The implementation of smoking cessation care in general practice

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Training health professionals in smoking cessation care

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ABSTRACT

Background

Cigarette smoking is one of the leading causes of preventable death worldwide. There is good evidence that brief interventions from health professionals can increase smoking cessation attempts. A number of trials have examined whether skills training for health professionals can lead them to have greater success in helping their patients who smoke.

Objectives

To determine the effectiveness of training health care professionals in the delivery of smoking cessation interventions to their patients, and to assess the additional effects of training characteristics such as intervention content, delivery method and intensity.

Search methods

The Cochrane Tobacco Addiction Group's Specialised Register, electronic databases and the bibliographies of identified studies were searched and raw data was requested from study authors where needed. Searches were updated in March 2012.

Selection criteria

Randomized trials in which the intervention was training of health care professionals in smoking cessation. Trials were considered if they reported outcomes for patient smoking at least six months after the intervention. Process outcomes needed to be reported, however trials that reported effects only on process outcomes and not smoking behaviour were excluded.

Data collection and analysis

Information relating to the characteristics of each included study for interventions, participants, outcomes and methods were extracted by two independent reviewers. Studies were combined in a meta-analysis where possible and reported in narrative synthesis in text and table.

Main results

Of seventeen included studies, thirteen found no evidence of an effect for continuous smoking abstinence following the intervention. Meta-analysis of 14 studies for point prevalence of smoking produced a statistically and clinically significant effect in favour of the intervention (OR 1.36, 95% CI 1.20 to 1.55, p=

0.004). Meta-analysis of eight studies that reported continuous abstinence was also statistically significant (OR 1.60, 95% CI 1.26 to 2.03, p= 0.03). Healthcare professionals who had received training were more likely to perform tasks of smoking cessation than untrained controls, including: asking patients to set a quit date (p< 0.0001), make follow-up appointments (p< 0.00001), counseling of smokers (p<0.00001), provision of self-help material (p< 0.0001) and prescription of a quit date (p< 0.00001). No evidence of an effect was observed for the provision of nicotine gum/replacement therapy.

Conclusions

Training health professionals to provide smoking cessation interventions had a measurable effect on the point prevalence of smoking, continuous abstinence and professional performance. The one exception was the provision of nicotine gum or replacement therapy, which did not differ between groups.

INTRODUCTION

Every year approximately 5.4 million people die from tobacco-related diseases, translating to 1 in every 10 deaths among adults worldwide.[1] Approximately 80% of those deaths are from people living in less developed countries and by 2030 this figure will increase to more than 8 million per year if no action is taken.[1] If current trends continue on this trajectory, an estimated 500 million people alive today will be killed by tobacco. In the 27 countries that form the European Union, over 25% of cancer deaths and 15% of all deaths can be attributed to smoking . Smoked tobacco is known to cause up to 90% of all lung cancers and is a significant risk factor for strokes and fatal heart attacks. In addition, tobacco use is linked to the development and treatment of many oral diseases[2;3] including oral cancer, delayed wound healing and peridentitis contributing to loss of teeth and edentulism.[4;5]

Description of the intervention

Health professionals are at the forefront of tobacco epidemics as they consult millions of people and can encourage them to quit smoking.[6] In developed countries, more than 80% of the population will see a primary care physician at least once a year, with doctors perceived to be influential sources of information on smoking cessation.[6-8] It has been reported that most dentists and dental hygienists believe the lack of skills and training is a significant barrier to effectively providing tobacco cessation interventions into routine care.[4;9-11]

Providing training in smoking cessation care is one possible method for increasing the number and quality of delivered interventions by primary care health professionals, and a variety of training methods are available.[12-14] To date, individual studies have shown an effect of training on physician's activities, but there have been doubts about the extent to which this translates into changes in patient behaviour and actual smoking abstinence.[15-17] Training health professionals to deliver smoking cessation messages has been known to increase the frequency with which interventions are offered to patients in the clinical context.[18]

How the intervention might work

Provision of advice and support to smokers by healthcare professionals in primary care settings has been shown to be the most cost-effective preventive service and has a small but significant effect on cessation rates.[19-21] Even though these rates appear low from the perspective of many clinicians, they could translate into a substantial public health benefit if consistently provided, as approximately 70-80% of adults have contact with a health care practitioner, usually in primary care, at least once each year.[6-8;22] It is therefore disappointing that despite ongoing developments in this field worldwide, the number of patients who report receiving advice on smoking cessation from health professionals is still low.[23]

Why it is important to do this review

On a worldwide scale, tobacco use currently costs hundreds of billions of dollars each year.[24] Data on the global impact of tobacco is incomplete, however it is known to be high, with annual tobacco related health care costs being US$81 billion for the USA, US$7 billion for Germany and US$1 billion for Australia.[25]

The first systematic review on this topic was published over a decade ago and showed that training health professionals to provide smoking cessation interventions had a positive effect on professional performance. However, there was no strong evidence that it changed smoking behaviour of patients.[26] Since then, a number of new trials have examined whether specific skills training for health professionals leads them to overcome frequently mentioned barriers and to have greater success in helping their patients to quit smoking.

We therefore systematically identified and reviewed the evidence from new published randomized controlled trials that have studied the effects of training and supporting health care professionals in providing smoking cessation advice. Furthermore, we assessed the effects of training characteristics, such as the content, setting, and intensity.

Objectives

The aim of this review was to assess the effectiveness of training health care professionals to deliver smoking cessation interventions to their patients, and to assess the effects of training characteristics (such as contents, setting, delivery and intensity).

METHODS

Criteria for considering studies for this review

Types of studies

We considered only randomized controlled trials.

Types of participants

We considered trials in which the unit of randomization was a healthcare practitioner or practice, and that reported the effects on patients who were smokers.

Types of interventions

We considered interventions in which healthcare professionals were trained in methods to promote smoking cessation among their patients. To be included in the review studies had to have allocated healthcare professionals to at least two groups (including one which received some form of training) by a formal randomization process. Studies that used historical controls were excluded. We included studies that compared a trained group to an untrained control group, and studies that examined the effectiveness of adding prompts and reminders to training.

Types of outcome measures

The primary outcome measure was abstinence from smoking six months or more after the start of the intervention, assessed as:

- point prevalence (defined as not smoking at a set period (e.g., seven days) prior to the follow-up), and
- continuous abstinence (defined as not smoking for an extended/prolonged period at follow-up)

The strictest available criteria to define abstinence were used. In studies where biochemical validation of cessation was available, only those participants who

met the criteria for biochemically confirmed abstinence were regarded as being abstinent. Those lost to follow-up were regarded as being continuing smokers. Secondary 'patient level' outcome measures included process variables such as the number of smokers who were:

- asked to set a date for stopping (quit date)
- given a follow-up appointment
- counselled
- given self-help materials
- offered nicotine gum/replacement therapy
- prescribed a quit date, and
- cost effectiveness for interventions.

Secondary 'physician level' outcome measures include the number of referrals made (to local smoking cessation services). To be included in the review, studies had to assess changes in the long term smoking behaviour of patients. Studies which only assessed the effect of training on the consultation process were excluded.

Search methods for identification of studies

We identified potentially relevant study reports from the Cochrane Tobacco Addiction Group Specialised Register. This Register includes reports of trials and other evaluations of interventions for smoking cessation and prevention, based on regular highly sensitive searches of multiple electronic databases including MEDLINE, EMBASE, PsycINFO and CENTRAL, and hand searches of conference abstracts. For details of search strategies and dates see the Cochrane Tobacco Addiction Group Module in the Cochrane Library. The most recent search of the Register was in March 2012. Records were identified from the Register as potentially relevant if they included the free text terms 'training' or 'trained' or the MeSH keywords 'Education, Premedical' or 'Education, Professional' or 'Inservice Training' or 'Physician's Practice Patterns' or 'Dentist's Practice Patterns' or 'Delivery of Health Care' or 'Comprehensive Health Care' or 'Critical Pathways' or 'Disease Management' or the EMBASE indexing terms 'clinical education' or 'continuing education provider' or 'continuing education' or 'medical education' as indexing terms. We conducted an additional search of MEDLINE (via OVID, to 2012 Feb week 5) exploding the same MeSH keywords in combination with the terms for smoking cessation and controlled trials used in the regular search of MEDLINE for the Specialised Register. Records included definite and probable reports of randomized trials, and reviews.

Data collection and analysis

Selection of studies

Two reviewers (KC, MV) pre-screened all study reports identified from the Specialised Register (limited to papers published after 1999 for this update). Articles were rejected if the title and/or abstract did not meet the inclusion/exclusion criteria. In instances where the study could not be categorically rejected, the full text was obtained and screened. Reference lists of screened articles were scanned for other potentially relevant articles. Two reviewers then independently assessed the relevant studies for inclusion (KC and MV), with discrepancies resolved by consensus.

Data extraction and management

A combination of two reviewers independently extracted data from published reports (KC, MV, and MB). Disagreements were resolved by referral to a third party. No attempt was made to blind any of these reviewers to either the results of the primary studies or the intervention the subjects received. The data extraction process identified information on the following design characteristics:

- Country and setting of study
- Description of training delivery method, duration, content
- Number of therapists (intervention, control, post randomization dropouts)
- Number of patient participants (intervention, control, losses to follow-up in each condition), method of identification/enrolment
- Number of patients per therapist (range and/or average)
- Description of intervention and control conditions
- Definition of abstinence for smoking cessation outcome(s), duration of follow-up, method of biochemical validation if used
- Secondary outcomes reported

Data was extracted and entered into Review Manager for the following outcome variables, where reported:

- Point prevalence abstinence at longest follow-up (preferred outcome for meta-analysis is continuous or sustained abstinence)
- Continuous or sustained smoking abstinence at longest follow-up
- Cost effectiveness analysis for intervention

We also extracted data on process outcomes where reported. These included patient reported or documented delivery of interventions, such as: setting a quit date, making a follow-up appointment, number of smokers counselled, provision of self-help materials, prescription of nicotine replacement therapy and/or prescription of a quit date.

Assessment of risk of bias in included studies

Two reviewers independently assessed the full text versions of all included papers for risk of bias using the Cochrane Handbook guidelines, using a domain-based evaluation.[27] In addition, extra criteria developed by the Cochrane EPOC Group (2009) were used to address potential sources of bias related to clustering effects. These domains included sequence generation, allocation concealment, blinding for participants, blinding for outcome assessors, incomplete outcome data, selective reporting, imbalance of outcome measures at baseline, comparability of intervention and control group characteristics at baseline, protection against contamination, selective recruitment of participants and any other sources of potential biases. The risk of bias was assessed for each domain as 'high risk', 'low risk', and 'unclear risk' (using the guidelines from Table 8.5.c of the Cochrane Handbook[27]). Two of three reviewers (KC, MV or MB) independently assessed the included studies for risk of bias. Conflicts were resolved by consensus or by referring to a third party if disagreement persisted.

Unit of analysis issues

The trials included in the review used cluster randomization. Outcomes relate to individual patients whilst allocation to the intervention is by provider or practice, and ignoring this may introduce unit of analysis errors. Using statistical methods which assume for example that all patients' chances of quitting are independent ignores the possible similarity between outcomes for patients seen by the same provider. This may underestimate standard errors and give misleadingly narrow confidence intervals, leading to the possibility of a type 1 error. All trials were expected to be cluster randomized studies, with analysis performed at the level of individuals whilst accounting for the clustering in the data. This was performed by using a random effects model for pooled meta-analysis as recommended in the Cochrane Handbook (Chapter 16.3.3)[27] and checked by a statistician (AE). For those studies which did not adjust for clustering the actual sample size was replaced with the effective sample size (ESS), calculated using a rho= 0.02.[28] Trials may use a variety of statistical methods to investigate or compensate for clustering; we have recorded whether studies used these and whether the significance of any effect was altered. In instances where the studies appeared

homogenous via a combination of the statistical I^2 test in addition to homogeneity expressed in the visual inspection of a Funnel plot we meta-analysed using a fixed effect model. However in the presence of significant heterogeneity (as defined below under 'Data Synthesis') the random effects model was used. In the case of multi-arm trials each pair-wise comparison was included separately, but with shared intervention groups divided out approximately evenly among the comparators. However, if the intervention groups were deemed similar enough to be pooled, the groups were combined using appropriate formulas in the Cochrane Handbook.[27]

Dealing with missing data

Missing participant data were evaluated on an available case analysis basis as described in Chapter 16.2.2 of the Cochrane Handbook.[27] Missing standard deviations were addressed by imputing data from the studies within the same meta-analysis or from a different meta-analysis as long as these use the same measurement scale, have the same degree of measurement error and the same time periods (between baseline and final value measurement, as per Chapter 16.1.3.2 of the Cochrane Handbook)[27]. Where statistics essential for analysis were missing (e.g. group means and standard deviations for both groups are not reported) and could not be calculated from other data, we attempted to contact the authors to obtain data. Loss of participants that occurred prior to performance of baseline measurements was assumed to have no effect on the eventual outcome data of the study. Losses after the baseline measurement were taken were assessed and discussed. Studies that had more than 30% attrition (i.e., deaths and withdrawals) were reported in text only and excluded from the meta-analysis. We made an attempt to contact all authors for verification of methodological quality, classification of the intervention(s) and outcomes data. We attempted to contact the second author if we were unsuccessful in contacting the first author.

Assessment of heterogeneity

The review was expected to have some heterogeneity due to factors such as differing characteristics of clinics, practices and medical surgeries, differences in intervention characteristics and varying measurement tools used to assess outcomes. The Chi^2 and I^2 statistic[27] were used to quantify inconsistency across studies. The presence of significant heterogeneity was further explored through subgroup analyses. These were conducted for:

- 'treatment type' (e.g., counseling alone, counseling plus nicotine replacement therapy, counseling plus request for additional appointments, etc.)
- 'treatment intensity' (number of sessions)
- 'treatment intensity' (total exposure)
- 'mode of delivery' (e.g., face-to-face, group sessions or both)
- 'behavioural change techniques' (e.g., prompting, providing feedback, use of behavioural change theories)
- 'type of professional being trained' (e.g., dentist, doctor, health care worker etc.)
- 'length of follow-up' (i.e., >6 to <9 months, >9 to <12 months, >12 to <24 months), and
- 'risk of bias' (i.e., high risk of bias for: < 2 domains, 3 – 5 domains, 6 - 8 domains or > 9 domains).

The likelihood of false positive results among subgroup analyses increase with the number of potential effect modifiers being investigated.[27] As such we have adjusted these analyses using a Holm-Bonferroni method using $\alpha = 0.05$.

Assessment of reporting biases

With the inclusion of more than ten included studies, potential reporting biases were assessed using a funnel plot. Asymmetry in the plot could be attributed to publication bias, but may well be due to true heterogeneity, poor methodological design or artefact. Contour lines corresponding to perceived milestones of statistical significance (p= 0.01, 0.05, 0.1 etc.) were applied to funnel plots, which may help to differentiate between asymmetry due to publication bias from that due to other factors.[27]

Data synthesis

For dichotomous outcomes the fixed effect model with an odds ratio (OR) was calculated with 95% confidence interval (CI), which was synthesised using inverse variance. However for outcomes with greater than 10 included studies a test for heterogeneity was conducted using a combination of two methods. If heterogeneity was found (defined as the I^2 test >60% and visual inspection of the funnel plot indicating no clustering of large or small studies) the random effects model was used in place of the fixed effect model, as suggested by the Cochrane Handbook (Section 9.5.2 and 9.5.3).[27] Reasons for heterogeneity are further explored in the discussion. When studies appeared homogenous, the meta-analysis was redone using the fixed effect model.

