

Competitions and incentives for smoking cessation (Review)

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[Intervention Review]

Competitions and incentives for smoking cessation

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ABSTRACT

Background

Background

Material or financial incentives may be used in an attempt to reinforce behaviour change, including smoking cessation. They have been widely used in workplace smoking cessation programmes, and to a lesser extent within community programmes. Quit and Win contests are the subject of a companion review.

Objectives

To determine whether competitions and incentives lead to higher long-term quit rates. We also set out to examine the relationship between incentives and participation rates.

Search strategy

We searched the Cochrane Tobacco Addiction Group Specialized Register, with additional searches of MEDLINE, EMBASE, CINAHL and PsycINFO. Search terms included incentive*, competition*, contest*, reward*, prize*, contingent payment*, deposit contract*. The most recent searches were in December 2007.

Selection criteria

We considered randomized controlled trials, allocating individuals, workplaces, groups within workplaces, or communities to experimental or control conditions. We also considered controlled studies with baseline and post-intervention measures.

Data collection and analysis

Data were extracted by one author and checked by the second. We contacted study authors for additional data where necessary. The main outcome measure was abstinence from smoking at least six months from the start of the intervention. We used the most rigorous definition of abstinence in each trial, and biochemically validated rates where available. Where possible we performed meta-analysis using a generic inverse variance model, grouped by timed endpoints, but not pooled across the subgroups.

Main results

Seventeen studies met our inclusion criteria. None of the studies demonstrated significantly higher quit rates for the incentives group than for the control group beyond the six-month assessment. There was no clear evidence that participants who committed their own money to the programme did better than those who did not, or that different types of incentives were more or less effective.

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There is some evidence that although cessation rates have not been shown to differ significantly, recruitment rates can be improved by rewarding participation, which may be expected to deliver higher absolute numbers of successful quitters. Cost effectiveness analysis is not appropriate to this review, since the efficacy of the intervention has not been demonstrated.

Authors' conclusions

Incentives and competitions have not been shown to enhance long-term cessation rates, with early success tending to dissipate when the rewards are no longer offered. Rewarding participation and compliance in contests and cessation programmes may have more potential to deliver higher absolute numbers of quitters.

PLAIN LANGUAGE SUMMARY

Do competitions and incentives help smokers to quit in the medium to long term

Smokers may quit while they take part in a competition or receive rewards for quitting, but do no better than unassisted quitters once the rewards stop. The type of reward, and whether or not the smokers put up their own money to take part, make little difference to the success of the quit attempt. Competitions and rewards may attract more people to make a quit attempt than might otherwise do so, but cessation rates remain the same as for non-contestants.

BACKGROUND

Competitions and incentives routinely feature in many smoking cessation programmes, in support of the quitting process. They are used either to encourage recruitment into the programme, or to reward cessation achieved at predefined stages.

A variety of rewards have been used for these purposes, including cash payments, salary bonuses, promotional items such as T-shirts, pens and bags, lottery tickets, raffles, holidays, and luxury goods such as cars or boats. Rewards can be given for attendance, irrespective of subsequent performance (i.e. guaranteed), or can be paid and scaled relative to the participant's success within the programme (i.e. contingent). Some workplace initiatives have operated a policy of disincentives, whereby employees have payments deducted for non-compliance with a smoking policy, but this is less frequently used than a system of positive rewards.

Workplaces

The workplace is a common setting for use of competitions and incentives. This is briefly addressed in a companion review from the Tobacco Addiction Group (Moher 2005), but we explore it more fully here. Most of the relevant studies have been conducted in the United States of America (USA), in part because of the structure of the healthcare system there, which obliges employers to cover health insurance costs for their workforce. In other countries, where the state or private insurance companies are the main

healthcare provider, there may be less tangible incentive for employers to take direct responsibility for the health of their workers.

There are a number of advantages to offering smoking cessation support in the workplace, including the accessibility of the target population, the availability of occupational health support and the potential for peer pressure and peer support. Because of the existing salary and bonus structure, it is also relatively easy to set up a rewards system to supplement the programme, if that is the chosen mechanism. There are a number of smoking cessation studies in which groups are encouraged to compete against each other, either within a single workplace or between workplaces, often for material prizes as well as for financial incentives. More usually rewards are offered for individual participation or cessation, or both.

Communities

Quit and Win contests, and similar population-based initiatives, are examined in a companion review by the same authors (Cahill 2008).

Participation

Some studies have tested incentives as a way of increasing participation in smoking cessation programmes. While this may be an effective method of boosting enrolment, any enhanced participa-

tion rate that incentives may deliver also must also be weighed against the stability of the long-term quit rates that are achieved. Incentives may also lead to increased rates of deception, either by participants falsely claiming to be abstinent, or by non-smokers taking part and then claiming to have quit. Individuals who elect to take part in a cessation programme that offers material rewards may be differently motivated from those who sign up to more conventional cessation methods, and this may be reflected in differential relapse rates.

Cost effectiveness

The use of rewards and incentives increases the costs of running smoking cessation programmes. Tobacco control programmes need to assess whether the outlay is justified by the benefits that the component delivers. In other words, how many more quit attempters will join a programme that rewards their participation, and how much, if at all, is the quit rate enhanced by the end of programme follow up?

OBJECTIVES

To assess the effects of competitions and incentives as aids to smoking cessation. We addressed the following questions:

Cessation:

1. Do competitions, contests and incentives reduce the prevalence of smoking and relapse?
2. Does the amount and type of incentive affect cessation and relapse prevention?

Recruitment:

3. Do incentives improve recruitment to smoking cessation programmes, both within the community and within the workplace?
4. Does the amount and type of incentive affect recruitment?

General:

5. What are the cost implications, to employers and to the community, of incentives and competitions?
6. Are incentives and competitions more or less effective in combination with other aids to recruitment, cessation and relapse prevention?
7. How great is the risk of disbenefits arising from the use of competitions and incentives, e.g. false claims, ineligible applicants?

METHODS

Criteria for considering studies for this review

Types of studies

Randomized controlled trials allocating individuals, communities, workplaces or groups within workplaces to intervention or to control conditions.

Controlled trials with baseline measures and post-intervention outcomes

Types of participants

Adult smokers, of either gender, in any setting. We have not included trials aimed exclusively at adolescent smokers, as they are covered by other Cochrane reviews. We have not included trials aimed at pregnant smokers, since they are covered by the review *Interventions for promoting smoking cessation during pregnancy* (Lumley 2004) produced by the Cochrane Pregnancy and Childbirth Group.

Types of interventions

Contests, competitions, incentive schemes, lotteries, raffles, and contingent payments, to reward cessation and continuous 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, as these will be covered in a forthcoming companion review. We have also excluded reimbursement to patients for smoking cessation treatment costs, as these are covered in another Cochrane review (Kaper 2005).

Types of outcome measures

Cessation:

Cessation rates, point prevalence and sustained abstinence, for a minimum of six months from the start of the intervention, whether or not they are biochemically validated (Hughes 2003). The gold standard is biochemically verified sustained abstinence for at least six months.

Recruitment:

Rates of recruitment to and participation in smoking cessation programmes, where they are reported in addition to cessation rates, but not where they are the primary outcome of interest.

Dose-response assessment of levels of incentive

Search methods for identification of studies

We searched the Cochrane Tobacco Addiction Group Specialized Register, which includes studies identified by systematic electronic searches of multiple databases, handsearching of specialist journals, and 'grey' literature (conference proceedings and unpublished reports not normally covered by most electronic indexing systems). In addition, we used specifically developed strategies to search four electronic databases, MEDLINE, EMBASE, CINAHL and

PsycINFO. Search terms included incentive*, competition*, contest*, lottery*, reward*, prize*, contingent payment*, deposit contract*. The most recent searches were in December 2007.

Data collection and analysis

There were four stages in the review process:

Stage 1 One author prescreened all search results (abstracts), for possible inclusion or as useful background

Stage 2 Both authors independently assessed relevant studies for inclusion. We resolved discrepancies by consensus. We noted reasons for the non-inclusion of studies.

Stage 3 One author extracted data, and the second author checked them. This stage included an evaluation of quality. Both authors assessed each study according to the presence and quality of the randomization process, concealment of allocation, whether or not trialists and assessors were 'blinded', whether the analysis was appropriate to the study design, and the description of withdrawals and drop-outs.

Stage 4 The method of synthesizing the studies depended on the type, quality, design and heterogeneity of studies identified. We used the χ^2 test and the I^2 statistic to assess statistical heterogeneity. We have combined eligible studies using a generic inverse variance model but without pooling the effects across subgroups. We have used the intraclass correlation coefficient reported by Martinson (Martinson 1999) (ICC for percentage quit smoking in Worksite) to obtain an adjusted estimate of the effect size for the studies that were cluster randomized. These adjusted estimates were then used in a meta-analysis to obtain a pooled estimate for the effect.

We include the Tobacco Addiction Group's glossary of tobacco-related terms as an appendix (Appendix 1).

RESULTS

Description of studies

See: [Characteristics of included studies](#); [Characteristics of excluded studies](#).

We identified 17 studies which met our inclusion criteria. All the included studies rewarded smoking cessation, either alone or in combination with recruitment or participation or both (See the Characteristics of Included Studies table for full details).

