitly in people who smoked tobacco cigarettes, some may have also included people using other forms of combustible smoked tobacco. This was not always clearly reported.

We did not assess effect sizes of trials grouped by incentive type for this review update.

A final limitation is that we did not assess selective reporting, so we cannot rule this out.

### Agreements and disagreements with other studies or reviews

A number of systematic reviews addressing incentives for smoking cessation have been published in recent years. One review addressed smoking amongst other public health interventions based on incentives: Giles 2014 evaluated 16 studies of incentivised health behaviour change, 10 of which focused on smoking cessation. Using most of the same studies as in previous versions of our review, they demonstrated a benefit for smoking cessation at up to six months of follow-up (RR 2.48, 95% CI 1.77 to 3.46) and at later follow-up (more than six months) (RR 1.50, 95% CI 1.05 to 2.14), but with high heterogeneity ($I^2$ = 76%). Two further reviews were confined to smoking cessation only: Leeks 2010 demonstrated a 4.4% benefit at a median of 12 months' follow-up for worksite-based cessation programmes which included incentives or competitions. Sigmon 2012b explored incentive programmes within particular high-risk population subgroups, including substance abusers, adolescents and young adults, and people diagnosed with pulmonary disease, and also highlighted the use of shaping procedures for hard-to-treat smokers, the promise of developing technologies for delivery of the intervention, and varying the scale of the incentive. Similarly, Vijayaraghavan 2020 explored the effects of contingent reinforcement interventions in reducing smoking in people experiencing homelessness, but found no clear benefit (1 RCT; RR 0.67, 95% CI 0.16 to 2.77; low-certainty evidence), highlighting a need for more high-quality RCTs in this population.

By contrast, Hartmann-Boyce and colleagues were able to conduct a network meta-analysis of 33 Cochrane reviews (Hartmann-Boyce 2021), which included 19 incentive-based RCTs in mixed populations, with a total of 8877 participants – an indication of the sizeable amount of data accumulating in this field. They found high-certainty evidence supporting the use of guaranteed financial incentives for smoking cessation (odds ratio 1.46, 95% CI 1.15 to 185). We have included the same 19 RCTs in our previous and current review updates, and their findings align with our own.

We are aware of three reviews which synthesise evidence on incentive schemes in pregnant women. Higgins 2012 summarised a series of six trials of incentives in pregnant smokers, conducted by two US-based research groups and focused on addressing birth outcomes. Their findings were similar to ours, with Higgins and colleagues stating that such interventions "hold promise" as a mechanism for increasing cessation rates in this population of smokers. As highlighted above, however, studies suggest that implementing incentives may be difficult, regardless of the evidence. Our results in pregnant women are similar to those reported in the Pregnancy and Childbirth Cochrane review (Chamberlain 2017), but there are some key differences. The Chamberlain 2017 review assessed the effectiveness of psychosocial interventions for smoking cessation in pregnancy, and included a subset of studies using incentives. Their primary outcome was abstinence around the end of pregnancy, while ours is at longest follow-up (i.e. postpartum where available). Unlike in our review, Chamberlain and colleagues did not exclude prespecified withdrawals (termination, foetal demise) from the denominator. The Chamberlain 2017 meta-analysis included only data comparing contingent incentives with alternative interventions. They identified insufficient data for comparisons with usual care and found substantial heterogeneity ($I^2$ = 93%) when assessing incentives compared with less intensive interventions, precluding pooling of data. We have included six trials which do not appear in the Chamberlain 2017 meta-analysis. Their main result (incentives versus alternative interventions for smoking abstinence around the end of pregnancy) covers 212 women, giving a risk ratio of 2.26 (95% CI 1.36 to 4.09) (Chamberlain 2017). Our own analysis of the same (secondary) outcome in 1244 women delivers a risk ratio of 2.79 (95% CI 2.10 to 3.72) (Analysis 2.2). More recently, a review by Kock 2023 comprised 12 RCTs (with 3136 participants) – 11 of which are included in this review – and reported that pregnant women receiving financial incentives had more than twice the likelihood of being abstinent at their latest pregnancy assessment than those in the control group (RR 2.43, 95% CI 2.04 to 2.91; $I^2$ = 0.0%; high-certainty evidence). At two to three months postpartum, those in the incentives group were thrice as likely to be abstinent than their counterparts (RR 2.72, 95% CI 1.47 to 5.02; $I^2$ = 44.5%; moderate-certainty evidence). When incentives stopped, women who had been in the incentives group had nearly twice the likelihood of remaining abstinent (RR 1.93, 95% CI 1.08 to 3.46; $I^2$ = 51.8%; moderate-certainty evidence). Their findings are analogous to ours.

## AUTHORS' CONCLUSIONS

### Implications for practice

- There is high-certainty evidence that incentives boost long-term cessation rates (six months or more) in mixed-population studies. This effect appears to persist following the discontinuation of incentives, suggesting that even a time-limited incentivised intervention may support sustained abstinence.
- There is also high-certainty evidence (new for this version of the review; previously moderate certainty) that incentives boost the long-term cessation rates of pregnant people who smoke, an effect which continues postpartum.
- Low- to moderate-value incentives appear to achieve sustained success rates beyond the end of the reward schedule, suggesting that even modest incentive schemes may be effective at encouraging long-term smoking abstinence.
- Deposit-refund trials may be prone to low rates of uptake compared to reward-based programmes. However, people who do sign up and contribute their own money achieve comparable or higher quit rates than reward-only participants.
- Concern has been expressed about incentive-based interventions attracting people motivated more by the material rewards than by the desire to quit. However, levels of deception were similarly low between experimental and control participants. The motivation for entering an incentive-based cessation scheme may be less important than eventual engagement in promoting smoking cessation.
- The cost-effectiveness of incentive schemes, reported in studies linked to trials included in this review, suggests that incentives are highly cost-effective for smoking cessation, in both mixed and pregnant populations.

### Implications for research

- Evaluation of different incentive reward schedules for smoking cessation is needed.

- Further large, well-conducted trials are needed on the effectiveness of using incentives for smoking cessation in low- and middle-income countries.
- Trials are needed that directly compare high- and low-value incentives to assess whether there is a difference in effect. A possible approach would be to evaluate incentive value as a percentage of mean study participant income.
- Future updates or a separate analysis might usefully assess effect sizes between trials of different incentive types.
- An analysis comparing quit rates at last incentive point to quit rates at subsequent follow-ups where incentives are not provided would provide a more direct test of the lasting effect of incentives.
- The affordability and cost-effectiveness of incentive programmes should be tested in real-world settings, as part of the evaluation process.
- Implementation and acceptability of incentives in real-world settings should be formally evaluated, including directly comparing or assessing the value of incentives alongside other smoking cessation interventions.
- Trials in pregnant people should explore the effect of financial versus deposit-based incentives.
- Potential negative impacts and harms of incentive-based interventions require monitoring in future trials.
- Trials should clearly report the type of smoked tobacco used (e.g. manufactured cigarettes, roll-your-own products, cigars, or cigarillos). Where types of tobacco smoking are combined or not delineated, this should be clearly reported.

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**Editorial and peer-reviewer contributions**

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The following people conducted the editorial process for this article:

- Sign-off Editor (final editorial decision): Tari Turner, Cochrane Australia;
- Managing Editor (selected peer reviewers, provided editorial guidance to authors, edited the article): Hannah Payne, Cochrane Central Editorial Service;
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* Indicates the major publication for the study

## CHARACTERISTICS OF STUDIES

### Characteristics of included studies *[ordered by study ID]*

#### Ainscough 2017

| ***Study characteristics*** | |
|---|---|
| Methods | Randomised pilot study<br><br>Country: UK<br><br>Setting: outpatient drug addiction treatment centre |
| Participants | 37 smokers aged 18+ undergoing pharmacological treatment for opioid addiction<br><br>Intervention n = 19, control n = 18<br>Mean CPD = 10.<br>Women n = 12 (32%).<br>Mean age, ethnicity: not reported |
| Interventions | Both groups received standard smoking cessation treatment (manualised behavioural support and NRT according to NCSCT and NICE guidance over 6 weeks)<br><br>*Experimental Group(s):* contingency management for abstinence. Following an escalating reward with reset schedule, where rewards increase in a set increment value for each successive verified display of the desired behaviour. When the desired behaviour is not observed, no reward is given, and the reward value for the next verified display of the desired behaviour is reset to that of the initial reward. Reward values then begin to rise again in the same way as before. The desired behaviour in the experimental group is smoking abstinence, defined as breath CO reading of < 10 ppm.<br><br>*Control Group*: contingency management for attendance. The intervention followed an escalating reward with reset schedule as described above, but the incentives were for attendance at smoking cessation treatment at the clinic that week, not abstinence.<br><br>*Theoretical basis for intervention:* not reported<br><br>*Duration of intervention*: 5 weeks in total, starting in week 2 of the standard stop-smoking services treatment and ending in week 6<br><br>*Length of follow-up:* 6 months |
| Outcomes | Point prevalence abstinence at 6 months. Aimed to CO-verify with cut off at < 10 ppm |
| Notes | New for 2019 update<br><br>Trial encountered many problems and only 1 person was followed up at 6 months. Unpublished study; author provided outcome data by personal correspondence.<br><br>Funding: "This work was funded as part of TSA's PhD studentship by the Medical Research Council and the Institute of Psychiatry, Psychology and Neuroscience (MRC/IoP Excellence Studentship). LSB is funded by a Cancer Research UK (CRUK)/BUPA Foundation Cancer Prevention Fellowship (C52999/A19748). LSB and AM are members of the UK Centre for Tobacco and Alcohol Studies, a UK Clinical Research Collaboration Public Health Research: Centre of Excellence. Funding from the Medical Research Council, British Heart Foundation, Cancer Research UK, Economic and Social Research Council and the National Institute for Health Research under the auspices of the UK Clinical Research Collaboration is gratefully acknowledged 35 (MR/K/K023195/1). Neither the funding bodies nor study sponsors had any role in study design; collection, management, analysis and interpretation of data; writing of the report and the decision to submit the report for publication."<br><br>Declarations of interest: "JS has contributed to UK guidelines which include consideration of the potential role of contingency management in the management of addiction problems (NICE, 2007; chaired by JS), and JS also chaired the broader scope pan-UK working group preparing the 2007 and 2017 editions |

**Ainscough 2017** *(Continued)*

| | |
|---|---|
| | of the 'Orange Book' ('Guidelines on the Management of Drug Misuse & Dependence') for the UK Departments of Health, providing guidance on management and treatment of drug dependence and misuse, which include guidance on possible inclusion of contingency management. JS's institution has received support and funding from the Department of Health (England) and National Treatment Agency (England), and JS and JS's institution have provided funded consultancy advice on possible novel addiction treatments, products and formulations to a range of pharmaceutical companies but these do not have any connection to the intervention being investigated in this paper. JS's employer (King's College London) has registered intellectual property on a novel buccal naloxone with which JS is involved, and JS has been named in a patent registration by a pharmaceutical company as inventor of a potential novel concentrated nasal spray, but these do not have any connection to the work being reported in this paper. A fuller account of JS's interests is at http://www.kcl.ac.uk/ioppn/depts/addictions/people/hod.aspx. JS is supported by the National Institute for Health Research (NIHR) Biomedical Research Centre for Mental Health at South London and Maudsley NHS Foundation Trust and King's College London and is an NIHR Senior Investigator" |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Quote: "Randomisation will be performed by the principal investigator (PI), using the service provided by the company 'sealed envelope', 25 and will be performed using random permuted blocks within strata. Randomisation will be stratified based on participants' current smoking frequency (between 10 and 20 per day, and more than 20 per day)." |
| Allocation concealment (selection bias) | Unclear risk | Not discussed |
| Blinding of outcome assessment (detection bias)<br>All outcomes | High risk | Outcome not biochemically validated |
| Incomplete outcome data (attrition bias)<br>All outcomes | High risk | Only one participant was successfully followed up |
| Other bias | Low risk | None detected |

**Alessi 2014**

***Study characteristics***

| | |
|---|---|
| Methods | Randomised controlled trial<br><br>Country: Connecticut, USA<br><br>Setting: residential substance-use disorder clinic |
| Participants | 45 smokers, aged 18+, smoking 10+ CPD. All participants were men.<br><br>Intervention n = 24, control n = 21.<br>Mean age 37, ethnicity 84% non-Hispanic<br>Mean FTND 3.8<br>Mean CPD 18.6 |
| Interventions | All participants: 2 quit-smoking preparation sessions, i.e. in session 1: 2 x CO samples, 30-minute counselling session and a self-help quit guide; then in session 2 (4 days later) review of progress and obstacles, quit plan updated and TQD set |

**Alessi 2014** *(Continued)*

| | |
|---|---|
| | Participation rewards: everyone got USD 15 for intake, USD 25 per follow-up, and a USD 1 gift certificate or item (snacks and gum) for each CO and cotinine sample, irrespective of smoking status<br><br>*Control Group*: monitoring only; 2 x CO samples/day Monday to Friday for 4 weeks, plus brief individualised support/feedback (5 mins) from research staff. CPD tracked at every session; cotinine tested on Mondays<br><br>*Experimental Group:* as Controls, + incentives: In week 1 a "guaranteed prize" bowl with 70 cards, of which 64 had a USD 1 prize, e.g. toiletries, sports drink, gum, 5 worth a USD 20 prize, e.g. exercise weights, portable games, Barnes and Noble gift cards, and 1 for USD 100 (linens, TV, and DVD player). Week 1 started with 1 draw for an abstinent CO test, rising by 1 for each consecutive abstinent test, capping at 5. A positive test or unexpected missed sample reset back to 1<br><br>In weeks 2 to 4, standard prize bowl contained 500 cards, 50% worth a prize; 219 were USD 1 prizes, 30 were USD 20 prizes, and 1 USD 100 prize. A cotinine-negative test gave 5 bonus draws. Participants could earn 150 draws from this bowl for negative CO samples and 15 draws for negative cotinine samples. Increased draw entitlements from week 1 carried over to weeks 2 to 4<br><br>CM participants could earn up to 190 draws for negative CO tests, with average expected maximum earnings of USD 426.56, and 15 draws for negative cotinine tests, averaging USD 46.43 |
| Outcomes | % reduction in CPD; 7-day PPA at 4, 8, 12 and 24 weeks<br><br>Biochemical verification: twice daily (Monday to Friday) CO < 6 ppm; weekly (Monday) cotinine < 30 ng/mL |
| Notes | Additional information supplied by the author<br><br>Funding: "This study and the preparation of this report were funded by National Institutes of Health grants R21-DA021836; R21-DA029215; R01-DA013444; R01-DA027615; R01-DA024667; P30-DA023918 and P50-DA092410." |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Quote: "randomization to one of two conditions occurred using an urn procedure" and "stratifying on at least one CO ≤ 6 ppm during baseline". |
| Allocation concealment (selection bias) | Unclear risk | Not stated |
| Blinding of outcome assessment (detection bias)<br>All outcomes | Low risk | Abstinence biochemically validated |
| Incomplete outcome data (attrition bias)<br>All outcomes | Low risk | Very few losses; 2 participants left the treatment centre before completion |
| Other bias | Low risk | None detected |

**Anderson 2021**

| | |
|---|---|
| ***Study characteristics*** | |
| Methods | Randomised controlled trial |

**Anderson 2021** *(Continued)*

| | |
|---|---|
| | Country: Connecticut, USA<br><br>Setting: large statewide Federally Qualified Health Center (FQHC) |
| Participants | 311 daily smokers who wanted to quit, over 18 years old, and having a clinic visit in the past two years<br><br>Intervention group 1 (2 months of incentives only) n =107<br>Intervention group 2 (2 months of incentives plus subsequent optional deposit contract) n = 42<br>Intervention group 3 (2 months of incentives and pre-commitment deposit contract) n = 59)<br>Control (usual care) n =103<br><br>55% female, mean age 44, 30% Hispanic<br>*FTND:* 15% of participants exhibit high dependence and 32% exhibit moderate dependence |
| Interventions | All participants: "were encouraged to use the clinic's usual care cessation support services, including individual counselling, group counselling and nicotine replacement therapy, and the state's quitline. Clinic staff informed participants about available services in-person after enrollment and gave participants a small brochure with the same information."<br><br>Control group: usual care as described above for all participants<br><br>All experimental groups: "During study enrollment, all participants assigned to treatment arms were registered for a study-specific portal on a website that provides goal monitoring and online deposit contracts (https://stickK.com)."<br><br>Experimental group (incentives only) 1: "Participants in the incentive-only group were offered usual care, plus $200 for biochemically verified smoking cessation measured at two months and up to $100 for cessation support activities during the first two months, including group and individual counselling, for a total possible reward of $300. Rewards were paid at the conclusion of the first two months, via a gift card redeemable at a large supermarket chain"<br><br>Experimental group 2 (incentives + deposit, commitment): "Participants...were offered deposit contracts lasting for four months after the incentive period, in addition to the same financial incentives and usual care offered to the incentive-only group. In the commitment group, after the incentive earning period, participants who were verified as having quit smoking were asked after the incentive period if they wanted to transfer all or part of their earnings into a deposit contract. Clinic staff helped interested participants through the deposit contract setup process, usually during the participant's clinic visit to verify cessation."<br><br>Experimental group 3 (incentives + pre-commitment): "In the precommitment group, participants had the option at baseline to automatically transfer all or part of any future earned incentive into a deposit contract. Clinic staff helped participants who elected this option set up their deposit contract during study enrollment." |
| Outcomes | Biochemically-verified smoking cessation (point prevalence) at two, six, and twelve months after enrolment.<br><br>Defined cessation as "having a CO reading below 8 ppm and a urine cotinine level below or equal to 20 ng/mL. Passing the CO test is not an outcome itself but was instead used as a filter to reduce the number of participants requiring a urine cotinine test." |
| Notes | Author contacted for additional information but no additional information obtained.<br><br>Funding: study supported by the J-PAL North America Health Care Delivery Initiative<br><br>Declarations of interest: authors declare that they have no conflicts of interest |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|

**Anderson 2021** *(Continued)*

| | | |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Quote: "Participants were randomly assigned to a group via online software designed for the implementation of randomized controlled trials. Clinic staff inputted a new participant's study identification number into the software application to obtain the participant's treatment assignment." |
| Allocation concealment (selection bias) | Low risk | Quote: "Participants were randomly assigned to a group via online software designed for the implementation of randomized controlled trials. Clinic staff inputted a new participant's study identification number into the software application to obtain the participant's treatment assignment." |
| Blinding of outcome assessment (detection bias) All outcomes | Low risk | Report "no blinding" but biochemical validation was used. Quote: "We defined cessation as having a CO reading below 8 ppm and a urine cotinine level below or equal to 20 ng/mL. Passing the CO test is not an outcome itself but was instead used as a filter to reduce the number of participants requiring a urine cotinine test. Any participant who did not provide biochemical verification in the form of a urine cotinine test was recorded as still smoking." |
| Incomplete outcome data (attrition bias) All outcomes | Unclear risk | Not reported. |
| Other bias | High risk | No raw numbers reported, only odds ratios. |

**Aonso-Diego 2021**

| ***Study characteristics*** | |
|---|---|
| Methods | Randomised controlled trial<br>Country: Spain<br>Setting: substance-use disorder treatment |
| Participants | 54 smokers in substance-use disorder treatment<br>Intervention n = 24, control n = 30<br>24% female. Mean age, ethnicity, gender, mean CPD, and nicotine dependence not reported. |
| Interventions | *Experimental Group(s):* group-based cognitive behavioural therapy plus voucher-based contingency management. Participants were instructed to gradually reduce their nicotine intake by 20% weekly.<br>*Control Group*: group-based cognitive behavioural therapy. Participants were instructed to gradually reduce their nicotine intake by 20% weekly.<br>*Theoretical basis for intervention:* not reported<br>*Duration of intervention*: 8 weeks<br>*Length of follow-up:* 6 months |
| Outcomes | Biochemically verified continuous tobacco abstinence (CO ≤ 4 ppm, and urine cotinine ≤ 80 ng/mL) |
| Notes | New for 2023 update<br>Funding: not reported<br>Declarations of interest: none reported by authors |

**Aonso-Diego 2021** *(Continued)*

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Unclear risk | Not reported. |
| Allocation concealment (selection bias) | Unclear risk | Not reported. |
| Blinding of outcome assessment (detection bias) All outcomes | Low risk | Biochemically validated |
| Incomplete outcome data (attrition bias) All outcomes | Low risk | Minimal attrition |
| Other bias | Low risk | None detected |

**Baker 2018**

| ***Study characteristics*** | |
|---|---|
| Methods | 2-group randomised clinical trial. 2012 to 2016<br><br>Country: USA<br><br>Setting: perinatal support programme (First breath (FB)). Private and community health clinics providing perinatal healthcare services across Wisconsin as part of the FB programme |
| Participants | 1014 pregnant women, aged 18+, smoking daily (at least 1 CPD each day for at least 1 week) at some time within the last 6 months, enroled in Wisconsin Medicaid (BadgerCare Plus or Medicaid SSI).<br><br>Intervention n = 505, control n = 509. Mean age 26, ethnicity: % white CG: 47.2% IG: 45.4%, black or African American CG: 36.9% IG: 39.8%, Asian CG: 0.8% IG: 0.2%, American Indian/Alaska Native CG: 2.0% IG: 1.0%, 'Other' CG: 2.8% IG: 1.0%, Refused/do not know/missing CG: 7.5% IG: 8.5%, Hispanic CG: 5.3% IG: 4.8%, Non-Hispanic CG: 81.7% IG: 81.8%, Refused to answer/missing CG: 13.0% IG: 13.5%<br><br>Education % Less than high school CG: 3.7% IG: 4.2%, Some high school CG: 20.6% IG: 20.6%, High school or GED CG: 34.2% IG: 34.3%, Some college or 2-year degree CG: 25.55 IG: 22.0%, College degree CG: 3.0% IG: 5.4%, Refused to answer/missing CG: 13.0% IG: 13.7%. CPD: 1 to 10 CG: 39.3% IG: 38.4%; 11 to 20 CG: 39.1% IG: IG: 39.4%; 20+ CG: 17.5% IG: 19.4%; Refused to answer/missing CG: 4.1% IG: 2.8% |
| Interventions | *Control Group*: the study compensated all participants USD 40 for study registration/enrolment and USD 40/visit for attendance at post-birth Visit 1 (1 to 3 weeks post-birth) and post-birth Visit 4 (at month 6). Participants attending visits 1 and 4 completed CO testing to biochemically verify self-reports of abstinence from smoking; participants with CO test values of 7 ppm were considered to be abstinent. Thus, control condition participants could receive up to USD 120.<br><br>*Experimental Group(s):* incentive condition participants received a further USD 25/visit for any of the 6 pre-birth visits they completed, USD 25/visit for attendance at post-birth visits 2 and 3, USD 20/call for completion of 5 post-birth calls, and USD 40/visit for biochemically-confirmed abstinence at post-birth visits 1 and 4. Thus, incentive condition participants could receive up to USD 500 for meeting all payment criteria.<br><br>*Theoretical basis for intervention:* not reported |

**Baker 2018** *(Continued)*

| | |
|---|---|
| | *Duration of intervention:* 6 months post-birth<br><br>*Length of follow-up:* 6 months post-birth |
| Outcomes | PPA at 6 months with cut-off CO < 7 ppm. Number of post-birth home visits and phone calls taken; biochemically-confirmed abstinence at the post-birth week 1 visit; and self-reported smoking status at the 2- and 4-month visits<br><br>Engagement in treatment and cost-effectiveness also cited on NCT record but not reported |
| Notes | New for 2019 update<br><br>Previously listed as ongoing<br><br>Funding: not reported<br><br>Declarations of interest: not reported |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | FB staff used randomisation tables prepared by the UW-CTRI to randomise women upon consent. Separate computer-determined randomisation tables were created based on race (white/non-white) and county, with proportional randomisation (1:1) into the incentive and control conditions. |
| Allocation concealment (selection bias) | Unclear risk | Allocation not reported |
| Blinding of outcome assessment (detection bias)<br>All outcomes | Low risk | Results were CO-verified |
| Incomplete outcome data (attrition bias)<br>All outcomes | Low risk | For the primary outcome, 316 of 509 (37.9%) control condition participants had missing data; 145 of 505 (28.7%) incentive condition participants had missing data. Participants with missing data for the primary outcome were counted as smoking (ITT) |
| Other bias | Unclear risk | 6-month follow-up stated for primary outcome, but Table 2 results reports "4-6 months" follow-up |

**Beckham 2019**

***Study characteristics***

| | |
|---|---|
| Methods | Open-label RCT<br><br>Country: USA<br><br>Setting: community – homeless veterans |
| Participants | 127 veteran homeless smokers, enrolled in Durham Veterans Affairs (VA) Medical Center for medical care, current smoker (at least 10 cigarettes per day) and willing to quit smoking in the next 30 days<br><br>Intervention n = 64, control n = 63.<br>7.1% female, mean age 54.75, 96.1% non-Hispanic or Latino, 3.1% Hispanic or Latino |

**Beckham 2019** *(Continued)*

| | |
|---|---|
| Interventions | Controls: VA smoking cessation clinic for standard care treatment, including group counselling, individual counselling, self-help materials.<br><br>Intervention: telehealth programme, combining CBT-based support, telemedicine clinic for pharmacological aids (nicotine patches, bupropion), and mobile contingency management. Quote: "Mobile contingency management (mCM) is a behavioral intervention designed to provide positive reinforcement for remaining abstinent from smoking. In this intervention, participants are loaned a smart phone equipped with a videocamera and a carbon monoxide (CO) monitor. Participants are trained to upload videos of themselves taking CO readings. Any time a participant uploads a video recording that suggests abstinence (i.e., low CO reading), he/she will be provided a monetary reward." |
| Outcomes | Primary: smoking abstinence at 6 months (measured by self-report and bio-verified by salivary cotinine)<br><br>Secondary: quality-adjusted life-years (QALY), resource utilisation, intervention delivery costs and participant time costs |
| Notes | Funding and declarations of interest not reported (data from trial registry only) |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Unclear risk | Registry entry does not give details of randomisation method |
| Allocation concealment (selection bias) | Unclear risk | Registry entry does not give details of allocation concealment |
| Blinding of outcome assessment (detection bias)<br>All outcomes | Low risk | Biochemical verification |
| Incomplete outcome data (attrition bias)<br>All outcomes | Low risk | Intention-to-treat analysis and minimal attrition |
| Other bias | Unclear risk | Only results posted in registry entry extracted; no associated publication identified |

**Berlin 2021**

***Study characteristics***

| | |
|---|---|
| Methods | Randomised controlled trial<br><br>Country: France |
| Participants | 460 participants. N = 231 incentives, n = 229 control<br><br>Mean age 29. Mean CPD 8. FTND – 8.35.<br>Self-reported ethnicity in incentives group: African n = 10 (4%), Asian n = 1 (0.4%), European n = 217 (94%), other n = 3 (1%). Control group: African n = 10 (4%), Asian n = 2 (1%), European n = 214 (93%), other n = 3 (1%)<br><br>Inclusion criteria: pregnant smokers 18 years or older, smoked ≥ 5 cigarettes/day or ≥ 3 roll-your-own cigarettes/day, had a gestation of < 18 weeks, were motivated to quit smoking (scored > 5 on a visual |

**Berlin 2021** *(Continued)*

| | |
|---|---|
| | analogue scale ranging from 0 for not at all to 10 for extremely motivated), were affiliated to the social health insurance system as required by the French law on biomedical research, and had signed the informed written consent and agreed to the collection of the birth characteristics of their offspring.<br><br>Exclusion criteria: current treatment for a chronic psychiatric disorder using neuroleptics, antidepressants, or anxiolytics; use of tobacco products other than cigarettes; use of either bupropion or varenicline, which is contraindicated in pregnancy; and already participating in a biomedical research project. Electronic cigarette users were excluded. |
| Interventions | *Experimental Group(s):* participants could earn additional vouchers dependent on abstinence. The payoffs were based on two principles: a reward for abstinence today and a reward for continuous abstinence. Hence, the payoff increased with the number of visits at which abstinence was biochemically confirmed and with the length of continuous abstinence. For example, if participants were abstinent during six consecutive visits, they could earn up to 520 euros (EUR) in vouchers.<br><br>*Control Group:* control group received EUR 20 (GBP 17; USD 23) voucher at the end of each visit as a show-up fee, but abstinence was not rewarded. The total payoff depended on the total number of visits attended. The maximum amount a participant could earn was EUR 120 after six visits.<br><br>*Theoretical basis for intervention:* not reported<br><br>*Duration of intervention:* duration of pregnancy<br><br>*Length of follow-up:* end of pregnancy |
| Outcomes | Continuous smoking abstinence from the predefined quit date until the sixth visit. Abstinence was defined as a self-report of no smoking in the past seven days and expired air carbon monoxide (eCO) ≤ 8 ppm. |
| Notes | New for 2023 update<br><br>Funding: "This research was funded by the French National Cancer Institute (INCa) Recherche en Prévention Primaire (grant No 2014- 100). Logistic support was provided by Assistance Publique-Hôpitaux de Paris, Direction à la Recherche Clinique et Innovation, Paris, France. The present paper represents the opinions of the authors and does not necessarily reflect the position of their employers."<br><br>Declarations of interest: "All authors have completed the ICMJE uniform disclosure form at www.icmje.org/disclosure-of-interest/ and declare: no support from the French National Cancer Institute (INCa); no support from any organisation for the submitted work with the exception of LG who was supported by the study's grant and by a grant from the health chair—a joint initiative between Paris Sciences et Lettres (PSL), Université Paris-Dauphine, l'École nationale de la statistique et de l'administration économique (ENSAE), Mutuelle générale de l'Éducation nationale (MGEN), Université Paris-Dauphine, and ISTYA Collectives under the aegis of the Fondation du Risque as a postdoctoral fellow. All authors declare no financial relationships with any organisations that might have an interest in the submitted work in the previous three years; no other relationships or activities that could appear to have influenced the submitted work." |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Quote: "A statistician independent of the study prepared a computer generated randomisation list in blocks of 4. The individual randomisation list by centre was incorporated into the electronic case report form. After inclusion and exclusion criteria had been checked and written informed consent obtained, a randomisation number was allocated to the participant at the first visit." |
| Allocation concealment (selection bias) | Low risk | Quote: "Participants and investigators were blinded to assignment group at randomisation but not at subsequent visits." |

**Berlin 2021** *(Continued)*

| | | |
|---|---|---|
| Blinding of outcome assessment (detection bias) All outcomes | Low risk | Biochemically verified |
| Incomplete outcome data (attrition bias) All outcomes | Low risk | 17 lost to follow-up in each group |
| Other bias | Low risk | None detected |

**Brown 2019**

| ***Study characteristics*** | |
|---|---|
| Methods | Randomised controlled trial<br><br>Country: North West England, United Kingdom<br><br>Setting: participants were recruited from four services that delivered the same stop smoking program. |
| Participants | 159 smokers attending a Stop Smoking Service. Weekly self-incentive implementation intention n = 44, monthly self-incentive implementation intention n = 50, control n = 65.<br><br>60% female, mean age 38.6. Ethnicity: 1 non-white participant. Mean CPD 21. Nicotine dependence not reported.<br><br>Inclusion criteria: aged 18 years or over; able to understand written English; competent to provide informed consent; attending one of the four stop smoking programs taking part in the trial; and still smoking tobacco at baseline.<br><br>Exclusion criteria: under 18 years of age; unable to understand written and verbal English; not competent to provide informed consent; attending a stop smoking service or workplace which isn't within those listed above. |
| Interventions | *Experimental Group 1:* weekly self-incentivising implementation intention. Quote: "Participants in the weekly self-incentivizing condition were asked to complete the following stem: 'If I reach the end of the week and have not smoked at all, then I will reward myself by…' followed by sufficient space to write down a self-incentive."<br><br>*Experimental Group 2:* monthly self-incentivising implementation intention. Quote: "Participants in the monthly self-incentivizing condition were asked to complete the following stem: 'If I reach the end of the month and have not smoked at all, then I will reward myself by…' followed by sufficient space to write down a self-incentive."<br><br>*Control Group:* active control: participants were asked to form a simple plan to quit smoking but were not asked to form implementation intentions. All participants received standard SSS support. Quote: "The stop smoking program runs for a maximum of 12 weeks. Smokers are encouraged to attend the sessions in person on a fortnightly or weekly basis (i.e., attending 6–12 sessions in total), dependent on need. The first stop smoking session lasts approximately 30 min, with follow-up sessions lasting approximately 15 min. Smokers receive evidence-based behavioral support on a one-to-one basis alongside stop smoking medications (e.g., nicotine patches). Participants in the active control condition were provided with the following instructions: 'We want you to plan to quit smoking. Feel free to use the space below this question if you need more space to write your plan'."<br><br>*Theoretical basis for intervention:* not reported<br><br>*Duration of intervention:* 12 weeks<br><br>*Length of follow-up:* 6 months |

**Brown 2019** *(Continued)*

| | |
|---|---|
| Outcomes | 28-day point prevalence. No biochemical validation at 6 months |
| Notes | New for 2024 update<br><br>Funding: "This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors but was supported by the NIHR Manchester Biomedical Research Centre (BRC-1215–20007) and the NIHR Greater Manchester Patient Safety Translational Research Centre (PSTRC-2016-003)."<br><br>Declarations of interest: "The authors declare that they have no conflict of interest." |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Quote: "Participants were randomized individually on a 1:1:1 ratio using a web-based randomizer before anyone was recruited into the study. The researcher ensured that the interventions were placed at the end of otherwise identical looking questionnaires and that the questionnaires were placed in a random order. This procedure ensured that the person randomizing the questionnaire packs, the person administering the questionnaire packs, and the participants were blind to intervention allocation." |
| Allocation concealment (selection bias) | Low risk | Quote: "This procedure ensured that the person randomizing the questionnaire packs, the person administering the questionnaire packs, and the participants were blind to intervention allocation." |
| Blinding of outcome assessment (detection bias)<br>All outcomes | High risk | No biochemical verification at 6 months |
| Incomplete outcome data (attrition bias)<br>All outcomes | Low risk | Minimal attrition. Intention-to-treat analysis and per-protocol analysis |
| Other bias | Unclear risk | Trial registry indicates study was originally a four-arm trial. Target sample size not reached |

**Brunette 2017**

***Study characteristics***

| | |
|---|---|
| Methods | 3-arm RCT, 2012 to 2018<br><br>Country: USA<br><br>Setting: 10 New Hampshire community mental health clinics |
| Participants | 661 community-dwelling adult Medicaid beneficiaries (low income) with a mental illness diagnosis who were receiving services at community mental health clinics (CMHC). 22% schizophrenia, 23% bipolar, 24% major depression, 31% anxiety and other disorders.<br><br>Average 17 CPD at baseline.<br>Intervention: prescriber visit (PV) plus quitline (PV+Q) n = 303; PV + CBT n = 212; control (PV) only n = 146.<br>Mean age 46. 426 women (64%). Ethnicity: n = 610, 93% white. Employment: n = 545, 82% not employed. Education: n = 549, high school graduate (83%) |

**Brunette 2017** *(Continued)*

| | |
|---|---|
| Interventions | *Control Group*: usual care prescriber visit for smoking cessation. All conditions included a visit with participants' existing CMHC psychiatrist or nurse practitioner to discuss cessation medications and NRT and to obtain a prescription if they decided to use pharmacotherapy (PV). CMHC prescribers were trained with a yearly 45-minute session of group training in safety, efficacy, and techniques for providing brief tobacco cessation counselling with evidence-based pharmacotherapy tailored to smokers with mental illnesses. NRT (single product) and cessation medications (varenicline and bupropion) were covered by Medicaid. All participants received a participation reward of USD 30.<br><br>*Experimental Groups:*<br><br>PV + Q: PV plus facilitated quitline counselling (PV+Q). Participants met with their prescriber as described above, for which USD 15 was provided, and received a supported referral to the New Hampshire Tobacco Helpline, which provides an average of 3 manualised telephone counselling sessions to help smokers quit and to support abstinence. Participants' cellphone records or helpline staff verified participation, enabling rewards for up to 3 calls (USD 20 each).<br><br>PV + CBT: participants met with their prescriber as described above, for which a USD 15 participation reward was provided. Programme co-ordinators explained how to use telephone counselling and forwarded a referral to the telephone CBT therapist, who initiated the first call. The CBT used was a manualised adaptation of the 12-session Freedom From Smoking programme for people with severe mental illnesses provided by experienced tobacco treatment specialists. Participants received a USD 5 participation reward for each completed session, confirmed by counsellors' records.<br><br>*Incentives for smoking abstinence.* Within each intervention, half of participants were randomly assigned to receive monetary incentives contingent upon abstinence during 1 x 4-week cessation attempt. Programme co-ordinators explained how to use the abstinence incentive intervention. Participants agreed to come in to the clinic for abstinence confirmation after they initiated a quit attempt. Participants in the abstinence rewards conditions received USD 50 in cash for verified abstinence on Mondays, Wednesdays, and Fridays in the first 2 weeks of the quit attempt. The incentives were contingent on breath CO of 6 ppm on the first day and 4 ppm on subsequent days and urine cotinine sample, 100 ng/mL in the second week for those not using NRT. Participants could return in the third and fourth weeks for additional incentives (i.e. USD 75 for verified abstinence with the same criteria). Participants could earn up to USD 450 during the 4 weeks after quitting.<br><br>*Theoretical basis for intervention:* behavioural reinforcement theory. CBT<br><br>*Duration of intervention:* 1 month<br><br>*Length of follow-up:* 12 months |
| Outcomes | 12-month PPA confirmed by CO breath test and urinary cotinine. Expired breath CO ≤ 4 ppm and urine cotinine < 100 ng/mL (or solely breath CO if participant was using NRT). Treatment programme participation, medications |
| Notes | New for 2019 update<br><br>Half of participants in each intervention group randomised to receive incentives. N randomised to incentives not reported. 25 participants (4%) experienced a serious adverse event: 16 were hospitalised for psychiatric exacerbations, 7 were hospitalised for medical reasons (pneumonia, lung cancer, and heart attack), and 5 study participants died.<br><br>Funding: "This research received financial support from the Centers for Medicare and Medicaid Services (Medicaid Incentives for the Prevention of Chronic Diseases grant 1B1CMS330880) and from the New Hampshire Department of Health and Human Services (NHDHHS)."<br><br>Declarations of interest: "Dr. Brunette reports receipt of research funding from Alkermes. The other authors report no financial relationships with commercial interests." |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|

**Brunette 2017** *(Continued)*

| | | |
|---|---|---|
| Random sequence generation (selection bias) | High risk | Quote: "equipoise randomization that allowed participants to opt out of one of the cessation treatment conditions or allowed randomization to any of the three options. This strategy is recommended for comparative effectiveness trials that include more than two treatments. Randomization strata were defined by conditions to which the participant was willing to be randomly assigned. Within the stratum, a participant was then randomly assigned with equal probability to the selected treatment condition options. Computer-generated tables for each strata within each site were used for random assignment. In addition, participants were randomly assigned to receive incentives for biologically verified abstinence or no incentives. After randomization, participants were encouraged to initiate their assigned interventions, but interventions could be accessed for the one year study period."<br><br>Quote: “Within each intervention, half of participants were randomly assigned to receive monetary incentives contingent upon abstinence during one four-week cessation attempt” |
| Allocation concealment (selection bias) | Unclear risk | Not reported |
| Blinding of outcome assessment (detection bias)<br>All outcomes | Low risk | Biochemically validated |
| Incomplete outcome data (attrition bias)<br>All outcomes | Unclear risk | Full results not reported – unclear how many participants randomised to incentives/no incentives. Values for the primary outcome only presented as % in a figure |
| Other bias | Low risk | None detected |