For continuous outcomes, a fixed effect model with a weighted mean difference (WMD) or standardised mean difference (SMD) with 95% confidence intervals were calculated as appropriate. However, in the presence of significant heterogeneity (as defined above) the random effects model was used in place of the fixed effect model.

Sensitivity analysis

Sensitivity analysis was conducted on studies with an unclear or high risk of bias for sequence generation and/or allocation concealment.

RESULTS

Description of studies

Table 1 (p. 58) shows the characteristics of included studies.

Results of the search

Of 381 articles screened, 17 studies met all of the inclusion criteria (see Figure 1).

Included studies

Design

All 17 included studies used a randomized controlled trial design with clustering and eleven studies also adopted nesting of participants within practices/hospitals.[4;15;17;29-35] One study incorporated a 2x2 factorial design with randomization to: training plus incentive, training plus medication, training plus incentive and medication or usual care.[12]

Sample sizes

In total 28,531 patients were assessed at baseline (following randomization) with 21,031 remaining in the studies at final follow-up. Authors report a total of 1,434 individual health professionals recruited at baseline (across a known 260 practices) with follow-up available for 1,204. Sample sizes for individual studies were medium to large, with the smallest number of patients (randomized at baseline) found in the Wang 1994 study (n= 93) and the largest in the Kottke 1989 study. The smallest sample at follow-up remained with the Wang 1994 study (n= 82), and the largest remained with the Kottke 1989 study (n= 5266). At the health professional level, the Hymowitz 2007 study had the largest number of residents randomized at baseline (n= 275) and follow-up (n= 235) and likewise, Wang 1994

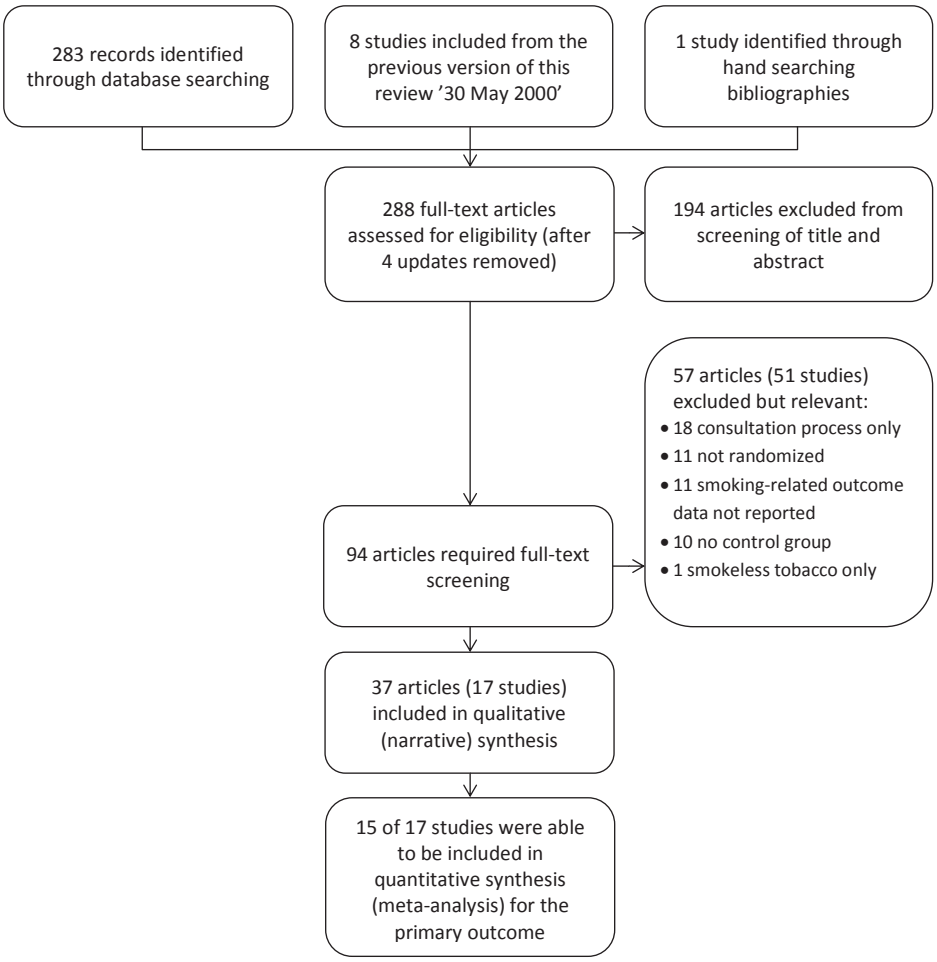

Figure 1. Study flow diagram

had the smallest number of residents at baseline and follow-up (n= 27 for both). Seven studies also reported baseline cluster sizes at the practice level: Lennox 1998 (n= 16); Sinclair 1998 (n= 62); Swartz 2002 (n= 50); Joseph 2004 (n= 20); Hymowitz 2007 (n= 16); Twardella 2007 (n= 82); and Gordon 2010 (n= 14).

Setting

Eleven of the 17 studies were conducted in the USA, one in Canada[34], one in Taiwan[36], one in Scotland[37], one in the United Kingdom[35], one in Switzerland[38] and one in Germany.[12] Two studies were performed in a dentistry setting[4;30], whilst the remaining 15 were conducted within primary care clinics, HMO (Health

Maintenance Organisation) medical centres[15;39], VAMC's (Veterans Affairs Medical Centres)[40] and one in a pharmacy setting.[37]

Participants

At the health professional level, two studies were performed with dentists[4;30], six studies included only primary care physicians[12;15;17;29;33;34], two studies were conducted with residents[31;38], three studies incorporated a combination of primary care physicians and internists[15;32;36], one study used pharmacists[37], whilst the remaining three studies used a combination of health professionals including physicians, nurse practitioners, physician assistants, psychologists, pharmacists and other health visitors.[35;39;40]

The individual patients in 16 of the 17 included studies were those visiting their health professional during the recruitment phase of each study. They were recruited during standard GP, dentist or outpatient visits, emergency department visits or from waiting rooms. The Hymowitz 2007 study was the only one to perform the training in a paediatric setting, targeting the parents/guardians of children visiting 16 primary care clinics.[31]

Interventions

Treatment type

Six studies provided patients with a counseling plus nicotine replacement therapy intervention arm.[12;29;30;34;37;40] The two Cohen et al studies had a second intervention arm of counseling plus a reminder for physicians to ask about smoking (chart prompt), and a third intervention arm combining the counseling, nicotine replacement therapy and chart prompt.[29;30] Another study[12] also had three intervention arms: counseling plus nicotine replacement therapy; counseling plus a monetary incentive to the physician following study completion per successful smoke-free participant (€130); and a counseling plus nicotine replacement therapy plus incentive arm. The Wilson 1988 study had two intervention arms in addition to usual care: counseling and nicotine gum (as mentioned above) and a second arm of nicotine gum plus usual care (i.e., physicians were not trained in counseling).[34] Three studies included multiple intervention methods to curtail smoking including counseling, nicotine replacement therapy, request for additional follow-up appointments and provision of self-help materials[4;15;16], whilst one study combined three of those four (counseling, nicotine replacement therapy, and self-help materials.[38] Five studies used counseling alone[32;33;35;36;39] and two studies used counseling with the addition of self-help materials.[17;31]

Treatment intensity

The level of training intensity for health professionals ranged from one 40-minute session in the Unrod 2007 study, to four or five day long sessions in the Joseph 2004 study. Nine studies had a training session for one day or less: Wilson 1988 (four hours), Cohen (Dent) 1989 (one hour), Cohen (Doc) 1989 (one hour), Kottke 1989 (6 hours), Lennox 1998 (one day), Sinclair 1998 (two hours), Twardella 2007 (two hours), Unrod 2007 (40 minutes) and Gordon 2010 (three hours). Four studies had two separate sessions: Strecher 1991 (two, one hour sessions scheduled two weeks apart), Wang 1994 (two sessions of unknown duration), Cornuz 2002 (two, four hour training sessions scheduled two weeks apart) and Swartz 2002 (two, 20 minute training sessions and another session of unknown duration, where residents were able to practice counseling techniques with standardised patients). Four studies had three or more sessions: Cummings (Priv) 1989 and Cummings 1989 both had three, one hour sessions over a four to five week period, Hymowitz 2007 had four, one hour sessions, four times a year and Joseph 2004 had four to five, day long sessions within six months.

Mode of intervention delivery

Three different modes of intervention delivery were used being groups sessions, one-on-one or a combination of the two. Two studies only used one-on-one sessions[33;40], eleven studies delivered the intervention in a group setting only[4;12;15;17;31;32;34-37;39] with an eighth study using group delivery as the primary mode, however doctors who were unable to attend received a private session in their office.[15] Finally three studies used both modes of intervention delivery[29;30;38], with health professionals in the two Cohen et al studies provided the option of a group or individual session.[29;30]

Theoretical model - behavioural change technique

Nine studies used behavioural change theories to underpin the intervention techniques. These included the 'stages of change' (also known as the transtheoretical) model[12;17;32;35-38] and the '5A' (Ask, Assess, Advise, Assist and Arrange) approach.[4;33] Three studies incorporated prompting or reminders to ask about tobacco use[29-31] and four provided feedback to the health providers, for example number of patients counselled.[33;38-40]

Type of professional being trained

Two studies only focused on dentists[29;30], one focused on pharmacists[37], and the remaining fourteen studies all involved doctors. Five of these fourteen studies included doctors still undergoing training, either residents[31;32;36;38] or a combina-

tion of physicians and internists.[15] Three other studies included training to other health care workers as well as doctors: Lennox 1998 also involved nurses and other health visitors; Swartz 2002 also trained nurse practitioners, physicians assistants and other health professionals; and, in addition to doctors, Joseph 2004 included nurses, psychologists and pharmacists.

Length of follow-up

Eight studies reported follow-up periods between six and nine months post intervention[4;29;30;32;33;35-37], eleven studies presented 12 month follow-up data[4;12;15;17;29;30;34;36;38-40] and two studies assessed extended follow-up periods of 14 months[35] and four years.[31] However, only two-year post intervention data was available for Hymowitz 2007 at the time of writing.

Outcomes

Smoking abstinence was assessed in all included studies through self-report of either continuous abstinence (no smoking for an extended period of time) or point prevalence (for example, no smoking for seven days prior to the time of outcome collection). Of the eight studies that reported continuous abstinence, six also reported a point prevalence measure of abstinence.[4;15;16;34;35;37] Ten of the included studies used biochemical validation through either exhaled carbon monoxide[29;30;32;38], serum cotinine[12;17], saliva cotinine[33;34] or a combination of exhaled carbon monoxide and serum cotinine.[15;16] A number of secondary outcomes measures were reported by some studies including: patients asked to set a quit date; patients asked to make a follow-up appointment; number of smokers counselled; number of smokers receiving self-help material; number of smokers receiving nicotine gum/replacement therapy; and number of smokers prescribed a quit date. Two studies reported n-values as a total across both intervention and control arms[29;30] and six studies reported n-values as percentages, which had to be transformed into whole numbers.[31;33;34;38-40] As such there is likely to be some small variance between actual n-values and those reported in these analyses, but this is not significant. Seven studies had multiple intervention arms, which were considered similar enough to be pooled together, two in the Wilson 1988, Kottke 1989 and Wang 1994 studies and three intervention arms in the Cohen (Dent) 1989, Cohen (Doc) 1989, Strecher 1991 and Twardella 2007 studies. One study did not report the n-value for subjects at randomization, and hence this was calculated based on the number eligible for study and the number at follow-up.[32] The Kottke 1989 study reported all outcome data as continuous variables, as such it was unable to be pooled in the meta-analyses. Smoking related outcomes

in the Hymowitz 2007 study were unable to be pooled as only change scores from baseline were presented.

Excluded studies

Sixty-five studies (71 articles) were excluded for the following reasons: 21 included consultation process only, 18 did not include a control group, 13 failed to measure smoking related outcome data, 12 were considered to be inadequately randomized and one only reported on smokeless tobacco use.

Risk of bias in included studies

Key methodological features are summarised in Figure 2.

Random sequence generation (selection bias)

Five studies reported adequate methods of sequence generation[12;15;31;33;38], two had inadequate methods[17;32] whilst the remaining ten did not provide enough information to assess risk of bias for sequence generation and were hence judged to be at unclear risk in this category. Adequate methods included the use of a random number generator or coin toss, whilst unclear methods were described as being 'random' in design, however methods were not described. The Kottke 1989 study required some physicians to be re-assigned due to inappropriate allocation methods during assignment. For the Strecher 1991 study appropriate randomization did not occur as residents were randomly assigned by clinic half-day session to one of four groups, which risks introducing bias. All 17 trials used cluster randomization, with five studies inadequately accounting for potential clustering effects in the data, requiring manual clustering adjustments.[15-17;34;36] Only two studies[17;31] reported outcome data at the level of randomization. No authors reported that differences in the method of analysis affected the results.

Allocation concealment (selection bias)

Allocation concealment was unclear in all 17 included studies as authors did not describe methods of allocation concealment. Authors of the Lennox 1998 study report that physicians were randomly and blindly allocated to control or intervention groups, however the methods were not described. Another study mentioned that an independent research assistant concealed the result of randomization until two weeks before the intervention, when residents were provided with details about training sessions, however, methods of concealment were again not reported.[38]

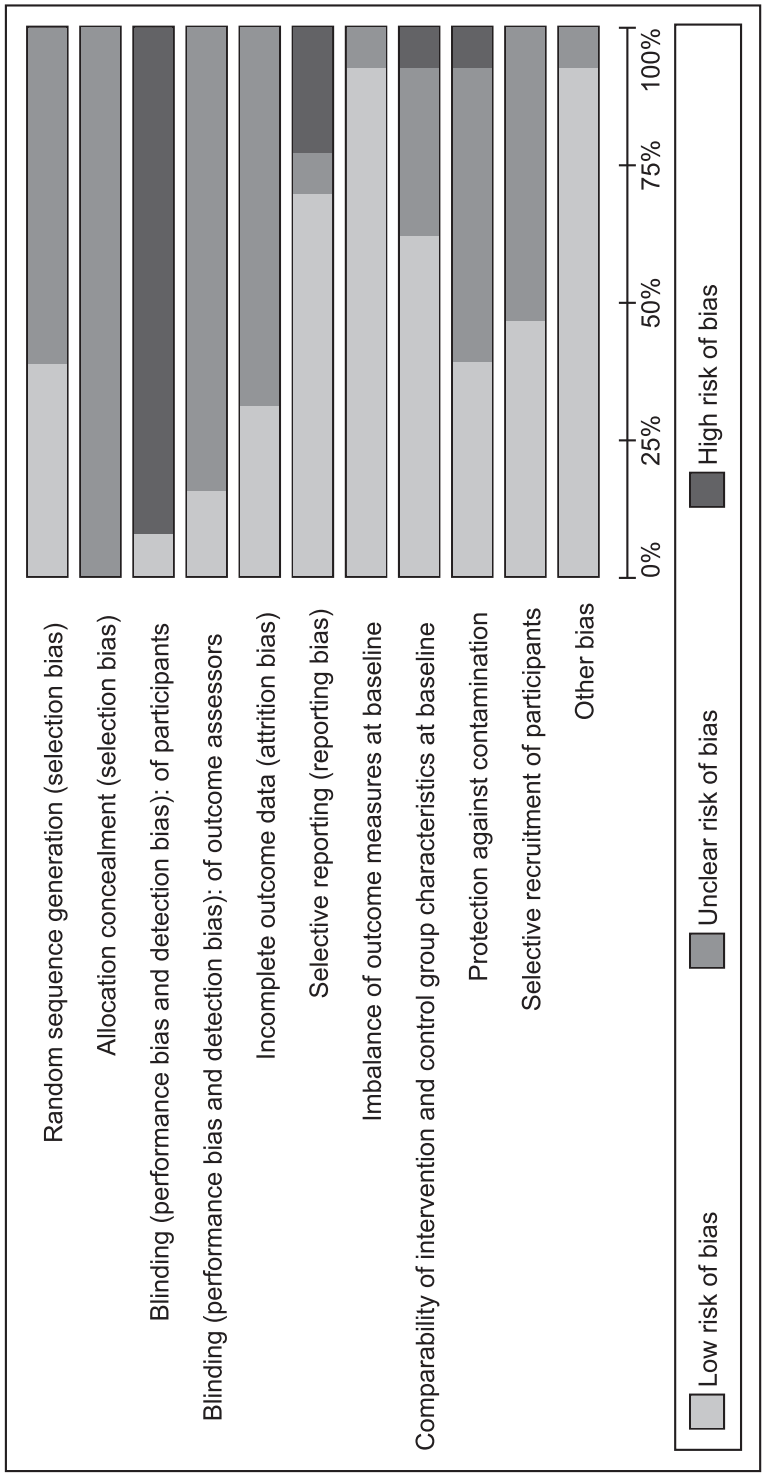

Figure 2. Risk of bias graph: review authors' judgement about each risk of bias presented as percentages across all included studies

Blinding of participants (performance bias and detection bias)

Only one study reported adequately blinding participants to the intervention[38], as residents were not informed about the aim of the trial and were advised only that a survey on cardiovascular risk factors and prevention would be conducted. Authors announced that a training programme in clinical prevention that included sessions on smoking cessation and management of dyslipidemia was being conducted. Authors also report that patients were blinded to the aim of the study and group allocation of their physician. Due to the nature of the intervention, blinding of participants was not possible for the remaining 16 studies. An attempt was made to blind physicians in the Unrod 2007 study, with physicians learning their group assignment only after signing the informed consent, however they were not blinded during the study intervention period and follow-up.