Seven of the studies were set in clinics or health centres (Crowley 1995 [COPD patients]; Gallagher 2007 [psychiatric patients, including people with schizophrenia]; Paxton 1980; Paxton 1981; Paxton 1983; Shoptaw 2002 [narcotic abuse patients]; Volpp 2006) and the rest in worksites. Twelve were based in the USA, three in the UK, one in Australia, and one in USA and Canada.

Incentives

Two studies used lottery tickets as the incentive (Crowley 1995; Gomel 1993). Six rewarded verified abstinence with cash payments (De Paul 1994; Gallagher 2007; Rand 1989; Shoptaw 2002; Volpp 2006; Windsor 1988). Three studies (Glasgow 1993; Henrikus 2002; Koffman 1998) combined cash payments to individual quitters with one or more site-wide prize draws. Two trials rewarded individuals in the experimental group with cash payments based on their team's performance within the worksite (Klesges 1986; Klesges 1987).

Four studies (Maheu 1990; Paxton 1980; Paxton 1981; Paxton 1983) tested a system of deposits refunded for abstinence over the course of the programme. The Paxton studies compared possible reward schedules by varying the timing and the amount of deposits and repayments. Koffman 1998 required a non-refundable cash payment from the incentive programme registrants to entitle them to compete for staged cash rewards.

Three studies compared the effects of automatic payments with payments contingent upon cessation (Crowley 1995; Maheu 1990; Rand 1989)

Two studies (Glasgow 1993; Maheu 1990) included lottery tickets for a prize draw for smoking 'buddies', who supported those smokers trying to quit.

Although all the studies rewarded smoking cessation as the primary outcome, several added incentives for other performance indicators. Participation and compliance were rewarded by Crowley 1995, Gallagher 2007, Glasgow 1993, De Paul 1994, Henrikus 2002, Klesges 1986, Klesges 1987, Maheu 1990 and Volpp 2006. Koffman 1998 also paid those smokers who 'faded' their cigarettes to no more than 80 in the first month of the programme, as a preparation for stopping completely.

Cessation methods

Only one trial (Glasgow 1993) of the 17 did not include any kind of cessation support programme.

Four of the earlier studies used aversive smoking as part of a multi-component programme (Maheu 1990; Paxton 1980; Paxton 1981; Paxton 1983). Five included nicotine replacement therapy to support their participants (Crowley 1995; Gallagher 2007; Maheu 1990 [supplementing aversive smoking]; Shoptaw 2002; Volpp 2006).

The eight remaining studies all used some form of multi-component support programme. Five studies primarily offered a self-help programme (De Paul 1994; Gomel 1993; Koffman 1998; Rand 1989; Windsor 1988), while the remaining three offered individual or group counselling (Henrikus 2002; Klesges 1986; Klesges 1987).

Risk of bias in included studies

Allocation concealment

Eleven of the included studies were described as randomized (Crowley 1995; De Paul 1994; Gallagher 2007; Glasgow 1993;

Gomel 1993; Hennrikus 2002; Klesges 1987; Rand 1989; Shoptaw 2002; Volpp 2006; Windsor 1988), with five of them also using stratification (Crowley 1995; De Paul 1994; Glasgow 1993; Hennrikus 2002; Volpp 2006). Two studies were described as 'quasi-experimental' (Klesges 1986; Koffman 1998). The remaining studies did not use randomization to assign intervention or control status.

Two studies (Volpp 2006; Windsor 1988) were rated A, for a description of adequate allocation concealment. Eight studies (De Paul 1994; Gallagher 2007; Glasgow 1993; Gomel 1993; Hennrikus 2002; Klesges 1987; Rand 1989; Shoptaw 2002) were rated B, for allocation procedure not clearly described. The remaining studies were rated C (allocation concealment inadequate or not applicable).

Blinding

Because of the explicit mechanism of rewards, only three trials reported any attempt to blind participants, trialists or assessors (Crowley 1995; De Paul 1994; Volpp 2006).

Drop-outs and losses to follow up

Ten of the included studies (Crowley 1995; De Paul 1994; Gallagher 2007; Glasgow 1993; Gomel 1993; Klesges 1987; Koffman 1998; Rand 1989; Volpp 2006; Windsor 1988) treated programme drop-outs and losses to follow up as continuing smokers, and conducted the analyses on an intention-to-treat basis, i.e. the denominator included all persons randomized at the start of the trial in their original groups.

Outcomes

Raw outcome data, particularly in the older studies, were often difficult to extract, with 12 of the 17 studies presenting results as percentages only, in tabular or graphic form. Six trials followed up participants for a maximum of six months (Crowley 1995; Klesges 1986; Klesges 1987; Paxton 1980; Paxton 1981; Rand 1989), two for between six and twelve months (Gallagher 2007; Volpp 2006), six for twelve months (Gomel 1993; Koffman 1998; Maheu 1990; Paxton 1983; Shoptaw 2002; Windsor 1988), and three for 24 months (De Paul 1994; Glasgow 1993; Hennrikus 2002).

All the included studies used some form of biochemical validation of smoking cessation. Fifteen tested levels of cotinine (a metabolite of nicotine) in blood, saliva or urine, either at baseline (Crowley 1995; Gallagher 2007; Gomel 1993; Klesges 1986; Klesges 1987; Shoptaw 2002; Windsor 1988), to validate reports of abstinence (Crowley 1995; De Paul 1994; Gallagher 2007; Glasgow 1993; Gomel 1993; Klesges 1986; Klesges 1987; Maheu 1990; Volpp 2006; Windsor 1988), among claimants of rewards (Hennrikus 2002) or among random samples of quitters (Hennrikus 2002; Paxton 1980; Paxton 1981; Paxton 1983). Ten trials (Crowley 1995; De Paul 1994; Gallagher 2007; Glasgow 1993; Klesges 1986; Klesges 1987; Koffman 1998; Maheu 1990; Rand 1989; Shoptaw 2002) verified abstinence by testing breath samples for carbon monoxide (CO) levels.

In order to test the robustness of the cessation interventions, we

have included in our review only those studies which follow up participants for at least six months from the beginning of the intervention. Three of the trials, however, (Klesges 1986; Klesges 1987; Rand 1989) delivered part of their cessation rewards six months into the programme, which was also the end of the designated follow-up period, thereby confounding the intervention rewards with testing at the longest follow up.

Appropriateness of analysis

Four of the six trials which used a cluster-randomized design made due allowance for this in their analyses, either by testing for intra-class correlation (De Paul 1994; Glasgow 1993), by including worksite as a random effect (Hennrikus 2002) or by incorporating a nested design structure into the analyses of variance and testing retrospectively for intra-cluster correlations (though not in smoking prevalence) (Gomel 1993).

Crowley 1995 collapsed the three-way groupings for the six-month follow-up results, since differences between groups were by then negligible, and Windsor 1988 collapsed the incentive/non-incentive groupings for analysis after the six-week assessment, as contradictory differences had emerged between the two pairs of groups.

Effects of interventions

Details of the results for the 17 included studies in this review are tabulated in the Analyses section (Analysis 1.1). None of the studies detected a significant effect of rewards, competitions or incentives on smoking abstinence at the longest follow up.

We conducted a meta-analysis on nine of the included studies, grouping by evaluation points (six to 24 months; Analysis 2.1). Crowley 1995 and Hennrikus 2002 were excluded from the formal analyses since no extractable data were available on programme participants at follow up; Klesges 1986, Koffman 1998 and Maheu 1990 were excluded because they were not fully randomized, and Paxton 1981 and Paxton 1983 because all the participants (experimental and control) received incentives. Shoptaw 2002 and Windsor 1988 are both presented with two separate comparisons, since each study compared incentives with two different interventions in a factorial design.

Odds ratios (ORs) were adjusted to take account of cluster randomization, using an intraclass correlation of 0.01049 (Martinson 1999). At six months, the effect was marginally statistically significant (adjusted OR 1.44, 95% Confidence Interval (CI) 1.01 to 2.01; Analysis 2.1.1). Two studies (De Paul 1994 and Windsor 1988) found statistically significant effects. However, both paid out their final reward to coincide with the six-month follow up, which may have biased the results. A sensitivity analysis excluding these two trials reduced the adjusted OR to 0.93 (95% CI 0.59 to 1.47). At twelve-month and later follow ups (Analyses 2.1.2/3/4), the adjusted odds ratios were not statistically significant for these or any other studies. These subgroups were not pooled as several studies provided data for more than one time point and therefore

a pooled estimate would use the information of these trials more than once (resulting in a biased estimate of the effect).

Analysis of cost benefits was not appropriate, since none of the trials demonstrated a clinically significant long-term benefit of the intervention.

DISCUSSION

There is no compelling evidence from this review that competitions or incentives improve long-term smoking cessation, whether offered in the community, in healthcare settings or in the workplace. The included studies were often underpowered and of variable quality.