**Cheung 2017**

| ***Study characteristics*** | |
|---|---|
| Methods | 3-arm RCT. 2013 to 2016<br><br>Country: Hong Kong<br><br>Setting: shopping malls and public areas in all 18 districts in Hong Kong |
| Participants | 1143 participants in the Hong Kong 4th QTW contest in 2013. Adult daily smokers who smoked at least 1 CPD in the past 3 months with exhaled CO ≥ 4 ppm. Intervention groups: early-informed (EI) n = 379, late-informed (LI) n = 385; control group: 379<br><br>Mean age 45. 208 (16.4%) women. Mean 15.2 CPD at baseline. Had secondary education (64.1%). Ethnicity not reported.<br>Monthly household income (HKD) (USD 1 = HKD 7.8) Below 10,000 EI: 94 (24.8) LI: 108 (28.0) CG: 115 (30.3); 10,000 – 19,999 EI: 128 (33.8) LI: 129 (33.5) CG: 116 (30.6)l 20,000 or more EI: 140 (36.9) LI: 131 (38.4) CG: 124 (32.8) |
| Interventions | All groups offered cash incentive if cessation was biochemically validated at 3 months (HKD 500/USD 64)<br><br>*Control Group*: control group was not informed about the incentive at any telephone follow-up, but the validated quitters at either 3- and 6-month follow-up received the incentive at 6-month follow-up |

**Cheung 2017** *(Continued)*

| | |
|---|---|
| | At 3-month follow-up, validated quitters participated in a lucky draw organised by the Council on Smoking and Health (COSH), in which each of the 5 winners obtained a gift voucher of HKD 10,000 (USD 1282). All participants were informed about this grand prize at enrolment.<br><br>To ensure fairness, all quitters received the incentive, and once only.<br><br>All participants received brief smoking cessation advice based on the AWARD protocol at enrolment, 1-week and 1-month follow-up, a pocket-sized self-help education card, and a 12-page self-help booklet.<br><br>*Experimental Groups:*<br><br>Early informed group: at 1-week and 1-month telephone follow-up, the early-informed group was informed about the incentive, which was offered to the validated quitters at 3-month follow-up.<br><br>Late informed group: at 3-month follow-up, the late-informed group was informed that they would receive the incentive if they quit and passed the biochemical validation at 6-month follow-up.<br><br>*Theoretical basis for intervention:* Health Action Process Approach (HAPA) model<br><br>*Duration of intervention*: 6 months<br><br>*Length of follow-up:* 6 months |
| Outcomes | Point prevalence abstinence at 6-month follow-up, verified by exhaled CO ≤ 4 ppm and saliva cotinine level ≤ 10 ng/mL. Quit attempts (longest duration and number of quit attempts (no smoking for at least 24 hours)); cessation aids |
| Notes | New for 2019 update<br><br>Quote: "loose inclusion criteria for the study might have led to the inclusion of low-rate/nondaily/light smokers who might simply stop smoking for a day in order to win. Such 'cheating' was possible"<br><br>Funding: "This work was supported by the Hong Kong Council on Smoking and Health (COSH)."<br><br>Declarations of interest: "Prof. Tai-hing Lam is the principal investigator of the FAMILY project, which was funded by the Hong Kong Jockey Club Charities Trust. All other authors do not have connection with the tobacco, alcohol, pharmaceutical or gaming industries, and nobody was substantially funded by these organizations." |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Quote: "Block randomisation was used to individually and randomly allocate the participants recruited on each recruitment day into 3 RCT groups. One investigator (YTCD) used random.org to generate random permutations of the 3 RCT groups and allocated these permutations to the blocks with a size equal to 3, 6 or 9. These blocks of permutations were assigned to the participant lists on each recruitment day. Other research staff conducted the telephone call and the intervention based on the allocation list at 1-week and 1-month telephone follow-up." |
| Allocation concealment (selection bias) | Low risk | All participants and recruitment staff were prevented from knowing the allocation procedures at enrolment |
| Blinding of outcome assessment (detection bias) All outcomes | Low risk | Biochemically validated |

**Cheung 2017** *(Continued)*

| | | |
|---|---|---|
| Incomplete outcome data (attrition bias) All outcomes | Low risk | Data completion at 6 months above 50% in all arms and no substantial between-group differences: early informed: n = 228, 60.2%; late informed: n = 221, 57.4%; control group: n = 228, 60.2% |
| Other bias | Unclear risk | Participants took part in a Quit to win contest (and may have already been randomised as part of that study) before being randomised to this trial. Potentially already motivated sample (incentivised by competition) |

**Cooney 2017**

| ***Study characteristics*** | |
|---|---|
| Methods | RCT. Dates not reported<br><br>Country: USA<br><br>Setting: USA. Department of Veterans Affairs (VA) intensive outpatient substance use treatment programme |
| Participants | 83 adults age 18+. Met DSM-IV criteria for alcohol abuse or dependence with last drink occurring within 90 days, reported current cigarette smoking of 10 or more CPD with at least a 3-year smoking history, substance detoxification when necessary was completed prior to randomisation. If history of recent cannabis use, required to have negative urine toxicology screen for cannabis at time of enrolment.<br><br>Intervention group: n = 42; control group: n = 41<br><br>Mean age 49.9. Mean 20 CPD at baseline. Women n = 3 (2.4%).<br>Ethnicity: 67% white:<br><br>• CBT plus NRT: Hispanic n = 3 (7.3%), white n = 26 (63.4%), African American n = 11 (26.8%), Other n = 1 (2.4%)<br>• CBT plus NRT plus CM: Hispanic n = 0 (0%), white n = 30 (71.4%), African American n = 12 (28.6%), Other n = 0 (0%)<br><br>Socioeconomic status: homeless 38.6%. Employed: CBT plus NRT n = 11 (26.8%); CBT plus NRT plus CM n = 16 (30.1%).<br>Other drug use diagnosis: (CG) 15 (36.6%) (CM) 18 (42.9%) |
| Interventions | *Control Group*: CBT plus NRT: 3 x 40-minute sessions (120 minutes total) at weekly intervals, focused on preparation to quit smoking, coping with nicotine withdrawal, and relapse prevention. All prescribed an 8-week course of nicotine patch therapy beginning on TQD with 21 mg dose for 4 weeks, then 14 mg for 2 weeks, then 7 mg for 2 weeks<br><br>*Experimental Group(s):* CBT plus NRT plus CM: same behavioural content and strategies as CG, but delivered across 12 shorter daily 10-minute sessions (120 min total) to correspond with daily CM sessions. Escalating financial incentives for biochemically-confirmed smoking abstinence following TQD. Readings of 5 ppm or less were reinforced with a progressive monetary incentive, along with a reset condition for tobacco lapse. Participants were eligible to receive financial reinforcements twice daily from session 5 through 12. Reinforcement began with USD 5 at the beginning of day 1, USD 5.50 at the end of day 1, USD 6 and USD 6.50 on day 2, USD 7 and USD 7.50 on day 3 and so on, up through USD 12 and USD 12.50 on day 8, totalling a potential maximum of USD 140 in financial reinforcement for 8 days of tobacco abstinence. Reinforcement was withheld for CO ≤ 5 ppm and was reset to USD 5 for the first CO ≤ 5 ppm after a smoking lapse. Vouchers for financial reinforcements were given to participants by the study therapist.<br><br>*Theoretical basis for intervention:* CBT<br><br>*Duration of intervention:* 8 weeks (12 days CM but 8 weeks NRT) |

**Cooney 2017** *(Continued)*

| | |
|---|---|
| | *Length of follow-up:* 6 months |
| Outcomes | PPA at 6 months. CO "Readings of ≤ 5 parts per million (ppm) were considered corroboration of smoking abstinence". Smoking at 1½ weeks after quit date, 1 month. Alcohol use, drug use |
| Notes | New for 2019 update<br>Funding: not reported<br>Declarations of interest: "Judith Cooney has worked as a promotional speaker for Pfizer, Inc" |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Urn randomisation computer programme |
| Allocation concealment (selection bias) | Unclear risk | Not reported |
| Blinding of outcome assessment (detection bias) All outcomes | Low risk | Biochemically validated |
| Incomplete outcome data (attrition bias) All outcomes | Low risk | High retention rates |
| Other bias | Unclear risk | Quote: "Design with an experimental condition that integrated CM within 12 brief CBT sessions compared with a more conventional, three-session CBT without CM treatment schedule. This design does not allow us to dismantle the effects of frequently scheduled CBT from the effects of CM procedures" |

**Dallery 2016**

***Study characteristics***

| | |
|---|---|
| Methods | RCT. 2010 to 2016<br>Country: USA<br>Setting: community smokers, recruited online |
| Participants | 94 adult community smokers, motivated to quit, with at least a 2-year history of daily smoking. Mean age 36, mean CPD at baseline = 17. Submission-contingent group (SC) n = 46; abstinence-contingent group (AC) n = 48.<br>56% women.<br>Ethnicity: AC: European American 77%; Hispanic American 4%; African American 15%; native American 0%; Asian 4%; More than 1 race 0%. SC: European American 71%; Hispanic American 7%; African American 7%; Native American 4%; Asian 9%; More than one race 2%.<br>Socioeconomic status: AC: Less than high school 2%; High school degree, no college 8%; Some college 44%; Associate professional degree 13%; Bachelor's degree or higher 37%. SC: Less than high school 2%; High school degree, no college 0%; Some college 48%; Associate professional degree 13%; Bachelor's degree or higher 37% |

**Dallery 2016** *(Continued)*

| | |
|---|---|
| Interventions | *Control Group*: submission-contingent (SC) group: financial incentives based on submitting CO samples (regardless of abstinence status).<br><br>Participants could earn a maximum of USD 480 in incentives based on abstinence or CO submissions. Participants in both groups were provided with the same CO-based goals. The only difference between groups was the target behaviour to receive incentives: the AC group had to meet video-verified CO cut-points and the SC group had to submit videos. A USD 50 deposit was required from all participants. Deposits were made to PayPal via debit, credit card or direct bank transfer. The first USD 50 earned went toward reimbursement for the initial deposit incentive. Participants were loaned a CO monitor (Bedfont piCO+ Smokerlyzer; Bedfont Scientific Ltd, Maidstone, UK) and a web-camera. Each participant's homepage consisted of a graph of CO sample results, voucher earnings history, a 'post video' button and a display showing their previous sample's date/time, and the earliest date/time at which they could provide their next sample.<br><br>*Experimental Group(s):* abstinence-contingent (AC) group: financial incentives based on abstinence<br><br>Tapering: for participants in the AC group, the average CO during baseline was calculated and every predetermined reduction from this value resulted in USD 3.00. The reductions were calculated for each participant such that the last day of this phase would serve as their quit day, with a target CO ≤ 4 ppm.<br><br>Induction: for participants in the AC group, CO samples were judged as either positive or negative (≤ 4 ppm). A USD 3.00 incentive was awarded for the first negative sample, and increased by USD 0.25 for each consecutive negative sample. In addition, every third consecutive negative CO resulted in a USD 5.00 bonus.<br><br>*Theoretical basis for intervention:* not reported<br><br>*Duration of intervention:* total length of intervention appears to be 49 days. 7 weeks stated in abstract<br><br>*Length of follow-up:* 6 months |
| Outcomes | PPA CO-verified by video at 6 months. CO ≤ 4 ppm. PPA at week 4 and 3-month follow-up. Treatment acceptability, behavioural change |
| Notes | New for 2019 update<br><br>Funding: "Research and preparation of this paper was supported by Grants R01DA023469 (Principal Investigator: J.D.) and P30DA029926 (Principal Investigator: L.M.) from the National Institute on Drug Abuse."<br><br>Declarations of interest: none reported by authors |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Quote: "Randomization was automated by an Excel macro that coded each participant based on smoking severity and gender, and then assigned the participant to the group with a lower number of participants with that combined smoking severity and sex code. If smoking severity and gender distributions were equal, then the participant was assigned randomly to a group" |
| Allocation concealment (selection bias) | Unclear risk | Not reported |
| Blinding of outcome assessment (detection bias) All outcomes | Low risk | Biochemically validated by online video (participant takes CO test and sends results by video to research team) |
| Incomplete outcome data (attrition bias) | Low risk | Low and similar rates of attrition in each arm |

**Dallery 2016** *(Continued)*
All outcomes

| | | |
|---|---|---|
| Other bias | Low risk | None detected |

**Donatelle 2000a**

***Study characteristics***

| | |
|---|---|
| Methods | Study design: RCT, conducted June 1996 to June 1997; data collection completed January 1998<br><br>Country: USA<br>Setting: 4 Oregon Women, Infants, and Children (WIC) programme sites<br><br>SOS (Significant Other Supporter) Programme I |
| Participants | 220 women smokers (112 intervention, 108 control)<br>Aged 15+, ≤ 28 weeks gestation, literate in English; withdrawal criteria included termination and foetal death |
| Interventions | All participants received a USD 5 participation voucher at each of 3 assessments. Everyone at baseline was given verbal and written advice on importance of smoking cessation by WIC- or SOS-trained staff, + self-help kit *A pregnant woman's guide to quit smoking*<br><br>*Experimental Group(s):* each participant was asked to designate a social supporter, preferably a female non-smoker. Both were eligible for vouchers if participant quit.<br>Participant was phoned monthly (up to 10 months) to report smoking status. If she reported quit and supplied confirmatory saliva sample, she got a USD 50 voucher, and "their social supporter received a voucher as well" (i.e. USD 50 for 1st quit month, USD 25 for other quit months, and USD 50 for final quit month). Vouchers were funded by contributions from 10 local 'community partners' (businesses, foundations and healthcare organisations)<br><br>*Control Group:* baseline advice and quit kit, plus monthly phone calls to determine smoking status |
| Outcomes | 7-day PPA at 8 months gestation, and at 2 months postpartum<br><br>Biochemical validation by salivary cotinine < 30 ng/mL, and salivary thiocyanate < 100 mg/mL |
| Notes | New for 2015 update<br><br>Funding: grant from Robert Wood Johnson Foundation Smoke-Free Families Program, plus support from local businesses and healthcare facilities |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Unclear risk | Not stated |
| Allocation concealment (selection bias) | Unclear risk | Not stated |
| Blinding of outcome assessment (detection bias)<br>All outcomes | Low risk | Abstinence biochemically validated |
| Incomplete outcome data (attrition bias) | High risk | Relatively high, but comparable with non-participant attenders at the WIC clinic |

**Donatelle 2000a** *(Continued)*

| | | |
|---|---|---|
| All outcomes | | Losses: Intervention: 32% at 8 months gestation, 36% at 2 months postpartum; Control: 51.5% at 8 months gestation, 52% at 2 months postpartum |
| Other bias | Low risk | None detected |

**Donatelle 2000b**

| | |
|---|---|
| ***Study characteristics*** | |
| Methods | Study design: RCT, dates not stated<br><br>Country: USA<br>Setting: 8 Oregon Women, Infants, and Children (WIC) programme counties<br><br>SOS (Significant Other Supporter) Programme III |
| Participants | Probably similar to Donatelle 2000a<br>186 pregnant smokers, randomised to E1 (N = 67); E2 (N = 59); Controls (N = 60) |
| Interventions | All participants received a 5As intervention (Ask, Advise, Assess, Assist, Arrange)<br><br>E1 group: USD 25 voucher (local department store) for each month achieving validated abstinence<br><br>E2 group: USD 25 voucher (local department store) for achieved abstinence + immediate feedback on risks to the foetus associated with CO results. CO ≤ 5 ppm confirmed monthly abstinence |
| Outcomes | Abstinence at end of pregnancy<br><br>Biochemical validation by salivary cotinine < 30 ng/ml. CO < 5 ppm monthly |
| Notes | New for 2015 update<br><br>Minimal information; emails to the author elicited no responses<br><br>Funding not stated |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Unclear risk | Not stated |
| Allocation concealment (selection bias) | Unclear risk | Not stated |
| Blinding of outcome assessment (detection bias)<br>All outcomes | Low risk | Abstinence biochemically validated |
| Incomplete outcome data (attrition bias)<br>All outcomes | Unclear risk | No information |
| Other bias | Low risk | None detected |

### Donatelle 2002

| ***Study characteristics*** | |
|---|---|
| Methods | Study design: RCT, 3-group design; interim report on data from August 2001 to September 2002<br><br>Country: USA<br>Setting: 9 Oregon private practice prenatal clinics<br><br>The MISS project |
| Participants | 298 "predominantly low-income, high risk pregnant women", smoking "even a puff" in the last 7 days, aged 15+, < 29 weeks gestation, literate in English<br><br>79% had Medicaid or Oregon Health Plan insurance; 24% had private insurance; mean age 24.1 years, mean education years 11.9<br><br>Target enrolment was 600 |
| Interventions | All participants received a 5As intervention (Ask, Advise, Assess, Assist, Arrange), + a copy of *A Pregnant Woman's Guide to Quit Smoking*, + local cessation resource guide<br><br>E1 group (102 women): USD 25 voucher (local department store) for each month achieving validated abstinence<br><br>E2 group (96 women): USD 75 voucher (local department store) for achieved abstinence<br><br>Control group (95 women): standard care as above |
| Outcomes | Abstinence at 8 months gestation, + phone call postpartum and a salivary cotinine test for self-reported non-smokers<br><br>Biochemical confirmation: salivary cotinine < 30 ng/mL; CO < 5 ppm at monthly tests |
| Notes | New for 2015 update<br><br>Funding: grant from Robert Wood Johnson Foundation Smoke-Free Families Program<br><br>Too little information to adequately assess risk of bias; emails to the author elicited no responses |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Unclear risk | Not stated |
| Allocation concealment (selection bias) | Unclear risk | Not stated |
| Blinding of outcome assessment (detection bias)<br>All outcomes | Low risk | Abstinence biochemically validated |
| Incomplete outcome data (attrition bias)<br>All outcomes | Unclear risk | No information. 298 reported enroled, but results given for only 293 |
| Other bias | Low risk | None detected |

**Drummond 2014**

| ***Study characteristics*** | |
|---|---|
| Methods | Randomised factorial 4-arm controlled trial, subset of a prospective, longitudinal cohort study (ALIVE: AIDS linked to the Intravenous Experience study)<br><br>Country: USA<br>Setting: Baltimore, MD<br><br>Study conducted March 2011 to February 2012 |
| Participants | 100 injecting drug-using patients randomised to 4 groups: Usual care (26); Lung age (24); Contingency management (26); Lung age + contingency management arm (24).<br><br>47% women, median age 50 (IQR 45 to 56); median FTND 4 (IQR 2 to 5); median pack years 19 (IQR 12.5 to 31)<br>Ethnicity % African-American: Usual care 92; Lung age 75; Contingency management 100; Lung age + contingency management 88 |
| Interventions | 6-month programme. Cotinine blood test at 6 months for everyone<br><br>• Usual care (UC; control) group: baseline visit, + visits at 1, 2, 4 weeks, and then 2, 3 and 6 months. Participants completed questionnaires, self-efficacy, motivation to quit, level of addiction, eCO testing, spirometry. At all visits, participants reviewed their spirometry results, and got guidance on quitting based on this.<br>• Lung age (LA) group: as for UC, + written report giving their chronological age and their lung age. 'Abnormal' = lung age exceeding chronological age<br>• Contingency management (CM) group: as for UC, + monetary compensation for verified cessation. On each visit, CO < 7 ppm = USD 25 at first visit, increasing by USD 5 for each consecutive negative sample, to a maximum of USD 50. If negative sample, no payment given, and schedule reverted to starting point.<br>• Combined lung age plus contingency management group*:* combined the CM and lung age elements |
| Outcomes | Primary: 7-day PPA at 6 months, cotinine-confirmed<br><br>Secondary: N of visits attended, smoking rates, N of quit attempts, change in FTND score, change in self-efficacy score |
| Notes | New for 2015 update |

| ***Risk of bias*** | | |
|---|---|---|
| **Bias** | **Authors' judgement** | **Support for judgement** |
| Random sequence generation (selection bias) | Low risk | Quote: "120 sequentially numbered opaque sealed envelopes were externally prepared that included random assignment to one of four interventions. Randomization sequence was computer-generated using a block randomization approach with randomly ordered four and eight sample blocks" |
| Allocation concealment (selection bias) | Low risk | See above |
| Blinding of outcome assessment (detection bias)<br>All outcomes | Low risk | Abstinence biochemically validated |
| Incomplete outcome data (attrition bias)<br>All outcomes | Low risk | > 80% followed up at 6 months across all groups |

**Drummond 2014** *(Continued)*

| | | |
|---|---|---|
| Other bias | Unclear risk | Ethnicity significantly different for LA group from others (P = 0.03), but no report of interaction with key outcomes. Authors stated they had predetermined to combine CM and non-CM arms if they found no interaction between lung age and CM. |

**Etter 2016**

| | |
|---|---|
| ***Study characteristics*** | |
| Methods | 2-arm, parallel-group, individually randomised controlled trial. 2011 to 2016<br><br>Country: Switzerland |
| Participants | 805 regular smokers, smoking at least 5 CPD for at least 1 year. Baseline CO reading of at least 10 ppm. Baseline saliva cotinine reading of NicAlert level 1 or higher (≥ 10 ng/mL). Age > 18 years old<br><br>CG n = 404, IG n = 401<br><br>Mean age 42, Mean CPD = 16.<br>Median annual income, CG: USD 20,700 IG: USD 19,200<br>Occupation, % Unemployed CG: 18 IG: 20. Student CG: 45 IG: 42. Mother at home CG: 3 IG: 1. Manual CG: 12 IG: 15. Clerical, administrative CG: 13 IG: 12. Professional CG: 9 IG: 10. Mean years of education: 15 |
| Interventions | *Control Group*: internet-based support<br><br>*Experimental Group(s):* financial rewards of up to CHF (Swiss francs) 1500 (USD 1650 in 2013) were paid to those participants biochemically verified as abstinent. Incentives given 6 times during 6 months: CHF 100, 150, 200, 300, 350, and 400 at 1, 2, and 3 weeks, and 1, 3, and 6 months, respectively (USD 110, USD 165, USD 220, USD 330, USD 385, and USD 440, respectively). If participants smoked or missed an assessment, the value of the next reward was reset to the value of the previous reward they had received.<br><br>*Theoretical basis for intervention:* not reported<br><br>*Duration of intervention:* 6 months<br><br>*Length of follow-up:* 18 months |
| Outcomes | Continuous abstinence between 6 and 18 months, CO-verified (0 to 3 ppm) and cotinine,10 ng/mL<br><br>Quit attempts during the intervention phase (number, duration and dates), cigarette consumption, motivation to quit, confidence in ability to quit, use of the online smoking cessation programme |
| Notes | New for 2019 update<br><br>Previously listed as ongoing. Relatively affluent population compared to other countries<br><br>Funding: "From the Institute of Global Health, Faculty of Medicine, University of Geneva, Geneva, Switzerland. The study was funded by the Swiss Tobacco Prevention Fund (Swiss Federal Office of Public Health), grant 11.001733. Dr. Etter's salary was paid by the University of Geneva. The authors have reported that they have no relationships relevant to the contents of this paper to disclose."<br><br>Declarations of interest: "The Swiss Tobacco Prevention Fund, which funded the study, suggested that the follow-up should be extended to 12 instead of 6 months after the final incentives were received, but had no other role in the conduct of the study." |
| ***Risk of bias*** | |

**Etter 2016** *(Continued)*

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Unclear risk | Quote: "sealed opaque envelopes drawn by participants. Neither the researchers nor the participants could know in advance the content of the envelopes. We did not use blocks for randomization. Participants could not be blinded to their assignment group. Researchers were not blinded, but online data collection at follow-up was computerized" |
| Allocation concealment (selection bias) | Low risk | Sealed opaque envelopes |
| Blinding of outcome assessment (detection bias)<br>All outcomes | Low risk | Biochemically verified |
| Incomplete outcome data (attrition bias)<br>All outcomes | Low risk | Quote: "very high follow-up rates." "All randomized participants were included in the denominator and participants with missing data at follow-up were counted as smokers." |
| Other bias | Low risk | None detected |

**Fraser 2017**

| ***Study characteristics*** | |
|---|---|
| Methods | 2-group randomised clinical trial. 2013 to 2017<br><br>Country: USA<br><br>Setting: recruited from Wisconsin Quit Line, primary care clinics, and community advertisements |
| Participants | 1900 community-dwelling smokers accessing a quit line or recruited from primary care or advertising<br><br>CG: n = 952; IG: n = 948<br>60% women. Mean age 45. Mean CPD = 16. 51% and 41% black and white, respectively. Education: 61% high school or less |
| Interventions | *Control Group*: all participants were incentivised for participating in baseline and 6-month follow-up biochemical assessment visits.<br><br>"Quit line coaching included a pre-quit call that typically occurred at study enrolment and 4 additional proactive calls. Participants could also initiate calls to the WTQL for additional assistance. WTQL quit coaches made 3 attempts (per protocol) on different days to reach a participant for each proactive call, leaving messages at least twice if possible. Those callers not reached on the first 2 proactive calls were sent a letter urging them to call. Study participants also received a mailed quit guide, access to recorded medication information (by phone), and access to Web Coach®, an online cessation programme maintained by the quit line. WTQL quit coaches routinely recommended that participants obtain a prescription for a Medicaid-approved smoking cessation medication from their primary care provider (at minimal or no co-pay). Participants in the control condition could receive a total incentive of USD 80: USD 40 each for attendance at the baseline and 6-month follow-up biochemical assessment visits. Compensation was in the form of prepaid Visa gift cards and took 2 to 4 weeks from the point of contact."<br><br>*Experimental Group(s):* "all participants were incentivised for participating in baseline and 6-month follow-up biochemical assessment visits. Incentive condition participants were additionally incentivised for participating in WTQL calls and for biochemically determined abstinence at the 6-month follow-up visit. Participants in the Incentive condition could receive a total payment of USD 270: USD 30/call for |

**Fraser 2017** *(Continued)*

| | |
|---|---|
| | up to 5 WTQL calls, USD 40/visit for attending the baseline and 6-month follow-up assessment visit, and USD 40 for producing biochemical evidence of abstinence at the 6-month follow-up visit."<br><br>*Theoretical basis for intervention:* none specified<br><br>*Duration of intervention:* 6 months<br><br>*Length of follow-up:* 6 months |
| Outcomes | PPA at 6 months. CO ≥ 7 ppm. Clinics chose different cut-scores for the urine cotinine test. Almost all the clinics chose to define smoking as a value that exceeded either 50 ng/mL, 100 ng/mL, or 200 ng/mL, depending on the clinic. 4 clinics used 300 ng/mL as the smoking cut-score. Treatment engagement, medication use |
| Notes | New for 2019 update<br><br>Funding: "This research was supported by Funding Opportunity Number 1B1CMS330876 from the Centers for Medicare & Medicaid Services."<br><br>Declarations of interest: "No financial disclosures were reported by the authors of this paper." |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Randomisation occurred by computer-generated lists, with order stratified by county and race |
| Allocation concealment (selection bias) | Unclear risk | Quote: “These randomization lists were supplied by the research team to the Wisconsin Tobacco QL and then programmed to automatically determine randomization at the time required in the consent protocol” |
| Blinding of outcome assessment (detection bias)<br>All outcomes | Low risk | Biochemically validated |
| Incomplete outcome data (attrition bias)<br>All outcomes | Low risk | 552 intervention (58%) and 562 control (59%) participants followed up at 6 months |
| Other bias | Low risk | None detected |

**Gallagher 2007**

***Study characteristics***

| | |
|---|---|
| Methods | Randomised 3-arm controlled trial<br><br>Country: USA<br><br>Setting: 3 psychiatric case management sites in La Frontera, Arizona |
| Participants | 180 smokers, aged 18+, English-speaking, smoked at least 10 CPD for at least 3 years, CO > 10 ppm. Diagnosed with DSM-IV Axis 1 psychotic-spectrum or affective disorders resulting in long-term mental illness and experiencing significant symptoms and functional impairment.<br>48% women, 76% Anglo, average age 43, average Fagerström Tolerance Questionnaire (FTQ) 6.1, average CPD 24.8<br>Not required to commit to cessation, but 98% expressed interest either in quitting or in reducing |

**Gallagher 2007** *(Continued)*

| | |
|---|---|
| | Randomised to contingent reinforcement (CR, n = 60), contingent reinforcement + NRT patches (CR + NRT, n = 60), or self-help (Control, n = 60) |
| Interventions | • CR: weekly visits weeks 1 to 4 (Phase 1), fortnightly weeks 6 to 12 (Phase II), monthly weeks 16 to 24 (Phase III). Payments USD 25 for baseline assessment and USD 5 per visit, plus USD 20 per abstinent visit in Phase I, USD 40 in Phase II, USD 60 in Phase III, and USD 80 if abstinent at 36-week follow-up. Maximum payable USD 580 for attendance + abstinence. At each visit weight, pulse rate, smoking status, intention to quit, withdrawal symptoms, CO, blood pressure measured<br>• CR + NRT: as for CR Group, plus 16-week course of 21 mg NRT patches, plus supporting instructions<br>• Control: visits at baseline and weeks 20 and 36, plus encouraged to use the community smoker helpline, ALA and ACS self-help information.<br><br>In all groups, salivary cotinine measured at baseline and at weeks 20 and 36; brief symptom inventory (psychiatric symptoms) at baseline and weeks 6, 16 and 36; FTND at baseline and at weeks 10, 24, 36 |
| Outcomes | Abstinence at weeks 20, 36<br>Verified by expired CO < 10 ppm and by salivary cotinine < 15 ng/mL<br>Other outcomes: smoking reduction, change in psychiatric symptoms |
| Notes | Additional information supplied by the author<br>New for 2008 update<br>Study funded by Arizona Biomedical Research Commission |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Unconcealed computer-generated random-number lists [personal communication] |
| Allocation concealment (selection bias) | High risk | Study staff oversaw allocation |
| Blinding of outcome assessment (detection bias)<br>All outcomes | Low risk | Abstinence biochemically validated |
| Incomplete outcome data (attrition bias)<br>All outcomes | Low risk | No significant differences between groups: attrition for CR at weeks 20 and 36 was 37% and 43%; CR + NRT at weeks 20 and 36 was 35% and 36%; and Controls 52% at both time points |
| Other bias | Low risk | None detected |

**Ghosh 2016**

***Study characteristics***

| | |
|---|---|
| Methods | 2-arm RCT (dates not reported)<br><br>Country: USA<br><br>Setting: Head and Neck Surgery clinic at the Philadelphia Veterans Affairs Medical Center |
| Participants | 14 patients with a previous diagnosis of head and neck cancer who had completed treatment or were undergoing treatment. Age 18+. Actively smoking at least, on average, five cpd. CG: n = 8 IG: n = 6. 'The majority' were male. Mean age 60. All black/African American. |

**Ghosh 2016** *(Continued)*

| | |
|---|---|
| | Education: 1 to 3 years at college. Income: USD 30,000 to 39,999. CPD reported as packs per day CG; 1, IG: 1.5 to 2. |
| Interventions | *Control Group*: participants in each study arm were offered free enrolment in a Veterans Administration-sponsored smoking cessation course. Attendance was recorded at each of the 3 classroom sessions. For all participants, a payment of USD 50 was made for each class attended. Payments for attendance at each class took place at the conclusion of the class on that day.<br><br>*Experimental Group(s):* information about smoking cessation and financial incentives in the form of cash payments at specific time intervals if class attendance or smoking abstinence was confirmed.<br><br>At 30 days: USD 150; at 3 months: USD 150; at 6 months USD 150<br><br>*Theoretical basis for intervention:* not reported<br><br>*Duration of intervention:* 6 months<br><br>*Length of follow-up:* 6 months reported but methods state 12 months |
| Outcomes | PPA CO-confirmed at 6 months, but cut-off not defined |
| Notes | New for 2019 update<br><br>Contacted author to request clarification on some issues but did not hear back<br><br>Funding: not reported<br><br>Declarations of interest: none declared |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | High risk | Quote: "Randomisation was performed, at the time of study enrolment, by the physician or clinical staff (physician assistant), according to a specific schema. Slips of paper were sequentially numbered with integers from 100 to 299, and for each person enrolling in the study 1 slip was selected at random. The number on the slip of paper in the envelope became the participant's study identification number. Group assignment was as follows: even numbers were assigned to the control group (information only), while odd numbers were assigned to the experimental group (financial incentives plus information)" |
| Allocation concealment (selection bias) | High risk | See above |
| Blinding of outcome assessment (detection bias)<br>All outcomes | Unclear risk | Biochemically verified, but cut-off level was not defined |
| Incomplete outcome data (attrition bias)<br>All outcomes | High risk | Of 24 randomised, only 14 included in analysis (others were post-randomisation exclusions but numbers not reported by group). All lost to follow-up at 6 months, apart from 2 in intervention group |
| Other bias | High risk | Inconsistent reporting of length of follow-up. Methods state 12-month follow-up but only 6-month follow-up reported |

### Giné 2010

| ***Study characteristics*** | |
|---|---|
| Methods | Randomised 3-arm controlled trial. Study conducted between August 2006 and May 2007<br><br>Country: Philippines (Mindanao)<br><br>The CARES study (Committed Action to Reduce and End Smoking), described as randomised |
| Participants | 2000 smokers aged ≥ 18, identified as "obvious smokers", and approached in the street by Green Bank marketing employees<br><br>3 waves of recruitment: 1) and 2) Butuan city; August 2006 to December 2006; 3) Ampayon; February 2007 to May 2007.<br><br>Totals were 418 smokers enroled from waves 1 and 2, and 515 from wave 3.<br><br>Allocation distributed as:<br><br>• Wave 1: 1a: 45%; 1b: 45%; cue cards: 5%; controls: 5% (to verify acceptability of CARES offer)<br>• Wave 2: 1a: 15%; 1b: 15%; cue cards: 30%; controls: 40% (to balance up numbers of cue card and control participants)<br>• Wave 3: presumably roughly 1:1:1 (no without-deposit CARES assignments) |
| Interventions | All individuals approached were given a pamphlet on dangers of smoking, and a quitting tip sheet.<br><br>People agreeing to participate were given a brief baseline survey (age, smoking status)<br><br>1a: CARES + deposit collection (most were visited weekly by a bank employee to collect the money)<br><br>1b: CARES without deposit collection (participant had to go to a bank to deposit money)<br><br>Both the CARES groups were encouraged to deposit the money they would normally spend on cigarettes (minimum 50 pesos (~USD 1)) in a non-interest-bearing account.<br><br>2: Cue cards: pocket-sized graphic depictions of negative health consequences of smoking; choice of 1 from 4 different images<br><br>3. Control (no additional intervention) |
| Outcomes | All participants contacted and tested (NicCheck urine test for nicotine and cotinine) for smoking status; those proved abstinent received their deposit money back at 6-month test. Those who could not be reached, did not attend, or who failed the test, forfeited their money to charity.<br><br>Pre-stated assessment at 6 months (PPA), and 'surprise' test at 12 months; continuous abstinence defined as abstinent at both time points.<br><br>All non-CARES participants received 30 pesos for attending testing at 6 months; all participants, including CARES, received 30 pesos for attending 12-month test. |
| Notes | New for 2015 update. Study was funded by the World Bank, and implemented by marketers of the Green Bank of Caraga<br><br>Additional information supplied by the authors |

| ***Risk of bias*** | | |
|---|---|---|
| **Bias** | **Authors' judgement** | **Support for judgement** |
| Random sequence generation (selection bias) | High risk | Randomised with stickers on backs of baseline questionnaires for waves 1 and 2. For wave 3, researchers used a calculation (residual of (birth date (dd+mm +yy)/3)) to allocate participants, 0s to CARES, 1s to cue cards, and 2s to control |

**Giné 2010** *(Continued)*

| | | |
|---|---|---|
| Allocation concealment (selection bias) | Unclear risk | Researchers revealed allocation concealed under a sticker on the back of the baseline face-to-face questionnaire for waves 1 and 2. Algorithm effectively concealed allocation for wave 3. Change in methods may have compromised concealment |
| Blinding of outcome assessment (detection bias) All outcomes | Low risk | Abstinence biochemically validated |
| Incomplete outcome data (attrition bias) All outcomes | Unclear risk | No differences between the groups; 36% attrition across the board in wave 3 at 12 months. Nothing reported for waves 1 and 2 |
| Other bias | Low risk | None detected |

**Glasgow 1993**

| | |
|---|---|
| ***Study characteristics*** | |
| Methods | Cluster-randomised controlled trial<br>Country: USA<br>Setting: 18 Oregon worksites (8 experimental, 10 control), stratified on number of employees and estimated smoking prevalence |
| Participants | Smokers defined as ≥ 7 cigs/week. Smoking prevalence average 21.5%; average age 40.5, 37% male, average 18.5 cpd. Smokers in intervention sites had higher education levels, and rated themselves more likely to try and quit smoking within next 6 months. 23% of baseline smokers in intervention sites joined the programme. 474 participants in intervention sites, 623 in control sites |
| Interventions | • Experimental: USD 10 for each monthly PPA over 1 year of programme + monthly worksite lottery (USD 5 to USD 20 first 6 months, then minimum USD 50 for 2nd 6 months). 12-month sweepstake for USD 200, USD 100 and USD 50 at each worksite. Also 'good buddy' non-smokers' lottery prize. No formal quitting support<br>• Control: baseline and follow-up surveys at 1 year, 2 years |
| Outcomes | PPA at 1 year, 2 years<br>Validation: CO < 9 ppm and salivary cotinine |
| Notes | This is the HIP study (Health Incentives Program). Great variability in outcome across sites (2-year follow-up cessation rates Intervention: 14 to 33%, Control: 9 to 27%), with 30% lost to follow-up at 2 years<br>Study was funded by National Cancer Institute |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Unclear risk | Quote: "the worksites were then randomized". Method not stated |
| Allocation concealment (selection bias) | Unclear risk | See above |
| Blinding of outcome assessment (detection bias) | Low risk | Abstinence biochemically validated |

**Glasgow 1993** *(Continued)*
All outcomes

| | | |
|---|---|---|
| Incomplete outcome data (attrition bias)<br>All outcomes | Low risk | At 12 months, 19% of incentives group had left, versus 24% of no-incentives group.<br>At 24 months, 27% of incentives group had left, versus 32% of no-incentives group. No statistically significant differences |
| Other bias | Unclear risk | Data extrapolated from percentages |

**Halpern 2015**

| ***Study characteristics*** | |
|---|---|
| Methods | 5-arm randomised controlled trial. Study conducted between February and October 2012<br><br>Country: USA<br><br>Setting: web-based and worksite-based across the USA |
| Participants | Employees of CVS/Caremark (retail pharmacy outlets) and their families and friends. Aged 18+, smoking at least 5 cpd, with internet access, and interested in learning about ways to quit.<br><br>Mean age 33, 63% women, 74% income < USD 60,000, 79% white, mean CPD 15, 64% in preparation stage of change (ready to quit within 30 days) |
| Interventions | All participants were paid for completing questionnaires and submitting samples, and all used the *Way to Health* web-based portal for communicating and accounting.<br><br>A random sample of 5% of enroled participants were invited for cotinine screening and offered USD 100 for completing the cotinine assay, to discourage non-smokers from signing up.<br><br>5 arms:<br><br>• *Control Group* (N = 468): usual care, i.e. information about local SC services, ACS cessation guides, and for the 41% on health benefits free access to behavioural support and NRT<br>• *Individual rewards* (N = 498): usual care, plus participants received USD 200 for sustained abstinence at each of 14 days, 30 days and 6 months, + a 6-month USD 200 bonus for sustained abstinence at that point<br>• *Collaborative rewards* (N = 519): usual care, plus participants grouped into teams of 6, linked by proximal TQDs. Rewards for sustained abstinence were given at 14 days, 30 days and 6 months, calculated at USD 100 per successful quitter in the group, i.e. up to USD 600 per person at each time point if all 6 remained quit, + USD 200 sustained abstinence bonus at 6 months. Linked by a web-based chat room throughout study, for mutual support<br>• *Individual deposits* (N = 582): usual care, plus participants put up USD 150 of their own money (by debit or credit card) within 60 days of enrolment or prior to the TQD, whichever came first. They received USD 200 for confirmed abstinence at each of 14 days, 30 days and 6 months, + a 6-months USD 200 sustained abstinence bonus.<br>• *Competitive deposits* (pari-mutuel principle) (N = 471): usual care, plus participants put up USD 150 of their own money (by debit or credit card) within 60 days of enrolment or prior to the TQD, whichever came first. Participants were grouped into teams of 6, linked by proximal TQDs. USD 600 per person was available, distributed at 14 days, 30 days and 6 months to successful quitters only, + USD 200 sustained abstinence bonus at 6 months. So USD 1200 potentially available at each time point for sustained abstinence, e.g. if 2 people quit at 14 days but relapsed by 30, the 2 quitters would get USD 600 each at 14 days and then no more rewards for anyone in the group. Participants got anonymised descriptions of their team-mates to encourage competitive interaction.<br><br>All intervention arms offered potentially the same financial returns, i.e. USD 800 per quitter, but for the 2 deposit arms, this included USD 150 of the participants' own money. |