Blinding of outcome assessors (performance bias and detection bias)

Three studies reported methods blinding of outcome assessors that we judged at low risk of bias. Authors of Cummings (Priv) 1989 stated that 'outcome assessors were blinded', authors of the Joseph 2004 study report interviewers collecting patient outcomes were blinded to subject treatment status and authors in the Strecher 1991 study report that telephone interviewers, who were blinded to residents' and patients' group assignments, obtained the patient reports. The remaining 14 studies did not report any attempts to blind outcome assessors and as such are unclear for this category.

Incomplete outcome data (attrition bias)

Incomplete outcome data was adequately addressed in three studies[4;15;16] and unclear in the remaining 14 studies. The Cummings (Priv) 1989 and Cummings 1989 studies reported that missing data was accounted for in analyses, whilst the Gordon 2010 study reported the use of multiple imputation procedures to account for missing data with participants lost to attrition discussed in the text. All unclear studies failed to mention if there was any missing outcome data and if so, how this was addressed when reporting results.

Selective reporting (reporting bias)

Selective reporting was evident in three studies[4;31;33], unclear in three studies[17;32;36] and not detected in the remaining eleven studies. Although all pre-specified outcomes were addressed in the four year follow-up for the Hymowitz 2007 study, the authors mention that outcome data for year one was omitted in order to provide a 'cleaner look' at the progress of the data. In the Unrod 2007 study, smoking abstinence from baseline to follow-up (an outcome that would be expected to

have been assessed in this study) was not reported. The Gordon 2010 authors report that secondary participant outcomes were examined with no significant differences on any variables, and that therefore they were not presented in the publication. Also, receipt of intervention was reported in text as percentages, however no information regarding this outcome was reported for the control.

Imbalance of outcome measures at baseline

One study did not report data for baseline smoking and made no mention of statistical analyses to potentially adjust for any imbalances[36], as such the risk of bias category was assessed as unclear. All remaining studies adequately addressed imbalances of outcome measures at baseline. Thirteen studies accounted for baseline imbalances through analysis of covariance, regression analyses or other analysis techniques, whilst three studies reported outcomes at baseline to be similar across groups and as such did not require adjustment.[16;35;37]

Comparability of intervention and control group characteristics at baseline

Five studies had unclear comparability between intervention and control groups at baseline[12;15;29;30;34] and the remaining twelve studies adequately addressed any differences found between groups via appropriate analysis methods.

Protection against contamination

Two studies reported contamination.[4;32] In Gordon 2010, authors reported contamination due to a tax increase on cigarettes in New York, which resulted in a drop in smoking prevalence from1 8.4% in 2006 to 15.8% in 2008. Authors believed that this tax increase contributed to the unusually high rate of smoking cessation in the usual care patients, thereby affecting the relative impact of the intervention. Authors of the second study, Strecher 1991, mention that "all four groups worked closely with one another at each site", leading to the possibility of contamination, however they also state that "…the effects appeared to be slight." Nine studies had unclear risk of bias for contamination with insufficient information to permit a judgement of yes or no, whilst the remaining six studies reported no potential contamination during the study period.[15-17;34;35;38]

Selective recruitment of participants

Although no studies were identified as having selectively recruited participants, this could not be completely ruled out for eleven studies, which were determined to have an unclear risk of bias for this outcome.[4;12;15;17;29;30;32;34;36;37;39] The sampling frames in these studies were unclear and as such, generalisability is of

a potential concern. The remaining six studies adequately reported recruitment methods and were determined as having a low risk of bias.

Other bias

No other biases were identified for the 17 included studies.

Effects of interventions

Intervention effectiveness was assessed in all seventeen included studies through smoking prevalence, as well as through multiple secondary outcomes. All data were analysed as per the pre-defined methodology outlined in the Methods section. For a summary of intervention effectiveness for each of these outcomes see Table 2.

Overall summary of smoking behaviour

Four out of 13 studies detected significant intervention effectiveness in training health professionals to influence point prevalence of smoking in their patients at primary follow-up.[4;12;29;38] Out of the eight studies reporting continuous abstinence at primary follow-up, only one reported a statistically significant effect in favour of the intervention.[4] Fifteen of the 17 included studies (the exceptions being Kottke 1989 and Hymowitz 2007) could be included in a meta-analysis for the primary outcome of smoking (see Appendix 1: Analysis 1.1a and 1.1b). Using a fixed effect model there was a statistically and clinically significant effect in favour of the intervention for point prevalence abstinence (OR 1.36, 95% CI 1.20 to 1.55, 14 trials, I^2 = 57%) and continuous abstinence (OR 1.60, 95% CI 1.26 to 2.03, 8 trials, I^2 = 59%). Using only the stricter outcome of continuous abstinence for studies reporting both types of cessation, a pooled estimate for all 15 trials gave a similar estimate (OR 1.60, 95% CI 1.35 to 1.89, I^2 = 55%, data not displayed). Since the heterogeneity in this analysis approached the level at which we proposed a random-effects model we did a sensitivity analysis; the point estimates were similar and the wider confidence intervals continued to exclude no effect. The trial contributing most evidently to the heterogeneity, particularly for the continuous outcome, was Lennox 1998 in which the point estimates for both abstinence outcomes favoured the control group. Two studies could not be included in the meta-analyses. In the Kottke 1989 study at one year follow-up almost half of the participants in each group who were smoking at baseline reported quit attempts for at least 24 hours during the previous year, with a mean duration of cessation of two months. No differences between the three groups were identified. For the Hymowitz 2007 study there was an increase in the special training condition of reported quitting during the past year of 3.8% (an

Table 2. Summary of findings for the main comparisons

Outcomes	Illustrative comparative risks* (95% CI)		Relative effect (95% CI)	No of Participants (studies)	Quality of the evidence (GRADE)**
	Assumed risk	Corresponding risk			
	Control	Training health professionals			
Point prevalence of smoking cessation self-report and some biologically validated Follow-up: 6 to 14 months	78 per 1000	107 per 1000 (88 to 131)	OR 1.41 (1.13 to 1.77)	13459 (14 studies)	⊕⊕⊕⊖ **moderate**[1,2]
Continuous smoking abstinence self-report and some biologically validated Follow-up: 6 to 14 months	27 per 1000	42 per 1000 (28 to 62)	OR 1.59 (1.05 to 2.42)	9443 (8 studies)	⊕⊕⊕⊖ **moderate**[1,2]
Number of smokers counselled self-report Follow-up: 6 to 48 months	465 per 1000	664 per 1000 (578 to 739)	OR 2.28 (1.58 to 3.27)	8531 (14 studies)	⊕⊕⊖⊖ **low**[1,3]
Patients asked to make a follow-up appointment self-report Follow-up: 6 to 12 months	166 per 1000	400 per 1000 (233 to 593)	OR 3.34 (1.52 to 7.30)	3114 (7 studies)	⊕⊖⊖⊖ **very low**[1,2,3]
Number of smokers receiving self-help material self-report Follow-up: 6 to 48 months	134 per 1000	351 per 1000 (227 to 500)	OR 3.51 (1.90 to 6.47)	4925 (9 studies)	⊕⊖⊖⊖ **very low**[1,2,3]
Number of smokers receiving nicotine gum/replacement therapy self-report Follow-up: 12 to 48 months	312 per 1000	416 per 1000 (283 to 563)	OR 1.57 (0.87 to 2.84)	5073 (9 studies)	⊕⊕⊖⊖ **low**[1,3]

*The basis for the **assumed risk** (e.g. the median control group risk across studies) is provided in footnotes. The **corresponding risk** (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

High quality: Further research is very unlikely to change our confidence in the estimate of effect

Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate

Low quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate

Very low quality: We are very uncertain about the estimate

[1] Unclear methods of sequence generation and allocation concealment in the majority of studies and all studies had inadequate blinding of participants

[2] Wide confidence intervals around the estimate of effect

[3] Significantly large amounts of heterogeneity were observed (I-squared >90%)

8.5% increase over baseline levels), however the change from baseline failed to achieve statistical significance. Among parents associated with standard training, the change was only 0.8%.

As per pre-specified methodology, a funnel plot examined the primary outcome of smoking cessation using contour lines to assess the presence of reporting biases. No publication biases were identified (Figure 3).

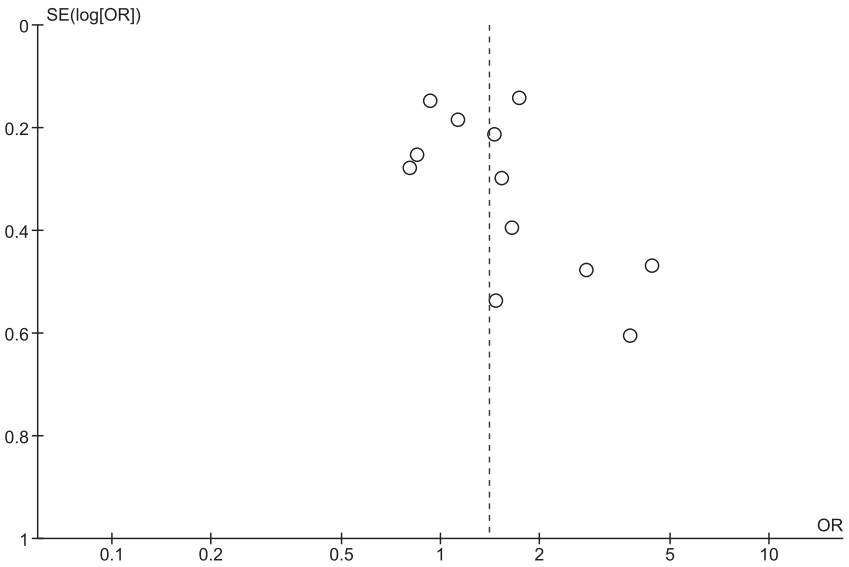

Figure 3. Funnel plot of comparison: the effect of training health professionals on patient smoking cessation (outcome: point prevalence of smoking cessation)

Overall summary of secondary outcomes

Asked to set a quit date for stopping (quit date)

Nine studies reported the effect of training health professionals on the number of patients being asked to set a quit date, eight of which could be included in the meta-analysis producing a significant result (random effects OR 4.98, 95% CI 2.29 to 10.86; see Appendix 1: Analysis 1.2). Only three of the seven studies crossed the line of no effect[32;38;39] but there was a very high level of heterogeneity (I^2 = 90%) suggesting that not all interventions had the same impact on this outcome. Subgroup analyses suggest that some of the heterogeneity might be due to whether or not the patient intervention included an offer of NRT. The two studies that reported this outcome and did not include NRT showed no difference between groups.[32;39] The other studies showed more consistent evidence that

intervention increased numbers although the size of effect remained variable. Contrary to what might have been expected, the studies where training took only a single session[29;30;34] had higher effect sizes compared to the five studies using multiple sessions. Duration of training was similar for the three sub-groups being examined as was intervention delivery via one-on-one compared to group sessions. There was a large amount of variability between the use of prompting and provision of feedback, however this difference was not significant. Intervention delivery by a doctor (six studies) or dentist (one study) produced a larger effect size compared to delivery by a healthcare worker[39], which may also explain some of the heterogeneity. When comparing follow-up periods, studies reporting between six and nine months[29;30;32] and between nine and 12 months (seven studies) produced similar effect sizes and large amounts of variability. Studies judged to be at lower risk of bias were more likely to show evidence of an effect (seven studies) compared to studies with between three and five categories rated at high risk of bias[32], however the between group analysis did not suggest that this was a source of heterogeneity.

Given a follow-up appointment

There was a significant increase in the intervention arm for patients being asked to make a follow-up appointment, as reported in seven studies available for meta-analysis (random effects OR 3.34, 95% CI 1.51 to 7.37; see Appendix 1: Analysis 1.3), although significant heterogeneity was observed (I^2 =92%). When comparing interventions using NRT with those that used counseling alone, an I^2 of 96% was observed, meaning any results from a pooled analysis would be too unreliable. As such only a visual analysis of odds ratios and confidence intervals are presented, showing similar variability between sub-groups. Subgroup analyses for treatment intensity suggest that some of the heterogeneity might be due to whether or not the training sessions were single or multiple. Two studies that employed single sessions[33;34] were more likely to show an effect (although variability was observed), compared to five studies using multiple sessions, which produced a smaller effect estimate with less variability. When comparing the duration of the training, significant heterogeneity was once again observed between groups, with studies presenting large amounts of variability, resulting in a pooled estimate being unreliable for comparison. There was little difference between delivery by one-on-one compared to group sessions, and due to significant heterogeneity (I^2=96%) the pooled comparison of prompting and provision of feedback was not possible, although a visual display shows variability is mostly due to the Unrod 2007 study. Similar to other outcomes, delivery of the intervention by a doctor (assessed in seven studies) meant that more

patients were likely to have a follow-up appointment compared to intervention delivery by a healthcare worker (one study), however the Swartz 2002 study was present in both sub-groups as the intervention included delivery by both a doctor and healthcare worker, as such a statistical between group comparison was not performed. Reporting of results at different follow-up periods were similar between sub-groups, although the five studies with follow-up between nine and 12 months had similar distributions with the exception of the Wilson 1988 study, which significantly favoured the intervention and had wide confidence intervals. No between group differences were observed for quality of the studies.