Several studies identified higher early and medium-term quit rates for the intervention groups, but these encouraging signs generally did not survive into long-term abstinence. Three studies (Klesges 1986; Klesges 1987; Rand 1989) confounded the final delivery of cessation rewards with the final follow-up assessment. Similarly, although De Paul 1994 and Koffman 1998 reported significantly higher cessation rates for the incentives groups at the six-month assessment, this evaluation coincided with the final phase of the rewards programmes. At later follow ups in these studies all such differences had disappeared. The only study (Maheu 1990) to detect a clear difference between the long-term quit rates of the intervention and control groups (50% versus 25%) was not randomized, had too small a sample to reach statistical significance, tested the allocation of incentives rather than the presence or absence of them, and may have confounded the intervention programme by including a sponsorship component which was not offered in the control site. Encouraging 30-day quit rates in Volpp 2006 dwindled to non-significant differences at six months. Although Gallagher 2007 achieved significantly different CO-validated quit rates, the cotinine-validated quit rates did not achieve clinically significant differences, suggesting that while some participants could achieve temporary abstinence for their clinic visit, the more rigorous urinary cotinine test did not indicate abstinence sustained beyond a few hours.

Glasgow 1993 reported one-year cessation rates for HIP participants more than double those of non-registrants (22.1% versus 9.4%, $P < 0.005$), but this difference had become non-significant at the two-year follow up; and again, the one-year evaluation was very close to the final lottery draw for HIP participants and may well have been influenced by that proximity. Gornall 1993 indicated that at three months (two weeks after programme end) the incentives group had a quit rate of 20%, compared with 17% in the comparison (BC) group, but that by 12 months the rates had switched to 20% for the BC group compared with 4% for the incentives group (estimated from graphical percentage figure). Shoptaw 2002 reported the same pattern of relapse, with signifi-

cant benefit to the contingency management groups rapidly vanishing over the nine-month post-programme follow-up period.

The consistent picture that emerges from these examples is that incentives may improve compliance while they are in place, but that once they are withdrawn the normal pattern of relapse will establish itself.

Incentives

The use of tangible rewards will always be a trade-off between maximizing participation and attracting smokers who are motivated more by the rewards than by the wish to stop smoking. An effective incentive should be large enough to attract smokers motivated to try and quit, but not so attractive that the desire to win outweighs the seriousness of the quit attempt. The type and scale of the incentive has therefore been considered a critical element in the design of a cessation programme, although from the perspective of this review, which is primarily concerned with sustained or permanent cessation, the type and scale of the incentives may be less significant than the negative effects of removing them altogether. The incentives varied considerably across the studies in this review, including cash prizes, vouchers for goods and services, state lottery tickets, prize draws, a catered meal and combinations of cash and state lottery tickets. No type or size of reward proved to be more effective than others in promoting long-term abstinence from smoking.

Participation rates

In this review we have included only those studies which specified smoking cessation as a primary outcome, and which applied the intervention rewards to achievement of abstinence. However, higher recruitment rates may have a role to play in improving long-term cessation rates. A recurrent feature of several studies in this review, both included and excluded, was the effect of incentives upon participation rates. A widespread assumption seemed to be that, since incentives are frequently shown to improve participation rates in cessation programmes, this would surely lead to higher quit rates (Grunberg 1990; USDHHS 1989). Our review has not found this to be the case. While the studies' authors noted the effectiveness of immediate or possible rewards in raising recruitment levels, this was generally not reflected in the long-term cessation rates (Henrikus 2002; Klesges 1986; Maheu 1990; Paxton 1983; Volpp 2006). The primary outcome of the Volpp 2006 study, for example, was to enhance enrolment into a free cessation programme by offering incentives for attendance, compliance and cessation. Although the incentives doubled participation rates (41.3% of invitees versus 19.5%), the six-month cessation rates were low in both groups (6.5% versus 4.6%), with negligible difference between the absolute numbers of quitters.

Given the potential for incentives to improve recruitment rates, the absolute numbers of successful long-term quitters may in some

cases be increased, even if cessation rates do not differ between the intervention and control groups.

Deception

All the included studies in this review used some form of biochemical verification to confirm the smoking status of those claiming abstinence. While this procedure is now the recommended gold standard for good trial design (Benowitz 2002), it is particularly important that quitters in an incentives- or competition-based trial are shown to be truly abstinent at the evaluation points. Eligibility for cessation rewards depended in all the included studies upon biochemical confirmation of the claim of abstinence.

Three of the studies in this review reported a good correspondence between claims of abstinence and their biochemical verification, with Koffman 1998 noting a 96% agreement, Windsor 1988 100% agreement for more than 600 saliva thiocyanate samples, and De Paul 1994 a 95% agreement. Maheu 1990 used the 'bogus pipeline' method (i.e. collecting saliva samples but not testing them for cotinine), but also verified abstinence throughout by CO testing. The Paxton studies took random urine samples to deter false reporting, and also occasionally cross-checked smoking status with family members or friends. He reported that levels of deception were 'very low', and attributed this to having warned subjects in advance about the random biochemical checks.

Three studies which targeted high-risk smoking groups went to some trouble to control for possible levels of deception. Crowley 1995, dealing with moderately-ill COPD patients who had been co-opted into the programme, anticipated a measure of deception, and calculated an expected ratio of CO divided by cigarettes smoked. This confirmed a greater disparity between cigarettes smoked and numbers reported among the non-verified self-report group and the control group than among the intervention group, who were rewarded only for verified abstinence. Shoptaw 2002, dealing with methadone-maintained drug abusers with high levels of smoking, reported similar findings between self-reported abstinence and its biochemical verification, but cautioned that it was possible that participants had found ways of substantially subverting the breath-testing schedule. Against this possibility, however, was the fact that subjects had averaged only 44% of the available prize vouchers for abstinence, suggesting that any subversion had not been particularly successful. Gallagher 2007, dealing with smokers with schizophrenia or other serious mental disorders, found considerable disparities between quit claims validated by CO breath samples (confirming abstinence for a few hours) and those validated by urinary cotinine (days or weeks of abstinence). This does not indicate deception, but suggests that the achieved

abstinence for which the rewards were being claimed was not robust or sustained.

The two studies which found a striking disparity between self-reported abstinence and biochemical verification of the claims were both large, worksite-based, cluster-randomized trials, which followed their subjects for 24 months. Hennrikus 2002 reported a 33.6% mismatch between self report and confirmation at 24 months, and Glasgow 1993 a 27% mismatch at the 12-month evaluation. Both trials had 'sprung' the biochemical validation requirement on the quitters at follow up. The clear discrepancies suggest that people responding indirectly (not face-to-face) to a question about their smoking, and not expecting to have their answer checked, may be significantly more likely to say what they think the questioner wants to hear.

AUTHORS' CONCLUSIONS

Implications for practice

- Incentives and competitions do not appear to enhance long-term cessation rates. Early success tended to dissipate when the rewards were no longer offered, and the normal relapse pattern re-established itself.
- Rewarding participation in contests and cessation programmes may have more potential to deliver higher absolute numbers of quitters.
- Although these interventions risk attracting smokers motivated more by the material rewards than by the desire to quit, there was little evidence that levels of deception varied between experimental and control subjects, or that rates of disconfirmation were unacceptably high.

Implications for research

Further research seems unlikely to change these conclusions to any significant degree.

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- * Indicates the major publication for the study

CHARACTERISTICS OF STUDIES

Characteristics of included studies [ordered by study ID]

Crowley 1995

Methods	Country: USA Setting: 'Quite-ill' (FEV < 70% of FVC) outpatient smokers at a Denver COPD clinic. Randomization: Patients stratified by sex and FEV, then randomly assigned to either Exp or CSR [cigarette self report] Groups; If Exp, next participant in stratum randomized to either remaining group, and last assigned to third group. If first randomized to CSR, then 2nd went to Exp and 3rd to Control. Randomization method not stated.
Participants	49 smokers (CO > 14 ppm). av age 61.4, 76% male, av FEV 49.5% normal value, av Fagerstrom score 5.4
Interventions	All participants had daily CO monitoring over 86 days, + brochure + nicotine gum. Encouraged to throw cigarettes down toilet. All were given 1 lottery ticket per day for 'time and effort'. 1. Exp Group: Rewarded with lottery tickets for every CO test < 10 ppm. 2. CSR Group: lottery tickets for each self report of abstinence since last visit. 3 Control Group: each control was paired with an exp participant and received the same reward as exp 'partner'. Measurement and payment schedules changed often. Reward intervals varied, became intermittent, unpredictable
Outcomes	End of trial (85 days), 6m PP. Biochemical validation: expired CO, urinary cotinine, finger pulse oximetry for blood oxygen saturation
Notes	Participants were given 3 lottery tickets for flushing cigs away. Relapsers went to special programs with larger more frequent payments

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	No	C - Inadequate

De Paul 1994

Methods	Country: USA Setting: 63 Chicago worksites, stratified on size and type of business Randomization: method not stated
Participants	844 smokers (280 self help (SH), 28 incentives (I), 283 Group (G)), av age 37.8, 63% male, av % black 20.5, av yrs education 13.8, av yrs smoking 19.9, av cpd 21.5. 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' 2. I (also=IM) as SH, plus US\$1 per day for each day abstinent up to 6m (maximum US\$175)

De Paul 1994 (Continued)

	3. G (also=GIM) as I, plus group meetings twice a week for first 3w, + 14 'booster' meetings over 6m; programme included a buddy system, and tips in booster sessions on living with a smoker, weight control, exercise and stress management	
Outcomes	Baseline, post-test (3w), and at 6, 12, 18 and 24m. Lottery system used to boost follow-up return rates. CO samples at all assessments, + cotinine at 6m. ICC 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	
Risk of bias		
Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Gallagher 2007