**Halpern 2015** *(Continued)*

| | |
|---|---|
| Outcomes | Primary: sustained abstinence (14 days, 30 days, 6 months) at 6 months, cotinine-verified (anabasine/anabitine for NRT users)<br><br>Biochemical verification: salivary cotinine < 10 ng/mL (urinary anabasine/anabitine < 3 ng/mL)<br><br>Secondary outcomes: initial quit rate at 14 days, sustained abstinence at 30 days and at 12 months; self-reported quit rates at 12 months; rates of acceptance of the assigned intervention |
| Notes | New for 2015 update<br><br>Funding was from National Cancer Insitute grant R01 CA159932 (SDH) and National Institute of Aging grant RC2 AG036592 (DAA and KGV), and through in-kind support from the host company |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Quote: “randomized individually”, stratified on 2 variables: access to full company-sponsored healthcare benefits; household income (USD 60,000 [median company income])<br><br>Quote: “We developed an adaptive randomization algorithm that updated the assignment probabilities to the five arms after every third enrolled patient. Updated probabilities reflected the inverse of the proportion of participants assigned to that arm who accepted the intervention, relative to total acceptance across arms”. |
| Allocation concealment (selection bias) | Low risk | See above |
| Blinding of outcome assessment (detection bias)<br>All outcomes | Low risk | Abstinence biochemically validated |
| Incomplete outcome data (attrition bias)<br>All outcomes | Unclear risk | Losses not reported; ITT analyses included all randomised. Compliance rates were rewards 89.9%, deposits 13.9% |
| Other bias | Low risk | None detected |

**Halpern 2018**

***Study characteristics***

| | |
|---|---|
| Methods | 5-arm RCT. 2015 to 2017<br><br>Country: USA<br><br>Setting: employees of companies using wellness programme |
| Participants | N = 6006 employees and spouses of company wellness programmes. CG; n overall = 3600, consisting of n = 813 usual care; n = 1588 free cessation aids; n = 1199 free e-cigarettes. IG: Reward group n = 1198, redeemable deposit n = 1208 |
| Interventions | *Control Group*: access to information about benefits of smoking cessation and motivational text message service plus free cessation aids (NRT, bupropion or varenicline with NJOY electronic cigarette if standard therapies tried and did not work) |

**Halpern 2018** *(Continued)*

| | |
|---|---|
| | *Experimental Groups:* REWARD Group: as for control, plus USD 600 in rewards for sustained abstinence. Eligible to earn USD 100, USD 200, and USD 300 if at 1, 3, and 6 months after the quit date, respectively, they submitted blood or urine samples for testing and the samples were negative for nicotine metabolites.<br><br>REDEEMABLE DEPOSITS group: as for control, plus USD 600 in redeemable funds deposited in separate account for each participant with money removed from account if cessation milestones not met (same schedule as rewards group).<br><br>*Theoretical basis for intervention:* not reported<br><br>*Duration of intervention:* 6 months<br><br>*Length of follow-up:* 12 months |
| Outcomes | PPA at 12 months. "CO verified cut off 20 ng per milliliter was the primary method for confirming abstinence". Urine sample with an anabasine level of < 3 ng per millilitre or a blood carboxyhaemoglobin level of less than 4%. For users of e-cigarettes who had a positive cotinine sample (cotinine level ≥ 20 ng per millilitre), also accepted a blood carboxyhaemoglobin level of < 4%. PPA for quitting at 1 month and sustained abstinence rates at 3 months and 6 months |
| Notes | New for 2019 update<br><br>Funding: "Supported by a grant from the Vitality Institute to the University of Pennsylvania Center for Health Incentives and Behavioral Economics."<br><br>Declarations of interest: none reported by authors |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Unclear risk | Randomisation method not stated |
| Allocation concealment (selection bias) | Unclear risk | Not specified |
| Blinding of outcome assessment (detection bias) All outcomes | Low risk | Biochemically validated, but low levels of completion. However, because "the definition of the primary outcome was biochemically confirmed sustained abstinence, participants who did not submit samples were coded as not having met the primary outcome" |
| Incomplete outcome data (attrition bias) All outcomes | High risk | Poor post-randomisation intervention engagement. 6006 randomised and included in ITT analysis. Only 1191 followed up as 'engaged' cohort, included in secondary analysis. At 12 months, very few participants completed self-report assessment: 6/1588 control; 21/1198 rewards; 33/1208 redeemable |
| Other bias | Low risk | None detected |

**Harris 2015**

***Study characteristics***

| | |
|---|---|
| Methods | Pilot RCT. Dates not stated<br><br>Country: USA |

**Harris 2015** *(Continued)*

| | |
|---|---|
| | Setting: rural Appalachian Ohio and Kentucky prenatal clinics |
| Participants | 17 pregnant women (mean = 10¾ weeks pregnant) aged 18+, daily smokers (reporting smoking at least 2 CPD verified by breath CO readings and urinary cotinine levels). IG: CM (n = 7) CG: SCHB (phone-delivered counselling) (n = 10). Mean age 24. 88% identified as white. Mean CPD = 12. Socioeconomic status and education not reported |
| Interventions | *Control Group*: SCHB participants received 5 telephone calls from a registered nurse, and as many as 5 check-in calls<br><br>*Experimental Group(s):* a 6-week web-based CM programme, with 2 follow-up sessions that occurred after the 6-week programme ended but before birth. The web-based CM programme was used to verify breath CO measurements. Each participant was loaned a piCO Smokerlyzer, web camera, and if necessary, a laptop computer with Internet access. The Motiv-8 portion of the CM programme lasted 6 weeks and consisted of 5 phases: Baseline (7 days), Shaping (4 days), Abstinence (21 days), Thinning (5 days), and Return to Baseline (5 days). During each phase, participants submitted video recordings of themselves twice a day (at least 8 hours apart) giving breath samples using the Smokerlyzer. They could earn vouchers exchangeable for online purchases with major retailers (e.g. Best Buy, Wal-Mart) for criterion breath samples based on programme phase. For the Abstinence phase, participants were required to have breath CO levels 4 ppm to indicate abstinence and to earn vouchers.<br><br>Escalating pay schedule: 1st sample that met criteria earned voucher of USD 1; vouchers then increased in value by USD 0.25 for each consecutive breath sample that met the abstinence criterion. USD 5.00 bonus for every 6 consecutive breath samples that met the abstinence criterion. Participants could earn a maximum of approximately USD 800 during study participation. If sample did not meet criterion, then the participant did not receive reinforcement and the value of the next voucher was reset to USD 1.00. However, if, after a reset, the participant provided 3 consecutive samples that met the criterion for recent abstinence, then the voucher returned to the value at which the reset occurred.<br><br>In addition, 2 spot checks (at random times, participants aware in advance) during remaining months of pregnancy following programme end – if abstinent, participant received USD 100 in cash.<br><br>Participants were aware these follow-up sessions would occur. These appointments were intended to extend incentives for abstinence later into pregnancy.<br><br>*Theoretical basis for intervention:* not reported<br><br>*Duration of intervention:* 6 weeks but with pre-birth follow-up (intervention) appointments<br><br>*Length of follow-up:* until end of pregnancy. Mean 8.47 months |
| Outcomes | PPA at end of pregnancy verified by urinary cotinine (cut-off not defined). Smoking reduction (time line follow-back method),<br><br>Stages of Change Ladder (SCL), Modified Fagerström Test of Nicotine Dependence (mFTND); Post-treatment assessments measured birth outcomes (e.g. gestational age at birth, birth weight, and time spent in NICU) and smoking-related variables |
| Notes | New for 2019 update<br><br>Funding: not reported<br><br>Declarations of interest: "The authors report no conflict of interest or relevant financial relationships" |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Random-number generator available via the Internet (Research Randomizer, n.d.) |

**Harris 2015** *(Continued)*

| | | |
|---|---|---|
| Allocation concealment (selection bias) | Unclear risk | Not reported |
| Blinding of outcome assessment (detection bias) All outcomes | Low risk | Biochemically validated |
| Incomplete outcome data (attrition bias) All outcomes | Low risk | All participants reported as followed up |
| Other bias | Low risk | None detected |

**Heil 2008**

| ***Study characteristics*** | |
|---|---|
| Methods | Study design: RCT; conducted between 2001 and 2003<br><br>Country: USA<br><br>Setting: 4 group obstetric practices and the Women, Infants, and Children (WIC) programme in Burlington, VT |
| Participants | 82 women, gestational age ≤ 20 weeks, smoked at all in the previous 7 days, locally resident, English-speaking<br><br>Mean age 24, education 11.8 years, mean CPD 18.6; mean gestation 9 weeks |
| Interventions | Abstinence monitoring for first 5 days (Monday to Friday) for all participants, then twice weekly (Mondays, Thursdays) for next 7 weeks, then once a week (Wednesday) for 4 weeks, then every other Wednesday until delivery. In postpartum period, monitoring increased to every Wednesday for first 4 weeks, then bi-weekly (every other Wednesday) for next 8 weeks to week 12. Final 24-week postpartum testing.<br><br>All participants received standard care from their clinic, over and above trial conditions. Also a pamphlet from study staff at baseline, plus another for those not smoking at end of pregnancy. NRT was discouraged for all participants, as it might contaminate testing.<br><br>*Experimental Group* (40 women): contingent vouchers: awarded for proven abstinence during first 5 days. From 2nd week, vouchers given for urine cotinine ≤ 80 ng/ml. Vouchers entirely contingent on biochemical specimens, not on self-report. Values started at USD 6.25, increasing by USD 1.25 per consecutive negative sample, to a maximum of USD 45, where they stayed until a missed visit or a positive test. If reset required, value went back to start point, but 2 valid tests restored to previous level<br><br>*Control Group* (37 women): vouchers delivered independent of smoking status, at USD 15 per visit antepartum and USD 20 per visit postpartum. This would average the mean payments earned in the other group.<br><br>Voucher-based reinforcement therapy (VBRT) applied until 12 weeks postpartum |
| Outcomes | Abstinence at end of pregnancy, 12 and 24 weeks postpartum<br><br>Biochemical confirmation by urine cotinine < 80 ng/mL, apart from CO ≤ 6 ppm for first week |
| Notes | New for 2015 update<br><br>Funding was from research grants R01DA14028 (STH) and GCRC M01RR109 |

**Heil 2008** *(Continued)*

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Unclear risk | Quote: "Randomization was stratified based on the clinic where participants received their pre-natal care". Participants "were assigned randomly". |
| Allocation concealment (selection bias) | Unclear risk | Not stated |
| Blinding of outcome assessment (detection bias)<br>All outcomes | Low risk | Abstinence biochemically validated |
| Incomplete outcome data (attrition bias)<br>All outcomes | Low risk | Relatively high compliance (83% to 95%) with assessment schedules, and no differences between groups. Withdrawals only for termination or foetal death. 3 intervention and 2 control participants removed from the denominators |
| Other bias | Low risk | None detected |

**Hennrikus 2002**

| ***Study characteristics*** | |
|---|---|
| Methods | Cluster-randomised controlled trial<br>Country: USA<br>Setting: 24 Minneapolis-St Paul worksites; 2 x 3 factorial design, stratified by gender and education |
| Participants | 2402 current smokers (smoked at least 100 cigs in lifetime). Mean age 39, 56.2% women, 62% married/partner |
| Interventions | • Group: 13 group sessions over 2 months<br>• Phone: sent printed materials, inc ALA *Freedom from Smoking* + 3 to 6 telephone counselling sessions<br>• Choice: free choice between group or phone programmes.<br>All programmes offered 3 times over 18 months; smokers could join more than once. Half of the sites in each intervention were offered direct incentives for participation and for quitting: Quitters at 1 month won USD 20 and entered lottery for grand prize (USD 500 as 1 prize (5 sites), 2 x USD 250 (6 sites) or 4 x USD 125 (1 site)). Drawn about every 6 months |
| Outcomes | Baseline, 7-day PPA at 12 months, 24 months<br>Validation: self-report, countersigned by friend or family member for monthly abstinence. Grand draw prize winners + 24 months random sample of quitters (paid USD 25 for compliance) tested for salivary cotinine |
| Notes | Study was funded by the National Heart, Lung, and Blood Institute. Data extrapolated from percentages |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Unclear risk | Quote: "Four worksites were randomly assigned to each of the 6 experimental conditions". Method not stated |

**Hennrikus 2002** *(Continued)*

| | | |
|---|---|---|
| Allocation concealment (selection bias) | Unclear risk | Not stated |
| Blinding of outcome assessment (detection bias) All outcomes | High risk | Not all participants had abstinence biochemically validated |
| Incomplete outcome data (attrition bias) All outcomes | Low risk | At 12 months, 14.5% lost, and at 24 months, 18.3% lost |
| Other bias | High risk | Group dropouts were not followed up; phone dropouts were rung for up to 10 times for each counseling session, and were then left messages or sent letters |

**Higgins 2014**

| ***Study characteristics*** | |
|---|---|
| Methods | Study design: 3-arm RCT; December 2006 to June 2012<br><br>Country: USA<br><br>Setting: group obstetric practices and the WIC office in Burlington, VT |
| Participants | 130 women; mean age 24; mean gestational age 10 weeks; mean CPD pre-pregnancy 18; while pregnant 8<br><br>12 women (revised contingent voucher (RCV): 4; usual contingent voucher (UCV): 5; non-contingent voucher (NCV): 3) withdrawn from denominators because of termination or foetal death |
| Interventions | All participants received standard antenatal care for smoking; study staff delivered additional counselling as 4 sessions over first 2 weeks, at final antepartum visit and during 3 postpartum study visits. Those who quit during pregnancy got brief counselling at routine visits whenever they reported temptations to smoke. Study staff used a printed booklet tailored for pregnant smokers, *Need help putting out that cigarette?* (ACOG 2001, URL in study report)<br><br>Women chose one of next 2 Mondays as a quit date; were then monitored from Monday to Friday that week, Monday and Thursday next 7 weeks, then every Wednesday for 4 weeks, then every other Wednesday until delivery for the UCV and NCV groups; in the RCV group it was every other week to week 12 and then every 3rd week through to delivery. After delivery, all 3 groups were on weekly monitoring for 4 weeks, then every other week through to 12 weeks postpartum. 1 final assessment at 24 weeks. Relapsers could continue the schedule or recycle back round the entire process (only offered once per woman). This was used fairly equally by all 3 groups (RCV 40%, UCV 46% and NCV 41%).<br><br>*Experimental Groups:*<br><br>• *Usual contingent voucher* (39 women): first 5-day week validated by CO, thereafter by urine cotinine. Vouchers based exclusively on valid biotesting, not self-report. Vouchers began at USD 6.25 and rose by USD 1.25 each time to a max of USD 45. Missed or positive results meant schedule was reset, but 2 passes reset the schedule to former point.<br>• *Revised contingent voucher* (40 women): same pattern as above, but with potentially USD 296.25 available early in weeks 1 to 6 by maintaining a ≤ 4 ppm breath CO in week 1 (i.e. USD 18.75 day 1 to USD 33.75 day 5 (going up by USD 3.75 per day)), testing cotinine-negative on 2nd Monday for an additional USD 87.50 and thereafter testing negative twice a week to week 6. The 2nd test each week increased by USD 15.50 if it was negative and the first had also been negative. This was meant to reinforce early continuous abstinence.<br>• *Non-contingent voucher (control group)* (39 women): voucher value was USD 15 per antepartum and USD 20 per postpartum visit, irrespective of smoking status. |

**Higgins 2014** *(Continued)*

| | |
|---|---|
| | Total available earnings were comparable across all 3 groups.<br>Duration: to 24 weeks postpartum |
| Outcomes | 7-day PPA at baseline, 1 month, end of pregnancy, 2, 4, 8, 12 and 24 weeks postpartum<br>Biochemical validation: CO ≤ 4 ppm or 6 ppm, + urine cotinine ≤ 80 ng/mL |
| Notes | New for 2015 update |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Unclear risk | Not stated; they were "randomly assigned" |
| Allocation concealment (selection bias) | Unclear risk | Not stated |
| Blinding of outcome assessment (detection bias)<br>All outcomes | Low risk | Abstinence biochemically validated |
| Incomplete outcome data (attrition bias)<br>All outcomes | Unclear risk | Losses not reported, apart from withdrawals and foetal demise, but ITT analyses conducted |
| Other bias | Low risk | None detected |

**Higgins 2022**

***Study characteristics***

| | |
|---|---|
| Methods | Randomised controlled trial plus matched never-smoker control<br>Country: Burlington, Vermont, USA<br>Setting: prenatal care |
| Participants | N = 249 pregnant smokers. Participants included 91 women assigned to best practices (BP) and 85 assigned to BP plus financial incentives (BP + FI). A third condition included 80 never-smokers (NS) socio-demographically-matched to women who smoked (not randomised and so not included in this review).<br>Inclusion criteria: gestational age < 25 weeks, planned to remain in the area for > 12 months following delivery, and English speaking<br>Exclusion criteria: incarceration, previous participation in a study on incentives for smoking cessation, residing with a current trial<br>100% female, average 25 to 26 years of age, most completed < 12 years of education, most were non-Latino white race/ethnicity, participants reported smoking on average 18 to 19 CPD pre-pregnancy and 9 to 10 CPD at intake. Nicotine dependence not reported. |
| Interventions | *Experimental Group:* BP plus financial incentives (BP + FI). "Women assigned to BP + FI received the BP intervention combined with voucher-based financial-incentives available from quit date through 12-weeks postpartum. They were asked to select a Monday as their quit date and to attend clinic or be met |

**Higgins 2022** *(Continued)*

| | |
|---|---|
| | by a staff member at an alternate site for the initial 5 days of the cessation effort; in Week 2, monitoring decreased to 2x weekly for next 7 weeks; weekly for 4 weeks; then once every other week until delivery. Following delivery, monitoring went back to weekly for 4 weeks, followed by every other week through 12-weeks postpartum when abstinence monitoring ended. Vouchers redeemable for retail items were earned contingent on submitting breath CO specimens ≤6 ppm during the initial five days of cessation. Beginning in Week 2, vouchers were delivered contingent on urine-cotinine levels ≤80 ng/ml determined using onsite enzyme immunoassay testing. These breath CO and urine-cotinine cut-points were previously validated with pregnant women (Higgins et al., 2007). Voucher delivery was based exclusively on meeting the biochemical-verification criterion.<br><br>For women smoking <10 CPD at intake, vouchers began at $6.25, and escalated by $1.25 per consecutive negative specimen to a maximum $45.00, where they remained barring positive-test results or missed abstinence-monitoring visits. Positive tests and missed visits reset voucher value back to the original low value, but two consecutive negative tests restored it to the pre-reset level. For women smoking > 10 CPD, voucher values were offered on the same schedule but twice the values described above.<br><br>Maximum total possible earnings for someone who participated in the voucher program for 32- weeks antepartum and 12-weeks postpartum and sustained abstinence throughout was $1,225 ($865 antepartum & $360 postpartum) for women smoking >10 CPD at intake and $2,450 ($1,730 antepartum & $720 postpartum) for those smoking ≥10 CPD. Because vouchers were only earned when women were abstinent, mean (+SEM) average earnings were $510.02 + 76.27 ($467.70 + 68.21 and $560.34 + 146.84 in lighter and heavier smokers, respectively)."<br><br>*Control Group:* Best practices (BP). "Following study enrollment, all participants assigned to BP chose a quit date within the subsequent two weeks. Once a quit date was selected, staff faxed a signed referral to the Vermont quitline which offered perinatal-specific individualized counseling (National Jewish Health, 2021); a maximum of five brief phone calls with a quit coach antepartum and four postpartum. To encourage call completion, the quitline offered up to $65 in incentives for completing calls. Women were eligible for free nicotine replacement if their medical provider agreed. In addition to quitline services, women received brief-cessation counseling from research staff at all assessments based on the brochure “Need Help Putting Out That Cigarette?” (National Partnership for Smoke Free Families, 2021)."<br><br>*Theoretical basis for intervention:* not reported<br><br>*Duration of intervention:* from quit date to 12 weeks postpartum<br><br>*Length of follow-up:* 12 weeks postpartum |
| Outcomes | Biochemically verified point prevalence smoking abstinence 12 weeks postpartum. "To be considered abstinent, women had to report no smoking for the past 7 days and meet urine-cotinine abstinence criteria (≤80 ng/ml)." |
| Notes | New for 2024 update<br><br>Funding: "National Institute of Child Health and Human Development Research Award in collaboration with Centers on Disease Control and Prevention R01HD075669; National Institute of General Medical Sciences Center of Biomedical Research Excellence Award P20GM103644; National Institute on Drug Abuse Institutional Training Grant T32DA007242. Funders had no role in the study."<br><br>Declarations of interest: "The authors report no conflicts of interest to disclose." |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Unclear risk | No details provided |

**Higgins 2022** *(Continued)*

| | | |
|---|---|---|
| Allocation concealment (selection bias) | Unclear risk | No details provided |
| Blinding of outcome assessment (detection bias) All outcomes | Low risk | Biochemically validated |
| Incomplete outcome data (attrition bias) All outcomes | Low risk | Minimal attrition; even across groups |
| Other bias | High risk | Absolute numbers not reported in paper; percentages who quit extracted from a graph. |

**Higgins 2023**

| ***Study characteristics*** | |
|---|---|
| Methods | 3 arm randomised controlled trial. June 2015 - October 2020<br><br>Country: Vermont USA<br><br>Setting: participants were recruited from local paediatric Offices, Women, Infants and Children (WIC) clinics, ads on Craig's List and Facebook, and referrals from study participants. |
| Participants | Mothers with young children (198 women-child dyads)<br><br>Intervention (best practices plus financial incentives) = 63, control (best practices) = 68, best practices + financial incentives + nicotine replacement therapy = 67<br><br>100% female, mean age 33, 92% non-Hispanic white, mean CPD = 17, FTND = 4.7 |
| Interventions | *Control group* (best practices): best practices consisting of implementing the 5As (Flore et al. 2008) and a referral to Vermont Quit Network offering free cessation services including NRT mailed to the participant's home, web-based modules on quitting and individual phone counselling.<br><br>*Incentives* (BP + FI): best practices plus financial incentives. "Participants received the BP services...plus 12 weeks of financial incentives (vouchers exchangeable for retail items) for biochemically verified abstinence (breath CO <6 ppm) (maximum earnings = $810.00). The initial smoking-negative test was worth $10.00. Each consecutive negative test increased incentive value by $2.50, with the 2nd negative test worth $12.50, the 3rd test $15.00, etc. Incentive value continued to escalate based on consecutive negative test results to a maximum value of $50.00. Positive tests or unexcused abstinences reset incentives back to initial $10.00 value. Two consecutive negative tests following a rest returned incentive value to pre-rest levels. Mean (+/- SEM) voucher earnings were $432.78 +/_ 43.24."<br><br>A second incentives condition offered the above best practices plus financial incentives, plus nicotine replacement therapy. |
| Outcomes | Maternal 7-day point prevalence abstinence at 24 and 48 weeks, biochemically verified by breath CO < 6ppm |
| Notes | New for 2024 update<br><br>Funding: "National Institute of Child Health and Human Development Research Award R01HD078332; National Institue of General Medical Sciences Centre of Biomedical Research Excellence Award P20GM103644; National Institute on Drug Abuse Institutional Training Award T32DA007242. Funders had no role in the study." |

**Higgins 2023** *(Continued)*

| | |
|---|---|
| | Declaration of interests: "The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper." |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Unclear risk | "Randomly assigned" but no further details given |
| Allocation concealment (selection bias) | Unclear risk | No details given |
| Blinding of outcome assessment (detection bias) All outcomes | Low risk | CO verified |
| Incomplete outcome data (attrition bias) All outcomes | Low risk | Minimal attrition |
| Other bias | Low risk | None detected |

**Hofmeyr 2020**

***Study characteristics***

| | |
|---|---|
| Methods | Randomised controlled trial<br><br>Country: South Africa<br><br>Setting: University of Cape Town |
| Participants | 87 university student smokers<br><br>Inclusion criteria: "the student was at least 18 years old; had smoked at least 100 cigarettes in his/her life; had smoked in the last 10 h; smoked at least five cigarettes a day; reported an interest in quitting smoking and taking part in a smoking cessation program; and had a carbon monoxide (CO) in expired air reading of at least 8 parts per million (ppm)."<br><br>22% female, mean age 22 years, 23% white ethnicity, mean CPD 10, FTND 3. |
| Interventions | *Experimental Group(s):* "Subjects in the treatment group (information and monitoring, plus CM) could additionally earn abstinence contingent incentives in the intervention sessions."<br><br>"In each of the four intervention sessions, treatment subjects who were abstinent were paid the R150 ($24) abstinence-contingent incentive, over and above the R50 ($8) show-up fee. maximum potential earnings for abstinence were R600 ($95), which amounts to 20% of the average monthly income of the sample."<br><br>"four weekly intervention sessions started one week after the subject's quit date."<br><br>*Control Group:* "subjects in the control group (information and monitoring) were given an aid-to-quit document in the baseline session and had their quit attempt monitored in the intervention and follow-up sessions."<br><br>*Theoretical basis for intervention:* not reported<br><br>*Duration of intervention:* 6 months |

**Hofmeyr 2020** *(Continued)*

| | |
|---|---|
| | *Length of follow-up:* 6 months |
| Outcomes | Biochemically verified seven-day point prevalence at 3 and 6 months |
| Notes | New for 2024 update<br>Funding: "The authors report no relevant financial conflicts."<br>Declarations of interest: none reported |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Quote: "Following baseline sign-up, randomization to either treatment or control occurred using computer-generated stratified random assignment conducted by the first author, where the stratification variables were gender, race, and CO reading." |
| Allocation concealment (selection bias) | Low risk | Quote: "Following baseline sign-up, randomization to either treatment or control occurred using computer-generated stratified random assignment conducted by the first author, where the stratification variables were gender, race, and CO reading." |
| Blinding of outcome assessment (detection bias)<br>All outcomes | Low risk | Biochemically verified |
| Incomplete outcome data (attrition bias)<br>All outcomes | Low risk | Higher attrition in intervention group but not 20% difference between group follow-ups. |
| Other bias | Low risk | None detected |

**Jason 1995**

***Study characteristics***

| | |
|---|---|
| Methods | Cluster-randomised 3-arm controlled trial<br>Country: USA<br>Setting: 63 Chicago worksites, stratified on size and type of business |
| Participants | 844 smokers (280 self-help (SH), 281 incentives (I), 283 group (G))<br>Mean age 37.8; 37% women; mean % black 20.5; mean years education 13.8; mean years smoking 19.9; mean CPD 21.5.<br>Sex and race differed across conditions and were controlled for in all analyses. |
| Interventions | 1. SH (also = M) 5-day cessation TV programme 'Smoke-free in the 90s' + 8-page newspaper supplement, self-help ALA manual *Freedom from smoking in 20 days*<br>2. I (also = IM) as SH, plus USD 1 per day for each day abstinent up to 6 months (maximum USD 175)<br>3. G (also = GIM) as I, plus group meetings twice a week for first 3 weeks, + 14 'booster' meetings over 6 months; programme included a 'buddy' system, and tips in booster sessions on living with a smoker, weight control, exercise and stress management |

**Jason 1995** *(Continued)*

| | |
|---|---|
| Outcomes | Baseline, post-test (3 weeks), and at 6, 12, 18 and 24 months. Lottery system used to boost follow-up return rates. CO samples at all assessments, plus cotinine at 6 months. Intra-class correlation coefficient calculated (no significant between-firm effects detected) |
| Notes | Only groups SH and I are used for the comparison, to isolate the effects of the incentives. Results extrapolated from percentages<br>Additional information supplied by the authors<br>Study was funded by the National Institute of Heart, Lung, and Blood<br><br>Previous reference was 'De Paul 1994' |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Unclear risk | Stratified by size and type and then randomised. Method not stated |
| Allocation concealment (selection bias) | Unclear risk | Method not stated |
| Blinding of outcome assessment (detection bias)<br>All outcomes | Low risk | Abstinence biochemically validated |
| Incomplete outcome data (attrition bias)<br>All outcomes | High risk | 1/63 companies dropped out before intervention, 1/62 during intervention, 3/61 during first 6 months<br>Only Groups I (SH only) and II (SH + incentive) used for this review; attrition by post-test was SH: 32.3%, Incentives: 23.3%; 6 months SH: 43.3%, Incentives: 46.5%; 12 months SH: 52.5%, Incentives: 47.2%. Although losses by 12 months are high, there was no significant difference in levels of missing data between the 2 groups. Across groups, those who were younger, heavier smokers, with lower health ratings, less effort to quit, more confident of quitting, and with less helpful coworkers were more likely to drop out. |
| Other bias | Unclear risk | Allocation was by worksite, but analysis by individual participant. The last scheduled rewards were paid out to coincide with the final assessment, and may therefore have confounded that result. |

**Kurti 2022**

***Study characteristics***

| | |
|---|---|
| Methods | Randomised controlled trial<br><br>Country: USA (33 states)<br><br>Setting: recruited nationally via social media; obstetrical clinics; and Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) offices |
| Participants | 92 pregnant smokers randomised<br><br>Intervention n = 42, control n = 48<br><br>Mean age 31.63 (standard deviation (SD) 4.67). 18% Black, 5% Hispanic, 75% white, 6% multiple, 1% other. CPD at intake < 10 cigarettes: 42%, n = 37. CPD at intake >10 cigarettes: 58%, n = 52. Time to first cigarette at intake < 5 min after waking 15%. |

**Kurti 2022** *(Continued)*

| | |
|---|---|
| Interventions | Control group: best practices (BP) BP included brief counselling and a tobacco quit-line referral.<br><br>Experimental group: best practices + financial incentives (BP + FI). Included BP plus an FI intervention in which smoking monitoring and incentive delivery were completed via smartphone app (DynamiCare Health Inc). Participants submitted videos of themselves conducting salivary cotinine tests remotely (Alere iScreen [New Line Medical]) and received auto-generated notifications detailing test results and associated earnings. Incentives were delivered from study start to 12 weeks postpartum via a debit card using an escalating schedule. Maximum earnings were approximately USD 1620; mean [SD] earnings, USD 330.52 [USD 446.18]). |
| Outcomes | The primary outcome was 7-day point prevalence abstinence (self-reported past week abstinence plus a cotinine-negative saliva test) 24 weeks postpartum |
| Notes | New for 2024 update<br><br>Funding: "This work was supported in part by Centers of Biomedical Research Excellence award P20GM103644 from the National Institute on General Medical Sciences and research award R01HD075669 from the National Institute of Child Health and Human Development and US Centers for Disease Control and Prevention."<br><br>Declarations of interest: no conflicts reported |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Unclear risk | Not reported |
| Allocation concealment (selection bias) | Unclear risk | Not reported |
| Blinding of outcome assessment (detection bias) All outcomes | Low risk | Biochemically validated |
| Incomplete outcome data (attrition bias) All outcomes | Low risk | Intention-to-treat analysis and equal loss to follow-up in both groups due to pregnancy loss |
| Other bias | High risk | Selective outcome reporting: protocol states parallel group of ethnic minority people, but not reported in this paper, and absolute numbers not reported. Study underpowered due to lower sample size than reported in protocol. |

**Ladapo 2020**

***Study characteristics***

| | |
|---|---|
| Methods | Randomised controlled trial<br><br>Country: USA<br><br>Setting: hospitalised participants from the Veterans Affairs (VA) New York Harbor Healthcare System's Manhattan campus |
| Participants | 182 hospitalised adult smokers<br><br>Intervention n = 90, control n = 92. |

**Ladapo 2020** *(Continued)*

| | |
|---|---|
| | 5% female, mean age 58, 27% were Hispanic, 41% were non-Hispanic Black, mean CPD 11 (SD = 8) |
| Interventions | *Control group:* enhanced usual care. Included hospital-directed tobacco-use screening, counselling, education, and pharmacotherapy, all at the discretion of nursing and physician staff, and referral to a state Quitline (this component represented the enhancement).<br><br>*Intervention group:* participants were eligible to receive up to USD 550 for participation in Quitline counselling (USD 50), participation in a community-based cessation program (USD 50), use of pharmacotherapy (USD 50), and biochemically-confirmed smoking cessation at 2 months (USD 150) and 6 months (USD 250). All participants were compensated in US dollars (USD) using ClinCards, a secure prepaid debit card system.<br><br>*Theoretical basis for the intervention:* the incentive intervention used goal-directed incentives (incentives weighted toward use of evidence-based therapies) and outcome-based incentives (incentives for successful achievement of an outcome, like successfully quitting).<br><br>*Duration of intervention:* 6 months<br><br>*Length of follow-up:* 12 months |
| Outcomes | Primary outcome was biochemically-confirmed smoking cessation at 6 months after hospital discharge. |
| Notes | New for 2024 update<br><br>Funding: funded by the Robert Wood Johnson Foundation (Grant 74140) and NIH (K24 DA038345)<br><br>Declarations of interest: none reported by authors |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Quote: "We employed a computer-generated block randomization design, and research staff implemented the allocation sequence using numbered, sealed opaque envelopes." |
| Allocation concealment (selection bias) | Low risk | Quote: "We employed a computer-generated block randomization design, and research staff implemented the allocation sequence using numbered, sealed opaque envelopes." |
| Blinding of outcome assessment (detection bias)<br>All outcomes | Low risk | Biochemically verified |
| Incomplete outcome data (attrition bias)<br>All outcomes | Unclear risk | Numbers followed up slightly different in CONSORT diagram to table 3 (outcomes). |
| Other bias | Unclear risk | 12-month follow-up not reported |

**Lasser 2017**

***Study characteristics***

| | |
|---|---|
| Methods | Unblinded, randomised clinical trial. 1 May 2015 to 4 September 2017<br><br>Country: USA |

**Lasser 2017** *(Continued)*

| | |
|---|---|
| | Setting: Boston Medical Center, a large urban hospital |
| Participants | 352 low socioeconomic status and minority daily smokers. Age of 18+, smoking 10 or more CPD in the past week; in contemplation or preparation stage of readiness to quit smoking; having a primary care clinician in the Section of General Internal Medicine or Department of Family Medicine.<br><br>CG n = 175; IG n = 177. 54% women. Mean age 50. Mean cpd = 15. "majority reported belonging to a racial/ethnic minority group".<br>Socioeconomic status: ≤ USD 20,000: 193 (55%); > USD 20,000: 90 (26%); Refused/do not know: 69 (20%)<br>Education: ≤ High school 80 (23%); High school or GED 137 (39%); > High school 133 (38%) |
| Interventions | *Control Group*: enhanced traditional care control participants received a low-literacy smoking cessation brochure and a list of hospital and community resources for smoking cessation<br><br>*Experimental Group(s):* up to 4 hours of participant navigation delivered over 6 months, and financial incentives for biochemically-confirmed smoking cessation at 6 and 12 months following enrolment. USD 250 for smoking cessation 6 months after study enrolment, as confirmed by a salivary cotinine, and an additional USD 500 for an additional 6 months after the initial cessation (12-month time point), confirmed by a salivary cotinine. Participants who did not quit smoking at 6 months and who had been unaware of the exact dollar amount of the incentive were given a 'second chance' to quit smoking and earn USD 250 at 12 months, having been notified of the exact amount of the incentive.<br><br>*Theoretical basis for intervention:* the Social Contextual Model; operant conditioning for incentives<br><br>*Duration of intervention:* 12 months<br><br>*Length of follow-up:* 12 months |
| Outcomes | Continued abstinence biochemically verified by saliva or urine cotinine (≥ 10 ng/mL) or anabasine test (for those on NRT, < 3 ng/mL). Receipt of counselling, medications |
| Notes | New for 2019 update<br><br>In terms of misreport or no measurement, 21 out of 41 self-reported at 12 months confirmed quit from intervention group versus 4/19 from control group<br><br>Funding: "This study was supported by American Cancer Society (grant No. 125785-RSG-14-034-01CPPB). The funder/sponsor had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication."<br><br>Declarations of interest: "Dr Quintiliani was a consultant on a research grant to Partners HealthCare Inc unrelated to the work presented in this article. No other conflicts are reported." |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Quote: "We randomized participants using a random number generator with allocation concealment to a research assistant using sealed envelopes. Randomization was stratified by stage of change (contemplation vs preparation) with regard to smoking cessation" |
| Allocation concealment (selection bias) | Low risk | Sealed envelopes given to research assistant |
| Blinding of outcome assessment (detection bias) All outcomes | Low risk | Biochemically verified |

**Lasser 2017** *(Continued)*

| | | |
|---|---|---|
| Incomplete outcome data (attrition bias) All outcomes | Low risk | Intervention: 48 lost to follow-up; Control: 53 lost to follow-up (at 12 months). Intention-to-treat analyses used |
| Other bias | Low risk | None detected |

**Ledgerwood 2014**

| ***Study characteristics*** | |
|---|---|
| Methods | Randomised controlled trial; conducted December 2007 to January 2011<br><br>Country: Michigan, USA<br><br>Setting: university clinic |
| Participants | 81 smokers, aged ≥ 18, FTND ≥ 4, literate in English; recruited through newspaper ads, bulletin boards, health fairs, broadcast messages in a health centre and a university<br><br>All participants had to submit 5+ CO samples during 1st week, to qualify to enter the study. Received USD 1 per sample, + a bonus of USD 20 if all 10 samples submitted in week 1<br><br>Standard care (SC): n = 17; Traditional contingency management (TCM): n = 28; Enhanced contingency management (ECM): n = 36; 61% women, mean age 44.8, mean FTND 6.3 |
| Interventions | • SC: Weeks 2 to 5: Monitoring of CO and cotinine + brief counselling (≃ 5 mins) twice a day, 5 days a week for 4 weeks; participants received USD 1 per sample, regardless of result, + weekly bonus of USD 20 for submitting all 10 samples<br>• TCM: as SC, plus chances to win prizes for every negative CO or cotinine or both. On Day 1, participant drew for a prize if CO down by at least 3 ppm; thereafter draws only if CO ≤ 6ppm. Weekly N of draws increased by 1 a day for every day (2 tests) abstinent, up to 5 daily draws by end of week. TCM urn contained 250 slips of paper: 50% had some kind of reward, i.e. 44.8% small (worth around USD 1, e.g. snacks, toiletries); 4.8% large (worth around USD 20, e.g. gift certificates, electronics); and 0.4% jumbo (worth USD 100, e.g. DVD player, gift certificate). In weeks 3 to 5, if Monday cotinine ≤ 100 ng/mL (i.e. weekend abstinence), participant had 5 draw chances. In whole 5-week study course 180 draws and 15 bonus draws were possible.<br>• ECM: as for TCM, but in 1st week, prizes were guaranteed for negative tests. In week 1, ECM urn had 91.2% small, 8% large, and 0.8% jumbo rewards. For remaining 3 weeks, urn contained 65.8% no prize, 30% small, 4% large, and 0.2% jumbo rewards. |
| Outcomes | PPA, cotinine-verified, at 2 months and 6 months<br><br>Other outcomes: prize money won; differences between TCM and ECM schedules |
| Notes | New for 2015 update<br><br>Funding by National Institutes of Health (NIH) grant, and Helene Lycaki/Joe Young Sr funding through the State of Michigan |

| ***Risk of bias*** | | |
|---|---|---|
| **Bias** | **Authors' judgement** | **Support for judgement** |
| Random sequence generation (selection bias) | Low risk | All participants had to have submitted at least 5 samples to qualify for entry.<br><br>Quote: "Statistician-prepared sequentially numbered randomization envelopes concealed group assignment until assigned". Stratified by gender and |