Counselled

Fourteen of the fifteen studies reporting on the number of smokers counselled were meta-analysed. Overall, a statistically and clinically significant effect in favour of the intervention was observed (OR 2.28, 95% CI 1.58 to 3.27, $p< 0.00001$; see Appendix 1: Analysis 1.4), assessed using the random effects model due to significant heterogeneity ($I^2= 93\%$). An investigation into the causes of heterogeneity found no differences between counseling with and without nicotine replacement therapy, however implementation via multiple sessions or single sessions did produce between group differences, with a larger effect size for single session delivery. Duration of intervention delivery also produced significant differences with total exposure of between 40 minutes and two hours producing a larger effect size compared to durations of between two and four hours and greater than four hours. Mode of intervention delivery (one-on-one compared to group sessions) produced very similar effect sizes, as did the provision of feedback and prompting to aid intervention delivery by the health professional. The type of health professional being trained may contribute to the heterogeneity with the one study evaluating dentists[30] producing a larger effect size compared to those with doctors and other health professionals which showed a more conservative effect with narrow confidence intervals. When examining follow-up periods, there was a slightly larger effect and more variability in the studies reporting results between six and nine months compared to results between nine and twelve months and 12 and 24 months. No sub-group differences were observed when analysing studies based on risks of bias.

Given self-help materials

The number of smokers receiving self-help material increased significantly in favour of the intervention for the nine studies able to be included in the meta-analysis (OR 3.52, 95% CI 1.90 to 6.52, $p< 0.0001$; see Appendix 1: Analysis 1.5). Provision of cessation materials in the Hymowitz 2007 study, which could not

be included in the meta-analysis, did increase significantly across both groups over the four year study period when compared to baseline values (intervention 28.8%, control 17.6%) however, this interaction was not statistically different between groups. The other study unable to be meta-analysed[17] also produced a statistically significant effect ($p< 0.001$). Significant heterogeneity was observed in the meta-analysis ($I^2= 91\%$) which was explored through subgroup analyses. The type of treatment did not show a significant difference between groups, although the counseling plus nicotine replacement therapy group did have a larger effect size compared to counseling alone. Likewise, no differences were observed for single compared to multiple session delivery or duration of delivery, although the Cornuz 2002 study with a total exposure over four hours did produce a very large effect with wide confidence intervals. No differences were observed for the mode of intervention delivery or provision of prompting or feedback to aid health professionals in the provision of self-help materials. The one study[39] which included healthcare workers for intervention delivery produced less of an effect compared to the pooled result of studies using doctors. No difference between sub-groups was observed for length of follow-up although studies identified as having less risk of bias did have a larger effect size compared to those with larger amounts of bias.

Offered nicotine gum/replacement therapy

Nine studies were pooled to assess the number of smokers receiving nicotine gum/replacement therapy. The meta-analysis did not produce evidence of an effect (OR 1.57, 95% CI 0.87 to 2.84, p= NS; see Appendix 1: Analysis 1.6), but significant heterogeneity was detected ($I^2=91\%$). The Hymowitz 2007 study also assessed this outcome with few parents in either condition reporting that residents prescribed nicotine replacement therapy (intervention 7.6%, control 5.9%). An exploration into the possible sources of heterogeneity found no difference between interventions containing counseling with or without nicotine replacement therapy, however surprising results were observed with much larger effect sizes for single session intervention delivery compared to multiple session, which could account for some of the heterogeneity. No differences were observed between sub-groups for treatment intensity, mode of intervention delivery, use of feedback or prompting, type of professional being trained or length of follow-up. However studies with less risk of bias did produce larger effect sizes compared to studies with three to five sources of bias identified, which could also contribute to some of the observed heterogeneity.

Prescribed a quit date

Only three studies reported on smokers being prescribed a quit date.[16;32;34] Pooling these together produced a statistically and clinically significant effect in favour of the intervention (OR 14.18, 95% CI 6.57 to 30.61, p< 0.00001; see Appendix 1: Analysis 1.7) with minimal observed heterogeneity. As such, sub-group analyses were not necessary for this outcome.

Cost effectiveness of interventions

Cost effectiveness data was presented in one study[38], with the incremental cost of the intervention reported to amount to (U.S.) $2.58 per consultation by a smoker. When considering 'cost per life-year saved', this translated to (U.S.) $25.40 for men and $35.20 for women, with one-way sensitivity analyses yielding a range of $4.00 to $107.10 in men and $9.70 to $148.60 in women. The Joseph 2004 study reported that the dollar spent per 1000 primary care patients did increase in the intervention sites and decrease in control sites, however this was not significant. Number of referrals made. No studies reported on the number of referrals made to local smoking cessation services.

Statistical analyses and cluster adjustments

All 17 studies used a cluster randomized design for practical reasons, with the unit of randomization being the health care practitioner or practice. However, in 15 of the 17 studies patients were the unit of analysis. Hymowitz 2007 and Kottke 1989 were the exceptions, reporting outcomes at the level of randomization (the doctor/resident). The majority of studies that reported outcomes at the level of patient accounted for potential clustering effects within their reported results, with four studies (three in the late 1980's[15;16;34] and one in the mid-1990's[36]) being the exceptions. The two Cummings et al studies did perform clustering analyses, however they were not included in the published results as they were seen to have had no effect on the final outcome. As such, the data for these studies were manually adjusted for potential clustering effects as per the pre-specified methodology outlined in the unit of analysis issues section of this review.

Sub-group analyses

Multiple sub-group analyses have been considered as per the predefined methodology to further explore heterogeneity. When considering these outcomes the level of statistical significance should be considered at p<0.01, to account for potential false positive results (as per the Bonferroni adjustment described Assessment of heterogeneity), which increase with the number of potential effect modifiers being investigated. Total study confidence intervals were as-

sessed at the 99% level for all sub-group analyses. Significant heterogeneity was determined through a combination of the I^2 statistic (I^2 >60%), Chi^2 statistic and visual inspection of the Forest plots, and was present for all outcomes with the exception of 'Smoking cessation at longest follow-up' and 'Number of smokers prescribed a quit date' where significant heterogeneity was not identified. In the presence of heterogeneity based on the I^2 statistic of > 96%, the pooled estimate has been removed, as the outcomes are considered too different to be combined in meta-analysis. Likewise, when a comparison contained the same study in different sub-groups, the pooled estimate was not used.

DISCUSSION

Summary of main results

Seventeen completed studies (total 28,531 subjects) assessed the benefits of interventions to train health professionals to provide smoking cessation initiatives to their patients. Whilst some methodological variations occurred between studies in relation to intervention, delivery mode, type of health professional and duration, they were all aimed at training health professionals to help their patients stop smoking. The primary outcome of smoking cessation was presented in pooled meta-analyses as point prevalence (14 studies) and continuous abstinence (eight studies). A statistically and clinically significant effect in favour of the intervention was observed for both of these outcomes at final follow-up (see Table 2 for a summary of findings for the main comparison). All secondary outcomes (with one exception) produced a statistically and clinically significant effect in favour of the intervention at final follow-up. These outcomes include asking patients to set a quit date, asking patients to make follow-up appointments, counseling of smokers, provision of self-help material and prescription of a quit date. No evidence of an effect was observed for the secondary outcome of providing patients with nicotine gum/replacement therapy. No studies were able to be meta-analysed to assess the cost effectiveness of interventions.

Overall completeness and applicability of evidence

In the context of current practice, this review should be used to provide readers with an outline of what interventions have a proven effect, and where resources need to be directed for future investigations. Studies which incorporated multiple intervention components such as provision of nicotine replacement therapy, requests for follow-up appointments and provision of self-help material were more likely to be successful than those with interventions of counseling alone.

Surprisingly, health professionals who were trained using only a single session and in a group setting were just as likely if not more likely to have patients quit smoking as those being trained with multiple delivery sessions and one-on-one training (i.e., face to face with the trainer). Similarly, the duration of training for the health professional of between 40 minutes to two hours was just as effective, and in some cases more so, than a duration of greater than two hours. Studies with multiple follow-up periods and closer monitoring of outcomes by investigators (including the provision of feedback) were more successful than those of lesser intensity. Smoking cessation interventions delivered by a doctor or dentist were more likely to produce successful quit attempts than those delivered by other health care workers. To ensure methodological rigour, future studies should aim to incorporate the following into the study design:

- Report patient level outcomes (e.g., smoking cessation) as well as health professional outcomes (e.g., physician report of number of smokers counselled) rather than providing details only relating to the consultation process
- Adequate methods of randomization and allocation concealment
- Report smoking related outcome data both pre and post intervention
- Incorporate a control group which adequately matches the demographic characteristics of the intervention population.

Quality of the evidence

Study quality was a potential issue in this review with many of the studies being of unclear methodological design. It is extremely difficult to blind participants in relation to what intervention they will be receiving, as there are two levels to consider: the health professional and the patient. All 17 included studies had unclear allocation concealment whilst only five studies adequately reported methods of random sequence generation, two had a high risk of bias with the remaining ten studies being unclear. Overall, the body of evidence identified permits a moderately robust conclusion regarding the objectives of this review, with 17 included studies (28,531 participants). Evidence presented in the summary of findings table (Table 2) was downgraded to take into account:

- limitations in design: methods of randomization, allocation concealment and/or blinding were not described or inadequate for the majority of studies assessing the particular outcome (-1)
- Inconsistencies: significant heterogeneity (-1)
- Imprecision: only few participants in few studies available to assess the outcome (-1)

Potential biases in the review process

A potential bias in the review process is exclusion of studies examining interventions that train health professionals in smoking cessation that are of questionable methodological design. This review does sacrifice inclusion of some relevant information, however the trade-off is a meta-analysis of higher quality evidence on which future investigations can be based. Some of the pertinent information from these studies is discussed below under agreements and disagreements with other studies or reviews though results should be interpreted with caution. Another limitation to the review is the under-reporting of the intervention for included studies. This means that some studies may have indeed included additional intervention components that, had we known they existed, would have led us to classify the study differently within the sub-groups. One key strength of the review process to address potential biases is the use of two experienced and independent review authors who assessed the studies for risk of bias, although this can do little to account for biases which occur in the methodological designs of the included studies.

Agreements and disagreements with other studies or reviews

A compilation of systematic reviews and surveys of key informants were published as a special edition in the journal 'Drug and Alcohol Review' in 2009, relating to the education and training of health professionals and students in tobacco, alcohol and other drugs.[41] The first published survey of 21 key informants from eight countries found a high level of consistency in the content of the smoking cessation interventions, with 72% of programmes using the 5 A's (Ask, Assess, Advise, Assist, Arange) model, 64% using the stages of change (trans-theoretical) model, 84% including pharmacotherapies, with 84% having some reference to clinical practice guidelines.[6] Only five of the seventeen included studies in our review had reference to any particular behavioural change technique, however it is quite likely that the majority of studies are based around some kind of theoretical behavioural change context, which is not reported in the publication. These results are similar to those reported elsewhere.[41] The authors identified a lack of interest (with other continuing education topics considered to be a higher priority) and lack of funding for interventions to be the major barriers for the uptake and sustainability of training programmes.[6] Some possible solutions were provided to address these barriers including raising awareness of the importance of smoking cessation for the health of patients and incorporating education on smoking cessation into vocational courses for specialties. Another systematic review of postgraduate smoking cessation training for physicians in 28 European countries found nine studies which met all of the inclusion criteria containing a

total of 170 postgraduate training programmes.[42] The key implications reported by the authors were that postgraduate training in smoking cessation may not be reaching physicians and was not rigorously evaluated. To combat this problem multiple authors suggest that future research needs to incorporate methods of disseminating effective educational activities with the intention of increasing participation.[42;43] It is also imperative that health professional organisations advocate for the systematic implementation of comprehensive tobacco cessation training programmes to increase the number of patients receiving tobacco cessation interventions.[44] Another study using direct observation of physician-patient encounters found similar results and concluded that strategies are needed to assist physicians to incorporate systematic approaches that will standardise smoking cessation care.[45] In this investigation, discussions around tobacco were more common in practices that utilised standard forms for recording smoking status and during new patient visits. Interestingly, the authors also found that discussions around tobacco use occurred less often among physicians in practice for more than 10 years and with older patients[45], which is similar to an observational study by Bertakis et al. investigating the factors associated with physician discussion of tobacco use with patients.[46] Considerable resistance was also observed in a cohort of physicians receiving academic detailing to promote tobacco-use cessation counseling in dental offices. Dental staff members (including receptionists, office managers, dental assistants and dental hygienists) were reluctant to participate in the interventions due to increased paperwork, having to deal with uncooperative patients, and the perception that only a few patients use tobacco anyway and that counseling does not work.[38;47] However, the resistance observed did decrease as follow-up visits progressed and staff became more comfortable with the intervention and the procedures involved. This evidence suggests that through the provision of first-hand experience prior to guiding patients through the same process, physicians may feel more comfortable in implementing smoking cessation interventions into standard practice, which has the potential to be highly cost-effective. One of the included studies by Cornuz et al. reported that training residents in smoking cessation counseling is very cost-effective and may be more efficient than the majority of currently accepted tobacco control interventions.[38] This has also been supported by more recent systematic reviews and investigations.[19-21] As such, the provision of counseling, advice and/or offers of assistance to the patient has the potential to significantly increase the number of quit attempts, which subsequently has the potential to reduce health related costs as well as morbidity and mortality associated with ongoing chronic tobacco use. The previous version of this Cochrane review included eight studies with six finding no effect of intervention.

The authors also stated that effects of training on process outcomes increased if prompts and reminders were used, however they concluded that there was no strong evidence that training health professionals to provide smoking cessation interventions changed smoking behaviour. With the addition of nine studies (more than half the initial number of inclusions), the findings of this review have now changed to support the training health professionals in smoking cessation interventions.

CONCLUSIONS

Implications for practice

Overall, a moderately large amount of methodologically rigorous evidence has been presented to support the effectiveness of training health professionals in smoking cessation. The following programme characteristics could be considered for individuals involved in future clinical practice initiatives:

- Combination of multiple intervention components including the provision of counseling, offer of follow-up appointments, setting or being prescribed a quit date and provision of self-help material
- A one-off group training session for health professionals of between one to two hours duration, providing there is adequate follow-up and monitoring of progress. This will need to include provision of follow-up feedback to health professionals and resources such as patient self-help materials, with consideration given to other intervention components as mentioned above.
- Consider organisational factors to ensure that smoking cessation messages are reliably delivered. Training can be expensive, and simply providing programmes for health care professionals, without addressing the constraints imposed by the conditions in which they practise, is unlikely to be a wise use of health care resources.

Implications for research

Multi-component investigations incorporating new pharmacological interventions for smoking cessation (such as varenicline tartrate and bupropion) or other cessation aids (such as electronic cigarettes) alongside physician training should be considered to determine if any additional benefit in long-term abstinence can be obtained. Future research needs to ensure that adequate methodological rigour is met with considerations relating to:

- Sequence generation and allocation concealment
- Demographics and comparability of the control comparison
- Reporting of smoking related outcome data
- Collection of data both pre and post intervention implementation.

So as to enable interventions to be replicated in clinical practice, it is also important that authors of future trial reports describe the content of the training in sufficient detail, for example detailing the educational methods, strategies and theories used to train the professionals.