Methods	Country: USA Setting: Three psychiatric case management sites in La Frontera, Arizona Randomization: Unconcealed computer-generated random number lists.*	
Participants	180 smokers, aged 18+, English-speaking, smoked at least 10 cpd for at least 3 yrs, CO>10ppm. Diagnosed with DSM-IV Axis 1 psychotic-spectrum or affective disorders resulting in long-term mental illness and experiencing significant symptoms and functional impairment. 48% F, 76% Anglo, mean age 43, mean FTQ 6.1, mean cpd 24.8 Not required to commit to cessation, but 98% expressed interest either in quitting or in reducing. Randomized to contingent reinforcement (CR, N=60), contingent reinforcement + NRT patches (CR+NRT, N=60), or self-help (Control, N=60).	
Interventions	1. CR: Weekly visits wks 1-4 (Phase 1), fortnightly wks 6-12 (Phase II), monthly wks 16-24 (Phase III). Payments \$25 for baseline assessment and \$5 per visit, plus \$20 per abstinent visit in Phase I, \$40 in Phase II, \$60 in Phase III, and \$80 if abstinent at 36wk follow up. Max payable \$580 for attendance + abstinence. At each visit weight, pulse rate, smoking status, intention to quit, withdrawal symptoms, CO, BP measured. 2. CR+NRT: As CR Group, plus 16-wk course of 21mg NRT patches, plus supporting instructions. 3. Control: Visits at baseline and wks 20 and 36, plus encouraged to use the community smoker helpline, ALA and ACS self-help information. In all groups, salivary cotinine measured at baseline and at wks 20 and 36; brief symptom inventory (psychiatric symptoms) at baseline and wks 6, 16 and 36; FTND at baseline and at wks 10, 24, 36.	
Outcomes	Abstinence at wks 20, 36. Verified by expired CO (<10ppm) and by salivary cotinine (<15ng/mL). Other outcomes: smoking reduction, change in psychaitric symptoms.	
Notes	* Addiitonal information supplied by author. New for 2008 update.	

Gallagher 2007 (Continued)

<i>Risk of bias</i>		
Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Glasgow 1993

Methods	Country: USA Setting: 18 Oregon worksites (8 exp, 10 control), stratified on number of employees and estimated smoking prevalence Randomization: method not stated
Participants	Smokers defined as ≥ 7 cigs/w. Smoking prevalence av 21.5%; av age 40.5, 37% male, , av 18.5 cpd. Smokers in intervention sites had higher education levels, and rated themselves more likely to try and quit smoking within next 6m. 23% of baseline smokers in intervention sites joined the programme. 474 participants in intervention sites, 623 in control sites.
Interventions	1. Int: US\$10 for each monthly PP abstinence over 1 yr of programme + monthly worksite lottery (US\$5-US\$20 first 6m, then minimum US\$50 for 2nd 6m). 12m sweepstake for US\$200, US\$100 and US\$50 at each worksite. Also 'good buddy' nonsmokers' lottery prize. No formal quitting support. 2. Control: Baseline and follow-up surveys at 1yr, 2yrs
Outcomes	PP cessation at 1 yr, 2 yrs. Validation: CO < 9 ppm and salivary cotinine
Notes	This is the HIP study (Health Incentives Program). Great variability in outcome across sites (2 yr follow up cessation rates Int: 14-33%, Control: 9-27%), with 30% lost to follow up at 2 yrs.

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Gomel 1993

Methods	Country: Australia Setting: 28 Sydney ambulance stations. Cluster-randomized to 4 intervention levels Randomization: method not stated
Participants	128 smokers; av age 32, 83% male, 59% married or cohabiting, av cpd 17.9. Sig baseline diff between groups on job description.
Interventions	1. Health risk assessment (HRA): risk factor profile feedback (10 stations) 2. Risk factor education (RFE): as 1 + advice, brochure, videos (8 stations) 3. Behavioural counselling (BC): as 2 + individual counselling (6 stations) 4. Behavioural counselling + incentives (BCI): as 3 + life-style change manual + counselling + incentives,

Gomel 1993 (Continued)

	i.e. 2 lottery draws for A\$40 over 10w period, + 5 draw tickets for 1w cessation; At 3m A\$40 voucher for achieved targets. Station achieving highest % of participants meeting 6m goals won A\$1000. (4 stations)	
Outcomes	Continuous cessation at 3, 6 and 12m. Validation: cotinine. ICC used in the analysis for other risk factors, but not for smoking, as numbers too small	
Notes	Only Groups 3 (BC [6 stations]) and 4 (BCI [4 stations]) used in the comparison. Contamination may have occurred by movement and transfer between stations	
Risk of bias		
Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Hennrikus 2002

Methods	Country: USA Setting: 24 Minneapolis-St Paul worksites; 2x3 factorial design, stratified by gender and education Randomization: method not stated	
Participants	2402 current smokers (+ smoked at least 100 cigs in lifetime). Av age 39, 43.8% male, 62% married/partner	
Interventions	1. Group: 13 group sessions over 2m. 2. Phone: sent printed materials, inc ALA 'Freedom from Smoking' + 3-6 telephone counselling sessions 3. Choice: free choice between group or phone programmes. All programmes offered x3 over 18m; smokers could join more than once. Half of the sites in each intervention were offered direct incentives for participation and for quitting: Quitters at 1m won US\$20 and entered lottery for grand prize (US\$500 as 1 prize [5 sites], 2xUS\$250 [6 sites] or 4xUS\$125 [1 site]). Drawn about every 6m	
Outcomes	Baseline, 7-day PP at 12m, 24m. Validation: self report, countersigned by friend or family member for monthly abstinence. Grand draw prize winners + 24m random sample of quitters [paid US\$25 for compliance] tested for salivary cotinine	
Notes	Group drop-outs were not followed up; phone drop-outs were rung for up to ten times for each counselling session, and were then left messages or sent letters.	
Risk of bias		
Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Klesges 1986

Methods	Country: USA Setting: 4 banks and a savings and loan company in Fargo ND. Randomization: not used. 'quasi-experimental' design
Participants	Baseline equivalence on age, sex, socio-economic status and smoking prevalence, but demographics not reported. Intervention smokers had significantly higher levels of nicotine dependence than the controls. 91 (88%) smokers in intervention sites, 16 (53%) in control site
Interventions	1. Controls: basic smoking programme (SP): 6w CBT programme. 2. Intervention: SP+competition: Cash prizes at institution level for participation (US\$100), greatest CO reductions at 6w (US\$150), and at 6m (US\$250). Individual awards of certificates, public recognition. Also catered meal for bank with highest cessation rate at 6m follow up, served to winning bank by executives of the losing banks. Participant badges distributed throughout competition sites, and 'smoking barometer' in each bank
Outcomes	PP 6w, 6m CO < 8 ppm and SCN samples
Notes	Smoking reduction was also a measured outcome. Six-month 'follow up' was also the main incentive point, so could more accurately be seen as end-of-programme, rather than true follow up

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	No	C - Inadequate

Klesges 1987

Methods	Country: USA Setting: 8 worksites (Fargo, ND=4; Eugene, OR=4). 2x2 factorial design (comp/no comp, RP training/no RP training) Randomization: method not stated. Randomization was by company, and analysis was by individual.
Participants	136 smokers. av age 38, 53% male, av cpd 28, av yrs smoking 19
Interventions	1. Basic Programme (BP: 6 weekly CBT group sessions, aimed at brand-switching and reduction, aiming for final quitting or reduced % of cig smoked. Also info on maintenance and RP) 2. Comp: BP + within-site team competitions. Weekly feedback on team performance, smoking 'barometer', prizes for completing treatment (- US\$5 per team member), for team with highest number of quitters at EOT (- US\$10 per member), and for highest abstinence at 6m follow up (- US\$15 per member). 3 RP: BP +/- Comp, +/- 1- or 2-monthly meetings to discuss, role-play, quit again, develop RP skills.
Outcomes	PP at 6m. Validation: CO < 10 ppm and SCN at baseline. CO preferred to SCN at 6m follow up.
Notes	Rewards were paid for team performance, not individual success or failure. Hessol disputes whether incentivized follow up compromises the study.