**Ledgerwood 2014** *(Continued)*

| | | |
|---|---|---|
| | | by any CO ≤ 6ppm (none vs 1 or more) on treatment day 1 (quit date). Randomised in a ratio of 2:1 CM:control |
| Allocation concealment (selection bias) | Low risk | Envelopes concealed allocation until assigned |
| Blinding of outcome assessment (detection bias) All outcomes | Low risk | Abstinence biochemically validated |
| Incomplete outcome data (attrition bias) All outcomes | Low risk | 2 months: SC 1/17; TCM 6/28; ECM 5/36 lost<br>6 months: SC 2/17; TCM 7/28; ECM 10/36 lost<br>All analyses conducted as ITT, and differences non-significant |
| Other bias | Low risk | None detected |

**López-Núñez 2016**

| ***Study characteristics*** | |
|---|---|
| Methods | Randomised controlled trial<br>Country: Spain<br>Setting: community setting |
| Participants | N = 154 treatment-seeking smokers in a community setting<br>61.7% female, mean age 44.58 (SD 12.64), mean CPD 21.10 (SD 8.52), FTND 5.53 (SD 1.91). Ethnicity not reported. |
| Interventions | *Control group:* cognitive behavioural therapy (CBT). "Group-based sessions of five or six patients. Each session took about one hour and was carried out once a week over 6 weeks. The components of the CBT program were highly structured and included: information about tobacco, behavioral contract through which the patients pledged to attend the sessions and quit smoking, self-monitoring and graphical representation of cigarette smoking, nicotine fading (a weekly reduction of 30% of nicotine intake from the first to the fourth week, and abstinence from the fifth session onwards), stimulus control, strategies for controlling nicotine withdrawal symptoms, physiological feedback consumption (measured by CO and cotinine), training in alternative behaviors, social reinforcement of objectives completion and abstinence, and relapse prevention strategies. CO and cotinine specimens were collected twice a week. One of the measures coincided with the weekly CBT session and the other was scheduled midweek between sessions. A total of eleven samples were collected for each participant during the treatment. Participants were informed of their CO level and urinalysis results (cotinine) immediately after submitting their specimens, but received no type of reward in exchange for achieving or maintaining abstinence."<br>*Experimental group 1:* CBT plus CM for Abstinence (CMA). "The CM protocol included a vouchers program through which smoking abstinence was reinforced. In order to reinforce patients' behavior, we checked cotinine specimens collected in the fifth CBT session (the first session after the patient was required to be abstinent), between the fifth and sixth CBT sessions and in the sixth CBT session. Participants that tested negative for cotinine earned points exchangeable for rewards on a schedule of escalating magnitude of reinforcement (the first cotinine-negative specimen earned 80 points, with a 20-point increase for each subsequent and consecutive cotinine-negative specimen) with a reset contingency (i.e., cotinine-positive specimens or failure to submit a scheduled specimen set the value back to the initial 80 points). It is noteworthy that this protocol delivered rewards contingent upon smoking abstinence and not only for attending the scheduled appointments. The maximum amount that patients could earn was 300 points, which were exchangeable for rewards with a variety of uses, including |

**López-Núñez 2016** *(Continued)*

| | |
|---|---|
| | leisure activities, cinema, theatre, museums, sports events, gyms, adventure sports, meals in restaurants, training, purchases in department stores, bookshops, clothes shops and art shops, and spa and beauty services."<br><br>*Experimental group 2:* "CBT plus CM for shaping Abstinence (CMS). Patients in this group received the same treatment as the CBT plus CMA group, with just one difference. The CMS procedure reinforced both the closer approximations to smoking abstinence (from the first to the fourth session) and smoking abstinence (from the fifth session onward). The specimens collected from the first to the fourth session that tested progressive reductions in cotinine according to an individualized percentile schedule earned points. The first weekly reduction of 30% of nicotine intake (checked at the session between the first and second CBT sessions and corroborated by a comparable reduction in urine cotinine levels) earned 12 points, with a 4-point increase for both each subsequent nicotine reduction of 30% and abstinence after the fifth CBT session (a maximum of 300 points could be earned). As explained above, failure to submit a urine specimen as scheduled rendered it cotinine positive if the patient did not provide official justification or did not attend the clinic the following day. Points could not be lost once earned, but cotinine-positive specimens or failure to submit a scheduled specimen set the value back to the initial 12 points. However, submission of two consecutive cotinine-negative specimens returned the value to its level before the reset. Points were exchangeable for the same type of rewards that were available for patients included in the CBT plus CMA group."<br><br>*Theoretical basis for intervention:* not reported<br><br>*Duration of intervention:* not reported<br><br>*Length of follow-up:* 6 months |
| Outcomes | Cotinine-verified smoking abstinence at 6 months |
| Notes | |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Unclear risk | Study states participants “were randomly assigned”; no further detail provided |
| Allocation concealment (selection bias) | Unclear risk | No details provided |
| Blinding of outcome assessment (detection bias)<br>All outcomes | Low risk | Biochemical validation (cotinine levels) |
| Incomplete outcome data (attrition bias)<br>All outcomes | Low risk | Minimal attrition |
| Other bias | High risk | Absolute numbers for smoking cessation not reported |

**Medenblik 2020**

***Study characteristics***

| | |
|---|---|
| Methods | Randomised controlled trial<br><br>Country: USA |

**Medenblik 2020** *(Continued)*

| | |
|---|---|
| | Setting: participants were recruited from various settings within a Southeastern metropolitan area |
| Participants | N = 34 adult smokers who met criteria criteria for schizophrenia, schizoaffective disorder, or another psychotic disorder as determined by the Structured Clinical Interview for DSM-5 diagnosis (SCID-5)<br><br>N = 13 control, n = 21 intervention. 20% female. Mean age 48.2. 21 participants identified as African American/Black, 5 as white, 8 as more than one race, and one participant identified as American Indian/Alaskan Native. No participants identified as Hispanic. Mean CPD 17.6. FTND = 5.9 |
| Interventions | *Control group:* "The intensive treatment comparison (ITC) included all the iCOMMIT all components except for the mobile contingency management. Participants received five-session phone CBT. However, these participants did not have a study phone to use, as in the contingency management group, so they completed CBT sessions using their personal phones." Pharmacotherapy was offered to all study participants.<br><br>*Experimental group:* "Multi-Component Mobile-enhanced Treatment for Smoking Cessation (iCOMMIT) is a smoking cessation treatment that combined mobile technology with behavioral, cognitive-behavioral, and pharmacologic approaches. The components of the intervention included the following: 1) behavioral therapy in the form of mobile contingency management (mCM) designed to increase early abstinent rates; 2) pharmacotherapy for smoking cessation (including nicotine replacement therapy [NRT] and bupropion); and 3) five sessions of guideline-based cognitive-behavioral smoking cessation counseling designed to increased coping skills specific to smoking cessation. Participants had the choice as to whether they preferred their first session as a home visit or by telephone. All remaining counseling sessions were conducted by telephone." "mCM Component.—iCOMMIT participants received monetary compensation based on their own reduced CO readings (≤ 6 ppm). The smartphone-based application through which we provided CM allowed participants to generate a video recording of themselves blowing into a handheld CO monitor. They logged in to a secure website via the smartphone application interface that includes pages tailored to each participant, uploaded the video recordings via encrypted network connections, and received reinforcement information all through a mobile smart phone." Incentive amount up to USD 388.50.<br><br>*Theoretical basis:* not reported<br><br>*Duration of incentives:* 6 weeks<br><br>*Length of follow-up:* 6 months |
| Outcomes | 30-day point prevalence smoking cessation confirmed by saliva cotinine at 6 months |
| Notes | New for 2024 update<br><br>Funding: "This grant was supported by the National Institute on Drug Abuse (R34DA038272) and a Senior Research Scientist Award from Veterans Affairs Clinical Sciences Research and Development (IK6BX003777)."<br><br>Declarations of interest: "The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article. The views expressed in this article are those of the authors and do not necessarily reflect the position or policy of Duke University, or any of the institutions with which the authors are affiliated." |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Quote: "Smokers were randomized in a 2:1 ratio to iCOMMIT versus an intensive treatment comparison (ITC). Block randomization was used with random block sizes of three or six, with the number of blocks and sequence developed by the study statistician. The study coordinator was blinded to the randomization sequence." |

**Medenblik 2020** *(Continued)*

| | | |
|---|---|---|
| Allocation concealment (selection bias) | Low risk | Quote: "The study coordinator was blinded to the randomization sequence." |
| Blinding of outcome assessment (detection bias) All outcomes | Low risk | Biochemically validated |
| Incomplete outcome data (attrition bias) All outcomes | Unclear risk | 34 randomised, 27 completed, only 52% retention at 6 months. Attrition not reported by group |
| Other bias | Low risk | None detected |

**Ondersma 2012**

| ***Study characteristics*** | |
|---|---|
| Methods | Study design: 4-arm factorial RCT; July 2008 to November 2009<br><br>Country: USA<br><br>Setting: 4 prenatal clinics in Detroit, Michigan |
| Participants | 110 pregnant smokers, aged 18+, gestation < 27 weeks. Allocated to CD-5As (N = 26); CM-Lite (N = 28); CD-5As+CM-Lite (N = 30); TAU (N = 26)<br><br>Mean age 27.9 years, 81.8% Black; mean CPD 8. |
| Interventions | *Control (TAU):* standard care from prenatal clinic staff, without any input from research team. Participants used PC tablets to complete a brief series of questions about their musical preferences, watched a series of tailored music videos, and answered questions about the videos, i.e. computer time was blinded, and comparable with intervention groups.<br><br>All participants completed a baseline 11-item assessment of ease of use, enjoyment, helpfulness, satisfaction.<br><br>*Experimental Groups:*<br><br>• *CD-5As:* PC tablet, with interactive software; participants accessed with headphones, for privacy. Content was 5As programme (Ask, Advise, Assess, Assist, Arrange), or 5Rs (Relevance, Risks, Rewards, Roadblocks, Repetition) for those unwilling to set a quit date. Included a 4- to 6-minute professional video of black male obstetrician + 3 testimonials, tailored to participant's reactivity, defensiveness, quit status. All gave positive advice to quit. Programme led participant through advice, feedback, plan development, support options. Participants at baseline completed 5-item additional assessment of likelihood of quitting, intention to quit, confidence in ability to quit, readiness to quit, desire to quit<br>• *CM-Lite:* designed for non-treatment-seeking participants in a healthcare setting. No proactive tracking, but relying on participant to request verification of smoking status. Testing offered only at antenatal visits, rather than multiple times a day. Participants eligible for unlimited incentivisation attempts, but only 5 reinforcement vouchers available (retail gift cards worth USD 50). Programme was delivered by a website, which took participants through verification process and recorded result (urinary cotinine test).<br>• *Combination of CD-5As and CM-Lite* |
| Outcomes | Follow-up at 10 weeks<br><br>7-day PPA, 30-day CA, validated by CO < 4 ppm, urinary cotinine (Nicalert strips) < 100 ug/mL |

**Ondersma 2012** *(Continued)*

| | |
|---|---|
| | Mean N of samples submitted, and modal N of negative samples; mean amount of gift vouchers earned; mean amount earned among those submitting a sample; help-seeking behaviour |
| Notes | New for 2015 update |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | By computer for brief intervention (1:1), then by random-number generator (www.randomization.com) for CM component |
| Allocation concealment (selection bias) | Low risk | See above |
| Blinding of outcome assessment (detection bias) All outcomes | Low risk | Abstinence biochemically validated |
| Incomplete outcome data (attrition bias) All outcomes | Low risk | CD-5As: 3/26 lost; CM-Lite 6/28 lost; CD-5As+CM-Lite 4/30 lost; TAU 3/26 lost. All participants included in ITT analyses |
| Other bias | Low risk | None detected |

**Pisinger 2022**

***Study characteristics***

| | |
|---|---|
| Methods | Cluster-randomised controlled trial with matched controls for each 'intervention' arm (only randomised part of the study included in this review).<br><br>Country: Denmark<br><br>Setting: the investigator invited Danish municipalities to participate. Six agreed and were randomised. |
| Participants | 875 motivated smokers approaching services (6 municipalities). N = 295 incentives; n = 580 control.<br><br>"The majority of the participants were 45 to 66 years old." Ethnicity not reported. Mean CPD 20.<br><br>FNTD Incentive group: low (0–6) 200 (67.8%); high: 95 (32.2%). FTND Control group: low 411 (70.9%); high: 169 (29.1%) |
| Interventions | *Control:* campaign group. "Each of the three CAM received 100,000 Danish kroner to use on campaigns aimed at smokers with low socio economy. The aim of the campaign was not to inform about the negative health effects of smoking or the benefits of smoking cessation, but to encourage smokers to use the municipal SC-GSP."<br><br>*Experimental:* "Each of the three FIM received 100,000 Danish kroner (approx. $16,000) to reward smokers who were abstinent when attending the SCGSP. The amount was given as a voucher to be used in a local shopping mall (which also had a grocery store). Smokers who did not know about the financial incentives when they signed up for the SC-group also received incentives when being abstinent. Abstinence from smoking was confirmed by carbon-monoxide levels." The maximum reward was 1200 Danish kroner (approx. $190) per ex-smoker. "Abstinent smokers received a voucher worth 200 Danish kroner (approx. $32) at the third, fourth and fifth session and a voucher worth 600 Danish kroner (approx. $95) when they attended the last session, having been abstinent for 4–6 weeks." |

**Pisinger 2022** *(Continued)*

| | |
|---|---|
| Outcomes | Self-reported 6-month point prevalence (smoke-free for at least the last 14 days). CO validated. |
| Notes | New for 2024 update<br><br>Funding: "This research was funded by Tryg Foundation (Trygfonden), Denmark (an independent charity that funds research and development related to health and social issues; grant 119404). Furthermore, the Danish Heart Foundation funded C.P.'s professorship during work on this paper. The Parker Institute, Bispebjerg and Frederiksberg Hospital is supported by a core grant from the Oak Foundation (an independent charity that funds research and development related to social issues; grant OCAY-18-774-OFIL)."<br><br>Declarations of interest: "The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results." |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Quote: "Randomisation of the intervention municipalities: At a start-up meeting (May 2017) with the SC-counselors from all six intervention municipalities, the municipalities were randomised by flipping a coin. We paired municipality representatives two and two and they decided who should flip the coin. Heads meant that the municipality was randomised to the FIM, tails to the CAM." |
| Allocation concealment (selection bias) | High risk | As above |
| Blinding of outcome assessment (detection bias)<br>All outcomes | Low risk | Biochemically verified |
| Incomplete outcome data (attrition bias)<br>All outcomes | High risk | Quote: "Lost to follow-up rates were much lower after 6 and 12+ months in the FIM than in the other groups". Loss to follow-up was 57% in control group. |
| Other bias | High risk | Quote: "Intervention was fully delivered in only one out of three municipalities. In one municipality, one of the two SC-counselors was on sick leave for half of the intervention year, and all SC-activities were stopped in another municipality after approx. eight months due to a local political decision."<br><br>Cluster-randomisation not considered in the analysis. |

**Rand 1989**

***Study characteristics***

| | |
|---|---|
| Methods | Quasi-randomised 3-arm controlled trial<br><br>Country: USA<br><br>Setting: employees at a Baltimore hospital |
| Participants | 51 smokers, average age 38.1, 74.5% women, CPD 26 |
| Interventions | Introductory lecture, ACS brochure *Clearing the Air*, baseline measures taken. After confirmed 5-day abstinence (USD 25 reward), participants assigned either to: |

**Rand 1989** *(Continued)*

- *Contingent Group*: contingent payment/frequent monitoring: checked twice a week at random times, paid USD 4 per CO < 11 ppm
- *Non-contingent Group*: non-contingent payment/frequent monitoring: checked twice a week at random times, paid USD 4 per CO sample, regardless of reading
- *Control Group*: non-contingent payment/infrequent monitoring: checked monthly at random times, paid USD 4 per CO sample, regardless of reading

Programme lasted 26 weeks

| | |
|---|---|
| Outcomes | 3 x daily CO samples < 11 ppm to confirm 5-day qualifying abstinence. Monthly survival analysis (continuous cessation) to 6 months. Dropouts and relapsers treated as continuing smokers |
| Notes | Study funded by National Institute on Drug Abuse |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Unclear risk | Randomisation method not stated; "subjects were randomly assigned to one of three follow-up groups" after 5 days confirmed abstinence. |
| Allocation concealment (selection bias) | Unclear risk | Not stated |
| Blinding of outcome assessment (detection bias) All outcomes | Low risk | Abstinence biochemically validated |
| Incomplete outcome data (attrition bias) All outcomes | High risk | 4/51 participants dropped out in abstinence week; by 6 months, 6 contingents, 1 non-contingent and 4 controls had dropped out. Although dropout reasons were generally unrelated to participation (e.g. heart attack, pregnancy, work move), significantly more contingents dropped out ($Chi^2 = 13.63$, P = 0.005) |
| Other bias | Low risk | None detected |

**Rettig 2018**

***Study characteristics***

| | |
|---|---|
| Methods | Pilot RCT. 2014 to 2018<br>Country: USA<br>Setting: Johns Hopkins Cancer Treatment Centers |
| Participants | 30 smokers with head and neck or thoracic malignancies undergoing radiation therapy. Age 18+. Reported smoking cigarettes within the previous 14 days. CG: n = 11; IG: n = 19.<br>Mean age = 55. Mean CPD = 8. N = 11 women (38%). Ethnicity: white: 18 (62%); Black or other non-white 11 (38%). Education: Did not finish high school n = 7 (24%); High school graduate or GED n = 11 (38%); Post-high school n = 11 (38%). Income: < USD 15,100: 11 (38%); USD 15,000 to USD 49,999: 6 (21%); USD 50,000 to USD 99,999: 4 (14%); > USD 100,000: 7 (24%)<br>Mental health history: anxiety: 3 (10%) depression: 6 (21%) bipolar disorder: 2 (7%) HADS-D (Hospital Anxiety and Depression Scale - Depression subscale) score < 8 (not depressed): 20 (69%); 8+ (depressed): 9 (31%). Ever used injection drugs: No: 23 (79%) Yes: 6 (21%) |

**Rettig 2018** *(Continued)*

| | |
|---|---|
| Interventions | *Control Group*: 'Enhanced usual care': single counselling session at the baseline visit. The baseline visit for the control group comprised 4 intervention components to constitute enhanced usual care: (1) brief counselling by a trained tobacco treatment specialist consistent with the '5 As' recommended by the United States Department of Health and Human Services37; (2) a smoking cessation workbook tailored to people with cancer; (3) contact information for local and national smoking cessation resources, including some offering free nicotine replacement therapy; and (4) mental health screening to evaluate depressive symptoms<br><br>*Experimental Group:* Usual care plus up to 4 additional daily visits during the first week. At baseline, the intervention group received the smoking cessation workbook and underwent intensive tobacco treatment specialist motivational interviewing, with brief follow-up motivational interviewing sessions at subsequent study visits, daily for the first week, then weekly for 8 weeks. Other additional interventions received included: enrolment in the National Cancer Institute's free smokefreetxt text-messaging programme (smokefree.gov); contingency management at each visit, by which participants received USD 5 gift cards for biochemically-confirmed smoking abstinence; and guided pharmacotherapy. Pharmacotherapeutic options offered were combination nicotine replacement therapy (patch/gum, patch/lozenge, or patch/nasal spray), bupropion, and varenicline. Participants were permitted to opt out of intervention components<br><br>*Theoretical basis for intervention:* not reported<br><br>*Duration of intervention:* 8 weeks<br><br>*Length of follow-up:* 12 months |
| Outcomes | PPA at 12 months, CO-verified, confirmed as exhaled CO 8 ppm. Smoking abstinence at 1, 2, 3, 4, 5, 6, 7 and 8 weeks, and at 3 and 6 months. Smoking intensity (total cigarettes per previous 7 days), reduction from baseline, and total cigarettes smoked |
| Notes | New for 2019 update<br><br>Funding: "This work was supported by the National Institute of Dental and Craniofacial Research and National Institutes of Health Research Training in Otolaryngology grant (grant number 2T32DC000027026) and the Maryland Department of Health and Mental Hygiene Cigarette Restitution Fund (grant number PHPA-G2034). The study sponsors had no role in study design or in the collection, analysis, or interpretation of data"<br><br>Declarations of interest: not reported |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Participants were randomised to enhanced usual care ("control") or intervention groups using 1:1 block randomisation with stratification by cancer site (head and neck versus thoracic) and sex. Randomisation was generated using SAS software (Cary, NC) |
| Allocation concealment (selection bias) | Low risk | Allocation concealed in sequentially-numbered opaque envelopes until study group assignment |
| Blinding of outcome assessment (detection bias) All outcomes | Low risk | Biochemically validated |
| Incomplete outcome data (attrition bias) All outcomes | Low risk | Quote: "One participant in the control group was lost to follow-up after the baseline visit; therefore, the analytic cohort comprised 29 participants (19 intervention and 10 control)" |
| Other bias | Low risk | None detected |

### Rohsenow 2015

| ***Study characteristics*** | |
|---|---|
| Methods | 4-arm RCT. Recruitment: June 2002 to June 2006. End date not reported<br><br>Country: USA<br><br>Setting: a state-funded inner-city 28-day residential substance abuse treatment programme |
| Participants | 184 people meeting current DSM-IV substance-use disorder (SUD) criteria, smoking at least 10 CPD for the past 6 months, not engaged in smoking treatment. CG: n = 86; IG (CV): n = 98.<br>Gender N = 102, 55.4% women. Mean age = 34.5. Mean CPD = 22.3. Ethnicity: 83.2% (n = 153) were white, 9.2% (n = 17) were black, 7.5% (n = 14) were of other races; 6.6% (n = 12) were Hispanic. Socioeconomic status: mean legal income was USD 9487 in the past year, mean education level was 12.2 years. 71.2% alcohol abuse or dependence, 73.9% cocaine abuse or dependence, 52.8% opiate abuse or dependence, and 37% marijuana abuse or dependence |
| Interventions | *Control Group*: BA (Brief advice): 1 x 15-minute session to promote motivation to quit, adapted for SUD recovery issues. Advice given re: quit date, NRT, support groups, resources, smoking cessation pamphlets and corrective information, if needed. Followed up after first session at 7, 14 and 19 days (10 to 15 minutes each). Progress asked and revision of goals, if necessary<br><br>*Experimental Group(s):* MI (motivational interviewing): 1 x 45-minute session providing education re: smoking cessation, discussion of pros and cons, health risks and costs, corrective information, goal-setting + written smoking cessation pamphlets. Followed up after first session at 7, 14 and 19 days (15 to 30 minutes each). Progress asked and revision of goals, if necessary<br><br>Intervention and control groups then randomised into receiving either Contingency Vouchers (CV) or Non-Contingency vouchers (NCV).<br>Contingent voucher procedures were provided during a 5-day reduction phase plus a 14-day abstinent phase. CO monitoring used an EC50 Micro III Smokerlyzer. In NCV, participants could earn the same payments a day for 19 days as those randomised to CV, simply for providing breath samples as scheduled.<br><br>*Theoretical basis for intervention:* MI<br><br>*Duration of intervention:* 4 sessions for MI; 4 sessions for BA. 19 days<br><br>*Length of follow-up:* MI: 12 months |
| Outcomes | PPA at 12 months. CO level ≤ 4 ppm and salivary cotinine level ≤ 15 ng/mL. Timeline follow-back method to assess smoking reduction (number of CPD), number of heavy-drinking days, number of drug-use days, and relapse to any heavy drinking or drug use over the 12 months |
| Notes | New for 2019 update<br><br>Funding: "Supported by 1 RO1 DA13616 from the National Institute on Drug Abuse; two Senior Career Research Scientist Awards from the Department of Veterans Affairs (DJR and PMM); and K05AA019681 from the National Institute on Alcohol Abuse and Alcoholism. The views expressed in this article are those of the authors and do not necessarily reflect the position or policy of the Department of Veterans Affairs."<br><br>Declarations of interest: not reported |

| ***Risk of bias*** | | |
|---|---|---|
| **Bias** | **Authors' judgement** | **Support for judgement** |

**Rohsenow 2015** *(Continued)*

| | | |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Stratified random assignment, using urn randomisation |
| Allocation concealment (selection bias) | Unclear risk | Not reported |
| Blinding of outcome assessment (detection bias)<br>All outcomes | Low risk | Biochemically validated. CO verification not required for those in prison at follow-up<br>Quote: "At follow-up, people with a CO 4 ppm, cotinine 15 ng/mL (if not using NRT), or missing CO or cotinine data, or with self-reported smoking were coded as having smoked with the following exception: if the participant was in prison, self-report was accepted since biological verification equipment was not allowed so lack of verification was unrelated to participant decision (Number of prisoners claiming abstinence: n = 2 at 3 months, n = 1 at 6 months, n = 3 at 12 months.)" |
| Incomplete outcome data (attrition bias)<br>All outcomes | Low risk | 12-month follow-up was completed by 139 (75.5%) |
| Other bias | Low risk | None detected |

**Rohsenow 2017**

| | |
|---|---|
| ***Study characteristics*** | |
| Methods | RCT. Initial start date not reported<br><br>Country: USA<br><br>Setting: 2 inner-city state-funded residential substance-use disorder (SUD) treatment programmes |
| Participants | 340 smokers who had not sought smoking treatment in a residential SUD treatment programme, meeting current DSM-IV SUD criteria and smoking at least 10 CPD for the past 6 months. CG (NV) n = 168. IG (CV) n = 172.<br><br>Gender: 33% women. Mean age: 37.58. Mean CPD = 19.48. Ethnicity: white: 86%; Black/ African American: 10%; Asian: < 1%; multi-racial: 2%. Annual Income: USD 0 to USD 9999: 59%; USD 10,000 to USD 29,999: 26%; USD 30,000 to USD 49,999: 9%; USD 50,000+ 6%. Education years, mean = 12.09. Alcohol use disorder: 76%; opiate use disorder: 49%; cocaine use disorder: 60%; marijuana use disorder: 36% |
| Interventions | *Control Group*: NV: vouchers not contingent on smoking status. (USD 8 per sample), plus a USD 40 bonus for providing all 33 samples (total possible = USD 304). All received brief advice (BA), a standard of care for smokers not seeking smoking treatment, then 7, 14, and 19 days later (subsequent sessions, 10 to 15 minutes). 4 sessions in total, and up to 8 weeks of NRT. To encourage participants to provide a breath CO sample regardless of whether they had been smoking, USD 1 was provided simply for providing the sample (non-contingent) regardless of results (total possible = USD 33).<br><br>*Experimental Group(s):* CV: 14 days of vouchers for smoking abstinence (based on CO readings twice a day) after a 5-day smoking reduction period.<br><br>Reduction phase. USD 2 per test for a 25% reduction from baseline CO, USD 4 for 50% reduction, and USD 6 for a 75% or greater reduction.<br><br>Abstinence phase. Escalating schedule of payments provided increasing levels of payments in vouchers for each successive CO reading ≤ 6 ppm. USD 3 for the first sample, increasing by USD 0.50 for each consecutive negative test to USD 16.50 for the 28th consecutive abstinent breath sample, plus USD 10 bonuses provided every time 3 consecutive readings showed abstinence. Whenever a breath sample |

**Rohsenow 2017** *(Continued)*

| | |
|---|---|
| | did not meet the criterion for abstinence, the participant earned no voucher and the payment schedule reverted to the initial USD 3 level, then after 3 consecutive abstinent samples the schedule returned to the payment level at which the reset occurred<br><br>Total possible payment: participants who completed all 19 days of samples and missed no more than 3 of the scheduled breath tests earned a USD 40 bonus voucher (total possible = USD 433 plus USD 33 for showing up = USD 466)<br><br>*Theoretical basis for intervention:* not reported<br><br>*Duration of intervention:* 19 days vouchers plus 8 weeks NRT<br><br>*Length of follow-up:* 12 months |
| Outcomes | PPA at 12 months, CO level ≤ 4 ppm and salivary cotinine ≤ 15 ng/mL<br><br>At 1, 3, 6 months, the Timeline Followback interview for number of cigarettes each day, number of days of drug use, and number of heavy drinking days. At pretreatment and at 1 month, participants completed a Smoking Self-Efficacy Questionnaire |
| Notes | New for 2019 update<br><br>Funding: "Supported by 1 R01 DA023995 from the National Institute on Drug Abuse; a Senior Career Research Scientist Award from the Department of Veterans Affairs to the first author; and K05AA019681 from the National Institute on Alcohol Abuse and Alcoholism. The views expressed in this article are those of the authors and do not necessarily reflect the position or policy of the Department of Veterans Affairs or the official views of the National Institutes of Health."<br><br>Declarations of interest: not reported |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Urn randomisation |
| Allocation concealment (selection bias) | Unclear risk | Not reported |
| Blinding of outcome assessment (detection bias) All outcomes | Low risk | Biochemically validated |
| Incomplete outcome data (attrition bias) All outcomes | Low risk | Incomplete data for Intervention: 27% (CV) and 32% (NCV). Judged low risk as below 50% and ITT used |
| Other bias | Low risk | None detected |

**Romanowich 2015**

***Study characteristics***

| | |
|---|---|
| Methods | RCT June 2005 to November 2010<br><br>Country: USA |

**Romanowich 2015** *(Continued)*

| | |
|---|---|
| | Setting: San Antonio, TX |
| Participants | 146 volunteers who worked at the University of Texas Health Science Center at San Antonio, lived near that centre, or both<br><br>Smoking > 15 CPD, regularly for at least 1 year, and planning to quit smoking within the next month. Age 18+ with CO > 15 ppm<br><br>All participants were classified as early success (ES) from the results of a 5-visit baseline fixed reinforcement period before randomisation. Participants were all classified as ES based on their performance during a 5-visit abstinence trial. During this trial, participants received USD 5.00 for each breath sample.<br><br>CG: n = 47, IG 'Hard to treat' (HTT) percentile criterion: n = 37; IG HTT fixed n = 40; IG- 'early success' (ES) Escalating: n = 59, IG-ES Fixed: n = 58.<br><br>Mean age 41. Mean CPD = Control: 21.9 (6.3), Escalating: 21.7 (5.3), Fixed: 24.3 (6.9).<br>Gender (% female) = Control:16 (55), Escalating: 25 (42), Fixed: 26 (45).<br>Ethnicity: white: Control: 16 (55%), Escalating: 43 (73%), Fixed 39 (67%).<br>Income: < USD 15,000 Control: 8 (28%), Escalating: 26 (44%), Fixed: 29 (50%); USD 15,000 to USD 24,999 Control: 7 (24%), Escalating: 12 (20%), Fixed: 13 (22%); USD 25,000 to USD 34,999 Control: 7 (24%), Escalating: 6 (10%), Fixed: 6 (10%); > USD 35,000 Control: 7 (24%), Escalating: 15 (25%), Fixed: 10 (17%).<br>Education: GED or high school: Control: 11 (38%), Escalating: 21 (36%), Fixed: 23 (40%); Vo tech or associated: Control: 12 (41%); Escalating: 21 (36%); Fixed: 22 (38%); Bachelors+: Control: 6 (21%), Escalating: 17 (29%), Fixed: 13 (22%) |
| Interventions | *Control Group*: payments for CO tests, not contingent on abstinence. A two-in-three chance of receiving a payment on any visit (the probability for each visit was independent of other visits), regardless of their breath CO sample<br><br>*Experimental Group(s):*<br><br>• Escalating reinforcement group: specifically, the value of the payment available started at USD 5.00 and increased by USD 0.50 with the delivery of each breath CO sample<br>• Fixed reinforcement group: the value of the potential payment for these participants was always USD 19.75, regardless of how many consecutive criterion breath CO samples they had previously submitted<br><br>For both escalating and fixed reinforcement groups, the total payment amount possible was USD 1185.00 over the 60-visit intervention period<br><br>*Theoretical basis for intervention:* not reported<br><br>*Duration of intervention:* 60 visits, approximately 12 weeks<br><br>*Length of follow-up:* 6 months |
| Outcomes | PPA at 6 months. CO criterion of < 4 ppm. Saliva cotinine level < 20 ng/mL. Use of smoking cessation medication. CPD in past 6 week at 6 months |
| Notes | New for 2019 update<br><br>CO cut-off of < 3 ppm stated in NCT entry but < 4 ppm stated in email correspondence with author<br><br>Funding: "The research reported in this paper was supported by Grant DA013304 to R. J. Lamb."<br><br>Declarations of interest: not reported |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|

**Romanowich 2015** *(Continued)*

| | | |
|---|---|---|
| Random sequence generation (selection bias) | Unclear risk | Not computer-generated<br><br>Quote: "Random assignment to one of the three groups was accomplished by assigning two participants to the escalating reinforcement group, two to the fixed reinforcement group, and one to the control group from each group of five participants who completed the abstinence trial" |
| Allocation concealment (selection bias) | Unclear risk | Not reported |
| Blinding of outcome assessment (detection bias)<br>All outcomes | Low risk | Biochemically validated |
| Incomplete outcome data (attrition bias)<br>All outcomes | Low risk | > 80% follow-up across all conditions (data supplied by authors).<br><br>Quote: "All participants randomly assigned to one of the study conditions were included in the analysis. All missing data points were counted as not meeting the breath CO criterion (i.e. positive) for that visit." |
| Other bias | Low risk | None detected |

**Secades-Villa 2014**

| ***Study characteristics*** | |
|---|---|
| Methods | Randomised controlled trial<br><br>Country: Spain<br><br>Setting: community-based, conducted in Addictive Behaviors Clinic at Oviedo University |
| Participants | 92 smokers of > 10 CPD, aged > 18, motivated to quit, recruited by flyers, local media ads and word of mouth<br><br>Mean 64.1% women; mean age 45.8 (SD 12.1); mean CPD 21.7 (SD 8.7); mean FTND 5.7 (SD 1.8); CBT 35.4% in full-time work, CBT+CM 55.8% |
| Interventions | • CBT (control) group: group-based counselling, 5 to 6 participants. 1-hour sessions, weekly over 6 weeks. Main technique nicotine fading, based on weekly 30% reduction, with abstinence required from week 5 onwards. Also info about tobacco, a behavioural contract, self-monitoring, withdrawal strategies, physiological feedback, social reinforcement, relapse prevention. Cotinine and CO collected twice a week, i.e. 11 samples over the 6 weeks<br>• CBT + CM: as for CBT, plus voucher system, beginning in week 5 CBT session; negative ≤ 80 ng/mL. First negative specimen earned 80 points (1 point = EUR 1), with a 20-point increase for each subsequent and consecutive negative sample. Missing samples counted as negative, and missing or failed set the reward back to 80 points. Max value EUR 300 (3 consecutive negative specimens)<br><br>Points could be exchanged for vouchers for “leisure activities, cinema, theatre, museums, sports events, gyms, adventure sports, meals in restaurants, training, purchases in department stores, bookshops, clothes shops and art shops, and spa and beauty services”. |
| Outcomes | Primary: 7-day PPA at end of treatment, at 1 month and at 6 months; CA at 6 months (all 3 time-point tests to be negative)<br><br>Biochemical validation by CO < 4 ppm, cotinine < 80 ng/mL<br><br>Secondary: treatment retention; % attending throughout the 6-week course |

**Secades-Villa 2014** *(Continued)*

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|---|---|
| | Testing was twice a week, rather than daily+ |
| Notes | New for 2015 update<br><br>Funding was from Spanish Ministry of Science and Innovation grant PS12011-22804, and predoctoral grants BP12-037; Foundation for the Promotion of Applied Science Research and Technology in Asturias; and Spanish Ministry of Economy and Competitiveness (BES-2012-053988). |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Quote: "Eligible participants were randomly assigned …, in accordance with a computer-generated randomization list" (p. 64) |
| Allocation concealment (selection bias) | Unclear risk | Not stated |
| Blinding of outcome assessment (detection bias)<br>All outcomes | Low risk | Abstinence biochemically validated |
| Incomplete outcome data (attrition bias)<br>All outcomes | Unclear risk | Attrition at 6 months not reported (at 1 month, 10 control and 1 intervention lost to follow-up) |
| Other bias | Low risk | None detected |

**Secades-Villa 2019a**

***Study characteristics***

| | |
|---|---|
| Methods | Randomised controlled trial<br><br>Country: Spain<br><br>Setting: clinical unit of addictive disorders |
| Participants | 120 people who smoke receiving treatment for depression<br><br>Intervention n = 60, control n = 60<br><br>71% female. Mean age 51. Ethnicity, not reported. Mean CPD 21. Nicotine dependence (FTND) 6.5 |
| Interventions | *Experimental Group(s):* cognitive behavioural therapy plus behavioural activation therapy plus contingency management. Contingent escalating incentives schedule<br><br>*Control Group*: cognitive behavioural therapy plus behavioural activation therapy<br><br>*Theoretical basis for intervention:* not reported<br><br>*Duration of intervention*: 3 months<br><br>*Length of follow-up:* 6 months |
| Outcomes | Continuous tobacco abstinence, non-biochemically validated |
| Notes | New for 2024 update |

**Secades-Villa 2019a** *(Continued)*

| | |
|---|---|
| | Funding: "This research was supported by the National Agency of Research of the Spanish Ministry of Science, Innovation and Universities and the European Regional Development Fund MINECO/FEDER(PSI2015- 64371-P) and by two predoctoral grants from the National Agency of Research of the Spanish Ministry of Science, Innovation and Universities (BES-2016-076663/FPU15/04327). The funders had no role in the study design, data collection and analysis, decision to publish, or preparation of the manuscript."<br><br>Declarations of interest: none reported by authors |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Participants were randomised using a computerized-random number generator |
| Allocation concealment (selection bias) | Unclear risk | Not reported |
| Blinding of outcome assessment (detection bias) All outcomes | Low risk | Quote: "Biochemical samples of carbon monoxide (CO) and cotinine samples were collected at the intake assessment and at each of the therapy and follow-up visits to confirm abstinence status. A piCO Smokerlyzer (Bedfont Scientific Ltd, Rochester, UK) and the BS-120 chemistry analyzer (Shenzhen Mindray Bio-medical Electronics Co. Ltd., Shenzhen, P. R. China) were used for this purpose. In all instances, CO readings ≤4 ppm (parts per million) and cotinine levels ≤80 ng/ml (nanograms per millilitre) indicated abstinence status." |
| Incomplete outcome data (attrition bias) All outcomes | Low risk | No differential follow-up |
| Other bias | Low risk | Only 2 arms of 3-arm trial reported in this paper but reported elsewhere |

**Secades-Villa 2019b**

***Study characteristics***

| | |
|---|---|
| Methods | Randomised controlled trial<br><br>Country: Spain<br><br>Setting: community |
| Participants | 110 treatment-seeking smokers from the general population, recruited through advertisements in the local media and flyers posted in the community and by word of mouth<br><br>Intervention n = 55, control n = 55<br><br>63.6% female, mean age 43.79, mean CPD 20.83, FNDT 5.43 (SD 1.89) |
| Interventions | Both groups received "11 sessions (i.e., six therapy sessions and five midweek sessions to collect biochemical samples) over 6 weeks (in the last week only one session was delivered). The CBT program was implemented in group-based sessions of five or six patients. Each session took about 1 hour and was carried out once a week over this 6-week period. The main component of this intervention was nicotine fading. From the first to the ninth session, patients were asked to gradually reduce their nicotine intake, and they had an individualized pattern of nicotine intake for session, based on a 15% reduction between each session. To achieve this goal, a maximum number of cigarettes per day and also specific cigarette brands with lower nicotine levels were recommended. From the ninth session up |