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Table 1. Characteristics of included studies

Cohen (Dent) 1989	
Methods	*Country:* United States of America, Indianapolis area *Design:* Randomized controlled trial; Nested; Clustered *Objective:* To improve the effectiveness of dentists helping their patients quit smoking *Methods of analysis:* A generalized linear model was used to analyse the results of the quit-smoking rates and a scale-factor was used to reflect the expected extra variance in quit rates caused by between-dentist variability; Chi-squared statistic based on changes in the deviance function for a series of nested models was used to test for main effect and interactions; Two-way analyses of variance were calculated on the weighted data for the amount of time spent in counselling patients about their smoking *Clustering adjustment made:* Yes - Generalised linear model allowed a scale-factor to reflect the extra variance expected to be inflated due to variability between dentists *Significance of cluster adjustment:* Not reported
Participants	*Therapist description:* Dentists *Eligible for study:* n= 54 *Randomized:* n= 50 *Completed:* Gum n= 9, reminder n= 10, gum & reminder n= 12, control n= 13 (total n= 44) *Age:* Not reported *Gender:* Not reported *Patient description:* n= 1027 patients from American private dental practices *Eligible for study:* n= 1027 *Randomized:* n= 1027 *Completed:* n= 647 *Age:* Mean = 37.1 (SD ± 10.4) (total population only) *Gender:* Males= 43.2% males (total population only)
Interventions	*Setting:* American private dental practices *Training of those delivering the intervention to the health professional:* Not reported *Intervention description:* Three intervention groups: Training & nicotine gum, training & reminder (chart prompt), combined training with prompt & nicotine gum *Control description:* Training alone (advice, quit date, follow up check); Dentists provided a booklet containing the four-step care protocol and were encouraged to counsel their patients who were smokers *Duration of intervention:* One hour *Intervention delivered by:* General dentist *Intensity:* One lecture
Outcomes	*Pre-specified outcome data:* Point prevalence of cessation at 12 months; Number advised to quit; Number asked about setting a quit date *Follow-up period:* Twelve months total: 6 months (defined as the smoking status determined at any visit that occurred at least 3 months after the initial appointment but not more than 9 months); 12 months (defined as the smoking status determined at any visit that occurred at least 9 months and 1 day and up to 15 months after the initial visit)
Notes	*Process measures:* Outcomes reported in Cohen 1987; Patients not having a visit during the 6 or 12 month periods were assumed to be smokers *Validation:* Expired carbon monoxide The three intervention groups were combined for meta-analyses to produce the single 'Intervention' sample

Cohen (Doc) 1989	
Methods	*Country:* United States of America *Design:* Randomized controlled trial; Nested; Clustered *Objective:* Evaluation of a RCT of interventions designed to improve effectiveness of physicians and dentists in helping their patients quit smoking *Methods of analysis:* Analysis of variance performed on percentages; Stepwise multiple regression analyses performed using the weighted number of minutes as the criterion to determine the extent to which the amount of counselling time was a function of the health professionals' initial attitudes and habits; Chi-squared analysis used to test main effects and interactions; Generalised linear interactive modelling (GLIM) software used *Clustering adjustment made:* Yes - Generalised linear model allowed a scale-factor to reflect the extra variance expected to be inflated due to variability between physicians *Significance of cluster adjustment:* Not reported
Participants	*Therapist description:* n= 112 primary care physicians (including n= 97 physicians in training) *Eligible for study:* Not reported *Randomized:* Total= 97 internal medicine residents and 15 faculty general internists *Completed:* Total= 97 internal medicine residents and 15 faculty general internists *Age:* Not reported *Gender:* Not reported *Patient description:* n= 1420 patients receiving primary care, not selected by motivation to quit *Eligible for study:* Participation refusal rate was 9.7% of all eligible patients contacted *Randomized:* n= 1420 *Completed:* n= 1091 medical patients *Age:* 18 to 64 years; Mean = 46.2 + 11.6 years *Gender:* Male= 37%; Female= 63%
Interventions	*Setting:* General medicine (primary care) clinic of a city-county teaching hospital in the USA *Training of those delivering the intervention to the health professional:* Registered internist *Intervention description:* Three intervention groups: Training & nicotine gum, training & reminder (chart prompt), combined training with prompt & nicotine gum *Control description:* Training alone (advice, quit date, follow up check); Physicians provided a booklet containing the four-step care protocol and were encouraged to counsel their patients who were smokers *Duration of intervention:* One-hour lecture or personalised instruction *Intervention delivered by:* David M Smith, registered internist *Intensity:* One, one hour lecture maximum
Outcomes	*Pre-specified outcome data:* Point prevalence of abstinence at 12 months; Patients who did not have an appointment in the period regarded as smokers; Rates also reported giving returnees as denominator; Number advised to quit; Number asked about setting a quit date; Had their doctor talked to them about smoking *Follow-up period:* Six and 12 months (12 months defined as patients visited 9 and 15 months after the initial visit)
Notes	*Process measures:* Outcomes reported in Cohen 1987; Patients not having a visit during the 6 or 12 month periods were assumed to be smokers *Validation:* Expired carbon monoxide The three intervention groups were combined for meta-analyses to produce the single 'Intervention' sample

Cornuz 2002	
Methods	*Country:* Geneva and Lausanne, Switzerland, Europe *Design:* Randomized controlled trial; Clustered *Objective:* To assess the efficacy of an educational program based on behavioural theory, active learning methods, and practice with standardized patients in helping patients abstain from smoking and changing physicians' counselling practices *Methods of analysis:* To compare baseline characteristics of patients and physicians' practices between groups, the authors used the chi-quare or Fisher exact tests for categorical data and the t-test or Wilcoxon rank-sum test for continuous data; To test the effectiveness of the training on the outcomes, the authors performed a logistic regression with generalized estimating equation to stratify by clinic and adjust for clustering on residents; Intention-to-treat analysis was performed for abstinence from smoking, in which smokers lost at follow-up were considered to be continuing smokers; Because smoking abstinence was validated in a sub sample of the study participants, the authors used simulation to perform sensitivity analysis of the likelihood of smoking cessation *Clustering adjustment made:* Yes - to test the effectiveness of the training on the outcomes, the authors performed a logistic regression with generalized estimating equation to stratify by clinic and adjust for clustering on residents *Significance of cluster adjustment:* Not reported
Participants	*Therapist description*: Resident physicians; All residents were at the end of postgraduate training in general internal medicine or family medicine *Eligible for study:* n= 35 *Randomized:* Intervention n= 17; Control n= 18 *Completed:* Intervention n= 17; Control n= 18 *Age:* Median 31 years *Gender:* 18 females and 17 males *Patient description:* Patients aged 16 to 75 years who consulted one of the outpatient clinics for a follow-up or an emergency visit *Eligible for study:* n= 1456 *Randomized:* Intervention n= 115; Control n= 136 *Completed:* Intervention n= 77; Control n= 100 *Age:* Range 16 to 75 years; Mean + SD: Intervention 35.1 + 14 years; Control 36.9 + 15 years *Gender:* Intervention = 63% male; Control= 57% male

Interventions	*Setting:* Two general internal medicine clinics of the university hospitals of Lausanne and Geneva, Switzerland; Both sites are public service clinics that provide adult ambulatory care to approximately 25,000 outpatient visits per year Training of those delivering the intervention to the health professional: Teachers are two authors, who are experienced physicians active in both clinical practice and teaching; Both were previously trained in smoking cessation counselling through a Master of Public Health course and are considered as national experts in smoking cessation *Intervention description:* The training program is based on 5 principles: 1) recent evidence-based content on tobacco use and cessation, 2) behavioural theory (stage-of-change model), 3) pharmacological therapy, 4) educational methods focusing on active skills training, and 5) tobacco control context; Session 1: Video-clips observations, interactive workshops and role plays; Sessions 2: practice with standardized patients; At the end of the first session, participants received a set of documents (reference manual, two algorithms of counselling strategies and pharmacological therapy, record sheet for consultations with smokers, brochures for patients and patient instructions for NRT) *Control description:* Training in management of dyslipidaemia with equal contact time to the intervention; This course taught residents about through the Swiss guidelines on screening for and diagnosis/management of high blood levels of cholesterol; Residents that were trained in smoking cessation attended the lesson on dyslipidaemia 4 months later, and vice versa *Duration* of intervention: Two, 4 hour sessions scheduled 2 weeks apart Intervention delivered by: Not specified though face-to-face workshops took place *Intensity:* Two, half-day sessions; Total contact time 8 hours
Outcomes	*Pre-specified outcome data:* Self-reported abstinence from smoking, 1 week point prevalence of abstinence; score of overall quality of counselling based on use of 14 counselling strategies; patient willingness to quit; and daily cigarette consumption; socio-demographic data, cardiovascular risk factors, smoking history, nicotine dependence, smoking intervention *Follow-up period:* Twelve months
Notes	*Process measures:* None reported *Validation:* Exhaled carbon monoxide testing at one clinic
Cummings (Priv) 1989	
Methods	*Country:* United States of America *Design:* Randomized controlled trial; Nested; Clustered *Objective:* To test if physicians who are trained to use the 'Quit for Life' (QFL) program are more effective in helping patients to quit smoking *Methods of analysis:* Chi-squared test for proportions and t-tests for means; Multiple logistic regression (for proportions) and ordinary least-squares (for means) and calculated adjustment rates from the partial slopes associated with a dummy variable; Individual patients were the unit of analysis *Clustering adjustment made:* No adjustment to presented data but separate analyses tested clustering effects *Significance of cluster adjustment:* Clustering effects were tested in separate analyses; These adjustments had no discernible effect on significance levels and did not alter the conclusion

Participants	*Therapist description:* Primary care physicians in private practice *Eligible for study:* n= 844 *Randomized:* Intervention n= 31; Control n= 28 *Completed:* Intervention n= 20; Control n= 18 *Age:* Not reported *Gender:* Intervention females n= 4; Control females n= 2 *Patient description:* n= 916 smoking patients not selected by motivation to quit *Eligible for study:* Not reported *Randomized:* Intervention n= 470; Control n= 446 *Completed:* Intervention n= 360; Control n= 364 *Age:* Intervention mean = 43 years; Control mean = 45 years *Gender:* Intervention mean = 53%; Control mean = 61%
Interventions	*Setting:* Private primary care internal medicine and family practice (primary care) in San Francisco, USA; Local hospitals at times that fit with the schedules of the participating physicians; Four who were unable to attend the second sessions received the training privately in their office *Training of those delivering the intervention to the health professional:* Not described *Intervention description:* Training (personalised advice, quit date, one follow up visit, self help materials and nicotine gum) *Control description:* Normal care (no training) *Duration of intervention:* Three, one hour seminars *Intervention delivered by:* Internist or psychologist *Intensity:* Three, one hour seminars; second seminar one or two weeks after the first; third seminar four to twelve weeks later
Outcomes	*Pre-specified outcome data:* Demographic characteristics; smoking history; how much do you want to quit smoking; how confident are you that you will not be smoking one year from now; pressure to quit from family and friends; was smoking discussed; did you receive a self-help booklet; did you receive a follow-up appointment about smoking *Follow-up period:* Twelve months
Notes	*Process measures:* None reported *Validation:* Expired carbon monoxide and serum cotinine Manual adjustment for potential clustering effects performed in the meta-analyses for primary outcome data
Cummings 1989	
Methods	*Country:* San Francisco, California, United States of America *Design:* Randomized controlled trial; Clustered *Objective:* To test whether physicians who receive a continuing education program about how to counsel smokers to quit would counsel smokers more effectively and have higher rates of long-term smoking cessation among their patients that smoke *Methods of analysis:* Chi-square for proportions and t-tests for means were used for significance measures; Binomial test for difference between paired proportions used to calculate confidence intervals for changes in attitudes and self-reported counselling practices of physicians in the experimental group before and after training; To analyse differences between the groups in patient reports about physicians counselling and rates of abstinence, large-sample difference-of-proportions and difference-of-means tests were used; To determine significance of intervention among those patients who had the greatest desire to quit, an interaction was tested between assignment to the experimental or control group and the smoker's rating of his or her desire to quit; Multiple logistic regression analysis used to determine significance for specific counselling strategies by experimental group physicians for abstinence levels *Clustering adjustment made:* No - The individual patient was the unit of analysis for these results; However, patients were clustered by physician and physicians were clustered by work station; "…Therefore for simplicity, we present the results with the patient as the unit of analysis" *Significance of cluster adjustment:* Not reported

Participants	*Therapist description:* Physicians *Eligible for study:* n= 189 internists *Randomized*: n= 81; Control n= 41; Intervention n= 40 *Completed:* n= 81; Control n= 41; Intervention n= 40 *Age:* Not reported *Gender:* Control: 27% female; Intervention 30% female *Patient description:* *Eligible for study*: n= 2056; Control n= 1032; Intervention n= 1024 *Randomized:* n= 2056; Control n= 1032; Intervention n= 1024 *Completed:* n= 2012; Control n= 1008; Intervention n= 1004 *Age:* Control 45 years; Intervention 46 years *Gender:* Control 53% female; Intervention 58% female
Interventions	*Setting:* Four Health Maintenance Organisation (HMO) medical centres in northern California Training: Three, one hour group tutorials *Training of those delivering the intervention to the health professional:* Not stated but delivered by internist or psychologist *Intervention description:* Training (personalised advice, quit date, one follow up visit, self help materials and nicotine gum) *Control description:* Normal care (no training) *Duration of intervention:* Three sessions over a five to fourteen week period *Intervention delivered by:* Internist or psychologist *Intensity:* Three, one hour sessions
Outcomes	*Pre-specified outcome data:* long-term abstinence from smoking (≥ 9 months); Number of smokers counselled; Asked to set a quit date; Asked to make a follow up appointment; Number receiving self help materials; Number receiving nicotine gum; Number of smokers prescribed a quit date *Follow-up period:* Point prevalence abstinence at 12 months
Notes	*Process measures:* None reported *Validation:* Expired carbon monoxide and serum cotinine Manual adjustment for potential clustering effects performed in the meta-analyses for primary outcome data
Gordon 2010	
Methods	*Country:* United States of America *Design:* Randomized controlled trial; Nested; Clustered *Objective:* With consideration to the oral health effects associated with chronic tobacco use, the dental visit provides a "teachable moment" during which the dental team can relate oral health and systemic problems to tobacco use and provide evidence-based brief interventions to patients who use tobacco in lower socio-economic areas *Methods of analysis:* Analysis of variance with clinics as a random, nested factor within condition and patients nested within clinic for both outcomes, for all participants, and within each racial/ethnic group; Logistic regression used for baseline measures of tobacco use with condition included as a covariate *Clustering adjustment made:* Yes: ICC and analysis of variance with nesting *Significance of cluster adjustment:* Not reported

Participants	*Therapist description:* Federally funded public health dental clinics in lower socio-economic areas *Eligible for study:* Not reported *Randomized:* Intervention n= 7 practices; Control n= 7 practices *Completed:* Intervention n= 7 practices; Control n= 7 practices *Age:* Not reported *Gender:* Not reported *Patient description:* Dental patients aged 18 years and older who were seen for a non-emergency visit to the clinic and were self-identified current tobacco users (within the past 7 days) *Eligible for study:* n= 2751 completed informed consent and baseline survey *Randomized:* Intervention n= 1434; Control n= 1203 *Completed:* Six weeks Intervention n= 1214; Control n= 1026; 7.5 months Intervention n= 990; Control n= 885 *Age:* Total sample only: Mean = 40.5 $\pm$ 12.6 years *Gender:* Total sample only: Female= 45.8% n= 1508
Interventions	*Setting:* Baseline survey completed in the clinic and were mailed follow-up surveys at 6 weeks and 7.5 months (lower socio-economic areas) *Training of those delivering the intervention to the health professional:* Not reported *Intervention description:* '5A approach' (Ask, Advise, Assess, Assist and Arrange): Ask - ask all patients about their tobacco use at every visit; Advise - relating the oral effects of tobacco use to the patients' oral health status and advising patients to quit tobacco; Assess - setting a quit date, discussing pharmacotherapy, providing free self-help materials and free nicotine replacement therapy; Arrange - arranging for follow-up by mail or phone for patients setting a quit date; Each intervention practice was provided with a supply of nicotine patches and lozenges, as well as printed patient self-help materials and information on the local tobacco quit line, which providers were asked to give to all tobacco-using patients *Control description:* Usual care - delayed intervention control; Following the study period control clinics received the in-service workshop and received all the intervention materials *Duration of intervention:* One workshop *Intervention delivered by:* Dentists, dental hygienists and dental assistants *Intensity:* One, 3 hour workshop
Outcomes	*Pre-specified outcome data:* Tobacco cessation, reduction in tobacco use, number of quit attempts, change in readiness to quit, number of cigarettes smoked per day, level of nicotine dependence *Follow-up period:* Seven and a half months (6 months post-enrolment plus a 6 week grace period)
Notes	*Process measures:* Intervention subjects only - 66.5% reported receiving the reading materials and the majority of patients reported reading them (96.7%); 16.9% reported using nicotine replacement therapy and 10.9% reported receiving quit line counselling *Validation:* No bio-chemical validation n-values re-calculated for meta-analysis to permit intention-to-treat analysis for primary outcome data
Hymowitz 2007	
Methods	*Country:* United States of America *Design:* Randomized controlled trial; Nested; Clustered *Objective:* The primary aim of the study was to compare the effects of the two training conditions on resident tobacco intervention as measured by annual resident tobacco survey and OSCEs, baseline, and end-of-study patient and parent/guardian tobacco surveys, and a survey of program graduates who enter paediatric practice *Methods of analysis:* Due to training site being the unit of randomization, analyses were based on aggregated data rather than on individuals; Likert scales were calculated as means; Two-stage mixed model relationship was used for waves of residents at baseline and 2 year follow-up *Clustering adjustment made:* No – However data were analysed based on aggregated data to account for unit of analysis issues; authors state that this will provide "…an unbiased estimate of the intervention effect and standard error." (also known as a 'mean analysis') *Significance of cluster adjustment:* Not reported