Risk of bias

Klesges 1987 (Continued)

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Koffman 1998

Methods	Countries: USA and Canada Setting: Aerospace manufacturing worksites in Pomona, Rancho Cucamonga and Ontario Randomization: not used. Quasi-randomized allocation of interventions.
Participants	Participation rate not known. 177 smokers, av age 41, av yrs smoking 22.7, 59% male. Sig baseline diffs in age, yrs at the company, job description, working with chemicals, yrs smoking, addiction level
Interventions	1. Multi: Self help ALA package + group cessation sessions in teams of 5-7 + monthly telephone counselling for 12m and maintenance sessions for weight, fitness and stress management. 2. Incentives: as 1 + incentives: US\$15 for abstinence each month during the 5m programme; US\$5 for 'fading' in 1st month. Participants organized into teams, and any US\$15 forfeited by an individual was added to US\$2500 super grand prize. 3 top teams (posted on 'smoking barometer') at end of programme shared super grand prize (by then US\$3960), top team 50% and 2x25%. 3. Traditional: self help ACS 'Fresh Start' manual + 5x90-min group support sessions + videos.
Outcomes	PP at 6m, 12m. Validation: CO (multi and incentives groups only, not 'traditional' (control) group)
Notes	Traditional participants paid US\$20 deposit, refundable on programme completion; incentive participants paid US\$50 non-refundable initiation fee. Suggests that the multi-component element may be the key factor for efficacy, though confounded by more thorough evaluation at baseline for multi and incentive than for the traditional group

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	No	C - Inadequate

Maheu 1990

Methods	Country: USA Setting: 2 aerospace worksites (Competition [C]: ~4500 employees; No Competition [NC]: ~12,000 employees) in San Diego, CA. Both sites had recent smoking bans in public areas. Randomization: not used
Participants	Total 56 (C: 32, NC: 24). Sig diffs on age and yrs smoking. 29.9 cpd, 59% male, 12% blue-collar workers. Recruitment at C site was 2% of eligible smokers, vs 0.6% at NC site (P < 0.01)
Interventions	Both sites received 9X2hr class meetings (self monitoring, smoke-holding, nicotine gum) and 9x1hr maintenance meetings over 14w. Strategies included stress and weight management, relaxation and RP. Participants all paid a US\$50 tuition fee, of which they could win US\$35 back for attendance and

Maheu 1990 (Continued)

	<p>abstinence.</p> <p>1. C participants were divided into 3 teams; team with most abstainers at 3m won pooled prize of US\$160. Also a site-wide raffle, and a participants' raffle for attendance at meetings. 'Buddies' whose sponsored smokers were confirmed abstinent at 3m were given 5 raffle tickets for a US\$150 travel voucher raffle.</p> <p>2. NC participants abstinent at 3m received pooled prize (US\$120) divided equally</p>
Outcomes	Continuous abstinence CO < 10 ppm from w5, and at 3m and 1yr. SCN also collected at 3m in 'bogus pipeline' procedure.
Notes	Intervention being tested and rewarded was group co-operation and competition rather than incentives per se. All participants received partial refunds for programme attendance, and for attending 1yr follow up.

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	No	C - Inadequate

Paxton 1980

Methods	<p>Country: UK</p> <p>Setting: Health Services Clinic, with consecutive treatment groups of smokers responding to hospital advertisements, or referred by local physicians</p> <p>Randomization: not used; participants joined the next available treatment group (1 intervention group, 3 control, then 4 intervention)</p>
Participants	60 smokers, av age 40.3, av cpd 28.2, 37% male
Interventions	<p>11 meetings over 4m. 1st meeting included programme outline, and weight and lung function measurement. 2nd meeting included aversive smoking, support leaflet, smoking diaries. Remaining meetings continued to monitor lung function and weight, and offered dietary advice. Telephone contact maintained after 4m. Participants who resumed smoking for a week or more were asked to drop out (most left before being asked).</p> <p>1. Intervention group: Participants signed a contract at 2nd meeting (quit date), and paid £20 deposit ; this was returned at £5 per week for each week's complete abstinence. Forfeited money was shared among the abstainers. At w5 a 2nd £20 deposit was paid over, to be returned in 2 fortnightly instalments of £10 for non-smoking, to test effect of varying payment intervals.</p> <p>2. Control group: main programme, without deposits or contracts</p>
Outcomes	Random urine testing and contact with families throughout treatment. Assessed at 3m, 6m
Notes	Because the trial was set in an NHS clinic, (health care free at point of delivery), participants unable or unwilling to pay deposits were entitled to join the intervention group programme (minus financial component), but their results were not included in the study reports. Take-up rates did not differ significantly between intervention and control groups

Risk of bias

Paxton 1980 (Continued)

Item	Authors' judgement	Description
Allocation concealment?	No	C - Inadequate

Paxton 1981

Methods	Country: UK Setting: Health Services Clinic, with consecutive treatment groups of smokers responding to hospital advertisements, or referred by local physicians Randomization: not used; allocation was 'not quite random', using a 'compromise experimental group-control group design'. Participants joined the next available treatment group, with each deposit condition applied in 4 'normally consecutive' groups.
Participants	83 smokers in 12 groups, 34.9% male, av age 37.9, av yrs smoking 19.6, cpd 29.3
Interventions	11 meetings over 4m. 1st meeting included programme outline, and weight and lung function measurement. 2nd meeting included aversive smoking, support leaflet, smoking diaries. Participants signed a contract at 2nd meeting (quit date), and paid £20 deposit. Remaining meetings continued to monitor lung function and weight, and offered dietary advice. Telephone contact maintained after 4m. Participants who resumed smoking for a week or more were asked to drop out. 1. D1 Group: deposit was returned at £5 per week for each week's complete abstinence. Forfeited money was shared among the abstainers. At w5 a 2nd £20 deposit was paid over, to be returned in 2 fortnightly instalments of £10 for abstinence 2. D2 Group: reversed schedule to D1, i.e. £10 per fortnight for abstinence over 1st month, then £5 per week for 2nd month. D3 Group: deposit was returned at £5 per fortnight over 2 months abstinence; 2nd £20 repaid at same rate over the next 2m
Outcomes	'Occasional' urine samples to deter and detect faking. Assessed weekly up to 6m
Notes	Trial tested efficacy of varying repayment schedules.

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	No	C - Inadequate

Paxton 1983

Methods	Country: UK Setting: Health Services Clinic, with consecutive treatment groups of smokers responding to hospital advertisements, or referred by local physicians Randomization: not used; allocation was 'not quite random', using a 'compromise experimental group-control group design'. Participants joined the next available treatment group, with each deposit condition applied in 4 'normally consecutive' groups (only 2 groups for 4CT condition).	
Participants	159 smokers, av age 40.7, 37.7% male, cpd 29.2	
Interventions	<p>11 meetings over 4m. 1st meeting included programme outline, and weight and lung function measurement. 2nd meeting included aversive smoking, issue of support leaflet, smoking diaries. Participants signed a contract at 2nd meeting (quit date), and paid £20 deposit. Remaining meetings continued to monitor lung function and weight, and offered dietary advice. Telephone contact maintained after 4m. Participants who resumed smoking for a week or more were asked to drop out (most left without being asked). All deposit repayments were contingent on abstinence since previous payment.</p> <p>Experiment 1: (i) 2LA Group [2m lump-sum abrupt termination]: deposit returned in equal payments over 4w. 2nd £20 deposit returned in equal payments over 4w. (ii) 4LA Group [4m lump-sum abrupt termination]: same as 2LA, but spread over 4m.</p> <p>Experiment 2: (i) 4LA Group: described in Exp 1 (ii). (ii) 4LT Group [4m lump-sum thinning]: Same as 4LA, but payments 'thinned', i.e. made at increasing intervals (2, 4, 8 and 16w).</p> <p>Experiment 3: (i) 4CT Group [4m cumulative thinning] : deposit paid as 4 weekly instalments of £6 (= higher total) with repayments thinned, compared with (ii) 4LT: see 2 (ii) above. To test (a) participation (b) 1yr abstinence (c) programme attendance</p>	
Outcomes	Random urine testing and contact with families throughout treatment. Assessed at 3, 6 and 12m	
Notes		
<i>Risk of bias</i>		
Item	Authors' judgement	Description
Allocation concealment?	No	C - Inadequate

Rand 1989

Methods	Country: USA Setting: Employees at a Baltimore hospital Randomization: method not stated; subjects randomized after 5 days confirmed abstinence	
Participants	51 smokers, av age 38.1, 25.5% male, cpd 26	
Interventions	Introductory lecture, ACS brochure 'Clearing the Air', baseline measures taken. After confirmed 5-day abstinence (US\$25 reward), subjects assigned either to	

Rand 1989 (Continued)

	<p>1. Contingent Group: Contingent payment/frequent monitoring: checked 2xweek at random times, paid US\$4 per CO < 11ppm 2. Non-contingent Group: Non-contingent payment/frequent monitoring: checked 2xweek at random times, paid US\$4 per CO sample, regardless of reading 3. Control Group: Non-contingent payment/infrequent monitoring: checked 1xmonth at random times, paid US\$40 per CO sample, regardless of reading.. Programme lasted 26w.</p>	
Outcomes	3xdaily CO samples < 11 ppm to confirm 5-day qualifying abstinence. Monthly survival analysis (continuous cessation) to 6m. Drop-outs and relapsers treated as continuing smokers	
Notes		
Risk of bias		
Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Shoptaw (B) 2002

Methods		
Participants		
Interventions		
Outcomes		
Notes	Dummy record to generate a reference for the table of comparisons. Details as in Shoptaw 2002	
Risk of bias		
Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Shoptaw 2002

Methods	Country: USA Setting: 3 narcotic treatment centres in LA Randomization: 'an urn randomization procedure'. A randomized 2x2 repeated measures design.
Participants	175 smokers (>=10cpd, expired CO > 8ppm, cotinine > 30 ng/ml), av age 44, 60.5% male, 22.1 av cpd. No sig diffs between groups, except group 3 reported higher cocaine use than other groups.
Interventions	2w baseline and randomization period, then 12w treatment with NRT patches, tapered from 21 mg for 8w, to 14 mg for 2w and 7 mg for 2w. CO and urine samples taken x3/w . Randomized to:

Shoptaw 2002 (Continued)

	<p>Group 1. NRT patch only Group 2 NRT patch + RP Group 3. NRT patch + CM: US\$2 for 1st CO sample < 8ppm; each consecutive sample rewarded with voucher increased by 50c, + bonus US\$5 for every 3 consecutive samples. If a sample > 8ppm, reward process reverted to US\$2 level again, but was restored to previous scale after one round of 3 consecutive samples < 8ppm. Participants could earn up to US\$447.50 Group 4. NRT patch + RP + CM (see group 3 procedure)</p>	
Outcomes	<p>Baseline measures, + thrice-weekly breath and urine samples throughout 12w treatment, + weekly self report, and same measures at 6m and 12m. Participants with missing data were counted as continuing smokers.</p>	
Notes	<p>No extractable raw figures for the separate groups</p>	
Risk of bias		
Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Volpp 2006

Methods	<p>Country: USA Setting: Philadelphia VA medical centre Randomization: Permuted blocks of 4, stratified by level of smoking (+/- 2 packs per day). Allocation by sequentially numbered surveys by computer-generated lists of random numbers. Participants not informed that they were in a trial until after final follow up.</p>	
Participants	<p>All outpatient self-identified smokers invited to complete baseline survey. 404 surveyed, 179 eligible: 92 invited to attend Incentives group, 87 to attend Control group. Mean age 52, 94% M, 25% white, 41.7% completed high school or GED, mean cpd 22, mean yrs smoking 30, 35% Fagerstrom score =>7, 17% smoking >2 packs per day.</p>	
Interventions	<p>1. Five free fortnightly sessions cessation programme, standardized group counselling, plus NRT patches every 2 wks (4 wks x 21mg, 2 wks x 14mg, 2 wks 7mg). 2. As 1, plus \$20 per session attended, + \$100 if quit -30 days after programme completion (75 days post-quit date). Incentives and control groups conducted separately, to avoid contamination, but same instructor, blinded to assignment and not involved in rewards distribution.</p>	
Outcomes	<p>Primary: Initial enrolment within the programme (= attended first session). Secondary: Cumulative attendance, programme completion. 7-day PP at ~1m post-completion (75 days post-quit date), and at 6m post-completion (~7.5m post-quit date) among those who had quit at earlier timepoint. ITT analysis, included all 179 eligible smokers, whether or not they had joined the cessation programme. Validation by urinary cotinine (<500 ng/mL). \$20 reimbursement for attending for validation procedure.</p>	

Volpp 2006 (Continued)

Notes	Sample size estimate of 100 per group would give >80% power to test enrolment at 5% level of significance, with a one-sided test of equality of proportions.	
Risk of bias		
Item	Authors' judgement	Description
Allocation concealment?	Yes	A - Adequate

Windsor (B) 1988

Methods		
Participants		
Interventions		
Outcomes		
Notes	Dummy record to generate a reference for the table of comparisons. Details as in Windsor 1988	
Risk of bias		
Item	Authors' judgement	Description
Allocation concealment?	Yes	A - Adequate

Windsor 1988

Methods	Country: USA Setting: University of Alabama, Birmingham Randomization: computer-generated assignment system in sealed and numbered envelopes, in a 2X2 factorial pretest/post-test control group design
Participants	378 smokers over 21m recruitment, av 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. Method 1: Controls: manuals only, brief chat. Method 2: cessation skills training (diary, deep breathing), contract to quit, and quit smoking buddy (with buddy education). Method 3: Monetary incentives: US\$25 after 6w confirmed cessation, and after 6m confirmed cessation. Group A: Method 1 only Group B: Methods 1 and 2 Group C: Methods 1 and 3 Group D: Methods 1, 2 and 3.

Windsor 1988 (Continued)

Outcomes	6w, 6m, 1yr. Baseline measure and confirmation at all timepoints by SCN (≤ 100 ug/ml). Participant smoking more than 2 cigarettes more than once in a follow-up period counted as a smoker. Losses to follow up counted as continuing smokers	
Notes	As no significant effect of incentives was detected after 6w, Groups A and C were collapsed for comparison with Groups B and D collapsed, to test programme efficacy	
Risk of bias		
Item	Authors' judgement	Description
Allocation concealment?	Yes	A - Adequate

ALA: American Lung Association
 ACS: American Cancer Society
 av: average (mean)
 CBT: cognitive behavioural therapy
 CM: Contingency Management
 CO: carbon monoxide
 COPD: Chronic obstructive pulmonary disease
 cpd: cigarettes per day
 EOT: end of treatment.
 ICC: Intra-class correlation.
 FEV: Forced expiratory volume.
 FVC: Forced Vital Capacity.
 m: month
 NRT: nicotine replacement therapy
 PP: point prevalence
 ppm: parts per million
 RP: relapse prevention
 SCN: saliva thiocyanate.
 w: week
 yr: year

Characteristics of excluded studies [ordered by study ID]

Bowers 1987	Outcomes were reduced CO and changes in blood pressure, not smoking cessation
Cavallo 2007	Randomized trial of school children, lasting 1 month. New for 2008 update.

(Continued)

Correia 2006	3-week trial of college students, randomized to high or low payments for abstinence. New for 2008 update.
Crowley 1991	Study 1 was not a controlled trial. Studies 2 and 3 did not give detailed 6m follow up. These studies laid the basis for Crowley 1995 (Included study)
Cummings 1988	Follow up was only 3m
Curry 1991	Incentives were for use of the materials, not for smoking cessation
De Paul 1989	Incentives component cannot be evaluated separately from the other components of the intervention
Donatelle 2000a	Target is pregnant smokers (covered by reviews in Childhood and Pregnancy Group)
Donatelle 2000b	Target is pregnant smokers (covered by reviews in Childhood and Pregnancy Group)
Donatelle 2002	Target is pregnant smokers (covered by reviews in Childhood and Pregnancy Group)
Elliott 1968	No control group, and followed up for 3 months only
Emont 1992	Aim of the study was to enhance recruitment, not smoking cessation
Fortmann 1995	Intervention being tested was self help versus nicotine gum. All participants could receive quitting incentive payment
Gilbert 1999	Long-term incentives were for attending follow up, not for smoking cessation
Gilbert 2002	No long-term follow up outcomes beyond 31 days
Gottlieb 1990	Competition was used as a recruitment tool, not for smoking cessation
Hanewinkel 2007	Smoking prevention trial among school children in Germany, Finland and Netherlands. See Schools prevention review. New for 2008 update.
Higgins 2004	Trial of contingent vs noncontingent rewards for abstinence on pregnancy and postpartum. New for 2008 update.
Jason 1990	Some baseline differences between (non-randomized) experimental and control companies, and intervention included several programme options as well as the incentive component.
Jeffery 1988	Intervention being tested was reduction versus cessation. Incentives were available to both groups
Jeffery 1989	Not a controlled trial. All participants were eligible for incentives
Jeffery 1993	Incentives were for attendance, not for cessation

(Continued)

Kassaye 1984	Objectives were cessation and reduction, and long-term follow-up outcomes were not fully reported
Lamb 2004	Trial of 102 adult smokers, rewarded for reduced CO in daily breath samples. Lasted 3 months, and outcome was lowered CO rather than cessation. New for 2008 update.
Lussier 2005	Trial of 63 adult smokers randomized to 14-, 7- or 1-day contingency payments for abstinence. lasted 2 wks.
Monti 2006	50 adult smokers randomized to MET+contingency payment, relaxation+contingency payment, MET+ non-contingency reinforcement or relaxation+noncontingency reinforcement. Followed for 3-wk treatment period. New for 2008 update.
Mooney 2004	97 adult smokers randomized to standard care, information or information+contingent payment. Lasted 15 days, and outcome was increased use of nicotine gum, not cessation. New for 2008 update.
Olsen 1990	Incentives could not be evaluated separately from other components
Pardell 2003	No baseline measurements reported, and incentives could not be separated from other programme components
Poole 2001	Prospective cohort study, not a controlled trial
Rohsenow 2005	187 substance abusers randomized to contingency reinforcement or noncontingent reinforcement for 19 days. No results reported for CR group. New for 2008 update.
Sloan 1990	Non-experimental design, with no control group
Spring 1978	Long-term follow-up outcomes not fully reported
Stitzer 1983	Outcome was reduced CO, and only 6w follow up
Stitzer 1984	Outcome was reduced CO, and only 2m follow up
Stitzer 1985	Outcome was reduced CO, and only 6w follow up
Strecher 1983	No long-term outcomes, and no control group
Winett 1973	Incentives were paid for attendance, reduction and cessation; no true control group (no incentives)
Wiseman 2005	20 cocaine users randomized to contingent or noncontingent payments. Treatment period and follow up lasted 2 wks. New for 2008 update.

CO: carbon monoxide

m: month

w: week

DATA AND ANALYSES

Comparison 1. RESULTS OF INCLUDED STUDIES

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 RESULTS TABLE			Other data	No numeric data

Comparison 2. Smoking cessation

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Smoking cessation (Adjusted)	12		Adjusted Odds Ratio (Fixed, 95% CI)	Subtotals only
1.1 6 months	11		Adjusted Odds Ratio (Fixed, 95% CI)	1.44 [1.01, 2.04]
1.2 12 months	7		Adjusted Odds Ratio (Fixed, 95% CI)	1.07 [0.78, 1.45]
1.3 18 months	1		Adjusted Odds Ratio (Fixed, 95% CI)	1.58 [0.88, 2.83]
1.4 24 months	2		Adjusted Odds Ratio (Fixed, 95% CI)	1.28 [0.92, 1.78]

Analysis 1.1. Comparison 1 RESULTS OF INCLUDED STUDIES, Outcome 1 RESULTS TABLE.