**Secades-Villa 2019b** *(Continued)*

| | |
|---|---|
| | to the end-of-treatment, abstinence was required. Other components of the CBT program included: information about tobacco, behavioral contracting through which the patients pledged to attend the sessions and quit smoking, self-monitoring and graphical representation of cigarette smoking, stimulus control, strategies for controlling nicotine withdrawal symptoms, physiological feedback consumption (measured by CO and cotinine), training in alternative behaviors, social reinforcement of objectives' completion and abstinence, and relapse prevention strategies."<br><br>*Control (CBT plus contingency management shaping)*: "The CM protocol was presented in two phases on a schedule of escalating magnitude of reinforcement with a reset contingency (Roll & Higgins, 2000). From the second to the eighth session, participants in this group received vouchers to reinforce the closer approximations to smoking abstinence according to an individualized schedule. That is, vouchers were contingent on achieving at least a 15% reduction in cotinine level. From the ninth session onward, vouchers were contingent on achieving abstinence (cotinine level <=80 ng/ml). Subjects earned 12 points for the first negative sample, with a four-point increase for each session that achieved the target behavior. Points were worth the actual value of 1€ (US$1.24) each. Participants were informed of their CO level and urinalysis results (cotinine) immediately after submitting their specimens and received the earned voucher in exchange for closer approximations to smoking abstinence (CMS group) or achieving abstinence (CMA group). Failure to submit a urine specimen as scheduled rendered it cotinine positive if the patient did not provide official justification (job-related or medical) and failed to attend the clinic by the following day to submit a specimen. Points could not be lost once earned, but cotinine-positive specimens or failure to submit a scheduled specimen set the value back to the initial 12 points. However, submission of two consecutive cotinine negative specimens returned the value to its level before the reset."<br><br>Maximum amount that participants could earn was EUR 300 and the average amount earned in vouchers was EUR 250.56 (USD 309.02).<br><br>*Intervention (CBT + contingency management abstinence): "*From the ninth session, participants in this group received vouchers to reinforce smoking abstinence (cotinine levels <=80 ng/ml) on a schedule of escalating magnitude of reinforcement with a reset contingency. The first cotinine-negative specimen earned 80 points, with a 20-point increase for each subsequent and consecutive cotinine-negative specimen. That is, closer approximations to smoking abstinence (from the first to the eighth session) were not reinforced.As explained above, failure to submit a urine specimen as scheduled rendered it cotinine positive if the patient failed to provide some sort of official justification and failed to attend the clinic by the following day to submit a specimen. Cotinine-positive specimens or failure to submit a scheduled specimen set the value back to the initial 80 points. The schedule of reward delivery did not allow participants to return to the value they had obtained prior to the reset. However, points could not be lost once earned."<br><br>Maximum amount that participants could earn was EUR 300 (USD 371) (EUR 80/USD 98.86; EUR 100/USD 124; EUR 120/USD 148), and the average amount earned in vouchers was EUR 253.45 (USD 312.59). |
| Outcomes | Point prevalence and continued abstinence at 12 months |
| Notes | Funding statement: "As explained above, failure to submit a urine specimen as scheduled rendered it cotinine positive if the patient failed to provide some sort of official justification and failed to attend the clinic by the following day to submit a specimen."<br><br>Declaration of interest: "The authors report no conflicts of interest." |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Computer-generated randomised list |
| Allocation concealment (selection bias) | Low risk | Computer-generated randomised list |

**Secades-Villa 2019b** *(Continued)*

| | | |
|---|---|---|
| Blinding of outcome assessment (detection bias) All outcomes | Low risk | Biochemical validation and intention-to-treat analysis |
| Incomplete outcome data (attrition bias) All outcomes | Low risk | <50% attrition, no differential attrition |
| Other bias | Unclear risk | No published protocol or statistical analysis plan to check against |

**Secades-Villa 2022**

| | |
|---|---|
| ***Study characteristics*** | |
| Methods | Randomised controlled trial conducted 2018 to 2020<br><br>Country: Spain<br><br>Setting: substance-use disorder treatment |
| Participants | Adults in substance misuse treatment<br><br>CBT: 46. CBT + CM: 34.<br><br>77% female, mean age 45, ethnicity not reported, mean CPD 21, FTND = 6 |
| Interventions | *Control:* CBT. "The CBT protocol included several components previously described in standard cognitive behavioral smoking cessation treatments (Secades-Villa et al., 2014) such as: psychoeducation, bio-chemical feedback, stimulus control, and training in strategies for reducing impulsivity, dealing with nicotine withdrawal symptoms, relapse prevention, and problem solving, among others. The CBT included a nicotine fading component that consisted of decreasing 20% of nicotine each week. Patients were asked to gradually reduce the number of cigarettes and switch their brand to lower-nicotine-content cigarettes each week. Patients were trained in EFT (the capability to pre-experience and project oneself into specific future events)(Morris et al., 2020)....Participants were trained in the visualization of a total of five situations (one situation in one week, two in two weeks, one in a month, and one in three months), and practice visualizing them at each of the therapy sessions and at home."<br><br>*Experimental:* CBT plus contingency management. "This condition included the CBT...and voucher-based CM component for reinforcing tobacco abstinence. It consisted of providing contingent points (incentives) in exchange for biochemically verified tobacco abstinence (CO<=4ppm and urine cotinine <=80ng/ml). Incentives started at 20 points (€20) in the sixth session and increased by 5 points (€5) for each negative sample. Additionally, after each two consecutive negative samples, patients received an additional 10 points. The reinforcement was continued through follow-ups: 45, 50, and 55 points were given to abstinent patients at one-, two-, and three-month follow-ups, respectively."<br><br>*Theoretical basis for intervention:* none specified<br><br>*Duration of intervention:* 3 months<br><br>*Length of follow-up:* 12 months |
| Outcomes | Point prevalence abstinence. CO and urine verification (CO ≤ 4 ppm and urine cotinine ≤ 80 ng/mL) was planned but biochemical verification was not conducted due to the COVID-19 pandemic. |
| Notes | |
| ***Risk of bias*** | |

**Secades-Villa 2022** *(Continued)*

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Unclear risk | "Randomly assigned" but no further details |
| Allocation concealment (selection bias) | Unclear risk | Not reported |
| Blinding of outcome assessment (detection bias) All outcomes | High risk | Biochemical verification not conducted as planned, due to COVID-19 pandemic |
| Incomplete outcome data (attrition bias) All outcomes | High risk | > 50% attrition, higher in control group |
| Other bias | Low risk | None detected |

**Shoptaw 2002**

| ***Study characteristics*** | |
|---|---|
| Methods | Randomised 4-arm controlled trial<br>Country: USA<br>Setting: 3 narcotic treatment centres in Los Angeles, CA |
| Participants | 175 smokers (≥ 10 CPD, expired CO > 8 ppm, cotinine > 30 ng/mL), average age 44, 39.5% women, average 22.1 CPD. No significant differences between groups, except group 3 reported higher cocaine use than other groups |
| Interventions | 2-week baseline and randomisation period, then 12 weeks of treatment with NRT patches, tapered from 21 mg for 8 weeks, to 14 mg for 2 weeks and 7 mg for 2 weeks. CO and urine samples taken x 3/week. Randomised to:<br>• *Group 1*. NRT patch only<br>• *Group 2* NRT patch + relapse prevention (RP)<br>• *Group 3*. NRT patch + CM: USD 2 for 1st CO sample < 8 ppm; each consecutive sample rewarded with voucher increased by USD 0.50, + bonus USD 5 for every 3 consecutive samples. If a sample > 8 ppm, reward process reverted to USD 2 level again, but was restored to previous scale after 1 round of 3 consecutive samples < 8 ppm. Participants could earn up to USD 447.50<br>• *Group 4*. NRT patch + RP + CM (see group 3 procedure) |
| Outcomes | Baseline measures, + thrice-weekly breath and urine samples throughout 12 weeks treatment, + weekly self-report, and same measures at 6 months and 12 months. Participants with missing data were counted as continuing smokers |
| Notes | Additional outcome data supplied by the authors<br>Study funded by National Institute on Drug Abuse, and National Cancer Institute |

| ***Risk of bias*** | | |
|---|---|---|
| **Bias** | **Authors' judgement** | **Support for judgement** |

**Shoptaw 2002** *(Continued)*

| | | |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Quote: "an urn randomization procedure". A randomised 2 x 2 repeated measures design |
| Allocation concealment (selection bias) | Unclear risk | Not stated |
| Blinding of outcome assessment (detection bias) All outcomes | Low risk | Abstinence biochemically validated |
| Incomplete outcome data (attrition bias) All outcomes | Low risk | Group A (patch only): 6 months 5/43, 12 months 7/43 dropped out; Group B (patch + CM): 6 months 6/43, 12 months 8/43 dropped out |
| Other bias | Low risk | None detected |

**Tappin 2015**

| ***Study characteristics*** | |
|---|---|
| Methods | Phase II single-blind randomised controlled trial, conducted July 2012 to September 2013<br><br>Country: UK<br><br>Setting: large health board area, inner city, Greater Glasgow and Clyde (Scotland) |
| Participants | 612 pregnant smokers, aged 16+, English-speaking, gestation 24+ weeks, exhaled CO > 7 ppm. Intervention n = 306, control n = 306. |
| Interventions | *Control:* standard care: all smokers identified at maternity booking referred to the stop-smoking services (SSS), who attempted to contact them. SSS set up a 1-hour session to discuss cessation, + 4 weekly phone calls to support, and 10 weeks free NRT if wished. SSS contacts at 4 weeks, 12 weeks (if quit at 4), 34 to 38 weeks gestation, and 6 months post-natal if quit at 34 to 38 weeks<br><br>*Experimental group:* as for control, plus: up to GBP 400 of shopping vouchers (Love2shop), for engagement or for quitting, or both: GBP 50 for attending the 1-hour face-to-face and setting a TQD (engagement). At 4-week phone check-up, if self-reported no smoking for past 2 weeks, had a researcher visit and CO breath test < 10 ppm; if OK, another GBP 50 voucher. Routine phone call at 12 weeks (for those quit at 4) + CO test, GBP 100 voucher if validated<br><br>Some time between 34 and 38 weeks' gestation, all participants contacted by helpline staff. Researchers visited self-reported quitters for CO and cotinine, and gave GBP 200 for confirmed intervention quitters<br><br>To minimise losses to follow-up, all participants (intervention and control) reporting smoking status and with saliva or urine sample at final follow-up given a GBP 25 shopping voucher (engagement) |
| Outcomes | Abstinence at 4 weeks for all participants (2-week PPA, CO < 10 ppm); 12 weeks, if quit at 4, intervention only (4-week PPA, CO < 10 ppm); 34 to 38 weeks gestation, all participants (< 5 cigs in past 8 weeks, CO < 10 ppm, cotinine (urine < 44.7 ng/mL; saliva < 14.2 ng/mL) if self-reported quit); 6 months post-natal for confirmed quitters at 34 to 38 weeks: still quit or < 5 cigs since quit date, cotinine-confirmed. |
| Notes | Published after last search date<br><br>Change to protocol meant that research team were allowed to collect routine blood samples (residual) in late pregnancy (32 to 42 weeks) from the last 200 women enroled. |

**Tappin 2015** *(Continued)*

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Quote: "The Glasgow clinical trials unit embedded the randomisation in the trial database using randomised permuted blocks, with a block length of four". |
| Allocation concealment (selection bias) | Low risk | Quote: "Allocation was concealed from staff and clients until after consent and recruitment." "The helpline … contacted women, confirmed that all selection criteria had been met, enrolled participants using telephone consent, and conducted concealed random allocation". |
| Blinding of outcome assessment (detection bias) All outcomes | Low risk | Abstinence biochemically validated |
| Incomplete outcome data (attrition bias) All outcomes | Low risk | Attrition equal across groups: 43/303 (14%) control, 46/306 (15%) incentives. ITT analysis assumed all lost to follow-up were continuing smokers, and cross-checked this where possible by residual blood samples |
| Other bias | Low risk | None detected |

**Tappin 2022**

| ***Study characteristics*** | |
|---|---|
| Methods | Randomised controlled trial<br>Country: UK<br>Setting: Stop smoking services |
| Participants | 944 pregnant people attending stop smoking services<br>Intervention group (n = 471)<br>Control group (n = 470)<br>100% female. Mean age 27.9. Ethnicity: 98% white, 0.6% mixed ethnic groups, 0.2% African/Caribbean/Black, 0.2% Asian. Mean CPD: 58% < 10; 35% 11 to 20; 4.5% 21 to 30; 0.4% >31. Nicotine dependence (FTND) mean 4. |
| Interventions | *Experimental Group(s):* incentives at four time points throughout pregnancy, contingent on smoking abstinence<br>*Control Group*: usual stop smoking service care based on NICE guidelines<br>*Theoretical basis for intervention:* not reported<br>*Duration of intervention*: pregnancy<br>*Length of follow-up:* until late pregnancy (between 34 and 38 weeks gestation) |
| Outcomes | Biochemically verified continuous tobacco abstinence (CO ≤ 4 ppm) |
| Notes | New for 2024 update |

**Tappin 2022** *(Continued)*

Funding: "Funded by Cancer Research UK (C48006_A20863); Chief Scientist Office, Scottish Government (HIPS_16_1); HSC Public Health Agency Northern Ireland (NI; SM/R/22); Health and Social Care R&D Division NI Opportunity-Led Research Award (COM/5352/17); Chest Heart and Stroke Northern Ireland 2017_09; Scottish Cot Death Trust; Lullaby Trust 272. The funders had no role in considering the study design or in the collection, analysis, interpretation of data, writing of the report, or decision to submit the article for publication."

Declarations of interest: "All authors have completed the ICMJE uniform disclosure form at www.icmje.org/disclosure-of-interest/ and declare no financial relationships with any organisations that might have an interest in the submitted work in the previous three years; no other relationships or activities that could appear to have influenced the submitted work."

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Automated randomised group allocation, ensuring concealment. Non-stratified randomisation (1:1 allocation) used randomly permuted blocks of varying size (four, six, and eight). Randomisation sequence was computer generated by the York Trials Unit and stored in a specially designed, secure, online programme for data collection. |
| Allocation concealment (selection bias) | Low risk | Automated randomised group allocation, ensuring concealment. |
| Blinding of outcome assessment (detection bias) All outcomes | Low risk | Biochemically validated |
| Incomplete outcome data (attrition bias) All outcomes | Low risk | Even attrition across groups |
| Other bias | Low risk | None detected |

**Tevyaw 2009**

***Study characteristics***

| | |
|---|---|
| Methods | Randomised controlled trial<br>Country: USA<br>Setting: public and private colleges and universities |
| Participants | 110 young adult smokers, with a baseline CO ≥ 10 ppm. Mean age 19.7, 38.2% women, average 12 CPD, 77% white. No significant differences between groups on any demographic variables. Motivation to quit not required (51% reported no plans to quit). |
| Interventions | 2 x 2 psychosocial condition x reinforcement condition<br>• 3 sessions motivational enhancement therapy (MET) counselling over 2 weeks, with either contingent or non-contingent rewards<br>• 3 sessions of progressive muscle relaxation control (REL), with either contingent or non-contingent rewards<br>3 weeks of reinforcement, with CO samples collected in person twice daily from each participant. All participants received USD 75 for completion of baseline interview, and cash payments for follow-ups, |

**Tevyaw 2009** *(Continued)*

| | |
|---|---|
| | i.e. USD 25 at 1 month, USD 35 at 3 months, USD 75 at 6 months, + USD 40 for timely completion of all 3 follow-ups<br><br>(i) *Non-contingent rewards*: USD 5 for each sample, + USD 10 per week for attending ≥ 80% of sample collections. Total available USD 240<br><br>(ii) *Contingency management rewards*: Week 1: USD 1 for reduction of 25% to 49%, USD 2 for 50% to 74%, USD 3 for > 75%. Weeks 2 to 3: Payments for abstinence (< 5 ppm): USD 3 for 1st abstinent sample, increasing by 50c for each subsequent abstinent sample.<br><br>Additional USD 1 for 2 consecutive abstinent samples. Non-abstinent sample meant no bonus for that reading and the clock set back to USD 3 for next abstinent reading. After a reset, 4 consecutive abstinent samples reset the bonus to the pre-reset level. Total available USD 285.50 |
| Outcomes | 7-day PPA at 6 months.<br>Validation: CO < 5 ppm for daily samples; cotinine < 15 ng/mL for non-attenders sending in samples at follow-up |
| Notes | New for 2011 update<br>Additional information supplied by the authors<br>Study funded by National Institute on Drug Abuse, and Dept of Veterans Affairs |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Unclear risk | Quote: "participants were randomly assigned" |
| Allocation concealment (selection bias) | Unclear risk | See above |
| Blinding of outcome assessment (detection bias)<br>All outcomes | Low risk | Abstinence biochemically validated |
| Incomplete outcome data (attrition bias)<br>All outcomes | Low risk | 6 months attrition: CM+MET: 2/28; CM+REL: 2/27; NR+MET: 1/27; NR+REL 1/27 |
| Other bias | Low risk | None detected |

**Tuten 2012**

***Study characteristics***

| | |
|---|---|
| Methods | Study design: 3-armed RCT; May 2005 to January 2009<br><br>Country: USA<br><br>Setting: Center for Addiction and Pregnancy, Baltimore, MD |
| Participants | 102 pregnant, methadone-maintained smokers, aged 18+, ≤ 30 weeks gestation, nicotine-dependent or smoking 10+ CPD<br><br>Contingent behavioural incentives (CBI): 42; non-contingent behavioural incentives (NCBI): 28; treatment as usual (TAU): 32 |

**Tuten 2012** *(Continued)*

| | |
|---|---|
| | Mean age 30.7; mean CPD 18; % unemployed 94.8; mean gestational age 16.5 weeks |
| Interventions | All participants completed an initial 8-day residential course, then went to outpatient status. In 1st week, all completed an Addiction Severity Test (ASI), a structured clinical interview for DSM-IV disorders (SCID), revised FTND. CO testing 3 times a week, urine samples 3 times a week (cotinine) + random cocaine testing once a week<br><br>ASI repeated at 1 month and 3 months and at 6 weeks postpartum, + CO and urine tests. At each testing, all participants received brief (10 mins) motivational interviewing (MI) feedback.<br>Standard info on adverse effects of smoking for mother and baby<br>All this was classified as 'Treatment as usual (TAU)'.<br><br>*Experimental Group:*<br><br>CBI: 12 weeks of eligibility for CBI rewards contingent on reduction or abstinence. Incentives for each negative breath test on Mondays, Wednesdays and Fridays, as follows: week 1: any reduction; weeks 2 to 4: 10% reduction; weeks 5 to 7: 25% reduction; weeks 8 to 9: 50% reduction; weeks 10 to 11: 75% reduction; week 12 – delivery: abstinence (CO < 4 ppm)<br><br>Voucher started at USD 7.50 and increased by USD 1 a day up to USD 41.50. If negative sample missed through the 12 weeks, schedule was reset to USD 7.50. If she achieved 5 consecutive negative tests, the voucher value was restored to former level<br><br>NCBI: "pseudo-yoked" schedules. NCBI participants were each yoked to a random participant in the pilot study (i.e. had submitted CO samples for at least 2 weeks). Participants were told that their behaviour did not determine rewards received, but that they would receive incentives in line with a previously established schedule. NCBI participants had to give breath and urine samples to receive their scheduled incentive. They were eligible for 12 weeks or until delivery |
| Outcomes | Primary target outcome was reduction. Abstinence measured at end of 12-week programme, and 6 weeks postpartum<br><br>Cessation was PPA, biochemically verified (CO < 4 ppm; urinary cotinine < 300 ng/mL) |
| Notes | New for 2015 update |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Unclear risk | Quote: "Participants were assigned randomly" |
| Allocation concealment (selection bias) | Unclear risk | Not stated |
| Blinding of outcome assessment (detection bias)<br>All outcomes | Low risk | Abstinence biochemically validated |
| Incomplete outcome data (attrition bias)<br>All outcomes | Low risk | CBI: 8/42 lost; NCBI 4/28 lost; TAU 7/32 lost, but all included in ITT analyses. |
| Other bias | Low risk | None detected |

**Van den Brand 2018**

| ***Study characteristics*** | |
|---|---|
| Methods | Cluster-RCT; 2016 to 2018<br><br>Country: the Netherlands<br><br>Setting: companies of varying size and from different industry types in the Netherlands. Companies were required to facilitate a smoking cessation training programme at the workplace during or directly after working hours |
| Participants | 604 employed smokers, aged 18+, had smoked tobacco for at least 1 pack year. Mean age 45. IG n = 319; CG n = 285.<br>CPD at baseline ≤ 10: IG n = 58 (18%) CG n = 55 (19%); 11 to 20: IG n = 179 (56%) CG n = 159 (56%); 21 to 30: IG n = 59 (18%) CG n = 58 (20%); ≥ 31: IG n = 9 (3%) CG n = 3 (1%); missing IG n = 14 (4%) CG n = 10 (4%).<br>Ethnicity not reported.<br>Income level: low IG n = 111 (35%), CG n = 68 (24%); middle IG n = 91 (29%), CG n = 84 (29%); high IG n=76 (24%) CG n = 105 (37%); missing IG n = 41 (13%) CG n = 28 (10%).<br>Education level: low: IG n = 97 (30%); CG n = 62 (22%); middle IG n = 136 (43%); CG n = 119 (42%); high IG n = 75 (24%); CG n = 90 (32%); missing IG n = 11 (3%); CG n = 14 (5%) |
| Interventions | *Experimental Group(s):* participants could earn 4 vouchers with a total worth of EUR 350. The first EUR 50 voucher was received on the condition of biochemically-validated smoking abstinence at the end of the smoking cessation training programme. The second and third EUR 50 vouchers could be earned when participants were abstinent 3 and 6 months after finishing the cessation programme. At the end of the study (12 months after completion of the cessation programme), participants could earn an additional EUR 200 voucher<br><br>The vouchers were sent by email in the form of a digital code that could be exchanged in a web shop for a large range of products or activities.<br><br>*Control Group*: a smoking cessation group training programme consisting of a 90-minute session each week for 7 weeks. The pre-existing training programme was designed to help participants to initiate a quit attempt and guide them through the first few difficult weeks of quitting smoking, with an important role for group dynamics and peer support. Participants quit together at the start of the third session, and had quit smoking for about 1 month at the last session |
| Outcomes | Primary: continuous abstinence at 12 months. Cut-off point 9 ppm<br><br>Secondary outcomes: 3 and 6 months biochemically validated abstinence, and self-reported abstinence |
| Notes | New for 2019 update<br><br>Funding: "This study is funded by the Dutch Cancer Society (grant number: UM 2015–7943)"<br><br>Decarations of interest: "DK received an unrestricted grant from Pfizer for an investigator-initiated trial on the effectiveness of practice nurse counseling and varenicline for smoking cessation in primary care (Dutch Trial Register NTR3067). OS received institutional research grants from Pfizer for investigator-initiated trials." |

| ***Risk of bias*** | | |
|---|---|---|
| **Bias** | **Authors' judgement** | **Support for judgement** |
| Random sequence generation (selection bias) | Low risk | The randomisation sequence was generated by a digital programme using the biased urn method, in order to maintain allocation to intervention groups as balanced as possible. |

**Van den Brand 2018** *(Continued)*

| | | |
|---|---|---|
| | | The randomisation programme was written by a statistician (BW), but companies were randomly allocated by an independent research assistant not involved in the study |
| Allocation concealment (selection bias) | Low risk | Group allocation was not revealed to participants or employers until the start of the first training session |
| Blinding of outcome assessment (detection bias) All outcomes | Low risk | Biochemically validated |
| Incomplete outcome data (attrition bias) All outcomes | Low risk | Only 1 post-randomisation exclusion (reported) |
| Other bias | Low risk | None detected |

**Van Schayck 2018**

| ***Study characteristics*** | |
|---|---|
| Methods | Cluster-randomised controlled trial<br>Country: the Netherlands<br>Setting: workplaces |
| Participants | 640 current tobacco smokers in 61 companies recruited<br>Intervention: 31 companies<br>Control: 30 companies<br>% female, mean age, ethnicity, mean CPD, and nicotine dependence not reported. |
| Interventions | *Experimental Group(s):* vouchers for abstinence at the end of training and after 3 and 6 months<br>*Control Group*: seven 90-minute sessions of smoking cessation group training in the workplace<br>*Theoretical basis for intervention:* not reported<br>*Duration of intervention*: 6 months<br>*Length of follow-up:* 6 months |
| Outcomes | Continuous abstinence - biochemical verification not reported |
| Notes | New for 2024 update<br>Funding: not reported<br>Declarations of interest: not reported |

| ***Risk of bias*** | | |
|---|---|---|
| **Bias** | **Authors' judgement** | **Support for judgement** |

**Van Schayck 2018** *(Continued)*

| | | |
|---|---|---|
| Random sequence generation (selection bias) | Unclear risk | Not reported |
| Allocation concealment (selection bias) | Unclear risk | Not reported |
| Blinding of outcome assessment (detection bias)<br>All outcomes | Low risk | Biochemically validated |
| Incomplete outcome data (attrition bias)<br>All outcomes | Unclear risk | Attrition not reported. ITT analysis |
| Other bias | Unclear risk | Conference abstract only. No absolute numbers reported. Unclear if clustering accounted for in the analysis |

**Volpp 2006**

| | |
|---|---|
| ***Study characteristics*** | |
| Methods | Randomised controlled trial<br><br>Country: USA<br><br>Setting: Philadelphia Veterans Affairs Medical Center |
| Participants | All outpatient self-identified smokers invited to complete baseline survey. 404 surveyed, 179 eligible: 92 invited to join Incentives group, 87 to join Control group<br>Mean age 52, 6% women, 25% white, 41.7% completed high school or GED, average 22 CPD, mean years smoking 30, 35% Fagerström score > 7, 17% smoking > 2 packs a day |
| Interventions | • 5 free fortnightly sessions of SC programme, standardised group counselling, plus NRT patches every 2 weeks (4 weeks x 21 mg, 2 weeks x 14 mg, 2 weeks 7 mg)<br>• As for first group, plus USD 20 per session attended, + USD 100 if quit ~ 30 days after programme completion (75 days post-quit date)<br><br>Incentives and control groups conducted separately, to avoid contamination, but same instructor, blinded to assignment and not involved in rewards distribution |
| Outcomes | Primary: initial enrolment within the programme (= attended 1st session)<br>Secondary: cumulative attendance, programme completion<br>7-day PPA at ~ 1 month post-completion (75 days post-quit date), and at 6 months post-completion (~ 7.5 months post-quit date) among those who had quit at earlier time point. ITT analysis, included all 179 eligible smokers, whether or not they had joined the cessation programme<br>Validation: urinary cotinine (< 500 ng/mL). USD 20 reimbursement for attending validation procedure |
| Notes | Sample size estimate of 100 per group would give > 80% power to test enrolment at 5% level of significance, with a 1-sided test of equality of proportions<br><br>New for 2008 update<br><br>Study funded by VA Health Services Research and Development; Center for Health Equity Research and Promotion; Leonard Davis Institute of Health Economics of the University of Pennsylvania School of Medicine; National Institute on Drug Abuse; National Cancer Institute |
| ***Risk of bias*** | |

**Volpp 2006** *(Continued)*

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Randomisation by permuted blocks of 4, stratified by level of smoking (± 2 packs per day) |
| Allocation concealment (selection bias) | Low risk | Sequentially-numbered surveys by computer-generated lists of random numbers |
| Blinding of outcome assessment (detection bias)<br>All outcomes | Low risk | Abstinence biochemically validated |
| Incomplete outcome data (attrition bias)<br>All outcomes | Unclear risk | Losses at 1 month: Intervention 29/92, Control 25/87; Losses at 6 months: Intervention 31/92, Control 26/87<br><br>Enroled in SC programme: Intervention 38, Control 17; Completion rates: Intervention 23/38, Control 10/17 |
| Other bias | Low risk | None detected |

**Volpp 2009**

| ***Study characteristics*** | |
|---|---|
| Methods | Randomised controlled trial<br><br>Country: USA<br><br>Setting: multiple worksites of General Electric Energy Company.<br><br>Results were adjusted for stratification variables, i.e. worksite, income and amount smoked |
| Participants | 878 smokers, randomised to Intervention (436) or control (442). Average age 45, 35% women, average 20 CPD, 25% high school or lower, 65% income > 500% of poverty level. Motivation to quit not required. No significant baseline differences between groups on any demographic variables |
| Interventions | All participants given information on local community-based SC services, + received standard employee benefits, e.g. physician visits, SC pharmacotherapies. All received USD 20 per telephone interview at baseline and at 3 follow-ups, plus USD 25 per confirmatory sample returned<br><br>Intervention: told they would receive USD 100 for completing an SC course, USD 250 for confirmed abstinence at 6 months, and USD 400 for confirmed sustained additional 6-month abstinence |
| Outcomes | Prolonged abstinence at 9 months or 12 months. Those not abstinent at 3 months were retested at 6 months, and followed from then if abstinent. All abstinent at both follow-ups were assessed again 6 months later, i.e. at 15 months or 18 months.<br><br>9- to 12-month endpoint used in 6-month meta-analysis, and 15- to 18-month endpoint in 12-month meta-analysis<br><br>Validation: cotinine by saliva or urine |
| Notes | New for 2011 update<br>Additional information supplied by the author<br>Study was funded by Centers for Disease Control and Prevention and by Pennsylvania Department of Health |

**Volpp 2009** *(Continued)*

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Quote: "performed in permuted blocks of four", stratified by level of smoking (± 2 packs per day), income and worksite. |
| Allocation concealment (selection bias) | Low risk | Quote: "assignments were concealed until all eligible criteria had been entered" |
| Blinding of outcome assessment (detection bias) All outcomes | Low risk | Abstinence biochemically validated |
| Incomplete outcome data (attrition bias) All outcomes | Low risk | At 6 months, 50/436 (Intervention) and 47/442 (Control) lost to follow-up, and 16 and 12 withdrew, respectively.<br>At 6 to 12 months, 43/436 (Intervention) and 35/442 (Control) lost to follow-up, and 13 and 12 withdrew, respectively.<br>At 12 to 18 months, 4/436 (Intervention) and 2/442 (Control) lost to follow-up, and 1 and 0 withdrew, respectively. |
| Other bias | Low risk | None detected |

**White 2013**

***Study characteristics***

| | |
|---|---|
| Methods | Randomised controlled trial; conducted from December 2010 to March 2011<br>Setting: Thailand rural villages |
| Participants | 215 smokers (10.5% of eligible smokers in 30/42 villages)<br>Participants grouped in 2-person teams, either choosing their own partner or being randomly assigned based on village and gender. Controls also paired up<br>N = 128 experimental; 68 control; 13% women, mean age 51, mean CPD 13.5 |
| Interventions | All participants received an initial group counselling session, and a further session at 3-month follow-up<br>Intervention group: signed a 'team commitment' contract:<br>• Opened a savings account, with a minimum deposit of THB 50 (USD 1.67), and a starter bonus of THB 150 (USD 5), with an extra bonus of THB 150 if the account balance reached THB 150 over the 10-week deposit period. Community Health Workers visited weekly for the 10-week duration, to try to elicit additional voluntary contributions.<br>• Cash bonus of THB 1200 (USD 40) to each partner if both were abstinent at 3 months.<br>• Weekly supportive text messages.<br>Intervention group received deposits back if verified quit at 3 months |
| Outcomes | 7-day PPA at 3 months, 6 months, 13 to 16 months ("14 months"); urine cotinine verified at 3 months and 6 months, but 14 months self-report only. Participants not attending at 3 months and 6 months were contacted by CHW or by phone, and tested at home if claimed abstinent |

**White 2013** *(Continued)*

| | |
|---|---|
| | Other outcomes: % receiving 3-month bonus; % quit as teams at 3 months, 6 months and 14 months; partner choice versus random assignment; team versus individual enhancing likelihood of quitting; impact of text messages; cost-effectiveness |
| Notes | New for 2015 update<br>Funded by grants from the US National Institute on Aging and the US National Institute for Child Health and Development<br>Additional information supplied by the author |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Quote: "computer-generated random numbers" by an independent programmer |
| Allocation concealment (selection bias) | Low risk | Quote: "...concealing the sequence from other field staff and participants" |
| Blinding of outcome assessment (detection bias)<br>All outcomes | Low risk | Abstinence biochemically validated |
| Incomplete outcome data (attrition bias)<br>All outcomes | Low risk | Intervention: 1/128 death, 3/128 missing baseline data; Control: 1/68 missing baseline data |
| Other bias | Low risk | None detected |

**White 2020**

***Study characteristics***

| | |
|---|---|
| Methods | Cluster-randomised controlled trial<br>Country: Thailand<br>Setting: workplaces |
| Participants | 4190 employees who had ever smoked more than 100 cigarettes, across 101 workplace clusters<br>Intervention groups:<br>• $20 individual bonus n = 507<br>• $40 individual bonus n = 479<br>• Team bonus n = 491<br>• Deposits n = 394<br>• Deposits plus $20 individual bonus n = 513<br>• Deposits plus $40 individual bonus n = 489<br>• Deposits plus team bonus n = 495<br>• Control n = 442<br>3% female. Median age 32, ethnicity 100% Asian, median CPD 6 (range 4 to 10), nicotine dependence not reported. |

**White 2020** *(Continued)*

| | |
|---|---|
| Interventions | *Experimental Group(s):*<br><br>*Deposits:* "Participants in deposit programmes were asked to provide refundable deposits contingent on smoking abstinence. These participants made a minimum initial contribution of $3 at the enrollment meeting, which was kept safe by an appointed company representative. Participants then received a personal deposit box, made of metal and designed to be tamper proof. Participants were free to make additional voluntary contributions to the box until the three month follow-up assessment. Study staff encouraged participants to contribute at least as much as they had typically spent on tobacco. Participants gave the project an additional $5 as collateral for the safe return of the box to deter tampering or theft. At the three month follow-up assessment, study staff opened each box with a can opener and recorded the total balance. All deposits were returned to participants if they were confirmed to be abstinent during the three month assessment. Deposits were forfeited to the project if participants were found to have smoked."<br><br>*Teammate:* "Participants in team based programmes were randomly assigned to another participant from the same worksite as a teammate. Team assignment was stratified by work shift and native language to facilitate opportunities for communication. Pairings were announced at the enrollment meeting at each worksite."<br><br>*Cash bonus:* "Participants were eligible for a cash bonus of $20 for abstaining from smoking at three months. Participants in groups 3 and 8 were eligible for a bonus of $40 for abstinence at three months. These amounts were roughly equivalent to one and two days' wages, respectively. Participants in groups 4 and 9 were eligible for a team bonus of $40 each that depended on both team members abstaining from smoking at three months. The team bonus was also designed to activate a sense of social commitment and peer pressure to quit. In teammate assignment stratums with an odd number of participants, extra participants were not paired with teammates; instead they were eligible for a $40 individual bonus."<br><br>*Control group*: brief counselling and text message programme<br><br>*Theoretical basis for intervention:* not reported<br><br>*Duration of intervention*: 3 months<br><br>*Length of follow-up:* 12 months |
| Outcomes | Biochemically-verified continuous tobacco abstinence (urine cotinine) |
| Notes | New for 2024 update<br><br>Funding: "This study was supported by the National Institute on Drug Abuse of the National Institutes of Health under award No R01DA035384. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health. The sponsors had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; or the decision to submit the manuscript for publication."<br><br>Declarations of interest: "no financial relationships with any organizations that might have an interest in the submitted work in the previous three years." |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Quote: "A study investigator implemented the random allocation sequences by using computer generated random numbers, concealing the sequence from field staff, company employees, and participants until after the baseline survey was completed. Participants were informed of their assignment in an enrollment invitation letter sent after the baseline survey." |

**White 2020** *(Continued)*

| | | |
|---|---|---|
| Allocation concealment (selection bias) | Low risk | Quote: "...concealing the sequence from field staff, company employees, and participants until after the baseline survey was completed." |
| Blinding of outcome assessment (detection bias) All outcomes | Low risk | The assessor of the biochemical urine test was masked to randomisation groups. |
| Incomplete outcome data (attrition bias) All outcomes | Low risk | Even across groups |
| Other bias | Low risk | Adjusted for clustering |

**Wilson 2023**

| ***Study characteristics*** | |
|---|---|
| Methods | Randomised controlled trial<br><br>Country: USA<br><br>Setting: community |
| Participants | 127 veterans who smoke and are experiencing homelessness<br><br>Intervention n = 63, control n = 64<br><br>8% female. Mean age 54. Ethnicity: 1% American Indian, 65% Black, 10% multiracial, 21% white, 3% Hispanic/Latino. Mean CPD, and nicotine dependence not reported. |
| Interventions | *Experimental Group(s):* incentives contingent on abstinence. Compensation for confirmed abstinence ranged from USD 1 to USD 14.75, with the compensation resetting following a missed/non-abstinent reading. After 4 weeks of modified contingency management (mCM), participants completed two weeks of CO monitoring without contingencies, with USD 1 compensation per video.<br><br>Participants in the mCM group were also offered individual telehealth counseling (5 sessions of telehealth CBT for tobacco cessation; Carpenter et al., 2015) and optional pharmacotherapy. Pharmacotherapy included VA prescriptions for a 12-week course of nicotine replacement therapy (NRT; prioritising nicotine patch plus as-needed oral NRT). If medically appropriate, participants could also receive a six-month prescription for bupropion 150 mg twice daily.<br><br>*Control Group*: smoking cessation clinic. "The clinic program lasts 6 weeks and includes: 3 group counseling sessions led by a clinical psychologist, an individual telephone counseling session following their quit date, and pharmacotherapy prescribed by a psychiatrist (options for NRT, bupropion, or varenicline)."<br><br>*Theoretical basis for intervention:* not reported<br><br>*Duration of intervention*: 4 weeks<br><br>*Length of follow-up:* 6 months |
| Outcomes | Biochemically verified prolonged smoking abstinence at 6 months post-randomisation (CO or saliva - cutoffs for CO (< 6 ppm) and cotinine (< 15 ng/mL)) |
| Notes | New for 2024 update<br><br>Funding: "This work was primarily supported by VA Rehabilitation Research and Development grant I01RX001301 (PI: JB). Additionally, SW, DB, and JY are supported by VA Career Development Awards |

**Wilson 2023** *(Continued)*

(IK2HX002398, IK2HX003085, and IK1CX002187/IK2CX002610, respectively). JB is supported by VA Clinical Science Research and Development Career Scientist Award IK6BX003777. JY and SG received support from the Department of Veterans Affairs Office of Academic Affiliations Advanced Fellowship Program in Mental Illness Research and Treatment, the Medical Research Service of the Veterans Affairs Durham Health Care System, and the Department of Veterans Affairs Mid-Atlantic Mental Illness Research, Education, and Clinical Center (MIRECC)."