Participants	*Therapist description:* Paediatric residents undergoing training in the New York/New Jersey metropolitan area *Eligible for study:* n= 16 Paediatric residencies; n= 2069 Residents *Randomized:* n= 16 residency training programs; 3rd year residents n= 140 in intervention arm; n= 135 in control arm *Completed:* n= 14 residency training programs; 3rd year residents n= 136 in intervention arm; n= 99 in control arm *Age:* Approximately 33 years of age for overall population; Intervention mean = 32.3 ± 5.1 years; Control mean = 33.7 ± 5.7 years *Gender:* Intervention female= 69.1%; Control female= 59.3% *Patient description: Parent/Guardian:* Parents of the patients visiting the primary care clinics *Eligible for study:* n= 1770 *Randomized:* Intervention n= 849; Control n= 776 *Completed:* Intervention n= 724; Control n= 617 *Age:* Overall= 29.88 ± 8.65 years *Gender:* Female= 85.8% *Patient description: Children:* Patients (children) visiting the primary care clinics *Eligible for study:* n= 550 *Randomized:* Intervention n= 255; Control n= 300 *Completed:* Intervention n= 255; Control n= 300 *Age:* Intervention 14.89 ± 1.84 years; Control 15 ± 2.16 years *Gender:* Intervention female= 55.3%; Control female= 60%
Interventions	*Setting:* New York/New Jersey metropolitan area; Continuity clinic (primary care clinic) served as the venue for resident tobacco-intervention activities *Training of those delivering the intervention to the health professional:* Not specified *Intervention description:* Special training – 'Solutions for Smoking' was the main teaching tool; Also provided with assistance with clinics (e.g., take-home educational and behavioural-change materials available in the waiting areas, anti-tobacco posters, marking charts of smokers etc); Packets of educational and behavioural materials designed for mothers of newborns, adolescent smokers, parents who smoke etc.; Seminar series provided opportunities to distribute program materials, highlight key concepts and aspects of the background material, and utilise role-laying to help residents acquire interviewing, counselling and tobacco-intervention skills; Power point presentations were used during these seminars on environmental tobacco smoke, smoking cessation and prevention of smoking onset and solutions for smoking audio/visual vignettes to demonstrate and model state-of-the-art counselling and intervention skills *Control description:* Standard training – Background reading material that included the clinical practice guideline 'Treating Tobacco Use and Dependence' and 'American Academy of Pediatrics Statement on Tobacco'; A manual entitled 'Clinical Interventions to Prevent Tobacco Use by Children and Adolescents'; A journal article on approaches to tobacco prevention and control in clinic and office settings; Standard training sites did not receive assistance with clinic mobilisation or have access to companion intervention material; They did receive pamphlets and related material to facilitate intervention on tobacco; Seminar also conducted the same as the intervention group with the exception of vignettes to demonstrate counselling and intervention skills *Duration of intervention:* One hour seminars, four times per year *Intervention delivered by:* Unclear, though the manuscript mentions 'training directors'; Seminars delivered by senior investigators from the New Jersey Medical School *Intensity:* One hour seminars, four times per year
Outcomes	*Pre-specified outcome data:* Primary outcome measures included changes in resident tobacco intervention activities and skills in the area of environmental tobacco smoke, tobacco-use prevention and tobacco-use cessation; Demographic information, knowledge and attitudes about tobacco prevention and control, tobacco-intervention activities during the past year, use of specific tobacco-intervention skills and strategies, and beliefs about the efficacy of tobacco intervention in patients and parents *Follow-up period:* Four years in total; Outcome data for participants only published for 2 year follow-up
Notes	*Process measures:* Sixty percent of residents in the special training condition reported review of 'Solutions for Smoking', although a higher proportion attended the seminar series (80%) and had access to companion intervention material in the clinic *Validation:* No bio-chemical validation

Joseph 2004	
Methods	*Country:* United States of America *Design:* Randomized controlled trial; Clustered *Objective:* To test the effect of modest intensity, practical systems changes that might increase the delivery of smoking cessation treatment within VAMCs (Veterans Medical centres); Authors hypothesized that an intervention addressing common barriers to delivery of smoking cessation treatment at the organisation level (as opposed to provider or patient level) might be an effective strategy to improve compliance with guideline recommendations; The trial was designed to test the effectiveness of this intervention *Methods of analysis:* McNemar odds on change to assess differences in the change between intervention groups; Pearson chi-squared statistic to compute the significant of the resulting odds ratio between the intervention and control group; Differences in smoking cessation rates were determined via the Pearson Goodness-of-Fit chi-squared statistic; Change scores were used for continuous variables and the relative difference in change was measured using the Wilcoxon rank sum test; Logistic regression was used for binary outcomes; SAS glimmix macro was used to incorporate the design effect and allow for the binary outcome *Clustering adjustment made:* Yes - SAS glimmix macros used to incorporate the design effects *Significance of cluster adjustment:* Not reported
Participants	*Therapist description:* Physicians, nurses, psychologists and pharmacists were present at the training meeting *Eligible for study:* n= 164 VAMCs (Veteran Medical Centres) nationwide *Randomized:* Intervention n= 10; Control n= 10 *Completed:* Intervention n= 10; Control n= 10 *Age:* Not reported *Gender:* Not reported *Patient description:* A random selection of patients who had seen their primary care provider (at VAMCs) within 6 weeks were phoned for baseline surveys; Current smokers were identified and underwent 1 year follow-up also via phone *Eligible for study:* Cohort n= 5793; Eligible n= 5367 *Randomized:* Intervention n= 2112; Control n= 2142 *Completed:* Intervention n= 641; Control n= 783 *Age:* Baseline - Intervention 64.6 years; Control 63.1 years; Follow-up - Intervention 64.9 years; Control 63.8 years *Gender:* Baseline (male) - Intervention 96.1%; Control 95.3%; Follow-up - Intervention 95.8%; Control 98.0%
Interventions	*Setting:* Veterans Affairs Medical Centers (VAMCs) *Training of those delivering the intervention to the health professional:* Registered nurse who was trained in smoking cessation methods and had considerable administrative experience within Veteran Affairs *Intervention description:* Intervention sites received 5 copies of the AHCPR Smoking Cessation Guideline for distribution; Plus a multi-component intervention designed to increase implementation of 3 specific Guideline recommendations: 1) documentation of tobacco use status in the medical record 2) delivery of intervention to all smokers and 3) liberal use of smoking cessation medications; The organisational support included a training meeting, site visits and a study interventionist at the co-ordinating site in Minneapolis; Removal of formulary restrictions were encouraged for smoking cessation aids as were the requirements for attendance at a cessation class to access pharmacotherapies; Bupropion SR was suggested as an addition to formulary; However approaches were individualised for each site *Control description:* Control sites also received 5 copies of the AHCPR Smoking Cessation Guideline for distribution *Duration of intervention:* Authors state intervention lasted through a 6 month period, however level of exposure for participants not specified *Intervention delivered by:* Registered nurse face-to-face through 2 to 3 site visits within the first 6 months to communicate with directors of primary care, pharmacy service chiefs, smoking cessation co-ordinators and primary care nurses, as well as the 2 day training meeting *Intensity:* One, 2 day training meeting held in Minneapolis for the site-based principal investigator; Two to 3 day visit to each site by the interventionist within the first 6 months

Outcomes	*Pre-specified outcome data:* General health, smoking history/status, nicotine dependence, services provided at the last primary care visit, mood, alcohol use and demographics, provision of counselling, referred to a smoking cessation clinic, provided advice or medications and cessation discussed (documented in medical records) *Follow-up period:* Twelve months
Notes	*Process measures:* None reported *Validation:* No bio-chemical validation
Kottke 1989	
Methods	*Country:* United States of America *Design:* Randomized controlled trial, cluster *Objective:* "…the task of Doctors Helping Smokers was to be the development and testing of a program to help physicians incorporate currently identified smoking cessation intervention into their practice routine." Hypothesis: that physicians trained in a workshop would be more effective in helping their smoking patients quit than would similar volunteer physicians who received only patient education materials or a group of physicians that received no assistance *Methods of analysis:* Data presented as proportions were analysed with the chi-squared analysis; Data reported as means and SDs were analysed with analysis of variance; Life-table analysis used to examine relapse patterns of the patients who attempted to quit smoking *Clustering adjustment made:* Physicians unit of analysis; Multivariate regression used to adjust for confounding effects of differences among the groups of doctors and their patients *Significance of cluster adjustment:* Not reported
Participants	*Therapist description:* n= 109 family practitioners *Eligible for study; n-value:* 1110; n= 109 physicians returned postcards *Randomized; n-value:* Workshop group n= 27; No-assistance group n= 17; Materials group n= 22 *Completed; n-value:* Workshop group n= 27; No-assistance group n= 17; Materials group n= 22 *Age:* Workshop group 37.9 ± 9.7; No-assistance group 39.5 ± 7.7; Materials group 44.3 ±11.7 *Gender:* Workshop group F=22.2%; No-assistance group F=9.1%; Materials group f=11.8% *Patient description: n=* 1653 primary care smoking patients not selected by motivation to quit *Eligible for study; n-value:* Not reported *Randomized; n-value:* 6053 total (89.4% of patients whose names were submitted by the physicians) *Completed; n-value:* 87% of the n= 6053 were available for follow-up; 86.8%, 87.5% and 86.8% for the workshop, materials and no-assistance groups respectively *Age:* 18 to 70 years; Mean =slightly over 40 *Gender:* Two thirds women

Interventions	*Setting:* Private family practice (primary care) in Minnesota, USA; workshop site not described though likely centralised *Training of those delivering the intervention to the health professional:* Not described *Intervention description:* Two intervention groups: Materials group - physicians given self-help manuals to distribute; Workshop group - self-help manuals plus 6 hour group workshop *Control description:* Normal care *Duration of intervention:* Workshop group: 6-hour workshop given on two occasions. Workshop started in the morning with two presentations of 30-minutes about the effects of smoking, chronic disease and organisation for smoking cessation interventions; 1-hour presentation on doctor-patient intervention skills; 1-hour introduction to smoking cessation techniques; Two 1-hour small-group workshop sessions on counselling sessions and planning for smoking cessation interventions and 30-minutes for summary and discussion; Materials group: 100 copies of Quit-and-Win, a smoking cessation manual *Intervention delivered by:* Not described *Intensity:* Workshop: 6-hr workshop given on 2 occasions; Materials group: None; No assistance: None
Outcomes	*Pre-specified outcome data:* Physicians: Characteristics, knowledge, skills, confidence and beliefs about smoking cessation in relation to their performance during the trial Patients: demographics, smoking habits, health status, details about visit with physician, prevalence of smoking in their social environment and support received from spouse or others who were emotionally important to them; Four questions about extent tot which they felt in control of their life, the confidence they felt about handling personal problems, extent that "things were going [their] way," and the extent to which difficulties were piling up; serum cotinine levels *Follow-up period:* 12-months
Notes	*Process measures:* None *Validation:* Serum cotinine Not able to be meta-analysed due to unit of analysis being the practitioners instead of the individuals
Lennox 1998	
Methods	*Country:* United Kingdom *Design:* Randomized controlled trial; Nested; Clustered *Objective:* To assess the impact of the training intervention on both health professionals and smoking subjects *Methods of analysis:* Comparison of binary outcomes were analysed using the chi-squared test; Logistic and multiple regression analyses were carried out where appropriate for these outcome measures; Comparisons of continuous outcomes were analysed using t-tests and multiple linear regression; Confounders were adjusted including age, sex and deprivation score for the regression analysis as well as for indicators for the intervention group *Clustering adjustment made:* Yes - GLMM (Generalised linear mixed model) approach used for regression techniques which added the general practice as a random factor nested within the treatment groups to the other fixed-effect factors *Significance of cluster adjustment:* Regression techniques used to explore clustering effects for variables significant in individual level analyses; No significant difference in point prevalence of abstinence after adjustment

Participants	*Therapist description:* n= 16 general practices with training for doctors, nurses and health visitors *Eligible for study:* n= 26 practices *Randomized:* n= 16 practices *Completed:* n= 16 practices *Age:* Not reported *Gender:* Not reported *Patient description:* Smoking patients of the practices identified from questionnaires to random sample *Eligible for study:* Not reported *Randomized:* Number of patients surveyed: Intervention n= 6631; Control n= 6631; Number of patients responding: Intervention n= 5022; Control n= 5217; Number of smokers identified: Intervention n= 1381; Control n= 1207 *Completed:* Eight months - Intervention n= 941; Control n= 864; 14 months - Intervention n= 898; Control n= 795 *Age:* Not reported *Gender:* Not reported
Interventions	*Setting:* Primary care medical practices in Aberdeen, UK *Training of those delivering the intervention to the health professional:* Two authors conducted the training, one a senior health promotion officer experienced in group work with primary health care teams and the other a GP *Intervention description:* One day training workshop based on stages of change model *Control description:* Usual care control group *Duration of intervention:* Six identical one day training workshops were held within a three week period based on stages of change model *Intervention delivered by:* Two authors, one a senior health promotion officer experienced in group work with primary health care teams and the other a GP *Intensity:* One day training workshop
Outcomes	*Pre-specified outcome data:* Changes in attitudes, self-reported behaviour, change in readiness to change, cessation attempt made, point prevalence, continuous abstinence *Follow-up period:* Eight and 14 months post workshop for patient questionnaires
Notes	*Process measures:* Some subjects did not attend their practice during the study and therefore were not exposed to the effects of the training *Validation:* No bio-chemical validation n-values re-calculated for meta-analysis to permit intention-to-treat analysis for primary outcome data