RESULTS TABLE

Crowley 1995	36	24hr PP [Point Prevalence]	6 months	CCO<10ppm	N=5	X2 N.S.	Mean CO values (reduction)	Groupings were col- lapsed at fol- low up
De Paul 1994	281 (I) 280 (SH)	PP	24 months	CO<9ppm	13.2% (I) 10.3 % (SH)	N.S.	PP, ITT and continuous quit rates re- ported at all time points	Compari- son confined to I and SH groups in this review
Gallagher 2007	60 (CR) 60 (CR+NRT) 60 (Cont)	PP	36 wks	CO<=10ppm SCN<15ng/ mL	7% (CR) 5% (Cont) (based on SCN)	N.S.	CO-val- idated rates higher, i.e. 37% (CR), 8% (Cont). Reduc- tion, psychi- atric symp- toms.	CR+NRT group not used in our comparison.

RESULTS TABLE (Continued)

Glasgow 1993	344 (I) 426 (C)	7 days abstinence	2 years	CO \leq 9ppm Cotinine \leq 25ng/mL	14.2% (I) 11.5% (C)	N.S.	In- centives had a sig. effect ($p < 0.03$) on less ed- ucated sub- jects (18.6% vs 8.8% @ 2yr 'probab- ly chance'). Com- pared partic- ipants with non- participants (22.1% vs 9.4% @ 1yr, $p < 0.005$; 21.3% vs 16.8% @ 2yr, N.S.)	27% of all abstinent claims could not be bio- chemically verified
Gomel 1993	30 (BCI) 30 (BC)	Continuous	12 months	Cotinine < 100 ng/mL	1 (3%) BCI 3 (10%) BC	N.S.	PP (N.S.) Various car- dio- vascular risk factor modi- fications	Groupings were col- lapsed at fol- low up be- cause of small num- bers. Compar- ison in our review only between BC and BCI groups
Hennrikus 2002	407	7 days PP	24 months	Saliva from 149 random sample of quitters @ 24m.	19.4% (cohort sur- vey)	Not stated	Cohort prevalence and ces- sation rates (PP and continuous) Recruit- ment rate Programme format	Pro- gramme reg- istrants' out- comes not available

RESULTS TABLE (Continued)

Klesges 1986	134 (all smokers)	PP	6 months	CO<8ppm SCN	17/104 (I) 2/30 (C)	N.S. (not reported)	CO reduction in non- quitters	Higher Fager- strom base- line scores in Competi- tion sites
Klesges 1987	127 (all smokers who completed treatment)	PP	6 months	CO<=10ppm	8/66 (I) 7/61 (C)	N.S. (not reported)	Relapse prevention training Changes in smoking habits among non- quitters	
Koffman 1998	185	7 days abstinence	12 months	CO (level not stated)	37% (MI) 30% (M) 11% (C)	X ² 7.70, p=0.006 (MI vs C) X ² 3.73, p=0.05 (M vs C)		No sig diff between M (30%) and (MI) (37%) @ 12m (X ² =0.853, p=0.356)
Maheu 1990	32 (I) 24 (C)	7 days abstinence	12 months	CO<=10ppm	50% (I) 25% (C)	N.S. X ² 3.61, p=0.25	'Buddy' supportiveness Number of sick days	
Paxton 1980	33 (I) 27 (C)	At least 7 days	6 months	Random urine samples, but none after 4m	~43% (I) ~45% (C)	N.S.	Weight and lung function monitored for 4 months	Quit rates presented as graphic % only
Paxton 1981	33 (D1) 27 (D2) 23 (D3)	At least 7 days	6 months	Random urine samples, but none after 4m	~35% (D1) ~38% (D2) ~42% (D3)	N.S.	Weight and lung function monitored for 4 months	Quit rates presented as graphic % only. Group D1 is the same data as Paxton 1980 Group I
Paxton 1983	60 (2LA) 49 (4LA) 31 (4LT) 19 (4CT)	No smoking since last measured	12 months	Random urine samples, but	26.7% (2LA) 26.5%	N.S.	'thinning' de- posit repay-	

RESULTS TABLE (Continued)

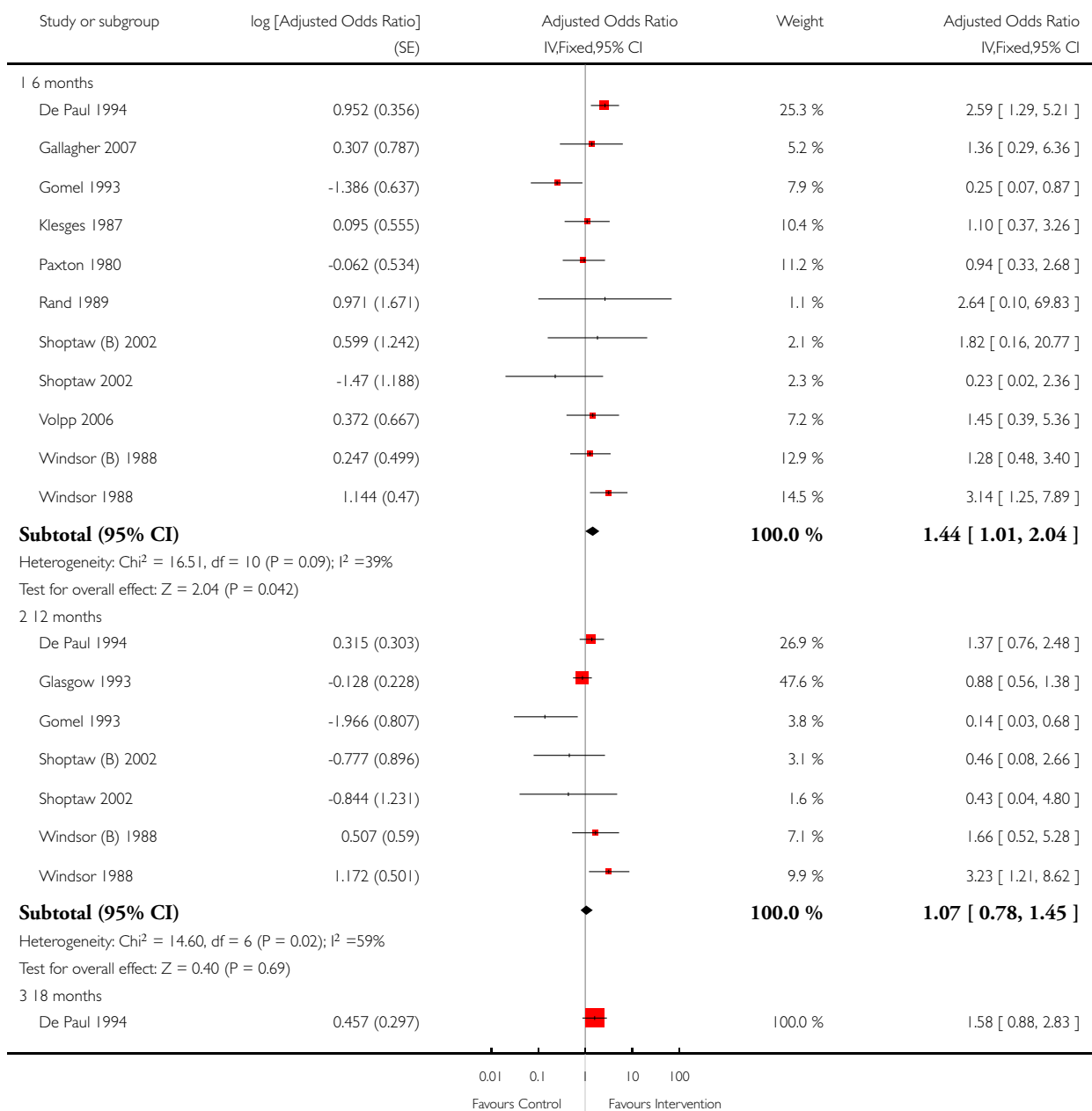
				none after 4m	(4LA) 38.7% (4LT) 36.8% (4CT)		Participation rate Effects of cu- mulative vs lump-sum deposits Effects of	
Rand 1989	17 contingent 16 non-cont 14 control	Continuous	6 months	CO≤11ppm	1/17 contin- gent 1/16 non- cont 0/14 control	N.S.	Numbers of ab- stinent CO samples and missed sam- ples	Pairwise comparisons gave sig diffs @ 11ppm, but not @ 8ppm
Shoptaw 2002	42 (P) 42 (RP) 43 (CM) 47 (CMRP)	PP	12 months	CO≤8ppm Cotinine <30ng/mL	4/36 (P) 2/33 (RP) 2/35 (CM) 1/38 (CMRP)	N.S.	Treatment group and cocaine and opiate abuse	Quit rates supplied by authors. P group re- lapsed more slowly than other groups (p=0.0017)
Volpp 2006	92 (I) 87 (C)	7-day PP	6 months post- comple- tion (-7.5m post-quit date	Urinary co- tinine <500 ng/mL	6/92 (I) 4/87 (C)	N.S.	Enroll- ment, atten- dance, pro- gramme completion	Denomina- tors could be Ns enrolled (I:38, C:17). No quitters outside the enrollers.
Windsor 1988	95 (A) 94 (B) 95 (C) 94 (D)	Continuous	12 months	SCN≤ 100 ng/mL	?6% (A) ?18% (B) ?5% (C) ?10% (D)	Not reported	AC (14.4%) vs BD (5.8%), continuous quit, p<0.001,	Incentives comparison was aban- doned @ 6w

Analysis 2.1. Comparison 2 Smoking cessation, Outcome 1 Smoking cessation (Adjusted).