Declarations of interest: "The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper"

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Unclear risk | Limited details: "Then participants were randomized to two treatment groups (see below), as well as to a three-month abstinence incentive condition" |
| Allocation concealment (selection bias) | Unclear risk | Not reported |
| Blinding of outcome assessment (detection bias)<br>All outcomes | Low risk | CO verification |
| Incomplete outcome data (attrition bias)<br>All outcomes | High risk | More than 50% attrition |
| Other bias | Low risk | None detected |

**Windsor 1988**

***Study characteristics***

| | |
|---|---|
| Methods | Study design: 2 x 2 factorial pretest/post-test control group design<br>Country: USA<br>Setting: University of Alabama, Birmingham |
| Participants | 378 smokers over 21 months' recruitment, mean age 37, CPD 25; sex ratio not stated |
| Interventions | Baseline survey, ALA *Freedom from smoking in 20 days* self-help manual and *A lifetime of freedom from smoking* maintenance manual at quit date.<br>*Method 1*: Controls: manuals only, brief chat<br>*Method 2*: Cessation skills training (diary, deep breathing), contract to quit, and quit smoking 'buddy' (with buddy education)<br>*Method 3*: Monetary incentives: USD 25 after 6 weeks confirmed cessation, and after 6 months confirmed cessation<br>Group A: Method 1 only<br>Group B: Methods 1 and 2<br>Group C: Methods 1 and 3<br>Group D: Methods 1, 2 and 3 |
| Outcomes | 6 weeks, 6 months, 1 year. Baseline measure and saliva were obtained for thiocyanate (SCN) analysis of smoking status (≤ 100 ng/mL). Participants smoking > 2 cigs more than once in a follow-up period counted as smokers. Lost to follow-up counted as continuing smokers |

**Windsor 1988** *(Continued)*

| | |
|---|---|
| Notes | As no significant effect of incentives was detected after 6 weeks, the authors collapsed Groups A and C for comparison with Groups B and D (collapsed), to test programme efficacy.<br>Our meta-analyses were conducted using Group C versus Group A (Windsor 1988), and Group D versus Group B (Windsor (B) 1988)<br>Study funded by National Heart, Lung, and Blood Institute |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Quote: "computer-generated assignment method". |
| Allocation concealment (selection bias) | Low risk | Quote: "labels were placed in separately sealed envelopes". |
| Blinding of outcome assessment (detection bias)<br>All outcomes | Low risk | Abstinence biochemically validated |
| Incomplete outcome data (attrition bias)<br>All outcomes | Unclear risk | Quote: "Employees lost to follow-up were counted as smokers. The data indicate that these individuals were equally distributed among groups". N lost to follow-up in each group not provided |
| Other bias | Unclear risk | The last scheduled rewards were paid out to coincide with the final assessment, and may therefore have confounded that result. Data extrapolated from percentages |

**ACS:** American Cancer Society; **ALA:** American Lung Association; **av:** average (mean); **B:** black; **CA:** continuous abstinence; **CBT:** cognitive behavioural therapy; **CG:** control group; **CHW:** community health worker; **CM:** contingency management; **CO:** carbon monoxide; **COPD:** chronic obstructive pulmonary disease; **CPD:** cigarettes per day; **DSM-IV:** Diagnostic and Statistical Manual of Mental Disorders, Edition 4; **EoT:** end of treatment; **FEV:** forced expiratory volume; **FTND:** Fagerström test for nicotine dependence; **FVC:** forced vital capacity; **ICC:** intra-class correlation coefficient; **IG:** intervention group; **IQR:** interquartile range; **NCSCT:** National Centre for Smoking Cessation and Training; **NICE:** National Institute for Health and Care Excellence; **NICU:** neonatal intensive care unit; **NRT:** nicotine replacement therapy; **pp:** postpartum; **PPA:** point prevalence abstinence; **ppm:** parts per million; **QTW:** quit to win; **RCT:** randomised controlled trial; **RP:** relapse prevention; **SC:** smoking cessation; **SCN:** saliva thiocyanate; **SD:** standard deviation; **TAU:** treatment as usual; **TQD:** target quit date

## Characteristics of excluded studies *[ordered by study ID]*

| Study | Reason for exclusion |
|---|---|
| Alessi 2008 | Outcome was reduction rather than smoking cessation, and participants were followed for 12 weeks only. New for 2011 update |
| Berg 2014 | Too short: follow-up to 12 weeks only. New for 2015 update |
| Bloom 2020 | Ineligible design: non-randomised study |
| Correia 2006 | 3-week trial of college students, randomised to high or low payments for abstinence. New for 2008 update |
| Cummings 1988 | Follow-up was only 3 months |
| De Paul 1989 | Incentives component cannot be evaluated separately from the other components of the intervention |

| Study | Reason for exclusion |
|---|---|
| Donatelle 2000c | SOS II Programme: non-randomised; used the control group from Donatelle 2000a as historical controls. New for 2015 update; pregnancy trial |
| Dunn 2008 | RCT of contingency management; study only lasted 2 weeks. New for 2011 update |
| Glover 2015 | Trial only 8 weeks' duration, not necessarily to end of pregnancy or beyond. New for 2015 update; pregnancy trial |
| Higgins 2004 | Study previously included, but excluded from the 2019 update because only 16 of 53 participants were randomly allocated |
| Jassal 2021 | Ineligible outcomes |
| Jeffery 1988 | Intervention being tested was reduction versus cessation. Incentives were available to both groups. |
| Joyce 2021 | Pilot 2 follow-up was postpartum only and not for 6 months of follow-up. In pilot 3, only 1 pregnant person so cannot include as unsure if outcome relates to pregnancy or not. New for 2024 update |
| Kendzor 2015 | Follow-up for only 3 months. New for 2015 update |
| Kollins 2010 | Non-randomised trial, and participants were followed for only 24 days. New for 2011 update |
| Lamb 2007 | Aim was reduction, not cessation; participants followed only for 3 months. New for 2015 update |
| Lamb 2010 | Randomised controlled trial of contingency management; participants followed for only 3 months. New for 2010 update |
| Lopez 2015 | Ineligible study design |
| Lopez-Nunez 2015 | No abstinence outcomes reported by group. New for 2024 update |
| Lussier 2005 | Trial of 63 adult smokers randomised to 14-, 7- or 1-day contingency payments for abstinence. Lasted only 2 weeks |
| MacKillop 2009 | Participants followed for only 8 weeks. New for 2015 update |
| Meredith 2011 | Participants followed for only 2 weeks. New for 2015 update |
| Monti 2006 | 50 adult smokers randomised to motivational enhancement therapy (MET) plus contingency payment, relaxation plus contingency payment, MET plus non-contingency reinforcement, or relaxation plus non-contingency reinforcement. Followed only for 3-week treatment period. New for 2008 update |
| Mooney 2004 | 97 adult smokers randomised to standard care, information, or information plus contingent payment. Lasted 15 days, and outcome was increased use of nicotine gum, not cessation. New for 2008 update |
| NCT00718835 | Follow-up of less than 6 months |
| NCT00807742 | Follow-up of less than 6 months |
| NCT01145001 | Follow-up of less than 6 months |
| NCT01303081 | Follow-up of less than 6 months |

| Study | Reason for exclusion |
|---|---|
| Nowicki 1984 | Complex intervention, including monthly lottery; cannot separate out the effect of the components. New for 2015 update; pregnancy trial |
| Olsen 1990 | Incentives could not be evaluated separately from other components |
| Ormston 2015 | Not a randomised controlled trial: report on the "quit4u" stop smoking service. New for 2015 update; pregnancy study |
| Orr 2018 | Author confirmed no cessation outcomes collected. New for 2024 update |
| Pardell 2003 | No baseline measurements reported, and incentives could not be separated from other programme components |
| Parker 2007 | Complex intervention, including USD 100 lottery for 30-day abstinence. Cannot separate out the components. New for 2015 update; pregnancy trial |
| Paxton 1980 | Study previously included, but excluded from the 2019 update because participants were not randomised |
| Paxton 1981 | Study previously included, but excluded from the 2019 update because participants were not randomised |
| Paxton 1983 | Study previously included, but excluded from the 2019 update because participants were not randomised |
| Rash 2018 | Trial offered competition incentives only. New for 2024 update |
| Rohsenow 2005 | 187 substance abusers randomised to contingency reinforcement (CR) or non-contingent reinforcement for 19 days. No results reported for CR group. New for 2008 update |
| Roll 2008 | Randomised controlled trial of deduction contingency management (CM) versus incremental CM. Trial only lasted 5 days, and abstinence was for 48 hours. New for 2011 update |
| Romanowich 2010 | No non-incentive control group, and participants only followed for 3 months. New for 2015 update |
| Romanowich 2013 | No non-incentive group, and participants only followed for 3 months. New for 2015 update |
| Romanowich 2014 | No non-incentive group, and particiants only followed for 3 months. New for 2015 update |
| Sigmon 2012 | No non-incentive group, and participants only followed for 3 months. New for 2015 update |
| Tanaka 2006 | Complex intervention, in which impact of incentive cannot be isolated. New for 2011 update |
| Winhusen 2014 | Unable to establish length of follow-up (no response from author). New for 2015 update |
| Wiseman 2005 | 20 cocaine users randomised to contingent or non-contingent payments. Treatment period and follow-up lasted 2 weeks. New for 2008 update |
| Yi 2008 | Outcome was reduction rather than smoking cessation, and duration of study only 5 days. New for 2011 update |
| Yoon 2009 | Randomised controlled trial of variable contingency payments for abstinence; participants followed for only 2 weeks. New for 2011 update |

**Characteristics of ongoing studies** *[ordered by study ID]*

### ACTRN12623000922673

| | |
|---|---|
| Study name | Public Title: Quitting Using Incentives Trial for a HEaLthy Pregnancy (QUIT-HELP)<br>Scientific Title: Investigating the Efficacy and Effectiveness of Financial Incentives to Encourage Smoking Cessation in Pregnancy |
| Methods | Randomised controlled trial |
| Participants | "Pregnant women, aged 18 +, who smoke tobacco, verified by expired CO breath at enrolment, at their first antenatal visit (~14 weeks pregnant)" |
| Interventions | "Financial incentives (voucher gift cards), for negative CO breath analysis (≥ 4 ppm) at routine antenatal visits. Value of vouchers increase during gestation from 50 USD, to 150 USD and finally 400 USD. The maximum is 600 USD. Urinary analysis will be completed at the end of the trial, but will not determine financial incentives." |
| Outcomes | Primary outcome: sustained abstinence after first antenatal visit, confirmed by exhaled CO ≤ 3 ppm (at 4 and 12 weeks following enrolment and 37 weeks gestation)<br><br>Secondary outcomes: qualitative data regarding experiences and attitudes of participants and health professionals. |
| Starting date | 01 October 2023 |
| Contact information | Professor Lisa Smithers (paedperiepi@adelaide.edu.au) |
| Notes | |

### Boderie 2020

| | |
|---|---|
| Study name | PERSonalised Incentives for Supporting Tobacco cessation (PERSIST) among healthcare employees |
| Methods | Randomised, controlled, non-blinded trial with two parallel arms |
| Participants | 220 employees of Dutch healthcare institutions, aged ≥ 18 years, who are daily smokers. |
| Interventions | Both groups will undergo a smoking cessation training programme (7 sessions, ~ 90 minutes each, 8 weeks)<br><br>Control group: no incentives<br><br>Intervention group: personalised incentives in the form of four different schemes of monetary vouchers from which the participants are free to choose from (standard scheme, descending schemes, ascending scheme, and deposit-based scheme). First incentive is received right after the group-based smoking cessation training. The remaining incentives are provided on validated smoking cessation at different timepoints after this stage. |
| Outcomes | Primary outcome: CO-validated 12-month continuous abstinence from smoking (Russel's Standard, RS12). Both point (7-day abstinence) and continuous self-reported abstinence (total continuous abstinence period) validated by exhaled CO concentrations using a PICO smokerlyzer (< 10 ppm indicates abstinence). |
| Starting date | Not reported |

**Boderie 2020** *(Continued)*

| | |
|---|---|
| Contact information | Dr Jasper V Been (j. been@ erasmusmc.nl) |
| Notes | |

**Edelman 2021**

| | |
|---|---|
| Study name | A SMARTTT approach to Treating Tobacco use disorder in persons with HIV (SMARTTT) |
| Methods | Hybrid type 1 effectiveness-implementation multisite study |
| Participants | People with HIV, aged ≥ 18 years, who smoke and receive care at enroled sites |
| Interventions | Group 1: nicotine replacement therapy + contingency management (CM) for 12 weeks<br>Group 2: nicotine replacement therapy for 12 weeks<br>Participants with biochemically-verified abstinence at 12 weeks continue with same intervention for another 12 weeks. Participants with non-response are re-randomised to either replace NRT with varenicline or receive higher CM schedule. |
| Outcomes | Primary outcomes: self-report tobacco use and biochemically-verified 7-day abstinence with exhaled CO at 12 weeks and 24 weeks<br>Secondary outcomes: CD4 cell count, HIV viral load and VACS Index 2.0 (at 12 and 24 weeks) |
| Starting date | Not reported |
| Contact information | E. Jennifer Eldelman (ejennifer.edelman@yale.edu) |
| Notes | |

**ISRCTN55218215**

| | |
|---|---|
| Study name | Trial of financial incentives for preventing postpartum return to smoking |
| Methods | Randomised controlled trial |
| Participants | Women at end of pregnancy who are confirmed as having stopped smoking during their pregnancy |
| Interventions | Group 1: no financial incentives to remain abstinent<br>Group 2: incentives for the participant of GBP 60 for remaining abstinent from smoking up to 3 months postpartum, plus a further payment of GBP 60 to a nominated supportive person if both that person and the participant remain abstinent (total of GBP 120)<br>Group 3: same incentives as group 2 plus further GBP 60 at 6, 9 and 12 months postpartum (total of GBP 300). |
| Outcomes | Smoking status of all participants is assessed at 3 and 12 months postpartum |
| Starting date | February 2018 |
| Contact information | Prof. Michael Ussher (mussher@sgul.ac.uk) |

**ISRCTN55218215** *(Continued)*

| | |
|---|---|
| Notes | |

**Kendzor 2022**

| | |
|---|---|
| Study name | Mobile contingency management for smoking cessation among socioeconomically disadvantaged adults |
| Methods | Randomised parallel trial |
| Participants | Socioeconomically disadvantaged individuals living in the USA, aged 18 or older, who currently smoke ≥ 5 cigarettes per day and have an exhaled CO level > 6 ppm and are willing to quit smoking one week after enrolment. |
| Interventions | Group 1: standard care (weekly smoking cessation counselling and combination NRT (nicotine patches + gum or lozenges). Each participant will be randomly paired with a group 2 participant and will receive the same financial incentives as them, irrespective of their abstinence status. Incentives will be disbursed once a week.<br><br>Group 2: standard care + contingency management (small financial incentives for biochemically-verified abstinence - CO breath samples of ≤ 6 ppm twice per day, 8 hours apart, during all assessment weeks). Participants may receive up to 205 USD by 4 weeks post-quit, and an additional USD 70 at weeks 8 and 12 post-quit. |
| Outcomes | Primary outcome: biochemical verification of 7-day point prevalence smoking abstinence at 26 weeks post-quit<br><br>Secondary outcomes: cost-effectiveness of interventions, self-efficacy, motivation and treatment engagement |
| Starting date | Not reported |
| Contact information | Darla E. Kendzor (Darla-Kendzor@ouhsc.edu) |
| Notes | |

**Kohn 2022**

| | |
|---|---|
| Study name | Comparing Smoking Cessation Interventions Among Underserved Patients Referred for Lung Cancer Screening |
| Methods | Prospective randomised controlled trial using opt-out consent with longitudinal follow-up of patients over 12 months |
| Participants | 3200 participants. Aged ≥ 18 years, referred to lung cancer screening, who are black or Latinx and reside in a rural area, completed high school and smoke at least 5 cigarettes a day. |
| Interventions | Participants will be randomised into four study arms.<br><br>Arm 1: Ask-Advise-Refer (AAR) usual care<br><br>Arm 2: FDA-approved pharmacotherapy<br><br>Arm 3: financial incentives - "Patients will be eligible to earn $100, $200, and $300 if they submit negative test results for nicotine metabolites at 2 weeks, 3 months, and 6 months after their TQD, respectively" |

**Kohn 2022** *(Continued)*

| | |
|---|---|
| | Arm 4: EFT - behavioral tool that promotes contemplation of long-term rewards |
| Outcomes | Primary outcome: biochemically-confirmed smoking abstinence sustained for 6 months, requiring self-report of smoking cessation followed by biochemical verification at 2 weeks, 3 months and 6 months.<br><br>Secondary outcomes: 2 weeks, 3 months, 6 months, 12 months: Quit status (self-report); quit status (biochemically confirmed); Baseline, 6 months, 12 months: health-related quality of life (EQ-5D); perceived barriers to cessation (CSS-21); Self-efficacy related to cessation efforts (10-item situational measure); Motivation to quit (SOC); temporal "delay" discounting (5-trial adjusting delay task). |
| Starting date | 17 May 2021 |
| Contact information | Rachel Kohn (rachel.kohn2@pennmedicine.upenn.edu.) |
| Notes | |

**Lynagh 2012**

| | |
|---|---|
| Study name | ENtiCe Project - Encouragement for Nicotine Cessation in pregnant smokers |
| Methods | 3-armed randomised trial (smaller incentives, larger incentives, control (no incentive)); non-concealed allocation, randomising by day and antenatal session. No blinding |
| Participants | 90 pregnant women who smoke, aged 16+, < 31 weeks gestation |
| Interventions | 1. Small (AUD 20) incentives; 2. Large (AUD 40) incentives; 3. (Control) usual care. Incentive starts at AUD 20/AUD 40, and increases by AUD 20/AUD 40 for every consecutive abstinent check. Up to AUD 720/AUD 1440 available if quit throughout programme |
| Outcomes | Primary: consenting to participate; acceptance of cash incentives; 7-day PPA, self-reported and cotinine-verified, over 8 routine a/n sessions (10 weeks)<br><br>Secondary: abstinence confirmed by cotinine content of hair |
| Starting date | Registered April 2012 |
| Contact information | Dr Marita Lynagh (marita.lynagh@newcastle.edu.au) |
| Notes | Pregnancy trial<br><br>ACTRN12612000399897 |

**Molina 2022**

| | |
|---|---|
| Study name | Contingency management to promote smoking cessation in people experiencing homelessness |
| Methods | Pragmatic randomised controlled trial |
| Participants | Individuals who experience homelessness, 18 years+, who are current smokers (100 cigarettes lifetime, smoked daily past 7 days and at least 5 cigarettes per day, verified by expired CO), have an intention to quit in the next 6 months, are attending on-site smoking cessation counselling and are enaged in care at the clinic |

**Molina 2022** *(Continued)*

| | |
|---|---|
| Interventions | Group 1: cessation care (behavioral counselling and pharmacotherapy). Fixed incentive of USD 5 for each of 25 abstinence assessment visits in the first 6 months<br><br>Group 2: cessation care + CO-verified asbtinence contingency management via gift cards of national chains according to predefined schedule (start at USD 13 and will increase USD 0.50 for each negative CO sample) |
| Outcomes | Nicotine dependence (Fagerstrom's test) and tobacco cessation history (intention to quit, quit attempts in the past year, length of last quit attempt, use of cessation aids during last quit attempt); alternative tobacco and nicotine product use (lifetime use and past-30 days use of non-cigarette tobacco and nicotine products); chronic diseases (liver, renal, cardiovascular disease, HTA, diabetes, cancer, COPD or HIV), mental health (depression, anxiety GAD-7, PTSD screen for DSM-5, Urban stress- Urban Life Stressors Scale) |
| Starting date | 09 November 2021 |
| Contact information | Maya Vijayaraghavan (Maya.Vijayaraghavan@ucsf.edu) |
| Notes | |

**NCT00064922**

| | |
|---|---|
| Study name | Incentive program for female substance abusers who smoke |
| Methods | 3-arm intervention trial (not clear if randomised or not) |
| Participants | 90 substance-abusing women, aged > 15 |
| Interventions | 2 voucher incentive programmes; 1 targeting abstinence alone, and the other additional incentives for negative blood alcohol level and urinalysis |
| Outcomes | Not stated; would include abstinence |
| Starting date | January 2002 |
| Contact information | Leslie Amass (leslie.amas@uchsc.edu) |
| Notes | |

**NCT00079469**

| | |
|---|---|
| Study name | Contingency management to enhance smoking cessation for cancer survivors: a proof of concept trial |
| Methods | Multicentre RCT |
| Participants | Smokers of at least 2 years who had been diagnosed and completed treatment for cancer at least 6 months, but not more than 5 years, before study entry |
| Interventions | 12 weeks bupropion + 6 weeks counselling for all participants; intervention arm get CM payments for abstinence in weeks 1 to 6. |
| Outcomes | Primary: feasibility of study; 7-day PPA at weeks 12, 24 |

**NCT00079469** *(Continued)*

| | |
|---|---|
| | Secondary: characteristics of participants determining success |
| Starting date | February 2004 to August 2004 |
| Contact information | Glen D Morgan |
| Notes | |

**NCT00273793**

| | |
|---|---|
| Study name | Increasing contingency management success in smoking cessation |
| Methods | Open-label RCT |
| Participants | 240 adult smokers |
| Interventions | Contingent and non-contingent incentives, with fixed and variable schedules, for hard-to-treat and easy-to-treat smokers |
| Outcomes | CO-verified abstinence at 6-month follow-up |
| Starting date | June 2005 |
| Contact information | Richard J Lamb, University of Texas |
| Notes | |

**NCT00408265**

| | |
|---|---|
| Study name | Smoking cessation in substance abuse treatment patients: a feasibility study |
| Methods | Open-label RCT |
| Participants | Substance-abusing men (N not given) |
| Interventions | Self-help materials versus self-help materials + CM component, i.e. rewards equivalent to USD 1, USD 20, USD 100 for validated abstinence<br>Participants checked 4 times a week in weeks 1 to 4, twice a week in weeks 5 to 8, weekly in weeks 9 to 12. Follow-ups at 1, 3 and 6 months following TQD |
| Outcomes | Primary: % negative CO readings; % negative cotinine readings; longest period of continuous abstinence<br><br>Secondary: self-reported smoking; objective substance use; self-reported substance use; treatment retention |
| Starting date | January 2004 to March 2007 |
| Contact information | Sheila M Alessi (salessi@uchc.edu) |
| Notes | |

**NCT00683280**

| | |
|---|---|
| Study name | Contingency management and pharmacotherapy for smoking cessation |
| Methods | Open-label Phase II RCT |
| Participants | 70 adult smokers, motivated to quit (59 recruited) |
| Interventions | 12-week course of varenicline alone versus 12-week course of varenicline + CM rewards for validated abstinence at weeks 5, 12 and 24 |
| Outcomes | Primary: abstinence validated by CO, cotinine<br>Secondary: changes from baseline in ambulatory 24-hour blood pressure |
| Starting date | May 2008 to August 2010 |
| Contact information | Prof Sheila M Alessi (salessi@uchc.edu) |
| Notes | |

**NCT00690131**

| | |
|---|---|
| Study name | An integrated approach to smoking cessation in severe mental illness (SMI) |
| Methods | Open-label RCT |
| Participants | 50 adult smokers with severe and persistent mental illness |
| Interventions | Group counselling, pharmacotherapies and CM with financial incentives for reductions in smoking |
| Outcomes | Smoking abstinence and number of quit attempts at 3-month follow-up |
| Starting date | June 2008 |
| Contact information | Melanie E Bennett, University of Maryland |
| Notes | |

**NCT01484717**

| | |
|---|---|
| Study name | Interactive voice response technology to mobilise contingency management for smoking cessation |
| Methods | Open-label RCT |
| Participants | 90 smokers motivated to quit |
| Interventions | NRT (8 weeks of patches) + brief telephone counselling for all participants. Intervention arm also receives chance to win prizes for negative breath tests |
| Outcomes | Primary: longest duration of abstinence (up to 24 weeks)<br>Secondary: not stated |

**NCT01484717** *(Continued)*

| | |
|---|---|
| Starting date | January 2012 |
| Contact information | Shelia M Alessi (salessi@uchc.edu) |
| Notes | |

**NCT01736982**

| | |
|---|---|
| Study name | Contingency management for smoking cessation in the homeless |
| Methods | Open-label RCT |
| Participants | 70 homeless smokers |
| Interventions | Standard care: 8 weeks NRT, breath sample monitoring, standard SC counselling; Intervention: as for standard care + prizes for negative breath samples |
| Outcomes | Longest duration of abstinence (Week 4) |
| Starting date | October 2012 |
| Contact information | Eileen M Ciesielski (echiesielski@uhc.edu) |
| Notes | |

**NCT01789710**

| | |
|---|---|
| Study name | Contingency management for smoking cessation in homeless smokers |
| Methods | Single-arm trial |
| Participants | 30 homeless smokers |
| Interventions | Internet-based smoking cessation programme, plus NRT and bupropion, plus 4 counselling sessions. Participants will use smartphone to relay images of verification. Payment contingent on CO readings |
| Outcomes | Breath CO, throughout study to 12 months |
| Starting date | January 2013 |
| Contact information | Jean C Beckham |
| Notes | |

**NCT01826331**

| | |
|---|---|
| Study name | Incentives for participation versus outcomes |
| Methods | Single-blind randomised controlled trial |

**NCT01826331** *(Continued)*

| | |
|---|---|
| Participants | 880 smokers |
| Interventions | 1. Those incentivised for participation in an evidence-based treatment designed for smokers at each stage of change<br><br>2. Those incentivised for biologically-validated prolonged abstinence at 6 and 12 months who could also choose to participate in the TTM (Transtheoretical Model)-tailored intervention<br><br>3. An assessment-only control condition |
| Outcomes | Smoking abstinence at 24 months |
| Starting date | March 2014 |
| Contact information | James O Prochaska, PhD, University of Rhode Island jop@uri.edu |
| Notes | |

**NCT01965405**

| | |
|---|---|
| Study name | Smoking cessation for people living with HIV/AIDS |
| Methods | Open-label RCT |
| Participants | 400 smokers with HIV/AIDS |
| Interventions | Standard care (controls): bupropion + brief counselling; Phase 1: as standard care + high-value prize contingency management for validated abstinence; Phase 2a: Non-responders A: bupropion, brief counselling + monitored support to quit; Phase 2a: Non-responders B: as A, + chance to win prizes for validated abstinence. 2b: Responders A: Bupropion, no additional treatment; 2b: Responders B: bupropion, continued monitoring + low-intensity prize contingency management<br><br>All participants received USD 35 for intake, and USD 25 for each follow-up interview at post-phase 1, post-phase 2, 6 and 12 months |
| Outcomes | Primary: urinary cotinine at all test points, up to 12 months; Longest duration of continuous abstinence; 7-day PPA at all time points; CO result at all time points |
| Starting date | August 2013 |
| Contact information | Lisa Sulkowski (lulkows@med.wayne.edu) |
| Notes | |

**NCT02737566**

| | |
|---|---|
| Study name | Small financial incentives to promote smoking cessation (Prevail II) |
| Methods | Open-label parallel-assignment randomised controlled trial |
| Participants | 320 English-speaking adult smokers of at least 5 cigarettes a day, in receipt of Medicaid or uninsured |

**NCT02737566** *(Continued)*

| | |
|---|---|
| Interventions | Experimental: standard care plus financial incentives ("the opportunity to earn small gift cards for biochemically-verified abstinence through 12 weeks post-quit. The amount of the gift cards will escalate each week from the quit date through 4 weeks post-quit with continuous abstinence. Participants who are non-abstinent at any visit may earn incentives for abstinence at the next visit, but the amount will reset to the starting level. Participants may additionally earn an additional gift card for abstinence at the 8 and 12 weeks post-quit visits."<br><br>Control: standard care (weekly smoking cessation counselling and pharmacotherapy) |
| Outcomes | Primary outcome: biochemically verified 7-day point prevalence smoking cessation at 26 weeks<br><br>Secondary outcome: biochemically verified 7-day point prevalence smoking cessation at 12 weeks |
| Starting date | 30 January 2017 |
| Contact information | Principal investigator: Darla Kendzor<br><br>Email: Darla-Kendzor@ouhsc.edu |
| Notes | |

**NCT02952703**

| | |
|---|---|
| Study name | Disseminating and implementing a smoking cessation program for pregnant and postpartum women |
| Methods | Single-blind parallel-assignment randomised controlled trial |
| Participants | 250 pregnant women, 18 to 65 years, willingness to quit, enroled in first breath program |
| Interventions | Intervention: "Striving to quit". Includes "additional pre-natal counseling (in-person and telephonic); post delivery counseling (in-person and telephonic) and incentives"<br><br>Control: brief pre-natal smoking cessation counselling |
| Outcomes | Primary outcome: biochemically-verified smoking abstinence (breath CO < 9 ppm, 6 months post-intervention)<br><br>Secondary outcome: motivation to quit/remain quit measured on a 5-point Likert scale at 6 months |
| Starting date | May 2018 |
| Contact information | Michael Fiore (mcf@ctri.wisc.edu) |
| Notes | Pregnancy trial |

**NCT03528304**

| | |
|---|---|
| Study name | Native Women's Wellness: contingency management for tobacco cessation and weight loss (NWW) |
| Methods | Open-label factorial assignment randomised controlled trial |

**NCT03528304** *(Continued)*

| | |
|---|---|
| Participants | 125 women aged 18 to 44 of American Indian or Alaska Native heritage, currently smoking and overweight and not interested in using NRT |
| Interventions | No-intervention control<br><br>Intervention 1: contingency management for smoking cessation. As part of the CM intervention, women attending visits for smoking are rewarded with prizes for abstaining from smoking.<br><br>Intervention 2: contingency management for smoking cessation and weight loss. As part of the CM intervention, women attending visits for smoking and weight loss assessment and are rewarded with prizes for abstaining from smoking and for losing some weight.<br><br>The study also included a third arm which does not meet the inclusion criteria for this review, involving contingency management alone. |
| Outcomes | Primary outcome: smoking abstinence at 16 weeks |
| Starting date | September 2010 |
| Contact information | Dr Dedra Buchwald<br><br>Email: dedra.buchwald@wsu.edu |
| Notes | Pregnant women and those planning to become pregnant in the next 4 months were excluded |

**NCT03608852**

| | |
|---|---|
| Study name | Bad is Stronger Than Good: Unconventional Financial Incentives for Smoking Cessation |
| Methods | Prospective randomised study |
| Participants | 36 veterans, aged 18+ years, smokers, willing to quit |
| Interventions | Reward group: NRT + 50 USD for each biochemically-verified abstinence testing<br><br>Bank-money group: NRT + 50 USD for each biochemically-verified abstinence testing. Participants can only withdraw the money at the end of the trial if they complete it by quitting smoking for 6 months. |
| Outcomes | Primary outcome: smoking cessation rate (1 year)<br><br>Secondary outcomes: household income (1 year), smoking habits (1 year), nicotine dependence (1 year), nicotine withdrawal symptoms (1 year), anxiety / depression (1 year) |
| Starting date | 01 August 2018 |
| Contact information | Isabel A Vital (isabel.vital@va.gov) |
| Notes | |

**NCT03979885**

| | |
|---|---|
| Study name | Financial Incentives for Smoking Treatment |

**NCT03979885** *(Continued)*

| | |
|---|---|
| Methods | Randomised parallel trial |
| Participants | Adults, aged age ≥ 18 years, who smoked tobacco in the past 30 days and are contemplating quitting smoking assessed by readiness to quit |
| Interventions | Arm 1: Smoking cessation counseling (quitline) + pharmacotherapy + financial incentives for use of evidence-based smoking cessation therapies<br>Arm 2: Smoking cessation counseling (quitline) + pharmacotherapy + financial incentives for biochemically confirmed smoking cessation<br>Arm 3: Smoking cessation counseling (quitline) + pharmacotherapy |
| Outcomes | Primary outcome: smoking abstinence assessed by self-report and biochemically verified by salivary cotinine (6 months)<br>Secondary outcomes: use of evidence-based treatment; quality of life (QoL) PROMIS-29 Profile v2.0; short-term cost analysis; long-term cost analysis |
| Starting date | 06 January 2020 |
| Contact information | Joseph Ladapo, MD, PhD, University of California, Los Angeles, USA<br>Scott Sherman, MD, NYU Langone Health, USA |
| Notes | |

**NCT04445662**

| | |
|---|---|
| Study name | Financial Incentives for Homeless Smokers: A Community-based RCT |
| Methods | Randomised controlled trial |
| Participants | 180 English-speaking lifetime smokers of ≥ 100 cigarettes with current daily smoking of ≥ 5 cigarettes per day, verified by a saliva cotinine level of ≥ 30 ng/mL; aged ≥18 years; ready to try quitting within next 3 months; currently or previously homeless, with a primary care provider within BHCHP system |
| Interventions | Arm 1: Control (n = 90) varenicline + tobacco coaching + saliva cotinine monitoring with fixed payments (USD 10) irrespective of test results<br>Arm 2: Financial incentives (n = 90) varenicline + tobacco coaching + saliva cotinine monitoring with escalating payments (USD 25 to 70) for levels < 30 ng/mL |
| Outcomes | Primary outcome: cotinine-verified 7-day smoking abstinence at 12 weeks<br>Secondary outcome: cotinine-verified 7-day smoking abstinence at 24 weeks |
| Starting date | 10 June 2021 |
| Contact information | Travis Baggett, (TBAGGETT@mgh.harvard.edu) |
| Notes | |

**NCT04605458**

| | |
|---|---|
| Study name | Contingency Management to Promote Smoking Abstinence in Cancer Patients |
| Methods | Open-label RCT |
| Participants | Individuals aged 18 or older; smoking 1 or more combustible tobacco products per day, with suspicion or diagnosis of operable cancer |
| Interventions | Standard care (counselling + nicotine patch) versus standard care (counselling + nicotine patch) + contingency management (monetary payment by CO breath test) |
| Outcomes | Primary outcome: self-reported past 7 days abstinence verified by CO breath test (4 ppm) and/or anabasine testing (urine levels 2 ng/mL) between baseline and day of surgery (up to 5 weeks)<br><br>Secondary outcome: self-reported past 7 days abstinence verified by CO breath test (4 ppm) and/or anabasine testing (urine levels 2 ng/mL) at 3 and 6 months post-surgery |
| Starting date | 25 November 2020 |
| Contact information | Benjamin Toll, Medical University of South Carolina, USA |
| Notes | |

**NCT05181891**

| | |
|---|---|
| Study name | Pharmaceutically-Enhanced Reinforcement for Reduced Alcohol and Smoking |
| Methods | Randomised placebo-controlled trial |
| Participants | English-speaking individuals, aged 18 or older, 4 or more standard drinks for females or 5 or more standard drinks for males on at least 4 occasions in the past-30 days; seeking alcohol-use disorder (AUD) and smoking cessation treatment, DSM-5 diagnosis of AUD, current smokers, breath alcohol of 0.00 during informed consent, at least 1 ethyl glucuronide (etG)-positive urine test and 1 cotinine (COT)-positive test during induction, attended 4 of 6 visits during induction |
| Interventions | Non-contingent control (incentives for submitting urine samples) + Usual Care (varenicline + video counselling) versus Contingency Management (incentives for negative-alcohol urine samples) + Usual care |
| Outcomes | Primary outcomes: change in biochemically-verified alcohol use (12-week treatment and 7-month post-follow-up period), change in biochemically-verified tobacco use (12-week treatment and 7-month post-follow-up period)<br><br>Secondary outcomes: change in self-reported alcohol use (12-week treatment and 7-month post-follow-up period); change in self-reported tobacco use (12-week treatment and 7-month post-follow-up period) |
| Starting date | 11 July 2022 |
| Contact information | Abigail Bowen (abigail.bowen@wsu.edu) |
| Notes | |

**NCT05415371**

| | |
|---|---|
| Study name | Monetary Incentives to Promote Engagement With the Oklahoma Tobacco Helpline Among Pregnant Women With Medicaid |
| Methods | Open-label RCT |
| Participants | Females ≤ 25 weeks pregnant, aged ≥ 18 years, smoke ≥ 5 cigarettes per day, who read and speak English |
| Interventions | Standard care + financial incentives versus standard care alone |
| Outcomes | Primary outcomes: biochemically 7-point prevalence verified abstinence 12 weeks post enrolment; self-reported abstinence 12 weeks postpartum |
| Starting date | 30 September 2022 |
| Contact information | TSET Health Promotion Research Center, Oklahoma City, USA |
| Notes | |

**Patten 2023**

| | |
|---|---|
| Study name | Alaska native family-based, financial incentives intervention for smoking cessation |
| Methods | RCT |
| Participants | 656 ANAI (Alaska Native and American Indian) adults who smoke cigarettes and adult family members across Alaska |
| Interventions | No-incentives control group: standard care (Generic resources and referral information on evidence-based smoking cessation interventions (quitline, regional tribal cessation programs, smokefree.gov), family wellness resources on general health, links to domestic violence programs + family members will receive information on how to support individuals in cessation) + expired CO, smoking status and salivary cotinine monitoring weekly for first 30 days then at 3 and 6 months + USD 25 gift card for each of monitorings for participant and family member<br><br>6-month financial incentive group: standard care + expired CO, smoking status and salivary cotinine monitoring weekly for first 30 days then at 3 and 6 months + incremental money rewards with verified smoking abstinence at each monitoring + SMS with test results and corresponding rewards |
| Outcomes | Primary outcomes: continuous abstinence (self-reported smoking abstinence from the end of the 6-month trial to 12 months' post-trial, verified by negative CO breath and salivary cotinine tests at the end of trial, 6 and 12 months' post-trial. |
| Starting date | Not reported |
| Contact information | Christi A. Patten (patten.christi@mayo.edu) |
| Notes | |

**Pratt 2019**

| | |
|---|---|
| Study name | Incentivizing healthy lifestyle behaviors to reduce cardiovascular risk in people with serious mental illness |

**Pratt 2019** *(Continued)*

| | |
|---|---|
| Methods | Pragmatic equipoise randomised controlled trial |
| Participants | 661 Medicaid recipients, aged 18+, with serious mental illness receiving care at any of the participating 10 community mental health centers in New Hampshire, smoking ≥ 10 cigarettes/day, expired CO ≥ 8 ppm, and willingness to quit smoking. |
| Interventions | Program 1A: USD 30 for prescriber visit only<br>Program 1B: Program 1A + cash for biologically-confirmed abstinence<br>Program 2 A: USD 15 for prescriber visit + USD 20 for 3 Quitline sessions<br>Program 2B: Program 2A + cash for biologically-confirmed abstinence<br>Program 3A: USD 15 for prescriber visit + USD 5 for 12 telephone CBT sessions<br>Program 3B: Program 3A + cash for biologically-conformed abstinence |
| Outcomes | Primary outcome: biochemically-verified abstinence by expired C0 < 4 ppm (only for participants in NRT) and urine cotinine < 100 ng/mL<br>Secondary outcomes: timeline follow-back (past-3 months smoking behaviour), Fagerstrom Test for Nicotine Dependence, Smoking Self-Efficacy Questionnaire, Smoking Effects Questionnaire |
| Starting date | Not reported |
| Contact information | Sarah I.Pratt (sarah.i.pratt@dartmouth.edu) |
| Notes | |

**Rojewski 2021**

| | |
|---|---|
| Study name | Preoperative contingency management intervention for smoking abstinence in cancer patients |
| Methods | Multisite randomised controlled trial |
| Participants | 282 individuals who smoke and have a diagnosis or suspicion of an operable cancer with a scheduled surgery within 10 days to 5 weeks |
| Interventions | Monitoring-only group: standard care (3 to 6 sessions counselling, dual NRT each week until surgery) + monitoring only (CO breath monitoring)<br>Financial incentives group: standard care + financial incentives contingent of negative breath CO monitoring (incentives start at 15 USD, 5 USD increments until 55 USD per negative breath test) |
| Outcomes | Primary outcome: 7-day point prevalence abstinence (self-reported no use of cigarettes or other tobacco products), verified by expired CO ≤ 4 ppm and/or urine anabasine ≤ 2 ng/mL on the day of surgery.<br>Secondary outcomes: 7-day point prevalence abstinence assessed at 3-month and 6-month follow-ups. |
| Starting date | 25 November 2020 |
| Contact information | Dr Alana M Rojewski (rojewski@musc.edu) |
| Notes | Trial registration number NCT04605458 |

### Ussher 2021

| | |
|---|---|
| Study name | Financial Incentives for Preventing Postpartum return to Smoking (FIPPS) |
| Methods | Multicentre, three-arm, superiority, parallel-group, individually randomised controlled trial, with 1:1:1 allocation |
| Participants | Women who have undergone the Smokefree Pregnancy Programme in Greater Manchester, 34 weeks gestation to 2 weeks postpartum, self-reported 4 weeks abstinence, exhaled CO reading < 4 ppm, aged 16+, are willing to remain abstinent after delivery, and can read and write in English. |
| Interventions | Control group: no incentives (usual postpartum care and GBP 20 voucher payment at 3 months and 12 months postpartum)<br><br>Intervention group 1: three GBP 20 Love2shop gift cards offered up to 3 months postpartum conditional on self-reported and biochemically validated abstinence + option of incentive to significant other supporter (GBP 60 if woman is abstinent 3 months postpartum)<br><br>Intervention group 2: 20 GBP Love2shop gift cards offered up to 12 months postpartum conditional on self-reported and biochemically validated abstinence (at 3-monthly intervals after first three months) + option of incentive to significant other supporter (GBP 60 if woman is abstinent 3 months postpartum) |
| Outcomes | Primary outcome: self-reported, lapse-free smoking abstinence from last quit attempt in pregnancy to 12 months postpartum, biochemically-validated by expired CO test of < 8 ppm, and/or saliva cotinine or anabasine.<br><br>Secondary outcome: self-reported, lapse-free smoking abstinence from last quit attempt in pregnancy to 3 months postpartum, biochemically-validated by expired CO test of < 8 ppm |
| Starting date | Not reported |
| Contact information | M. Ussher (mussher@sgul.ac.uk) |
| Notes | |