Sinclair 1998	
Methods	*Country:* Scotland *Design:* Randomized controlled trial *Objective:* To evaluate a training workshop for community pharmacy personnel to improve their counselling in smoking cessation based on the stage-of-change model *Methods of analysis:*To demonstrate the differences between intervention and control groups, parametric tests (t-tests for quantitative variables) and non-parametric tests (Mann-Whitney tests for quantitative variables) were used. Multiple logistic regression was carried out for the binary outcomes of point prevalence at one month, and continuous abstinence at four and nine months, and to assess the effect of potential confounders *Clustering adjustment made:* Yes; authors mention that the effect of cluster randomization was assessed by firstly calculating the degree of intra-cluster correlation for each of the binary outcomes of abstinence. Secondly, regression techniques, adding the pharmacy as a random factor nested within the treatment groups to the other fixed effect factors, were considered leading to a generalised linear mixed model. The authors mention that intra-cluster correlations for the outcomes at each time point were calculated. The estimated values were less than 0.0001 and therefore negligible *Significance of cluster adjustment:* No; authors mention that trends in outcome were not affected by potential confounders or adjustment for clustering Setting: Residents and physicians in Family Medicine, Taiwan Training: Two lessons Randomization: Stratified by number of years in practice (method not stated)
Participants	*Therapist description:* *Eligible for study; n-value:* n= 76 pharmacies *Randomized; n-value:* Intervention n= 32 pharmacies; Control n= 30 pharmacies *Completed; n-value:* Intervention n= 32 pharmacies (specify: n= 94 (54 assistants, 40 pharmacists); Control n= 29 pharmacies *Age:* Not described *Gender:* Intervention: 54 female assistants; 25 female pharmacists; Control: not described *Patient description:* *Eligible for study; n-value:* n= 775 smokers *Randomized; n-value:* Intervention n= 224; Control n= 268 *Completed; n-value:* Intervention n= 159; Control n= 188 *Age:* Intervention 41.7 (17-74); Control 41.5 (17-77) *Gender:* Intervention 61.2% men; Control 62.7% men
Interventions	*Setting:* Eight workshops were scheduled with a choice of dates, times and location (Aberdeen or Elgin - the major population centres which are located 70 miles apart at opposite ends of the study area) *Training of those delivering the intervention to the health professional:* Not described *Intervention description:* Training in stages of change approach to smoking cessation *Control description:* Usual care *Duration of intervention:* two-hour workshop *Intervention delivered by:* Not described *Intensity:* One workshop
Outcomes	*Pre-specified outcome data:* self-reported point prevalence smoking cessation rates at one month; self-reported continuous abstinence from zero to four months and from zero to nine months; the pharmacy support process (registration, counselling and client record) *Follow-up period:* 1, 4, 9 months; Point prevalence of abstinence at 12 months No process outcomes
Notes	*Validation:* none n-values re-calculated for meta-analysis to permit intention-to-treat analysis for primary outcome data

Strecher 1991	
Methods	*Country:* United States of America *Design:* Randomized Controlled Trial; Factorial design; Nested; Cluster *Objective:* The study evaluated the effectiveness of training and prompting under realistic conditions, including: the use of simple and generalisable interventions; training conducted by existing faculty; and evaluation at several sites with residents from three primary care specialties *Methods of analysis:* Contingency tables with chi-squared tests, t-tests, and analysis of variance (ANCOVA) were used to investigate the pre-test equivalencies of the four groups and all outcomes for selected other variables; ANCOVA compared the effects of the two interventions, alone and in combination, whilst controlling for pre-test scores and physician speciality *Clustering adjustment made:* No *Significance of cluster adjustment:* N/A (Physician speciality adjusted for but not individual physician clustering effects)
Participants	*Therapist description:* 250 residents in internal medicine, family practice and paediatrics *Eligible for study; n-value:* 261 *Randomized; n-value:* 250; Tut (Tutilage) and Pro (Prompt) n= 66; Tut only n= 66; Pro only n= 60; Control n= 58 *Completed; n-value:* 234; Tut and Pro n= 62; Tut only n= 63; Pro only n= 55; Control n= 54 *Age:* Not reported *Gender:* Not reported *Patient description:* 937 patients from American primary care medical practice *Eligible for study; n-value:* 937; Tut and Pro n= 250; Tut only n= 243; Pro only n= 228; Control n= 225 *Randomized; n-value:* 843 *Completed; n-value:* 659; Tut and Pro n= 184; Tut only n= 156; Pro only n= 162; Control n= 157 *Age:* 17 to 75 years; Mean age = 45 years *Gender:* Female =63%
Interventions	*Setting:* American primary care residency programmes (physicians in training) *Training of those delivering the intervention to the health professional:* Not specified though one of the authors in each instance conducted the tutorial *Intervention description:* Three intervention groups: Tutilage only (minimal contact counselling); Prompt only (chart-reminder and advice sheet); Tutilage and Prompt *Control description:* Normal care *Duration of intervention:* Only held once, two sessions in total - the first included slide presentations the second group discussions *Intervention delivered by:* One of the authors, usually a clinic director or a faculty member conducted the tutorial *Intensity:* Tutorial: two sessions - initial one-hour long, second session two weeks later
Outcomes	*Pre-specified outcome data:* Self-administered questionnaires requesting self-reports on smoking-cessation counselling frequency, content, attitude and training; patients were asked about smoking habits and physicians advice to stop smoking *Follow-up period:* 6-months
Notes	*Process measures:* None *Validation:* Expired CO; Bio-chemical verification was obtained where possible The three intervention groups were combined for meta-analyses to produce the single 'Intervention' sample; n-values re-calculated for meta-analysis to permit intention-to-treat analysis for primary outcome data

Swartz 2002	
Methods	*Country:* United States of America *Design:* Randomized controlled trial; Clustered *Objective:* Primary goal of this study was to determine if in-person feedback intervention, compared to mailed feedback, would lead to a higher use of tobacco treatments by patients who smoke *Method of Analysis:* Odds ratios, 95% confidence intervals and p-values were calculated to evaluate intervention effects on patient and provider behaviour; Unadjusted models and models adjusted for age, insurance at baseline, practice speciality and region of the state were calculated using logistic regression; All analyses were completed with SAS statistical software *Clustering adjustments made:* Yes – survey logistic procedures *Significance of clustering:* Not reported
Participants	*Therapist description:* Primary care providers with practices of at least 75% internal medicine or family medicine clinicians providers combined with Medicaid and HMO panel size of at least 200 adults; n= 176 were physicians, n= 26 nurse practitioners, n= 20 physician assistants, n= 3 unknown classification *Eligible for study:* n= 150 practices; n= 230 providers within the 50 practices recruited were eligible *Randomized:* n= 50 practices; n= 225 providers *Completed:* n= 50 practices; n= 179 providers *Age:* Not reported *Gender:* Not reported *Patient description:* Patients were adults receiving primary care by a study practice aged 18 years and older who were seen within the prior year *Eligible for study:* n= 17318 identified as receiving primary care by a study practice; n= 11547 eligible *Randomized:* n= 7461 completed baseline survey; n= 1238 patients identified as smokers at baseline *Completed:* n= 807 reporting provider visit in the year proceeding follow-up; n= 516 smokers with baseline and follow-up surveys reporting one serious quit attempt *Age:* Intervention mean age= 41.9 years; Control mean age= 42.9 years *Gender:* Intervention male= 26.4%; Control male= 23.2%
Interventions	*Setting:* Maine Medicaid and Maine HMO, USA *Training of those delivering the intervention to the health professional:* Not reported *Intervention description:* Experimental study practices received two educational office sessions, with data feedback presented during the first visit; Second visit reinforced the guidelines and discussed office systems to improve tobacco treatment *Control description:* Control practices received information and feedback data by mail *Duration of intervention:* For the intervention: Two educational office sessions, the second occurred five months after the first *Intervention delivered by:* One nurse practitioner well-versed in motivational interviewing and tobacco guidelines *Intensity:* Twenty minute slide presentation followed by feedback and discussions for the first visit; Second visit discussions time not stated
Outcomes	*Pre-specified outcome data:* Reports of provider asking about tobacco, advice to quit, spending time talking about smoking or quitting, discussing tobacco treatment medications, and discussing counselling services or programs; Smokers were asked about serious attempts at quitting for 24 hours or longer, use of medication or counselling to aid quitting, and use of any tobacco in the previous week (7 day point prevalence) *Follow-up Period:* Fifteen to 18 months later which corresponded to 12 months following the practice intervention
Notes	*Process measures:* None reported *Validation:* No bio-chemical validation

Twardella 2007	
Methods	*Country:* Germany *Design:* Randomized controlled trial; Nested; Clustered; Factorial design 2x2 *Objective:* The aim of this study was to examine whether and to what extent structural changes could enhance promotion of smoking cessation in general practice. In particular, we aimed to investigate the effect of the following strategies on smoking cessation rates: (1) specific training of general practitioners in methods of promoting smoking cessation and a financial incentive to general practitioners for each recruited patient who successfully quits; and (2) specific training of general practitioners in promotion of smoking cessation and the cost-free prescription of drugs proved effective in supporting smoking cessation *Methods of analysis:* Primary end-point data were assessed on an intention-to-treat basis; smoking abstinence at 12 months was assessed using a mixed logistic regression model accounting for cluster randomization including a random effect for medical practice in the model; baseline imbalances between intervention arms were adjusted using multivariate analyses; the effect of drug use during follow-up, as recorded by general practitioners, was evaluated in a bivariate mixed logistic regression model *Clustering adjustment made:* Yes - mixed logistic regression model, using PROC NLMIXED in "SAS V8.1" (including a random effect for medical practice) *Significance of cluster adjustment:* Not reported
Participants	*Therapist description:* General practitioners in the Rhine-Neckar region located in southwest Germany *Eligible for study:* n= 174 met the inclusion criteria *Randomized:* Total= 94 general practitioners from n= 82 practices; Usual care: n= 21 therapists (20 practices); Training + incentive: n= 24 therapists (21 practices); Training + medication: n= 23 therapists (21 practices); Training, incentive + medication: n= 26 therapists (20 practices) *Completed:* n= 59 practices; Usual care: n= 14 practices; Training + incentive: n= 16 practices; Training + medication: n= 11 practices; Training, incentive + medication: n= 18 practices *Age:* Not reported *Gender:* Not Reported *Patient description:* Patients visiting the practices and who smoked at least 10 cigarettes per day and aged between 36 to 75 years, were recruited by participating general practitioners, irrespective of intention to quit smoking and conditional on written informed consent *Eligible for study:* n= 587 *Randomized:* n= 587; Usual care: n= 76; Training + incentive: n= 146; Training + medication: n= 144; Training, incentive + medication: n= 221 *Completed:* n= 488; Usual care: n= 61; Training + incentive: n= 123; Training + medication: n= 121; Training, incentive + medication: n= 183 *Age:* Range 36 to 75 years; <45 years: Usual care n= 30; Training + incentive n= 55; Training + medication n= 59; Training, incentive + medication n= 95; 45 to 54 years: Usual care n= 24; Training + incentive n= 63; Training + medication n= 44; Training, incentive + medication n= 86; > 55 years: Usual care n= 22; Training + incentive n= 28; Training + medication n= 41; Training, incentive + medication n= 40 *Gender:* Female: Usual care n= 38; Training + incentive n= 74; Training + medication n= 71; Training, incentive + medication n= 121

Interventions	*Setting:* Not reported *Training of those delivering the intervention to the health professional:* Not reported *Intervention description:* Three intervention groups: Training + incentive – Two hour cost-free group tutorial for general practitioners in methods of promoting smoking cessation including stages of change model, approaches for counselling in general practice and potential of pharmacological support; Financial remuneration of €130 after study completion per smoke-free participant; Training + medication – Same group tutorial as above plus general practitioners could offer cost-free prescription of drugs proved effective in supporting smoking cessation; Training, incentive + medication – All of the above *Control description:* Usual care *Duration of intervention:* A single 2 hour tutorial available at two session times *Intervention delivered by:* Not reported *Intensity:* Two Hour workshop
Outcomes	*Pre-specified outcome data:* Primary outcome measure - Self-reported point prevalence of smoking abstinence obtained at 12 months follow-up Second outcome measure - Continuous smoking abstinence for at least 6 months (183 days) at 12 months follow-up; Frequency of the use of methods to support smoking cessation among patients during the follow-up period as reported by general practitioners *Follow-up period:* Twelve months
Notes	*Process measures:* None reported *Validation:* Serum cotinine *Other:* Definition of abstinence - Participants were categorised as 'at least 6 months abstinent' if they were smoke free at 12 months follow-up, validated by serum cotinine, and, according to self-report, had stopped smoking at least 6 months before the date of follow-up The three intervention groups were combined for meta-analyses to produce the single 'Intervention' sample
Unrod 2007	
Methods	*Country:* United States of America *Design:* Randomized controlled trial; Nested; Clustered *Objective:* To bolster the rate at which physicians delivered smoking cessation services and to increase patients' quit rates *Methods of analysis:* Descriptive statistics for characterisation of sample at baseline; Pearson's chi-squared test and independent sample t-test to measure differences between groups; Hierarchic generalised linear model analysis of variance controlling for baseline variables used to measure physician performance; Abstinence analysed via generalised linear model *Clustering adjustment made:* Yes - Mixed linear modelling with physician as clustering variable used for smoking related outcomes *Significance of cluster adjustment:* Not reported
Participants	*Therapist description:* Primary care physicians recruited from the four largest metropolitan boroughs, Bronx, Brooklyn, Manhattan and Queens *Eligible for study:* n= 579 *Randomized:* Intervention n= 35; Control n= 35 *Completed:* Intervention n= 35; Control n= 35 *Age:* Mean = 51.1 ± 8.1 years (total population only) *Gender:* Males= 74% (total population only) *Patient description:* Patients in primary care physician waiting rooms who were identified as smokers *Eligible for study:* n= 5826 *Randomized:* Intervention n= 270; Control n= 248 *Completed:* Intervention n= 237; Control n= 228 *Age:* Intervention mean= 43.5 ± 14.7 years; Control mean= 42.8 ± 14.2 years *Gender:* Intervention 58% male; Control 64% male

Interventions	*Setting:* Training conducted during a 40 minute visit to the physicians' office *Training of those delivering the intervention to the health professional:* Not reported *Intervention description:* Physician training in brief smoking cessation counselling based on the 5As Clinical Practice Guideline algorithm; Patients and physicians provided with a one page report containing smoking-related information and recommendations based on the information provided during the patient assessment *Control description:* Physicians in the control condition were not given any training and were instructed to continue their usual smoking cessation practices; Patients completed the same assessments but did not receive the report (being the one page report characterising patients smoking habits) *Duration of intervention:* One session only *Intervention delivered by:* Health educator *Intensity:* One, 40 minute session
Outcomes	*Pre-specified outcome data:* Patients asked - Did your doctor… ask whether you smoke, ask whether you are ready to quit, advise you to quit smoking, help you to quit smoking, help you set goals about quitting, give you written materials about quitting, refer you to a quit smoking program, talk to you about quit-smoking medications, make a follow-up appointment to discuss smoking Primary outcome measure - 7 day point prevalence abstinence; Longest quit attempt (in days); Total number of 25 hour quit attempts, stage-of-change progression *Follow-up period:* Six months
Notes	*Process measures:* None reported *Validation:* For sub-group of participants - Saliva-cotinine test; Fourteen of 16 samples confirmed abstinence (88%) n-values re-calculated for meta-analysis to permit intention-to-treat analysis for primary outcome data
Wang 1994	
Methods	*Country:* Taiwan *Design:* Randomized Controlled Trial *Objective:* To assess the stages-of-change model in cigarette smoking and practice guidelines for practicing cigarette smoking cessation counselling in a short training program, designed to make physicians more willing to help their patients to quit smoking and increase success rates *Methods of analysis:* All data were analysed using either the chi-square or Fisher's exact tests *Clustering adjustment made:* No *Significance of cluster adjustment:* Not applicable