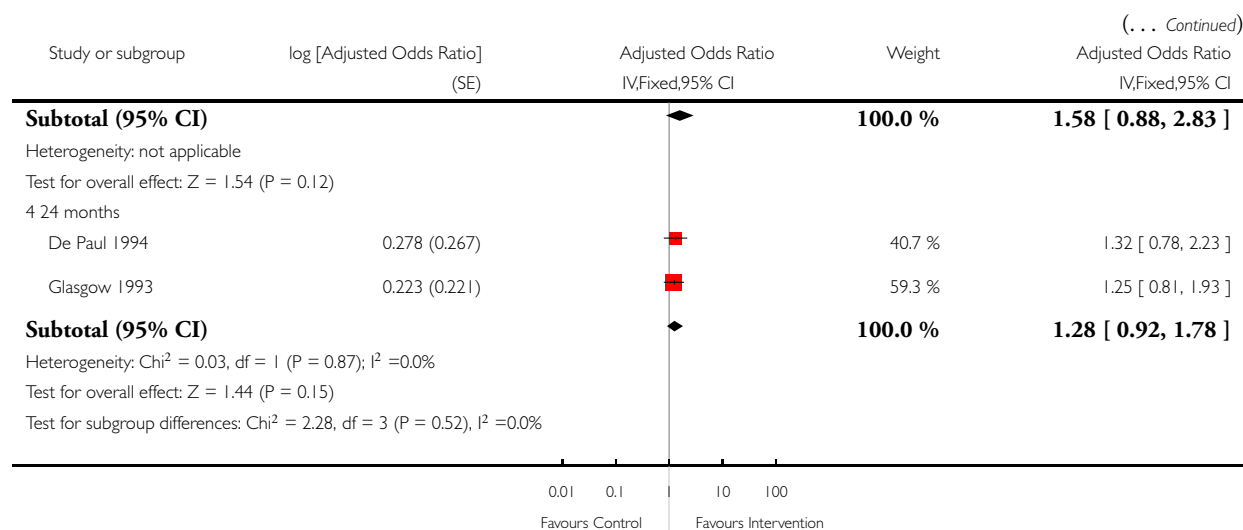
Review: Competitions and incentives for smoking cessation

Comparison: 2 Smoking cessation

Outcome: 1 Smoking cessation (Adjusted)



(Continued . . .)



APPENDICES

Appendix I. Glossary of tobacco-related terms

Term	Definition
Abstinence	A period of being quit, i.e. stopping the use of cigarettes or other tobacco products, May be defined in various ways; see also: point prevalence abstinence; prolonged abstinence; continuous/sustained abstinence
Biochemical verification	Also called 'biochemical validation' or 'biochemical confirmation': A procedure for checking a tobacco user's report that he or she has not smoked or used tobacco. It can be measured by testing levels of nicotine or cotinine or other chemicals in blood, urine, or saliva, or by measuring levels of carbon monoxide in exhaled breath or in blood.
Bupropion	A pharmaceutical drug originally developed as an antidepressant, but now also licensed for smoking cessation; trade names Zyban, Wellbutrin (when prescribed as an antidepressant)
Carbon monoxide (CO)	A colourless, odourless highly poisonous gas found in tobacco smoke and in the lungs of people who have recently smoked, or (in smaller amounts) in people who have been exposed to tobacco smoke. May be used for biochemical verification of abstinence.
Cessation	Also called 'quitting' The goal of treatment to help people achieve abstinence from smoking or other tobacco use, also used to describe the process of changing the behaviour

(Continued)

Continuous abstinence	Also called 'sustained abstinence' A measure of cessation often used in clinical trials involving avoidance of all tobacco use since the quit day until the time the assessment is made. The definition occasionally allows for lapses. This is the most rigorous measure of abstinence
'Cold Turkey'	Quitting abruptly, and/or quitting without behavioural or pharmaceutical support.
Craving	A very intense urge or desire [to smoke]. See: Shiffman et al 'Recommendations for the assessment of tobacco craving and withdrawal in smoking cessation trials' Nicotine & Tobacco Research 2004: 6(4): 599-614
Dopamine	A neurotransmitter in the brain which regulates mood, attention, pleasure, reward, motivation and movement
Efficacy	Also called 'treatment effect' or 'effect size': The difference in outcome between the experimental and control groups
Harm reduction	Strategies to reduce harm caused by continued tobacco/nicotine use, such as reducing the number of cigarettes smoked, or switching to different brands or products, e.g. potentially reduced exposure products (PREPs), smokeless tobacco.
Lapse/slip	Terms sometimes used for a return to tobacco use after a period of abstinence. A lapse or slip might be defined as a puff or two on a cigarette. This may proceed to relapse, or abstinence may be regained. Some definitions of continuous, sustained or prolonged abstinence require complete abstinence, but some allow for a limited number or duration of slips. People who lapse are very likely to relapse, but some treatments may have their effect by helping people recover from a lapse.
nAChR	[neural nicotinic acetylcholine receptors]: Areas in the brain which are thought to respond to nicotine, forming the basis of nicotine addiction by stimulating the overflow of dopamine
Nicotine	An alkaloid derived from tobacco, responsible for the psychoactive and addictive effects of smoking.
Nicotine Replacement Therapy (NRT)	A smoking cessation treatment in which nicotine from tobacco is replaced for a limited period by pharmaceutical nicotine. This reduces the craving and withdrawal experienced during the initial period of abstinence while users are learning to be tobacco-free The nicotine dose can be taken through the skin, using patches, by inhaling a spray, or by mouth using gum or lozenges.
Outcome	Often used to describe the result being measured in trials that is of relevance to the review. For example smoking cessation is the outcome used in reviews of ways to help smokers quit. The exact outcome in terms of the definition of abstinence and the length of time that has elapsed since the quit attempt was made may vary from trial to trial.
Pharmacotherapy	A treatment using pharmaceutical drugs, e.g. NRT, bupropion

(Continued)

Point prevalence abstinence (PPA)	A measure of cessation based on behaviour at a particular point in time, or during a relatively brief specified period, e.g. 24 hours, 7 days. It may include a mixture of recent and long-term quitters. cf. prolonged abstinence, continuous abstinence
Prolonged abstinence	A measure of cessation which typically allows a 'grace period' following the quit date (usually of about two weeks), to allow for slips/lapses during the first few days when the effect of treatment may still be emerging. See: Hughes et al 'Measures of abstinence in clinical trials: issues and recommendations'; Nicotine & Tobacco Research, 2003; 5 (1); 13-25
Relapse	A return to regular smoking after a period of abstinence
Secondhand smoke	Also called passive smoking or environmental tobacco smoke [ETS] A mixture of smoke exhaled by smokers and smoke released from smouldering cigarettes, cigars, pipes, bidis, etc. The smoke mixture contains gases and particulates, including nicotine, carcinogens and toxins.
Self-efficacy	The belief that one will be able to change one's behaviour, e.g. to quit smoking
SPC [Summary of Product Characteristics]	Advice from the manufacturers of a drug, agreed with the relevant licensing authority, to enable health professionals to prescribe and use the treatment safely and effectively.
Tapering	A gradual decrease in dose at the end of treatment, as an alternative to abruptly stopping treatment
Titration	A technique of dosing at low levels at the beginning of treatment, and gradually increasing to full dose over a few days, to allow the body to get used to the drug. It is designed to limit side effects.
Withdrawal	A variety of behavioural, affective, cognitive and physiological symptoms, usually transient, which occur after use of an addictive drug is reduced or stopped. See: Shiffman et al 'Recommendations for the assessment of tobacco craving and withdrawal in smoking cessation trials' Nicotine & Tobacco Research 2004; 6(4): 599-614

WHAT'S NEW

Last assessed as up-to-date: 28 April 2008.

6 August 2008	Amended	Source of support added
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HISTORY

Protocol first published: Issue 2, 2003

Review first published: Issue 2, 2005

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

KC and RP extracted data. KC wrote the review, with comments from RP. RP conducted the statistical analysis and the Forest plots.

DECLARATIONS OF INTEREST

None known.

SOURCES OF SUPPORT

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- National School for Health Research School for Primary Care Research, UK.

External sources

- NHS Research and Development Fund, UK.

INDEX TERMS

Medical Subject Headings (MeSH)

*Motivation; *Reward; Health Promotion [methods]; Randomized Controlled Trials as Topic; Smoking Cessation [methods; *psychology]

MeSH check words

Humans