### Wali 2023

| | |
|---|---|
| Study name | Financial Incentives for Smoking Treatment II (FIESTA II) |
| Methods | Randomised controlled trial |
| Participants | 1058 English- or Spanish-speaking hospitalised individuals, ≥ 18 years, who smoked in the past 30 days and are contemplating quitting. |
| Interventions | Enhanced usual care arm: enhanced usual care (hospital-directed replacement therapy and counselling) + USD 20 compensation for completing each visit at 2 weeks, 1 month, 2 months, 6 months and 12 months and USD 30 for completing a salivary cotinine or expired CO test if they quit smoking.<br><br>Outcome-based incentive arm: enhanced usual care + financial incentives for smoking cessation validated by salivary cotinine test or exhaled CO test (≤ 7 ppm) at 2 weeks (USD 100), 1 month (USD 150), 2 months (USD 200) and 6 months after enrolment (USD 250).<br><br>Goal-directed arm: enhanced usual care + financial incentives for speaking with coach from quitline at 1 month or 2 months (USD 150), completing 3 follow-up calls (USD 150), discussing varenicline |

**Wali 2023** *(Continued)*

| | |
|---|---|
| | with doctor (USD 150), and using NRT (USD 1000). Those who report quitting will have a salivary cotinine or exhaled CO test (≤ 7 ppm) at each visit. |
| Outcomes | Primary outcomes: smoking status, use of evidence-based smoking cessation therapies and quality of life measure at 2 weeks, 1 month, 2 months and 12 months |
| Starting date | Not reported |
| Contact information | Soma Wali (swali@dhs.lacounty.gov) |
| Notes | |

**Wells 2022**

| | |
|---|---|
| Study name | Contingency management and cognitive behavior therapy for smoking cessation among veterans with posttraumatic stress disorder (PTSD) |
| Methods | Randomised controlled trial |
| Participants | Veterans, aged 18 to 80 years, with PTSD and who have smoked at least one cigarette per day in the past 12 months. |
| Interventions | Yoked reinforcement arm: CPT-SMART (twelve 90-minute sessions: cognitive processing therapy (CPT), CBT for smoking cessation, pharmacotherapy)<br><br>Contingent reinforcement arm: CPT-SMART + CM incentive (start at USD 30 at third session and increase by USD 5 each consecutive instance of abstinence) |
| Outcomes | Primary outcome: smoking abstinence validated by CO breath testing (first week post-quit, starting at session 5, first 30 days post-quit, post-treatment abstinence, long-term abstinence) |
| Starting date | Not reported |
| Contact information | Eric A. Dedert (Eric.Dedert@va.gov) |
| Notes | |

**CBT:** cognitive behavioural therapy; **CM:** contingency management; **DSM-5:** Diagnostic and Statistical Manual of Mental Disorders, 5th Edition; **(e)CO:** (exhaled) carbon monoxide; **GBP:** pounds sterling; **NRT:** nicotine replacement therapy; **PPA:** point prevalence abstinence; **ppm:** parts per million; **RCT:** randomised controlled trial; **SC:** smoking cessation; **USD:** US dollars

## DATA AND ANALYSES

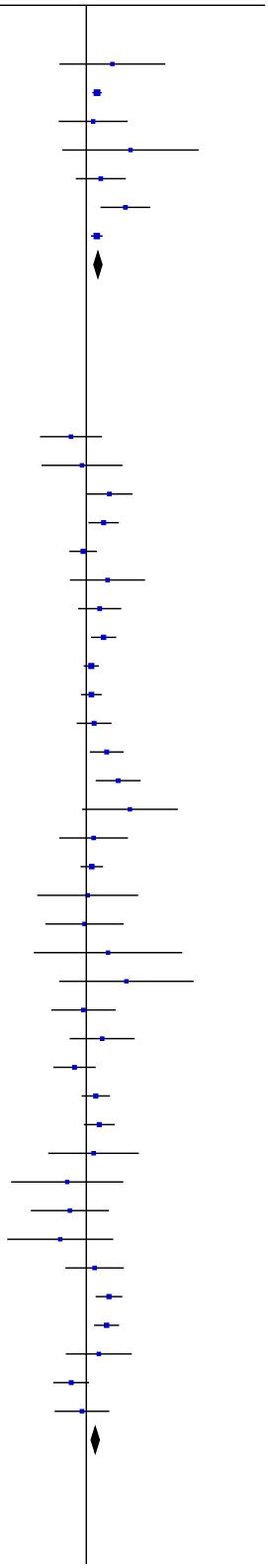
### Comparison 1. Incentives for smoking cessation: mixed populations

| Outcome or subgroup title | No. of studies | No. of participants | Statistical method | Effect size |
|---|---|---|---|---|
| 1.1 Smoking cessation (subgrouped by when incentives were provided) | 39 | 18303 | Risk Ratio (M-H, Random, 95% CI) | 1.52 [1.33, 1.74] |

| Outcome or subgroup title | No. of studies | No. of participants | Statistical method | Effect size |
|---|---|---|---|---|
| 1.1.1 Incentives provided at longest follow-up | 7 | 3221 | Risk Ratio (M-H, Random, 95% CI) | 1.63 [1.38, 1.93] |
| 1.1.2 Incentives not provided at longest follow-up | 32 | 15082 | Risk Ratio (M-H, Random, 95% CI) | 1.46 [1.23, 1.73] |
| 1.2 Smoking cessation (grouped by substance misuse) | 39 | 18303 | Risk Ratio (M-H, Random, 95% CI) | 1.52 [1.33, 1.74] |
| 1.2.1 Substance misusers | 9 | 1152 | Risk Ratio (M-H, Random, 95% CI) | 1.22 [0.82, 1.82] |
| 1.2.2 Non-substance misusers | 30 | 17151 | Risk Ratio (M-H, Random, 95% CI) | 1.57 [1.35, 1.83] |
| 1.3 Smoking cessation in mixed populations (generic inverse-variance analysis - including new cluster trials) | 43 | 23960 | Odds Ratio (IV, Random, 95% CI) | 1.57 [1.37, 1.79] |

## Analysis 1.1. Comparison 1: Incentives for smoking cessation: mixed populations, Outcome 1: Smoking cessation (subgrouped by when incentives were provided)

| Study or Subgroup | Incentives Events | Incentives Total | No incentives Events | No incentives Total | Weight | Risk Ratio M-H, Random, 95% CI |
|---|---|---|---|---|---|---|
| **1.1.1 Incentives provided at longest follow-up** | | | | | | |
| Drummond 2014 | 3 | 50 | 1 | 50 | 0.4% | 3.00 [0.32 , 27.87] |
| Fraser 2017 | 205 | 948 | 131 | 952 | 10.8% | 1.57 [1.29 , 1.92] |
| Gallagher 2007 | 4 | 60 | 3 | 60 | 0.8% | 1.33 [0.31 , 5.70] |
| Ghosh 2016 | 2 | 6 | 0 | 8 | 0.2% | 6.43 [0.36 , 113.52] |
| Ladapo 2020 | 9 | 90 | 5 | 92 | 1.5% | 1.84 [0.64 , 5.28] |
| Lasser 2017 | 21 | 177 | 4 | 175 | 1.5% | 5.19 [1.82 , 14.81] |
| Van den Brand 2018[a] | 120 | 292 | 69 | 261 | 9.7% | 1.55 [1.22 , 1.99] |
| **Subtotal** | | **1623** | | **1598** | **25.0%** | **1.63 [1.38 , 1.93]** |
| Total events: | 364 | | 213 | | | |
| Test for overall effect: Z = 5.67 (P < 0.00001) | | | | | | |
| Heterogeneity: Tau² = 0.00; Chi² = 6.32, df = 6 (P = 0.39); I² = 5% | | | | | | |
| **1.1.2 Incentives not provided at longest follow-up** | | | | | | |
| Alessi 2014 | 3 | 24 | 5 | 21 | 1.0% | 0.53 [0.14 , 1.94] |
| Aonso-Diego 2021 | 2 | 24 | 3 | 30 | 0.6% | 0.83 [0.15 , 4.59] |
| Beckham 2019 | 13 | 63 | 5 | 64 | 1.7% | 2.64 [1.00 , 6.97] |
| Brown 2019 | 30 | 94 | 10 | 65 | 3.4% | 2.07 [1.09 , 3.94] |
| Cheung 2017 | 30 | 764 | 17 | 379 | 4.0% | 0.88 [0.49 , 1.57] |
| Cooney 2017 | 5 | 42 | 2 | 41 | 0.7% | 2.44 [0.50 , 11.88] |
| Dallery 2016 | 11 | 48 | 6 | 46 | 2.0% | 1.76 [0.71 , 4.36] |
| Etter 2016 | 39 | 401 | 19 | 404 | 4.5% | 2.07 [1.22 , 3.52] |
| Giné 2010 | 86 | 781 | 55 | 616 | 7.9% | 1.23 [0.89 , 1.70] |
| Glasgow 1993[a] | 35 | 243 | 35 | 301 | 5.8% | 1.24 [0.80 , 1.92] |
| Halpern 2015[b] | 50 | 1053 | 8 | 234 | 2.8% | 1.39 [0.67 , 2.89] |
| Halpern 2015[c] | 82 | 1017 | 8 | 234 | 2.9% | 2.36 [1.16 , 4.81] |
| Halpern 2018 | 29 | 2406 | 5 | 1588 | 1.8% | 3.83 [1.48 , 9.87] |
| Higgins 2023 | 12 | 130 | 1 | 68 | 0.4% | 6.28 [0.83 , 47.26] |
| Hofmeyr 2020 | 4 | 52 | 3 | 53 | 0.8% | 1.36 [0.32 , 5.78] |
| Jason 1995[a] | 34 | 259 | 27 | 259 | 5.2% | 1.26 [0.78 , 2.02] |
| Ledgerwood 2014 | 4 | 64 | 1 | 17 | 0.4% | 1.06 [0.13 , 8.90] |
| Medenblik 2020 | 3 | 21 | 2 | 13 | 0.7% | 0.93 [0.18 , 4.84] |
| Rand 1989 | 1 | 17 | 0 | 14 | 0.2% | 2.50 [0.11 , 56.98] |
| Rettig 2018 | 4 | 19 | 0 | 11 | 0.2% | 5.40 [0.32 , 91.76] |
| Rohsenow 2015 | 4 | 97 | 4 | 86 | 1.0% | 0.89 [0.23 , 3.44] |
| Rohsenow 2017 | 6 | 172 | 3 | 168 | 0.9% | 1.95 [0.50 , 7.68] |
| Romanowich 2015 | 15 | 193 | 6 | 47 | 2.0% | 0.61 [0.25 , 1.48] |
| Secades-Villa 2014 | 17 | 43 | 13 | 49 | 3.9% | 1.49 [0.82 , 2.70] |
| Secades-Villa 2019a[d] | 19 | 60 | 11 | 60 | 3.4% | 1.73 [0.90 , 3.31] |
| Secades-Villa 2022 | 2 | 34 | 2 | 46 | 0.5% | 1.35 [0.20 , 9.13] |
| Shoptaw 2002[e] | 1 | 47 | 2 | 42 | 0.3% | 0.45 [0.04 , 4.75] |
| Shoptaw 2002[f] | 2 | 43 | 4 | 43 | 0.7% | 0.50 [0.10 , 2.59] |
| Tevyaw 2009 | 1 | 55 | 3 | 55 | 0.4% | 0.33 [0.04 , 3.11] |
| Volpp 2006 | 6 | 92 | 4 | 87 | 1.1% | 1.42 [0.41 , 4.86] |
| Volpp 2009 | 41 | 436 | 16 | 442 | 4.2% | 2.60 [1.48 , 4.56] |
| White 2013 | 58 | 131 | 13 | 69 | 4.6% | 2.35 [1.39 , 3.98] |
| Wilson 2023 | 5 | 63 | 3 | 64 | 0.9% | 1.69 [0.42 , 6.79] |
| Windsor 1988[g] | 9 | 94 | 17 | 94 | 2.7% | 0.53 [0.25 , 1.13] |
| Windsor 1988[h] | 5 | 95 | 6 | 95 | 1.3% | 0.83 [0.26 , 2.64] |
| **Subtotal** | | **9177** | | **5905** | **75.0%** | **1.46 [1.23 , 1.73]** |
| Total events: | 668 | | 319 | | | |
| Test for overall effect: Z = 4.31 (P < 0.0001) | | | | | | |
| Heterogeneity: Tau² = 0.06; Chi² = 45.78, df = 34 (P = 0.09); I² = 26% | | | | | | |

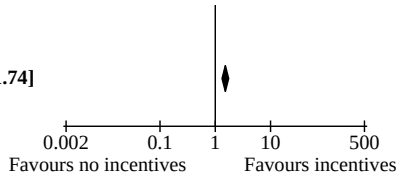


## Analysis 1.1. (Continued)

Heterogeneity: Tau² = 0.06; Chi² = 45.78, df = 34 (P = 0.09); I² = 26%

| | | | | | |
|---|---|---|---|---|---|
| **Total** | **10800** | **7503** | **100.0%** | **1.52 [1.33 , 1.74]** | |
| Total events: | 1032 | 532 | | | |

Test for overall effect: Z = 6.00 (P < 0.00001)
Test for subgroup differences: Chi² = 0.85, df = 1 (P = 0.36), I² = 0%
Heterogeneity: Tau² = 0.03; Chi² = 53.13, df = 41 (P = 0.10); I² = 23%

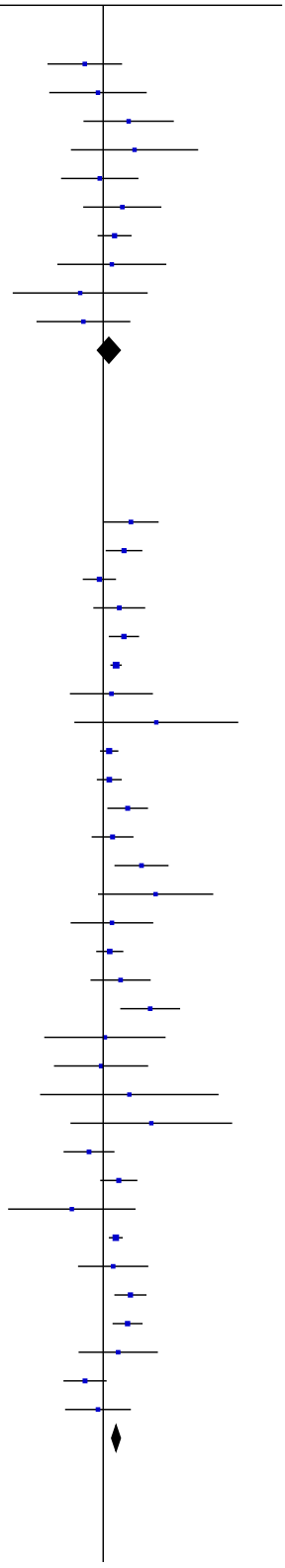



**Footnotes**

[a]Cluster-randomised; adjusted data used here
[b]Deposit arms versus control. Control split to avoid double-counting
[c]Rewards versus control. Control split to avoid double-counting
[d]Absolute numbers calculated from reported percentages.
[e]Four-armed study, two arms involve relapse prevention (RP). RP arms listed here.
[f]Four-armed study, two arms involve relapse prevention (RP). Non-RP arms listed here.
[g]Study includes four arms; 2 with cessation skills training (CST). CST arms listed here. Control groups split to avoid double-counting.
[h]Study includes four arms; 2 with cessation skills training (CST). Non-CST arms listed here. Control groups split to avoid double-counting.

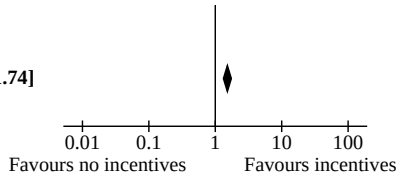
## Analysis 1.2. Comparison 1: Incentives for smoking cessation: mixed populations, Outcome 2: Smoking cessation (grouped by substance misuse)

| Study or Subgroup | Incentives Events | Incentives Total | No incentives Events | No incentives Total | Weight | Risk Ratio M-H, Random, 95% CI |
|---|---|---|---|---|---|---|
| **1.2.1 Substance misusers** | | | | | | |
| Alessi 2014 | 3 | 24 | 5 | 21 | 1.0% | 0.53 [0.14 , 1.94] |
| Aonso-Diego 2021 | 2 | 24 | 3 | 30 | 0.6% | 0.83 [0.15 , 4.59] |
| Cooney 2017 | 5 | 42 | 2 | 41 | 0.7% | 2.44 [0.50 , 11.88] |
| Drummond 2014 | 3 | 50 | 1 | 50 | 0.4% | 3.00 [0.32 , 27.87] |
| Rohsenow 2015 | 4 | 97 | 4 | 86 | 1.0% | 0.89 [0.23 , 3.44] |
| Rohsenow 2017 | 6 | 172 | 3 | 168 | 0.9% | 1.95 [0.50 , 7.68] |
| Secades-Villa 2014 | 17 | 43 | 13 | 49 | 3.9% | 1.49 [0.82 , 2.70] |
| Secades-Villa 2022 | 2 | 34 | 2 | 46 | 0.5% | 1.35 [0.20 , 9.13] |
| Shoptaw 2002[a] | 1 | 47 | 2 | 42 | 0.3% | 0.45 [0.04 , 4.75] |
| Shoptaw 2002[b] | 2 | 43 | 4 | 43 | 0.7% | 0.50 [0.10 , 2.59] |
| **Subtotal** | | **576** | | **576** | **10.0%** | **1.22 [0.82 , 1.82]** |
| Total events: | 45 | | 39 | | | |
| Test for overall effect: Z = 0.97 (P = 0.33) | | | | | | |
| Heterogeneity: Tau² = 0.00; Chi² = 6.10, df = 9 (P = 0.73); I² = 0% | | | | | | |
| **1.2.2 Non-substance misusers** | | | | | | |
| Beckham 2019 | 13 | 63 | 5 | 64 | 1.7% | 2.64 [1.00 , 6.97] |
| Brown 2019 | 30 | 94 | 10 | 65 | 3.4% | 2.07 [1.09 , 3.94] |
| Cheung 2017 | 30 | 764 | 17 | 379 | 4.0% | 0.88 [0.49 , 1.57] |
| Dallery 2016 | 11 | 48 | 6 | 46 | 2.0% | 1.76 [0.71 , 4.36] |
| Etter 2016 | 39 | 401 | 19 | 404 | 4.5% | 2.07 [1.22 , 3.52] |
| Fraser 2017 | 205 | 948 | 131 | 952 | 10.8% | 1.57 [1.29 , 1.92] |
| Gallagher 2007 | 4 | 60 | 3 | 60 | 0.8% | 1.33 [0.31 , 5.70] |
| Ghosh 2016 | 2 | 6 | 0 | 8 | 0.2% | 6.43 [0.36 , 113.52] |
| Giné 2010 | 86 | 781 | 55 | 616 | 7.9% | 1.23 [0.89 , 1.70] |
| Glasgow 1993[c] | 35 | 243 | 35 | 301 | 5.8% | 1.24 [0.80 , 1.92] |
| Halpern 2015[d] | 82 | 1017 | 8 | 234 | 2.9% | 2.36 [1.16 , 4.81] |
| Halpern 2015[e] | 50 | 1053 | 8 | 234 | 2.8% | 1.39 [0.67 , 2.89] |
| Halpern 2018 | 29 | 2406 | 5 | 1588 | 1.8% | 3.83 [1.48 , 9.87] |
| Higgins 2023 | 12 | 130 | 1 | 68 | 0.4% | 6.28 [0.83 , 47.26] |
| Hofmeyr 2020 | 4 | 52 | 3 | 53 | 0.8% | 1.36 [0.32 , 5.78] |
| Jason 1995[c] | 34 | 259 | 27 | 259 | 5.2% | 1.26 [0.78 , 2.02] |
| Ladapo 2020 | 9 | 90 | 5 | 92 | 1.5% | 1.84 [0.64 , 5.28] |
| Lasser 2017 | 21 | 177 | 4 | 175 | 1.5% | 5.19 [1.82 , 14.81] |
| Ledgerwood 2014 | 4 | 64 | 1 | 17 | 0.4% | 1.06 [0.13 , 8.90] |
| Medenblik 2020 | 3 | 21 | 2 | 13 | 0.7% | 0.93 [0.18 , 4.84] |
| Rand 1989 | 1 | 17 | 0 | 14 | 0.2% | 2.50 [0.11 , 56.98] |
| Rettig 2018 | 4 | 19 | 0 | 11 | 0.2% | 5.40 [0.32 , 91.76] |
| Romanowich 2015 | 15 | 193 | 6 | 47 | 2.0% | 0.61 [0.25 , 1.48] |
| Secades-Villa 2019a[f] | 19 | 60 | 11 | 60 | 3.4% | 1.73 [0.90 , 3.31] |
| Tevyaw 2009 | 1 | 55 | 3 | 55 | 0.4% | 0.33 [0.04 , 3.11] |
| Van den Brand 2018[c] | 120 | 292 | 69 | 261 | 9.7% | 1.55 [1.22 , 1.99] |
| Volpp 2006 | 6 | 92 | 4 | 87 | 1.1% | 1.42 [0.41 , 4.86] |
| Volpp 2009 | 41 | 436 | 16 | 442 | 4.2% | 2.60 [1.48 , 4.56] |
| White 2013 | 58 | 131 | 13 | 69 | 4.6% | 2.35 [1.39 , 3.98] |
| Wilson 2023 | 5 | 63 | 3 | 64 | 0.9% | 1.69 [0.42 , 6.79] |
| Windsor 1988[g] | 9 | 94 | 17 | 94 | 2.7% | 0.53 [0.25 , 1.13] |
| Windsor 1988[h] | 5 | 95 | 6 | 95 | 1.3% | 0.83 [0.26 , 2.64] |
| **Subtotal** | | **10224** | | **6927** | **90.0%** | **1.57 [1.35 , 1.83]** |
| Total events: | 987 | | 493 | | | |
| Test for overall effect: Z = 5.77 (P < 0.00001) | | | | | | |
| Heterogeneity: Tau² = 0.05; Chi² = 45.80, df = 31 (P = 0.04); I² = 32% | | | | | | |



## Analysis 1.2. (Continued)

| | | | | | |
|---|---|---|---|---|---|
| Heterogeneity: Tau² = 0.05; Chi² = 45.80, df = 31 (P = 0.04); I² = 32% | | | | | |
| **Total** | **10800** | **7503** | **100.0%** | **1.52 [1.33 , 1.74]** | |
| Total events: | 1032 | 532 | | | |
| Test for overall effect: Z = 6.00 (P < 0.00001) | | | | | |
| Test for subgroup differences: Chi² = 1.33, df = 1 (P = 0.25), I² = 24.6% | | | | | |
| Heterogeneity: Tau² = 0.03; Chi² = 53.13, df = 41 (P = 0.10); I² = 23% | | | | | |

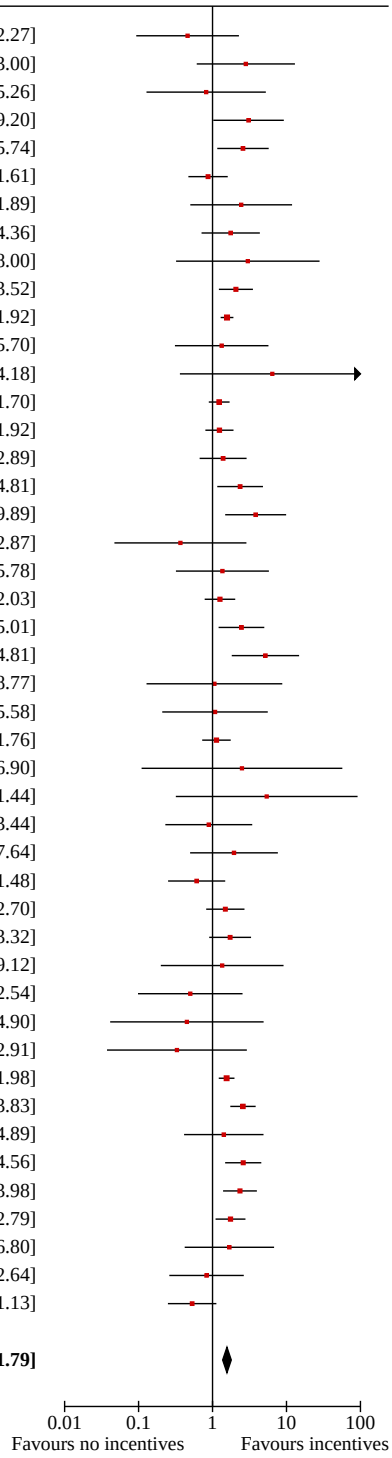



**Footnotes**

[a]Four-armed study, two arms involve relapse prevention (RP). RP arms listed here.
[b]Four-armed study, two arms involve relapse prevention (RP). Non-RP arms listed here.
[c]Cluster-randomised; adjusted data used here
[d]Rewards versus control. Control split to avoid double-counting
[e]Deposit arms versus control. Control split to avoid double-counting
[f]Absolute numbers calculated from reported percentages.
[g]Study includes four arms; 2 with cessation skills training (CST). CST arms listed here. Control groups split to avoid double-counting.
[h]Study includes four arms; 2 with cessation skills training (CST). Non-CST arms listed here. Control groups split to avoid double-counting.

## Analysis 1.3. Comparison 1: Incentives for smoking cessation: mixed populations, Outcome 3: Smoking cessation in mixed populations (generic inverse-variance analysis - including new cluster trials)

| Study or Subgroup | log[OR] | SE | Incentives Total | Control Total | Weight | Odds Ratio IV, Random, 95% CI |
|---|---|---|---|---|---|---|
| Alessi 2014 | -0.776529 | 0.815424 | 24 | 21 | 0.7% | 0.46 [0.09 , 2.27] |
| Anderson 2021 | 1.036737 | 0.779845 | 208 | 103 | 0.7% | 2.82 [0.61 , 13.00] |
| Aonso-Diego 2021 | -0.198451 | 0.947835 | 24 | 30 | 0.5% | 0.82 [0.13 , 5.26] |
| Beckham 2019 | 1.121026 | 0.560243 | 64 | 63 | 1.3% | 3.07 [1.02 , 9.20] |
| Brown 2019 | 0.947789 | 0.40837 | 94 | 65 | 2.2% | 2.58 [1.16 , 5.74] |
| Cheung 2017 | -0.139262 | 0.312512 | 764 | 379 | 3.2% | 0.87 [0.47 , 1.61] |
| Cooney 2017 | 0.891998 | 0.808179 | 42 | 41 | 0.7% | 2.44 [0.50 , 11.89] |
| Dallery 2016 | 0.565314 | 0.463009 | 48 | 46 | 1.8% | 1.76 [0.71 , 4.36] |
| Drummond 2014 | 1.098612 | 1.139558 | 50 | 50 | 0.3% | 3.00 [0.32 , 28.00] |
| Etter 2016 | 0.727549 | 0.270314 | 401 | 404 | 3.9% | 2.07 [1.22 , 3.52] |
| Fraser 2017 | 0.451076 | 0.101452 | 948 | 952 | 8.2% | 1.57 [1.29 , 1.92] |
| Gallagher 2007 | 0.285179 | 0.742781 | 60 | 60 | 0.8% | 1.33 [0.31 , 5.70] |
| Ghosh 2016 | 1.860975 | 1.46779 | 6 | 8 | 0.2% | 6.43 [0.36 , 114.18] |
| Giné 2010 | 0.207014 | 0.165095 | 781 | 616 | 6.3% | 1.23 [0.89 , 1.70] |
| Glasgow 1993 | 0.215111 | 0.223338 | 243 | 301 | 4.8% | 1.24 [0.80 , 1.92] |
| Halpern 2015[a] | 0.329304 | 0.372898 | 1017 | 234 | 2.5% | 1.39 [0.67 , 2.89] |
| Halpern 2015[b] | 0.858662 | 0.362832 | 1053 | 234 | 2.6% | 2.36 [1.16 , 4.81] |
| Halpern 2018 | 1.342865 | 0.484054 | 2406 | 1588 | 1.7% | 3.83 [1.48 , 9.89] |
| Higgins 2023 | -1 | 1.048433 | 63 | 42 | 0.4% | 0.37 [0.05 , 2.87] |
| Hofmeyr 2020 | 0.307485 | 0.738238 | 52 | 53 | 0.8% | 1.36 [0.32 , 5.78] |
| Jason 1995[c] | 0.231112 | 0.242749 | 259 | 259 | 4.4% | 1.26 [0.78 , 2.03] |
| Ladapo 2020 | 0.900161 | 0.362968 | 65 | 72 | 2.6% | 2.46 [1.21 , 5.01] |
| Lasser 2017 | 1.646734 | 0.534823 | 177 | 175 | 1.4% | 5.19 [1.82 , 14.81] |
| Ledgerwood 2014 | 0.058269 | 1.07815 | 64 | 17 | 0.4% | 1.06 [0.13 , 8.77] |
| Medenblik 2020 | 0.076961 | 0.838076 | 13 | 21 | 0.6% | 1.08 [0.21 , 5.58] |
| Pisinger 2022[d] | 0.122218 | 0.226357 | 295 | 580 | 4.8% | 1.13 [0.73 , 1.76] |
| Rand 1989 | 0.916291 | 1.594411 | 17 | 14 | 0.2% | 2.50 [0.11 , 56.90] |
| Rettig 2018 | 1.686399 | 1.44355 | 19 | 11 | 0.2% | 5.40 [0.32 , 91.44] |
| Rohsenow 2015 | -0.116534 | 0.690101 | 97 | 86 | 0.9% | 0.89 [0.23 , 3.44] |
| Rohsenow 2017 | 0.667829 | 0.696892 | 172 | 168 | 0.9% | 1.95 [0.50 , 7.64] |
| Romanowich 2015 | -0.494296 | 0.453666 | 193 | 47 | 1.8% | 0.61 [0.25 , 1.48] |
| Secades-Villa 2014 | 0.398776 | 0.304011 | 43 | 49 | 3.3% | 1.49 [0.82 , 2.70] |
| Secades-Villa 2019a[e] | 0.548121 | 0.332228 | 60 | 60 | 3.0% | 1.73 [0.90 , 3.32] |
| Secades-Villa 2022 | 0.300105 | 0.974764 | 34 | 46 | 0.5% | 1.35 [0.20 , 9.12] |
| Shoptaw 2002[f] | -0.693147 | 0.830179 | 47 | 42 | 0.6% | 0.50 [0.10 , 2.54] |
| Shoptaw 2002[g] | -0.798508 | 1.21865 | 43 | 43 | 0.3% | 0.45 [0.04 , 4.90] |
| Tevyaw 2009 | -1.108663 | 1.110607 | 55 | 55 | 0.4% | 0.33 [0.04 , 2.91] |
| Van den Brand 2018 | 0.438255 | 0.12482 | 292 | 261 | 7.5% | 1.55 [1.21 , 1.98] |
| Van Schayck 2018 | 0.947789 | 0.201274 | 320 | 320 | 5.3% | 2.58 [1.74 , 3.83] |
| Volpp 2006 | 0.350657 | 0.630786 | 92 | 87 | 1.0% | 1.42 [0.41 , 4.89] |
| Volpp 2009 | 0.955511 | 0.287067 | 436 | 442 | 3.6% | 2.60 [1.48 , 4.56] |
| White 2013 | 0.854415 | 0.268367 | 131 | 69 | 3.9% | 2.35 [1.39 , 3.98] |
| White 2020[c] | 0.559616 | 0.237436 | 3746 | 223 | 4.5% | 1.75 [1.10 , 2.79] |
| Wilson 2023 | 0.524729 | 0.70995 | 63 | 64 | 0.8% | 1.69 [0.42 , 6.80] |
| Windsor 1988[h] | -0.18633 | 0.5913 | 95 | 95 | 1.2% | 0.83 [0.26 , 2.64] |
| Windsor 1988[i] | -0.634878 | 0.384832 | 94 | 94 | 2.4% | 0.53 [0.25 , 1.13] |
| **Total** | | | **15270** | **8690** | **100.0%** | **1.57 [1.37 , 1.79]** |




Test for overall effect: Z = 6.60 (P < 0.00001)
Test for subgroup differences: Not applicable
Heterogeneity: Tau² = 0.05; Chi² = 64.09, df = 45 (P = 0.03); I² = 30%

**Footnotes**

[a]Rewards versus control; control split to avoid double-counting

## Analysis 1.3. (Continued)

Footnotes

[a]Rewards versus control; control split to avoid double-counting

[b]Deposit arms versus control; control split to avoid double-counting

[c]Cluster-randomised; adjusted data used here

[d]Cluster-randomised; adjusted data used here; new for 2024 update

[e]Absolute numbers calculated from reported percentages

[f]Four-armed study, two arms involve replapse prevention (RP). RP arms listed here.

[g]Four-armed study, two arms involve replapse prevention (RP). Non-RP arms listed here.

[h]Study included four arms; 2 with cessation skills training (CST). Non-CST arms listed here. Control groups split to avoid double-counting

[i]Study included four arms; 2 with cessation skills training (CST). CST arms listed here. Control groups split to avoid double-counting

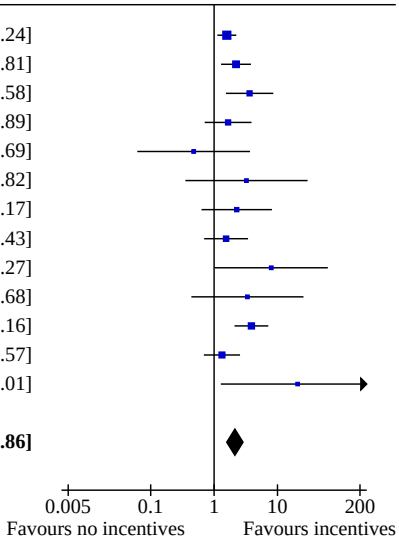
## Comparison 2. Incentives for smoking cessation: pregnant people

| Outcome or subgroup title | No. of studies | No. of participants | Statistical method | Effect size |
|---|---|---|---|---|
| 2.1 Smoking cessation at longest follow-up | 13 | 3942 | Risk Ratio (M-H, Random, 95% CI) | 2.13 [1.58, 2.86] |
| 2.2 Abstinence at end of pregnancy | 10 | 1965 | Risk Ratio (M-H, Random, 95% CI) | 2.78 [2.20, 3.50] |
| 2.3 Contingent rewards versus guaranteed payments | 3 | 225 | Risk Ratio (M-H, Random, 95% CI) | 3.33 [0.97, 11.38] |

## Analysis 2.1. Comparison 2: Incentives for smoking cessation: pregnant people, Outcome 1: Smoking cessation at longest follow-up

| Study or Subgroup | Incentives Events | Incentives Total | No incentives Events | No incentives Total | Weight | Risk Ratio M-H, Random, 95% CI |
|---|---|---|---|---|---|---|
| Baker 2018 | 74 | 505 | 47 | 509 | 20.9% | 1.59 [1.12 , 2.24] |
| Berlin 2021 | 38 | 231 | 17 | 229 | 14.7% | 2.22 [1.29 , 3.81] |
| Donatelle 2000a | 22 | 103 | 6 | 102 | 8.4% | 3.63 [1.54 , 8.58] |
| Donatelle 2000b | 13 | 67 | 7 | 60 | 8.5% | 1.66 [0.71 , 3.89] |
| Harris 2015 | 1 | 7 | 3 | 10 | 1.9% | 0.48 [0.06 , 3.69] |
| Heil 2008 | 3 | 37 | 1 | 40 | 1.7% | 3.24 [0.35 , 29.82] |
| Higgins 2014 | 7 | 40 | 3 | 39 | 4.5% | 2.27 [0.63 , 8.17] |
| Higgins 2022 | 13 | 85 | 9 | 91 | 9.4% | 1.55 [0.70 , 3.43] |
| Kurti 2022[a] | 7 | 43 | 1 | 49 | 1.9% | 7.98 [1.02 , 62.27] |
| Ondersma 2012 | 7 | 48 | 1 | 23 | 2.0% | 3.35 [0.44 , 25.68] |
| Tappin 2015[b] | 47 | 306 | 12 | 303 | 12.9% | 3.88 [2.10 , 7.16] |
| Tappin 2022 | 20 | 471 | 15 | 470 | 12.0% | 1.33 [0.69 , 2.57] |
| Tuten 2012 | 13 | 42 | 0 | 32 | 1.1% | 20.72 [1.28 , 336.01] |
| **Total** | | **1985** | | **1957** | **100.0%** | **2.13 [1.58 , 2.86]** |
| Total events: | 265 | | 122 | | | |

Risk Ratio M-H, Random, 95% CI




Test for overall effect: Z = 5.01 (P < 0.00001)
Test for subgroup differences: Not applicable
Heterogeneity: Tau² = 0.08; Chi² = 17.46, df = 12 (P = 0.13); I² = 31%

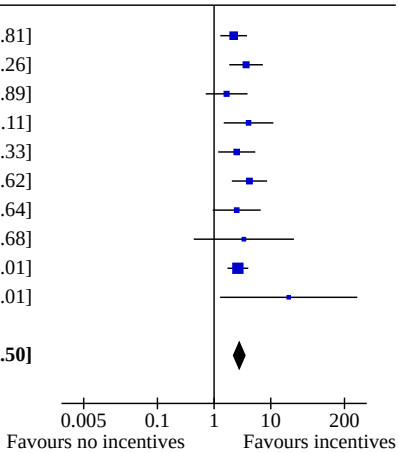
**Footnotes**

[a]Numbers interpreted from a figure, not reported in text
[b]12 months post-target quit date

## Analysis 2.2. Comparison 2: Incentives for smoking cessation: pregnant people, Outcome 2: Abstinence at end of pregnancy

| Study or Subgroup | Incentives Events | Incentives Total | No incentives Events | No incentives Total | Weight | Risk Ratio M-H, Random, 95% CI |
|---|---|---|---|---|---|---|
| Berlin 2021 | 38 | 231 | 17 | 229 | 18.2% | 2.22 [1.29 , 3.81] |
| Donatelle 2000a | 34 | 105 | 9 | 102 | 11.5% | 3.67 [1.85 , 7.26] |
| Donatelle 2000b[a] | 13 | 67 | 7 | 60 | 7.4% | 1.66 [0.71 , 3.89] |
| Heil 2008 | 15 | 37 | 4 | 40 | 5.3% | 4.05 [1.48 , 11.11] |
| Higgins 2014[a] | 18 | 40 | 7 | 39 | 9.4% | 2.51 [1.18 , 5.33] |
| Higgins 2022[a] | 31 | 81 | 8 | 88 | 10.4% | 4.21 [2.06 , 8.62] |
| Kurti 2022[b] | 11 | 43 | 5 | 49 | 5.6% | 2.51 [0.95 , 6.64] |
| Ondersma 2012[c] | 7 | 48 | 1 | 23 | 1.3% | 3.35 [0.44 , 25.68] |
| Tappin 2015 | 69 | 306 | 26 | 303 | 30.1% | 2.63 [1.72 , 4.01] |
| Tuten 2012[d] | 13 | 42 | 0 | 32 | 0.7% | 20.72 [1.28 , 336.01] |
| **Total** | | **1000** | | **965** | **100.0%** | **2.78 [2.20 , 3.50]** |
| Total events: | 249 | | 84 | | | |

Risk Ratio M-H, Random, 95% CI




Test for overall effect: Z = 8.65 (P < 0.00001)
Test for subgroup differences: Not applicable
Heterogeneity: Tau² = 0.00; Chi² = 6.87, df = 9 (P = 0.65); I² = 0%

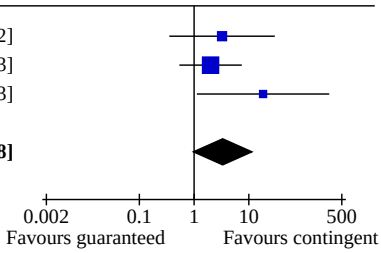
**Footnotes**

[a]Extrapolated from %
[b]Numbers interpreted from a figure, not reported in text
[c]Results reported only to end of 10-week programme (end of pregnancy)
[d]Results reported only to end of 12-week programme (end of pregnancy)