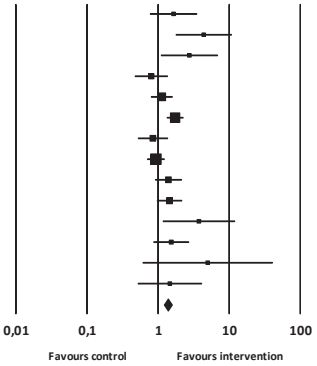
Participants	*Therapist description:* Residents and physicians in Family Medicine *Eligible for study; n-value:* Not reported *Randomized; n-value:* Group one: lessons n= 9, Group two: posters n= 9, Group three: usual care n= 9 *Completed; n-value:* Group one: lessons n= 9, Group two: posters n= 9, Group three: usual care n= 9 *Age:* Not reported *Gender:* Not reported *Patient description:* *Eligible for study; n-value:* Not reported *Randomized; n-value:* n= 93, Group one: n= 39, Group two: n= 26, Group three: n= 28 *Completed; n-value:* n= 82, Group one: n= 35, Group two: n= 24, Group three: n= 23 *Age:* Group one: <40 n= 14, 40-59 n= 17, ≥ 60 n= 8; Group two: <40 n= 14, 40-59 n= 8, ≥ 60 n= 4; Group three: <40 n= 7, 40-59 n= 12, ≥ 60 n= 9 *Gender:* Group one: male n= 38 female n= 1; Group two: male n= 24 female n= 2; Group three: male n= 27 female n= 1 Therapists: 27 physicians Patients: 93 patients
Interventions	*Setting:* Not reported *Training of those delivering the intervention to the health professional:* Not reported *Intervention description:* Two intervention groups: Training - stages of change model and practice guidelines; Poster - used as a reminder to give advice *Control description:* Usual care *Duration of intervention:* Group one: two lessons; Group two: provided with poster only; Group three: no intervention *Intervention delivered by:* Not reported *Intensity:* Group one: two lessons; Group two: provided with poster only; Group three: no intervention
Outcomes	*Pre-specified outcome data:* Demographic data, cigarette-smoking habits and health beliefs *Follow-up period:* 6-months; Point prevalence of abstinence at 12 months No process outcomes
Notes	*Validation:* None *Process measures:* None reported Manual adjustment for potential clustering effects performed in the meta-analyses for primary outcome data; The two intervention groups were combined for meta-analyses to produce the single 'Intervention' sample; n-values re-calculated for meta-analysis to permit intention-to-treat analysis for primary outcome data
Wilson 1988	
Methods	*Country:* Canada *Design:* Randomized controlled trial; Nested; Clustered *Objective:* To investigate the effects of a smoking cessation workshop on physician practices and on patients' smoking behaviour *Methods of analysis:* Analysis of covariance – Obtained by averaging patient values within the practice; Analysis of differences between groups – If there was no difference between the usual care and gum only groups (untrained cohorts) these would be combined and compared with the gum plus (trained cohort); Regression analysis performed on practice unit, adjusting for the effects of predictor variables and treatment *Clustering adjustment made:* No - None reported *Significance of cluster adjustment:* Not reported

Participants	*Therapist description:* Psysicians *Eligible for study:* n= 460 Family physicians *Randomized:* n= 90 Physicians *Completed:* n= 83 Physicians; Usual care n= 27; Gum only n= 29; Gum plus n= 27 *Age:* Usual care: Mean = 41.64 years; Gum only: Mean = 41.77 years; Gum plus: Mean = 40.57 years *Gender:* Usual care: Male 92.6%; Gum only: Male 93.1%; Gum plus: Male 81.5% *Patient description:* *Eligible for study:* Not stated as n-value; Participation consent rates were: Usual care 91%; Gum only 83%; Gum plus 76% *Randomized:* Not reported *Completed:* Usual care n= 601; Gum only n= 726; Gum plus n= 606 (total n= 1933) *Age:* <25 years: Usual care 22%; Gum only 19%; Gum plus 17%; 25 to 44 years: Usual care 50%; Gum only 54%; Gum plus 56%; ≥ 45 years: Usual care 27%; Gum only 27%; Gum plus 27% *Gender:* Male: Usual care 39%; Gum only 42%; Gum plus 33%
Interventions	*Setting:* Clinical practice setting – Participation during routine physician consultation; Based in Ontario, Hamilton *Training of those delivering the intervention to the health professional:* Not described; CME Protocol *Intervention description:* Two intervention groups: Gum only - Physicians instructed to approach patients in their usual manner about quitting smoking and to offer nicotine gum as an aid to quitting; Gum Plus Training - Gum in addition to training *Control description:* Usual care *Duration of intervention:* One, 4 hour training workshop to Gum plus physician cohort *Intervention delivered by:* Not described *Intensity:* Control - Not explicitly reported; Gum only - Not explicitly reported; Gum plus - One, 4 hour workshop for physicians; For patients - Use of gum, 1 to 6 follow up visits and quit dates
Outcomes	*Pre-specified outcome data:* Three month self-reported sustained abstinence prior to bio-chemically validated cessation at 12 months; smoking behaviour, cessation attempts and nicotine gum use measured by telephone interviews; Physicians performance measured by patient flow sheets and patient telephone exit interviews *Follow-up period:* Point prevalence of abstinence at 12 months
Notes	*Process measures:* None reported *Validation:* Salivary cotinine The two intervention groups were combined for meta-analyses to produce the single 'Intervention' sample; Manual adjustment for potential clustering effects performed in the meta-analyses for primary outcome data

Appendix 1. Forest plots of comparisons

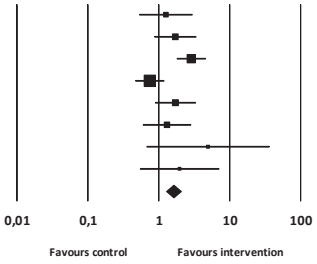
Analysis 1.1a. Smoking cessation at longest follow-up (point prevalence)

Study name	Events / Total		Statistics for each study			
	Intervention	Control	Relative weight	MH odds ratio	Lower limit	Upper limit
Cohen (Dent) 1989	39 / 771	8 / 256	2,8	1,65	0,76	3,58
Cohen (Doc) 1989	63 / 1065	5 / 355	1,7	4,40	1,76	11,03
Cornuz 2002	15 / 115	7 / 136	1,4	2,76	1,09	7,04
Cummings (Priv) 1989	26 / 386	30 / 364	7,0	0,80	0,47	1,39
Cumming 1989	67 / 837	60 / 840	13,4	1,13	0,79	1,63
Hymowitz 2007	158 / 1394	79 / 1155	18,7	1,74	1,31	2,31
Joseph 2004	32 / 280	39 / 295	8,2	0,85	0,51	1,40
Lennox 1998	100 / 1381	93 / 1207	22,5	0,94	0,70	1,25
Sinclair 1998	55 / 187	51 / 223	8,0	1,41	0,90	2,19
Strecher 1991	61 / 413	42 / 394	8,9	1,45	0,95	2,21
Swartz 2002	69 / 503	3 / 74	1,1	3,76	1,15	12,28
Twardella 2007	32 / 270	20 / 248	4,5	1,53	0,85	2,76
Unrod 2007	10 / 54	1 / 23	0,3	5,00	0,60	41,59
Wilson 1988	15 / 158	5 / 75	1,5	1,47	0,51	4,20
				1,36	1,20	1,55



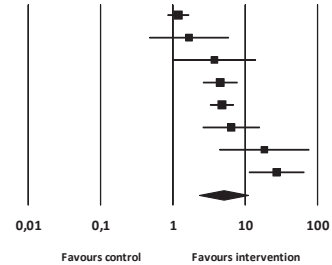
Analysis 1.1b. Smoking cessation at longest follow-up (continuous abstinence)

Study name	Events / Total		Statistics for each study			
	Intervention	Control	Relative weight	MH odds ratio	Lower limit	Upper limit
Cummings (Priv) 1989	12 / 386	9 / 364	8,0	1,27	0,53	3,04
Cummings 1989	22 / 837	13 / 840	11,2	1,72	0,86	3,43
Gordon 2010	74 / 1394	22 / 1155	20,2	2,89	1,78	4,68
Lennox 1998	32 / 1381	37 / 1207	34,2	0,75	0,46	1,21
Sinclair 1998	22 / 187	16 / 223	11,4	1,73	0,88	3,39
Strecher 1991	33 / 502	8 / 157	10,1	1,31	0,59	2,90
Twardella 2007	32 / 503	1 / 74	1,4	4,96	0,67	36,85
Wilson 1988	12 / 158	3 / 75	3,3	1,97	0,54	7,21
				1,60	1,26	2,03



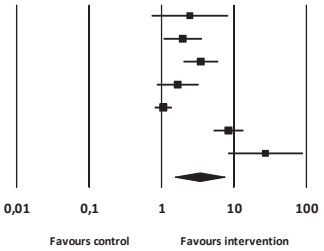
Analysis 1.2. Patients asked to set a quit date

Study name	Events / Total		Statistics for each study			
	Intervention	Control	Relative weight	MH odds ratio	Lower limit	Upper limit
Swartz 2002	343 / 413	317 / 394	14,7	1,19	0,83	1,70
Strecher 1991	16 / 156	3 / 47	10,8	1,68	0,47	6,02
Cornuz 2002	9 / 115	3 / 136	10,5	3,76	0,99	14,25
Cummings (Priv) 1989	84 / 218	18 / 148	14,1	4,53	2,58	7,95
Cummings 1989	146 / 388	39 / 348	14,6	4,78	3,23	7,07
Cohen (Dent) 1989	83 / 486	5 / 161	12,5	6,43	2,56	16,14
Wilson 1988	53 / 158	2 / 75	10,0	18,42	4,35	78,00
Cohen (Doc) 1989	275 / 816	5 / 273	12,7	27,25	11,12	66,78
				4,98	2,29	10,86



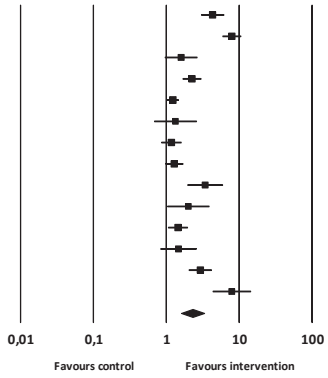
Analysis 1.3. Patient asked to make a follow-up appointment

Study name	Events / Total		Statistics for each study				MH odds ratio and 95% CI
	Intervention	Control	Relative weight	MH odds ratio	Lower limit	Upper limit	
Cornuz 2002	8 / 115	4 / 136	11,8	2,47	0,72	8,42	
Cummings (Priv) 1989	42 / 218	16 / 148	14,9	1,97	1,06	3,65	
Cummings 1989	59 / 388	17 / 348	15,2	3,49	1,99	6,12	
Strecher 1991	76 / 156	17 / 47	14,7	1,68	0,86	3,29	
Swartz 2002	164 / 413	151 / 394	16,1	1,06	0,80	1,41	
Unrod 2007	128 / 270	24 / 248	15,5	8,41	5,19	13,65	
Wilson 1988	84 / 158	3 / 75	11,9	27,24	8,23	90,13	
				3,34	1,51	7,37	



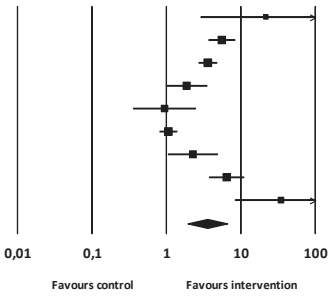
Analysis 1.4. Number of smokers counselled

Study name	Events / Total		Statistics for each study				MH odds ratio and 95% CI
	Intervention	Control	Relative weight	MH odds ratio	Lower limit	Upper limit	
Cohen (Dent) 1989	350 / 486	60 / 161	7,4	4,33	2,97	6,31	
Cohen (Doc) 1989	691 / 816	112 / 273	7,6	7,95	5,84	10,81	
Cornuz 2002	45 / 115	39 / 136	6,9	1,60	0,94	2,71	
Cummings (Priv) 1989	221 / 343	151 / 339	7,6	2,26	1,66	3,07	
Cumming 1989	392 / 783	352 / 785	7,9	1,23	1,01	1,50	
Hymowitz 2007	30 / 142	15 / 90	6,3	1,34	0,67	2,66	
Joseph 2004	165 / 280	162 / 295	7,5	1,18	0,85	1,64	
Lennox 1998	420 / 529	355 / 474	7,6	1,29	0,96	1,74	
Sinclair 1998	113 / 133	99 / 159	6,7	3,42	1,93	6,08	
Strecher 1991	114 / 156	27 / 47	6,3	2,01	1,02	3,96	
Swartz 2002	114 / 413	82 / 394	7,6	1,45	1,05	2,01	
Twardella 2007	257 / 377	32 / 54	6,7	1,47	0,82	2,64	
Unrod 2007	207 / 270	131 / 248	7,4	2,93	2,01	4,28	
Wilson 1988	123 / 158	23 / 75	6,5	7,95	4,28	14,74	
				2,28	1,58	3,27	



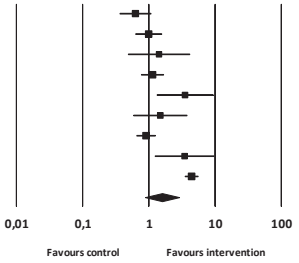
Analysis 1.5. Number of smokers receiving self-help material

Study name	Events / Total		Statistics for each study				MH odds ratio and 95% CI
	Intervention	Control	Relative weight	MH odds ratio	Lower limit	Upper limit	
Cornuz 2002	16 / 115	1 / 136	5,5	21,82	2,85	167,27	
Cummings (Priv) 1989	126 / 343	32 / 339	13,1	5,57	3,64	8,52	
Cumming 1989	195 / 783	66 / 785	13,5	3,61	2,68	4,87	
Hymowitz 2007	41 / 142	16 / 90	12,1	1,88	0,98	3,60	
Strecher 1991	19 / 156	6 / 47	10,3	0,95	0,35	2,53	
Swartz 2002	155 / 413	142 / 394	13,6	1,07	0,80	1,42	
Twardella 2007	107 / 377	8 / 54	11,4	2,28	1,04	4,99	
Unrod 2007	87 / 270	17 / 248	12,6	6,46	3,71	11,25	
Wilson 1988	77 / 158	2 / 75	7,9	34,70	8,23	146,30	
				3,52	1,90	6,52	



Analysis 1.6. Number of smokers receiving nicotine gum/replacement therapy

Study name	Events / Total		Statistics for each study			
	Intervention	Control	Relative weight	MH odds ratio	Lower limit	Upper limit
Cummings (Priv) 1989	29 / 218	29 / 148	11,8	0,63	0,36	1,11
Cumming 1989	40 / 388	36 / 348	12,2	1,00	0,62	1,60
Hymowitz 2007	11 / 142	5 / 90	9,1	1,43	0,48	4,25
Joseph 2004	59 / 280	56 / 295	12,4	1,14	0,76	1,71
Sinclair 1998	219 / 224	248 / 268	9,6	3,53	1,30	9,57
Strecher 1991	28 / 156	6 / 47	9,9	1,49	0,58	3,86
Swartz 2002	127 / 275	117 / 241	12,7	0,91	0,64	1,29
Twardella 2007	82 / 377	4 / 54	9,4	3,47	1,22	9,90
Wilson 1988	615 / 1064	108 / 458	12,9	4,44	3,47	5,69
				1,57	0,87	2,84



Analysis 1.7. Number of smokers prescribed a quit date

Study name	Events / Total		Statistics for each study			
	Intervention	Control	Relative weight	MH odds ratio	Lower limit	Upper limit
Cumming 1989	63 / 388	4 / 348	52,1	16,67	6,00	46,32
Strecher 1991	9 / 156	1 / 47	21,4	2,82	0,35	22,82
Wilson 1988	53 / 158	2 / 75	26,6	18,42	4,35	78,00
				14,18	6,57	30,61