## Analysis 2.3. Comparison 2: Incentives for smoking cessation: pregnant people, Outcome 3: Contingent rewards versus guaranteed payments

| Study or Subgroup | Contingent Events | Contingent Total | Guaranteed Events | Guaranteed Total | Weight | Risk Ratio M-H, Random, 95% CI |
|---|---|---|---|---|---|---|
| Heil 2008 | 3 | 37 | 1 | 40 | 25.8% | 3.24 [0.35 , 29.82] |
| Higgins 2014 | 6 | 39 | 3 | 39 | 56.8% | 2.00 [0.54 , 7.43] |
| Tuten 2012 | 13 | 42 | 0 | 28 | 17.4% | 18.21 [1.13 , 294.43] |
| **Total** | | **118** | | **107** | **100.0%** | **3.33 [0.97 , 11.38]** |
| Total events: | 22 | | 4 | | | |

Test for overall effect: Z = 1.92 (P = 0.06)
Test for subgroup differences: Not applicable
Heterogeneity: Tau² = 0.24; Chi² = 2.45, df = 2 (P = 0.29); I² = 18%



## ADDITIONAL TABLES

**Table 1. Results of included studies: mixed populations**

| Study ID | Denominator | Abstinence | Time point | Biological criterion | Quit rate | Stat sig? | Other outcomes | Comment |
|---|---|---|---|---|---|---|---|---|
| **Ainscough 2017** | 19 (IG)<br>18 (CG) | PPA | 6 months | CO < 10 ppm | 1 (IG) | N.S. | N of participants completing the smoking cessation intervention; opioid treatment outcomes (opioid treatment adherence, drug types, treatment schedule); illicit drug use. | Only 1 participant followed up, not CO verified |
| **Alessi 2014** | 24 (Contingency management (CM) - IG)<br>21 (CG) | 7-day PPA | 24 weeks | CO < 6 ppm<br>Cotinine < 30 ng/mL | 12.5% (IG)<br>23.8% (CG) | N.S. | % reduction in cpd; self-efficacy | Raw data supplied by the author |
| **Anderson 2021** | 208 (across three incentives conditions)<br>103 (control) | PPA | 6 months (followed up for 12 months but no available data) | Urine cotinine level below or equal to 20 ng/mL | Not reported (only report odds ratio for any treatment 2.82 (95% confidence interval 0.61 to 12.97) | N.S. | Service utilisation | No raw data available |
| **Anonso-Diego 2021** | 24 (IG)<br>30 (CG) | 24-hour smoking abstinence | 6 months | CO ≤ 4ppm and urine cotinine ≤ 80 ng/mL | 8.33% (IG)<br>10% (CG) | Not reported | None reported | Conference abstract only |
| **Beckham 2019** | 64 (IG)<br>63 (CG) | Smoking abstinence | 6 months | Salivary cotinine (cut-off not reported) | 20.6% (IG)<br>7.8% (CG) | Not reported | Adverse events; intervention delivery costs | Trial registry only |
| **Brown 2019** | 44 CM weekly<br>50 CM monthly<br>65 CG | 28-day PPA | 6 months | No biochemical validation at 6 months | 29.5% (I weekly)<br>34.0% (I monthly)<br>15.38 (CG) | P < 0.05 | Use of self-incentives | - |

**Table 1. Results of included studies: mixed populations** *(Continued)*

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Brunette 2017** | "approximately half of 146" (CG)<br>"approximately half of 146" (prescriber visit (PV) + incentives)<br>"approximately half of 303" (PV + Quitline)<br>"approximately half of 303" (PV + Quitline + incentives)<br>"approximately half of 212" (PV + CBT)<br>"approximately half of 212" (PV + CBT + incentives) | PPA | 12 months | CO < 4 ppm; cotinine 100 ng/mL | 8% (PV)<br>6% (PV + incentives)<br>3.5% (PV + Quitline)<br>14% (PV+ Quitline + incentives)<br>5% (PV + CBT)<br>12.5% (PV + CBT + incentives) | N.S. | Treatment programme participation, medications | - |
| **Cheung 2017** | 379 (Early informed)<br>385 (Late informed)<br>379 (Control) | PPA | 6 months | CO < 4 ppm<br>Cotinine < 10 ng/mL | 19 (5%) EI<br>11 (2.9%) LI<br>17 (4.5%) CG | N.S. | Quit attempts (longest duration and number of quit attempts, mean number of quit attempts, no smoking for at least 24 hours); cessation aids | - |
| **Cooney 2017** | 42 CM<br>41 CG | PPA | 6 months | CO ≤ 5 ppm | 5 (12%) CM<br>2 (5%) CG | P = 0.004 | Smoking at 1.5 weeks after quit date, 1 month. Alcohol use, drug use | - |
| **Dallery 2016** | 48 Abstinence-contingent group (AC)<br>46 SC (CG) | PPA | 6 months | CO ≤ 4 ppm | 11 (22.9%) AC<br>6 (13%) SC | N.S. | PP at week 4 and 3-month follow-up. Treatment acceptability, behavioural change | CO results were video-recorded and submitted remotely |
| **De Paul 1994** | 281 (Incentives (I)) | PPA | 24 months | CO < 9 ppm | 13.2% (I)<br>10.3 %(SH) | N.S. | PP, ITT and continuous quit rates reported at all time points | Comparison confined to I and SH groups in this re- |

**Table 1. Results of included studies: mixed populations** *(Continued)*

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 280 (Self-help (SH)) | | | | | | | view. Cluster-randomised so adjusted in main analyses; unadjusted data presented here |
| **Drummond 2014** | 50 (Usual care/ Lung age: UC/LA)<br>50 (CM x 2) | 7-day PPA | 6 months | Cotinine, eCO | UC/LA 1/50<br>CM 3/50 | N.S. | CO values, Fagerström score, N of visits wanting to quit, trying to quit, reporting cessation, eCO-confirmed quitting | Groupings collapsed, as Lung Age alone or combined with CM produced no quitters |
| **Etter 2016** | 401 (IG)<br>404 (CG) | Continuous abstinence from months 6 to 18 verified by PPA | 18 months | CO to 3 ppm; cotinine < 10 ng/mL | 39 (9.7%) IG<br>19 (4.7) CG | P = 0.001 | Quit attempts during the intervention phase (number, duration and dates)<br>Cigarette consumption, motivation to quit, confidence in ability to quit.<br>Use of the online smoking cessation programme | - |
| **Fraser 2017** | 948 (IG)<br>952 (CG) | PPA | 6 months | CO ≥ 7 ppm<br>Cotinine | 205<br>(21.62%) IG<br>131<br>(13.76%) CG | P < 0.001 | Treatment engagement, medications | Cotinine testing: value that exceeded either 50 ng/mL, 100 ng/mL, or 200 ng/mL, depending on the clinic. 4 clinics used 300 ng/mL as the smoking cut-score |
| **Gallagher 2007** | 60 (Contingent reinforcement (CR))<br>60 (CR+NRT)<br>60 (CG) | PPA | 36 weeks | CO ≤ 10 ppm<br>SCN < 15 ng/mL | 7% (CR)<br>5% (CG)<br>(based on SCN) | N.S. | CO-validated rates higher, i.e. 37% (CR), 8% (CG).<br>Reduction, psychiatric symptoms | CR+NRT group not used in our comparison |
| **Ghosh 2016** | 6 (IG)<br>8 (CG) | PPA | 6 months | Not defined | 2 (IG)<br>0 (CG) | N.S. | Quality of life (SF-12) | 6-month follow-up but methods state 12 months. Attempt- |

**Table 1. Results of included studies: mixed populations** *(Continued)*

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | ed to contact author to clarify but no reply |
| **Giné 2010** | 781 (CARES)<br>603 (Cards)<br>616 (Control) | PPA | 12 months | NicCheck strip (urinary cotinine) = 0 | 11% (CARES)<br>9.3% (Cards)<br>8.9% (Control) | P = 0.05 | 6-month PPA: CARES 9.7%, Cards 10%, Control 8.3%.<br>Cost-effectiveness: USD 700 per quitter | 12-month assessment was 'sprung' on participants |
| **Glasgow 1993** | 344 (IG)<br>426 (CG) | 7-day abstinence | 48 months | CO ≤ 9 ppm Cotinine ≤ 25 ng/mL | 14.2% (IG)<br>11.5% (CG) | N.S. | Incentives had a sig. effect (P < 0.03) on less educated participants (18.6% vs 8.8% at 2 years 'probably chance').<br>Compared participants with non-participants (22.1% vs 9.4% at 1 year, P < 0.005; 21.3% vs 16.8% at 2 years, N.S.) | 27% of all abstinent claims could not be biochemically verified. Cluster-randomised so adjusted in main analyses; unadjusted data presented here |
| **Halpern 2015** | 498 (Individual rewards (Ind R))<br>519 (Collaborative rewards (Coll R))<br>582 (Individual deposits (Ind D))<br>471 (Competitive deposits (Com D)<br>468 (Control - usual care (UC)) | Sustained | 12 months | Cotinine < 10 ng/mL<br>Anabasine/anabitine < 3 ng/mL | 7.4% (Ind R)<br>8.7% (Coll R)<br>3.6% (Ind D)<br>6.2% (Com D)<br>3.4% (UC) | Versus UC:<br>0.007<br>0.001<br>0.94<br>0.052 | Sustained verified abstinence @ 14 days, 30 days, 6 months;<br>Self-reported abstinence at 12 months;<br>per-protocol analyses;<br>Uptake rates of assigned intervention | No differences between individual and group interventions, so both reward arms versus both deposit arms combined for analysis |
| **Halpern 2018** | 1198 (rewards)<br>1208 (redeemable)<br>1599 (control) | PPA | 12 months | Cotinine < 20 ng/mL, anabasine level of less than 3 ng/mL or CO less than 4% | 13 (rewards)<br>16 (redeemable)<br>5 (control) | Deposits: P ≥ 0.001<br>Rewards P ≥ 0.006 | Point prevalence for quitting at 1 month and sustained abstinence rates at 3 months and 6 months | - |

**Table 1. Results of included studies: mixed populations** *(Continued)*

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Hennrikus 2002** | 407 | 7-day PPA | 24 months | Saliva from 149 random sample of quitters at 24 months | 19.4% (cohort survey) | Not reported | Cohort prevalence and cessation rates (PP and continuous) Recruitment rate Programme format | Programme registrants' outcomes not available. Unadjusted data presented here |
| **Higgins 2023** | 63 (Best practices + financial incentives (BP + FI))<br>67(BP+FI+NRT)<br>68 (CG) | 7-day PPA | 48 weeks | CO < 6 ppm | 7/63 (BP + FI)<br>5/67 (BP+FI +NRT)<br>1/68 (CG) | N.S. | Continuous abstinence, child urine cotinine levels | Note: incentives groups combined for MA |
| **Hofmeyr 2020** | 52 IG<br>53 CG | 7-day PPA | 6 months | CO ≤ 6 ppm | 4 (10%) IG<br>3 (6%) C | N.S. | Repeated measure of average number of cigarettes smoked per day | - |
| **Ladapo 2020** | 90 IG<br>92 CG | 7-day PPA | 6 months | CO ≤ 6 ppm<br>Salivary cotinine ≤ 10 ng/mL | 9 (19.6%) IG<br>5 (8.9%) CG | P = 0.10 | Use of evidence-based tobacco therapy | 12-month follow-up not reported |
| **Lasser 2017** | 177 IG<br>175 CG | Continuous verified at 6 and 12 months | 12 months | Saliva or urine cotinine (≤ 10 ng/mL) or anabasine < 3 ng/mL) | 21 (12%) IG<br>4 (2%) CG | P ≤ 0.001 | Receipt of counselling, medications | - |
| **Ledgerwood 2014** | Enhanced CM (ECM): 36<br>Traditiona CM (TCM): 28<br>SC (Control): 17 | PPA | 6 months | Urinary cotinine ≤ 100 ng/mL<br>CO ≤ 6 ppm | 4/64 (TCM +ECM)<br>1/17 | N.S. | Prize money won; 81% CM participants earned prizes (median USD 120.56); Differences between TCM and ECM in week 1 non-significant | Both CM arms combined for analysis |
| **Medenblik 2020** | 21 IG<br>13 CG | 30-day PP abstinence | 6 months | Saliva cotinine and CO ≤ 6 ppm | 3/21 IG<br>2/13 CG | N.S. | Feasibility, acceptability, smoking cessation knowledge | Feasibility study not powered to detect between-group differences |

**Table 1. Results of included studies: mixed populations** *(Continued)*

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Pisinger 2022** | IG: 295<br>CG: 580 | CO-validated PPA | 12 months | CO validated, cut-off not reported | 85/295 IG<br>102/580 CG | N.S. | NR | Intervention fidelity low |
| **Rand 1989** | 17 contingent<br>16 non-cont<br>14 control | Continuous | 6 months | CO ≤ 11 ppm | 1/17 contingent<br>1/16 non-contingent<br>0/14 control | N.S. | Numbers of abstinent CO samples and missed samples | Pairwise comparisons gave sig diffs at 11 ppm, but not at 8 ppm |
| **Rettig 2018** | 8 (CG)<br>13 (IG) | PPA | 12 months | 8 ppm | 0 (CG)<br>4 (31%) (IG) | P = 0.05 | Smoking abstinence at 1, 2, 3, 4, 5, 6, 7 and 8 weeks, and at 3 and 6 months. Smoking intensity (total cigarettes per previous 7 days), the reduction from baseline, and total cigarettes smoked | - |
| **Rohsenow 2015** | 44 Control (Brief advice/Contingency vouchers (BA/CV))<br>42 Control (BA/non-contingency vouchers (NCV))<br>53 Intervention (MI/CV)<br>44 Intervention (MI/NCV) | PPA | 12 months | CO ≤ 4 ppm and salivary cotinine ≤ 15 ng/mL | 0 Control (BA/CV)<br>2 Control (BA/NCV) (4.8)<br>4 (7.5) Intervention (MI/CV)<br>2 (4.5) Intervention (MI/NCV) | N.S. | Cigarette reduction (CPD), number of heavy drinking days, number of drug use days, relapse to any heavy drinking or drug use over the 12 months | - |
| **Rohsenow 2017** | 166 CG (Non-contingent vouchers (NV))<br>163 IG (Contingent vouchers (CV)) | PPA | 12 months | CO ≤ 4 ppm and salivary cotinine ≤ 15 ng/mL | 3 (1.8%) CG (NV)<br>6 (3.7%) IG (CV) | N.S. | CPD at 1, 3, 6 months. Number of heavy drinking days<br>Smoking Self-Efficacy Questionnaire pretreatment and at 1 month. | - |
| **Romanowich 2015** | 32 HTT percentile criterion<br>27 HTT fixed criterion | Continuous | 6 months | CO < 4 ppm. Cotinine < 20 ng/ml | 3 (8.3%) HTT percentile criterion<br>2 (5.0%) HTT fixed criterion | Not reported | Use of smoking cessation medication.<br>CPD in past 6 weeks at 6 months | Results confirmed by authors by email. CO < 3 ppm. Stated in NCT entry but < |

**Table 1. Results of included studies: mixed populations** *(Continued)*

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 14 HTT random payments<br><br>44 ES escalating payments<br><br>43 ES fixed payments<br><br>23 ES random payments | | | | 1 (5.6%) HTT random payments<br><br>4 (6.8%) ES escalating payments<br><br>6 (10.3%) ES fixed payments<br><br>5 (17.2%) ES random payments | | | 4 ppm stated in email correspondence.<br><br>HTT are participants who did not deliver a breath CO level < 4 ppm during the first 5 study days when they could earn USD 5 for doing so and were randomised to 1 set of conditions. ES did deliver at least 1 CO sample < 4, and were randomised to another set of conditions |
| **Secades-Villa 2014** | 43 CBT + CM<br><br>49 CBT | Continuous | 6 months | CO < 4 ppm; Cotinine < 80 ng/mL | 17/43 CM<br><br>13/49 CBT | N.S. | Treatment retention; % attending all sessions for 6 months | - |
| **Secades-Villa 2019** | 60 CBT + MA<br><br>60 CBT + MA + CM | Continuous | 6 months | CO readings ≤ 4 ppm and cotinine levels ≤ 80 ng/mL | 18.3% CG<br><br>31.7% IG | Significant | Effect of treatment condition and smoking abstinence on depression | - |
| **Secades-Villa 2022** | 46 CBT<br><br>34 CBT + CM | PPA | 12 months | Planned CO readings ≤ 4 ppm<br><br>and cotinine levels ≤ 80 ng/mL but not completed due to COVID-19 pandemic | 2/46 CG<br><br>2/34 IG | N.S. | Substance use abstinence; days of continuous abstinence | - |
| **Shoptaw 2002** | 42 (Patch (P)) | PPA | 12 months | CO ≤ 8 ppm | 4/36 (P)<br>2/33 (P+RP) | N.S. | Treatment group and cocaine and opiate abuse | Quit rates supplied by authors. |

**Table 1. Results of included studies: mixed populations** *(Continued)*

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 42 (Relapse prevention (RP))<br>43 (P+CM)<br>47 (P+RP+CM) | | | Cotinine < 30 ng/mL | 2/35 (P+CM)<br>1/38 (P+RP+CM) | | | P group relapsed more slowly than other groups (P = 0.0017) |
| **Tevyaw 2009** | 28 (CM+MET)<br>27 (CM+REL*)<br>27 (Non-contingent rewards (NR) +MET)<br>28 (NR+REL)<br>* REL = muscle relaxation control | 7-day PPA | 6 months | CO < 5 ppm<br>Cotinine < 15 ng/mL | 1/55 (CM)<br>3/55 (NR) | N.S. | Attendance, sample returns | - |
| **VanSchayck 2018** | 31 clusters (IG)<br>30 clusters (CG)<br>Total 640 individual participants | Continuous | 6 months | "CO validated" no further details provided | 44.4% IG<br>24.8% CG | P < 0.001 | None | Conference abstract only, minimal detail. Cluster-randomised, unadjusted data presented here. |
| **Van den Brand 2018** | 319 (IG)<br>284 (CG) | Continuous | 12 months | CO 9 ppm | 131 (41%) IG<br>75 (26%) CG | P < 0.001 | 3- and 6-month biochemically validated abstinence, and self-reported abstinence | Cluster-randomised so adjusted in main analyses; unadjusted data presented here |
| **Volpp 2006** | 92 (IG)<br>87 (CG) | 7-day PPA | 6 months post-completion (~7.5 months) post-quit date | Urinary cotinine < 500 ng/mL | 6/92 (IG)<br>4/87 (CG) | N.S. | Enrolment attendance programme completion | Denominators could be Ns enroled (I:38, C:17). No quitters outside the enrolers |
| **Volpp 2009** | 436 (IG)<br>442 (CG) | Prolonged | 15 or 18 months | Salivary cotinine < 15 ng/mL or urinary cotinine < 2 ng/mL | 41/436 (IG)<br>16/442 (CG) | P < 0.001 | Enrolment in SC course, completion of SC course | 15 to 18 months results shown in 12-month forest plot |
| **White 2013** | 131 (IG)<br>69 (CG) | 7-day PPA | 6 months | Urinary cotinine | 58/131 (IG)<br>13/69 (CG) | P < 0.001 | PPA at 3 months (verified), 14 months (self-report). | - |

**Table 1. Results of included studies: mixed populations** *(Continued)*

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Relative success of teams vs individuals? Yes<br><br>Choosing team partner vs random assignment? No<br><br>Did text messages help? No<br><br>Cost-effectiveness; No figures given | |
| **White 2020** | 507 (USD 20 individual bonus)<br><br>479 (USD 40 individual bonus)<br><br>491 (team bonus)<br><br>394 (deposits)<br><br>362 (deposits plus teammate (no bonus))<br><br>513 (deposits plus USD 20 individual bonus)<br><br>489 (deposits plus USD 40 individual bonus)<br><br>495 (deposits plus team bonus)<br><br>442 (CG) | 7-day PPA | 12 months | Cotinine cut-off level of 200 ng/mL | 74 (14.6%) (USD 20 individual bonus)<br><br>104 (21.7%) (USD 40 individual bonus)<br><br>60 (12.2%) (team bonus)<br><br>57 (14.5%) (deposits)<br><br>49 (13.5%) (deposits plus teammate (no bonus))<br><br>72 (14%) (deposits plus USD 20 individual bonus)<br><br>91 (18.6%) (deposits plus USD 40 individual bonus)<br><br>67 (13.5%) (deposits plus team bonus)<br><br>42 (9.5%) (CG) | Significantly higher for USD 40 bonus programmes than programmes with no bonus P = 0.01<br><br>All other comparisons N.S. | PPA at 3 and 6 months. Programme acceptance. | Cluster-randomised so adjusted in main analyses; unadjusted data presented here |

**Table 1. Results of included studies: mixed populations** *(Continued)*

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Wilson 2023** | 63 (IG)<br>64 (CG) | Continuous abstinence | 12 months | CO verified < 5ppm and/ or cotinine < 6 ng/mL) | 5/63 (IG)<br>3/64 (CG) | N.S. | PPA at 3, 6 and 12 months, intervention reach, mCM video upload adherence and earnings | |
| **Windsor 1988** | 95 (A)<br>94 (B)<br>95 (C)<br>94 (D) | Continuous | 12 months | SCN ≤ 100 ng/mL | ≃ 6% (A)<br>≃ 18% (B)<br>≃ 5% (C)<br>≃ 10% (D) | Not reported | Social enhancement vs self-help manual (± incentives) gave a continuous quit rate of 14.4% at 12 months, vs 5.8% | Incentives comparison was abandoned at 6 weeks |

Abbreviations: **CA:** continuous abstinence; **CG:** control group; **CO:** carbon monoxide (exhaled); **CM:** contingency management; **CPD:** cigarettes per day; **IG:** intervention group; **ITT:** intention-to-treat analysis; **MET:** motivational enhancement therapy; **MI:** motivational interviewing; **NR:** not reported; **NRT:** nicotine replacement therapy; **NS:** not significant; **PP:** per-protocol analysis; **PPA:** point prevalence abstinence; **ppm:** parts per million; **SCN:** saliva thiocyanate

**Table 2. Results of included studies: pregnant people**

| Study ID | Denominator | Abstinence | Time point | Biological criteria | Quit rate | Stat sig? | Other outcomes | Comment |
|---|---|---|---|---|---|---|---|---|
| **Baker 2018** | 505 (IG)<br>509 (CG) | 7-day PPA | 6 months | CO < 7 ppm | 74 (14.65%) (IG)<br>47 (9.23%) (CG) | P ≤ 0.01 | N of post-birth home visits and phone calls taken; biochemically confirmed abstinence at the post-birth week 1 visit; and self-reported smoking status at the 2- and 4-month visits | Engagement in treatment also cited on NCT record but not reported. Cost-effectiveness reported in linked paper (Mundt 2021) |
| **Berlin 2021** | 231 (IG)<br>229 (CG) | Continuous | End of pregnancy | CO ≤ 8 ppm | 38 (16%) (IG)<br>17 (7%) (CG) | P = 0.004 | PPA; gestational age at birth; birth weight; head circumference; length; Apgar score at five minutes; poor neonatal outcomes (a composite measure of transfer to the neonatal unit, congenital malformation, convulsions, or perinatal death); serious adverse events. | - |
| **Donatelle 2000a** | 112 (I)<br>108 (C) | 7-day PPA | 8 months gestation | Salivary cotinine < 30 ng/mL | 34/105; 32% (I)<br>9/102; 9% (C) | $Chi^2 = 18.4$; P < 0.0001 | Not reported | Differential losses to follow-up; (IG) 32% |

**Table 2. Results of included studies: pregnant people** *(Continued)*

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Thiocyanate < 100 ug/mL | | | | at 8 months, versus (CG) 51.5% |
| | 112 (I)<br>108 (C) | 7-day PPA | **2 months postpartum** | Salivary cotinine < 30 ng/mL<br>Thiocyanate < 100 ug/mL | 22/103; 21% (I)<br>6/102; 5.9% (C) | $Chi^2 = 11$; P < 0.001 | Not reported | Differential losses to follow-up; (IG) 36% at 2 months postpartum, versus (CG) 52% |
| **Donatelle 2000b** | 67 (E1)<br>59 (E2)<br>60 (C) | "Biochemically confirmed abstinence" | End of pregnancy | Salivary cotinine < 30 ng/mL<br>Monthly CO < 5 ppm | 19% (E1)<br>22% (E2)<br>12% (C) | Not reported | Not reported | Very little information available |
| **Donatelle 2002** | 102 (E1)<br>96 (E2)<br>95 (C) | Self-report (telephone call) | 8 months gestation | Salivary cotinine < 30 ng/mL<br>Monthly CO < 5 ppm | Not reported | Not reported | High versus low incentives;<br>cost per quitter | Results are interim analysis only, based on 298 enroled; target was 600.<br>No further information available |
| **Harris 2015** | 7 IG (Contingency management (CM))<br>10 CG (Smoking Cessation for Healthy Births (SCHB) - phone-delivered counselling) | PPA | Approximately 6 months | Urinary cotinine (cut-off not defined) | 1 IG (CM)<br>3 CG (SCHB) | Not stated but assume N.S. | Smoking reduction (time line follow-back method), Stages of Change Ladder (SCL), Modified Fagerström Test of Nicotine Dependence (mFTND). Post-treatment assessments measured birth outcomes (e.g. gestational age at birth, birth weight, and time spent in NICU) and smoking-related variables. | Follow-up time point reported as 8.75 months pregnant (IG) and 8.19 months pregnant (CG). Randomised at (mean = 10.75 weeks pregnant), so follow-up approximately 6 months |
| **Heil 2008** | 37 (IG)<br>40 (CG) | PPA | End of pregnancy | Urine cotinine < 80 ng/ml<br>CO ≤ 6 ppm | 15/37; 41% (IG)<br>4/40; 10% (CG) | P = 0.003 | Foetal growth | - |
| | | | Antepartum CA; | Urine cotinine < 80 ng/mL<br>CO ≤ 6 ppm | 3/37; 8% (IG)<br>1/40; 3% (CG) | N.S. | Baby health<br>Total voucher earnings | - |

**Table 2. Results of included studies: pregnant people** *(Continued)*

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | **24 weeks postpartum** | | | | | |
| **Higgins 2014** | 44 (Revised contingent voucher (RCV); E1)<br>44 (Contingent voucher (CV); E2)<br>42 (Non-contingent voucher (NCV); C) | 7-day PPA | 28 weeks gestation | Urinary cotinine ≤ 80 ng/mL<br>CO < 4 ppm or 6 ppm | 18/40; 45% (E1)<br>14/39; 36% (E2)<br>7/39; 18% (C) | N.S. | Foetal growth<br>Birth outcomes | - |
| | 44 (RCV; E1)<br>44 (CV; E2<br>42 (NCV; C) | 7-day PPA | **24 weeks postpartum** | Urinary cotinine ≤ 80 ng/mL<br>CO < 4 ppm or 6 ppm | 7/40; 18% (E1)<br>6/39; 15% (E2)<br>3/39; 8% (C) | Not reported | Foetal growth<br>Birth outcomes | - |
| **Higgins 2022** | 85 (IG)<br>91 (CG) | 7-day PPA | 48 weeks postpartum | Urine-cotinine ≤ 80 ng/mL | 13/85; 15% (IG)<br>9/91; 10% (CG) | N.S. | Foetal growth<br>Birth outcomes | - |
| **Kurti 2022** | 43 (IG)<br>49 (CG) | 7-day PPA | 24 weeks postpartum | "Cotinine-negative saliva test" | 7/43; 18% (IG)<br>1/49; 1% (CG) | Article states significant but P value at longest follow-up not reported | - | Note percentages interpreted from a figure; no numbers provided in text<br>Research letter so limited detail |
| **Ondersma 2012** | 26 (E1)<br>28 (E2)<br>30 (E3)<br>26 (CG) | 7-day PPA | **30-day CA**<br>7-day PPA | Urinary cotinine ≤ 100 ng/mL<br>CO < 4 ppm | 6/23: 26% (E1)<br>2/22: 10% (E2)<br>5/26: 19% (E3)<br>1/23: 4% (C) | E1 P < 0.05 | - | - |

**Table 2. Results of included studies: pregnant people** *(Continued)*

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 42 (E1)<br>28 (E2)<br>32 (C) | PPA | 12 weeks | CO < 4 ppm<br>Urine sample (for cocaine) | 13/42; 31% (E1)<br>0/28; 0% (E2)<br>0/32; 0% (C) | - | - | - |
| **Tappin 2015a** | 306 (IG)<br>306 (CG) | "Even a puff" in past 2 weeks<br>"Even a puff" in past 4 weeks<br>< 5 cigs in past 8 weeks | 4 weeks<br>12 weeks (if quit at 4)<br>34 to 38 weeks gestation (all participants) | CO < 10 ppm<br>Cotinine: Urine 44.7 ng/mL; saliva 14.2 ng/mL | 69/306 (IG)<br>26/303 (CG) | P < 0.001 | Adverse events;<br>engagement;<br>birth weight;<br>cost-effectiveness | 3 controls dropped out after randomisation - not included in denominators |
| | 306 (IG)<br>306 (CG) | Still quit or < 5 cigs since target quit date (TQD) | 6 months post-natal (for 34/38-week quitters) | Cotinine: Urine 44.7 ng/mL; saliva 14.2 ng/mL | 47/306 (IG)<br>12/303 (CG) | P < 0.001 | - | 3 controls dropped out after randomisation - not included in denominators |
| **Tappin 2022** | 471 (IG)<br>470 (CG) | Continuous abstinence | 6 months after estimated delivery date (EDD) | Cotinine: < 10 ng/mL or where current NRT or e-cigarette use was reported, saliva cotinine concentration was ≥ 10 ng/mL and saliva anabasine was ≤ 0.2 ng/mL. | 20/471 (IG)<br>15/470 (CG) | P < 0.001 | Engaged with service and set stop smoking date<br>Abstinence at 4 weeks<br>6 months PPA<br>Preterm birth | |
| **Tuten 2012** | 42 (E1)<br>28 (E2)<br>32 (CG) | Self-reported 24-hour PPA | 6 weeks PPA | None | 13/42; 31% (E1)<br>0/28; 0% (E2)<br>0/32; 0% (CG) | N.S. | Mean CPD | - |

**Table 2. Results of included studies: pregnant people** *(Continued)*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 42 (E1)<br>28 (E2)<br>32 (CG) | Self-reported 24-hour PPA | 6 weeks PPA | None | 13/42; 31% (E1)<br>0/28; 0% (E2)<br>0/32; 0% (CG) | N.S. | Mean CPD | Abstinence not reported for this time point |

Abbreviations: **CA:** continuous abstinence; **CG:** control group; **CO:** carbon monoxide (exhaled); **CPD:** cigarettes per day; **IG:** intervention group; **NRT:** nicotine replacement therapy; **N.S.:** not significant; **PPA:** point prevalence abstinence; **ppm:** parts per million

# APPENDICES

## Appendix 1. Search strategies

**Cochrane Tobacco Addiction Group Specialised Register (via CRS Web)**

1. (Incentive* or reward* or voucher* or pay* or paid* or prize*):TI,AB,MH,EMT,KY,XKY

2. (Contingen* ADJ5 (pay OR manage*)):TI,AB,MH,EMT,KY,XKY

3. MESH DESCRIPTOR Reimbursement, Incentive EXPLODE ALL

4. MESH DESCRIPTOR Reward EXPLODE ALL

5. #1 OR #2 OR #3 OR #4

**CENTRAL (via CRS Web)**

1. (Incentive* or reward* or voucher* or pay* or paid* or prize*):TI,AB,MH,EMT,KY,XKY

2. (Contingen* ADJ5 (pay OR manage*)):TI,AB,MH,EMT,KY,XKY

3. MESH DESCRIPTOR Reimbursement, Incentive EXPLODE ALL

4. MESH DESCRIPTOR Reward EXPLODE ALL

5. #1 OR #2 OR #3 OR #4

6. MESH DESCRIPTOR Tobacco Use Cessation EXPLODE ALL AND CENTRAL:TARGET

7. MESH DESCRIPTOR Tobacco Use Disorder EXPLODE ALL AND CENTRAL:TARGET

8. MESH DESCRIPTOR Tobacco Smoke Pollution EXPLODE ALL AND CENTRAL:TARGET

9. MESH DESCRIPTOR Tobacco, Smokeless EXPLODE ALL AND CENTRAL:TARGET

10. (SMOKING* or TOBACCO or TOBACCO-USE-DISORDER* or TOBACCO-SMOKELESS* or TOBACCO-SMOKE-POLLUTION* or TOBACCO-USE-CESSATION* or NICOTINE*):MH AND CENTRAL:TARGET

11. (smoking cessation):MH AND CENTRAL:TARGET

12. (SMOKING CESSATION or ANTISMOK*):TI,AB AND CENTRAL:TARGET

13. (quit* or smok* or nonsmok* or cigar* or tobacco* or nicotine*):TI AND CENTRAL:TARGET

14. MESH DESCRIPTOR Smoking Cessation EXPLODE ALL AND CENTRAL:TARGET

15. MESH DESCRIPTOR Tobacco Use Cessation Devices EXPLODE ALL AND CENTRAL:TARGET

16. #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15

17. #5 AND #16

**MEDLINE, Embase and PsycINFO (via Ovid)**

1. (Incentive* or reward* or voucher* or pay* or paid* or prize*).mp.

2. (Contingen* ADJ5 (pay OR manage*)).mp.

3. exp Reimbursement, Incentive/ [changed to exp Monetary Incentives/ for PsycINFO search]

4. exp Reward/ [changed to exp Rewards/ for PsycINFO search]

5. 1 OR 2 OR 3 OR 4

6. (randomized controlled trial or controlled clinical trial).pt. or randomized.ab. or placebo.ab. or clinical trials as topic.sh. or randomly.ab. or trial.ti.

7. exp animals/ not human/

8. 6 not 7

9. smoking cessation.mp. or exp Smoking Cessation/

10. tobacco cessation.mp. or "Tobacco-Use-Cessation"/

11. (nicotine dependence or tobacco dependence).mp.

12. exp Smoking/th

13. "Tobacco-Use-Disorder"/

14. Smoking reduction/ or Smoking reduction.mp.

15. exp Pipe smoking/ or exp Tobacco smoking/ or exp Tobacco Products/

16. ((quit* or stop* or ceas* or giv* or abstain* or abstinen*) adj5 (smoking or smoke* or tobacco)).ti,ab.

17. exp Tobacco/ or exp Nicotine/

18. 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17

19. 5 and 8 and 18

## WHAT'S NEW

| Date | Event | Description |
|---|---|---|
| 13 January 2025 | New search has been performed | Searches updated Nov 2023, 16 new studies incorporated |
| 13 January 2025 | New citation required and conclusions have changed | Updated with 16 new included studies; evidence of benefit for incentives in pregnant people now judged to be of high certainty; Monserrat Conde included as a co-author. |

## HISTORY

Protocol first published: Issue 2, 2003
Review first published: Issue 2, 2005

| Date | Event | Description |
|---|---|---|
| 21 January 2019 | New search has been performed | Search run 30th July 2018. Review updated with 16 new included studies in mixed populations and 2 new included studies in pregnant women. |
| 21 January 2019 | New citation required and conclusions have changed | Certainty of evidence for studies in mixed populations changed from low to high. Previously included non-randomised studies now excluded. |
| 6 January 2015 | New citation required and conclusions have changed | Review split into 'Incentives and contingency management' (this update) and 'Competitions' (companion update). 5 trials transferred to the Competitions update, and 7 new trials added, plus a complete new section (9 trials) on pregnant women. |

| Date | Event | Description |
|---|---|---|
| 16 December 2014 | New search has been performed | New searches conducted, and entire review reformatted and expanded. 16 new trials added. Non-randomised trials excluded. Analysis changed from OR to RR. |
| 14 April 2011 | Amended | Minor typographical errors corrected |
| 24 November 2010 | New search has been performed | 15 new trials added: 2 included, 13 excluded. |
| 24 November 2010 | New citation required and conclusions have changed | New included study (Volpp 2009) found long-term positive effects of their incentive-based trial. Risk of bias tables added for all studies. |
| 6 August 2008 | Amended | Source of support added |
| 29 April 2008 | New citation required but conclusions have not changed | Name change for first author |
| 2 April 2008 | Amended | Converted to new review format. |
| 2 April 2008 | New search has been performed | Two new included studies, nine new excluded studies, conclusions unchanged. |

## CONTRIBUTIONS OF AUTHORS

For this update:

CN (guarantor of the review) extracted data, conducted the analyses, and wrote the review.
SG double-data extracted and contributed to the analysis and writing of the review.
JHB contributed to the design of the update and contributed to the writing of the review.
RP checked the statistical analysis, ran the meta-regression, advised on analyses incorporating the cluster-randomised controlled trials, and commented on the review.
JLB ran the searches, checked the inclusion/exclusion criteria, offered critical appraisal and contributed to the writing of the review.
LB contributed to the writing and editing of the review.
MC assisted with completing the characteristics of studies tables and writing the review.

## DECLARATIONS OF INTEREST

CN: has received an honorarium from Vox media company for filming a 'nicotine explainer' on the role of nicotine in addiction. CN has given responses to press articles to correct misinterpretations and to reassert the importance of remaining focused on the evidence. CN is a member of the advisory council for 'Action on Smoking and Health' (ASH). None of these are deemed a conflict of interest.
SG: none known.
JLB: is an associate editor for Cochrane. He was not involved in the editorial process for this review. He has no conflicts of interest.
LB: is Co-Chair of the Smoking in Pregnancy Challenge Group (a network of professionals working to reduce smoking in pregnancy in England) that has indicated support for incentives for smoking cessation in pregnancy. She is also fiduciary Officer for Cancer Research UK and Diabetes UK. LB is co-author of one of the trials included in the review (Tappin 2015) and some of the studies cited as supporting evidence in the Background and Discussion sections (Berlin 2018; Hoddinott 2014). LB did not make study eligibility decisions about, extract data from, carry out the risk of bias assessment for, or perform GRADE assessments of the included Tappin study.
RP: none known.
MC: is supported by Cancer Research UK (Charity) in other research projects. She holds a Proposal Editor role for Cochrane. She was not involved in the editorial process of this review. She has undertaken commissioned work for the World Health Organization (WHO) unrelated to the topic of this review. None of these were deemed a conflict of interest.
JHB: writes regularly for *The Conversation* and is interviewed in the media on the topic of smoking. JHB holds an Editorial role for Cochrane. She was not involved in the editorial process of this review.

## SOURCES OF SUPPORT

### Internal sources

- No financial support has been received, Other

  No financial support has been received

### External sources

- No financial support has been received, Other

  No financial support has been received

## DIFFERENCES BETWEEN PROTOCOL AND REVIEW

For this 2024 update, we changed the language in the review to use 'person first' language, in keeping with the move to person-first language in the wider field. There were no further changes to the protocol beyond those described for the 2019 update (Notley 2019).

For the 2019 update, we removed the separate six-month follow-up time point analysis for studies of mixed populations, as long-term follow-up was our focus for this review.

For the 2019 update, we excluded non-randomised studies and changed the analysis from odds ratios to risk ratios, in accordance with standard methods of the Cochrane Tobacco Addiction Group. We also introduced a new subgroup analysis within mixed-population studies of trials recruiting from substance misuse populations (community or inpatient clinics), since a number of new studies included in this update recruited from this specific population and there is reason to believe the effect of incentives could be different in this population.

For the 2019 update, we changed the risk of bias assessments from evaluating performance and detection bias in one domain, to assessing detection bias alone, based on whether studies biochemically validated abstinence. We did this because the interventions being studied preclude effective blinding of participants and study personnel, and in order to simplify and clarify the assessment of detection bias.

We included sensitivity analysis to explore the relative size of incentives offered, and subgroup analysis to explore the potential impact of studies where incentives were continually offered up until the long-term follow-up point. We also included subgroup analysis of studies recruiting people who misuse substances as this is a distinct population.

## INDEX TERMS

### Medical Subject Headings (MeSH)

Behavior Therapy; Health Facilities; *Motivation; Randomized Controlled Trials as Topic; Reward; Smoking Cessation [*methods] [*psychology]; Smoking Prevention; Workplace

### MeSH check words

Female; Humans; Male; Pregnancy