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Interventions for smoking cessation in hospitalised patients

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Abstract

Background—Smoking contributes to reasons for hospitalisation, and the period of hospitalisation may be a good time to provide help with quitting.

Objectives—To determine the effectiveness of interventions for smoking cessation that are initiated for hospitalised patients.

Search methods—We searched the Cochrane Tobacco Addiction Group register which includes papers identified from CENTRAL, MEDLINE, EMBASE and PsycINFO in December 2011 for studies of interventions for smoking cessation in hospitalised patients, using terms including (hospital and patient*) or hospitali* or inpatient* or admission* or admitted.

Selection criteria—Randomized and quasi-randomized trials of behavioural, pharmacological or multicomponent interventions to help patients stop smoking, conducted with hospitalised patients who were current smokers or recent quitters (defined as having quit more than one month before hospital admission). The intervention had to start in the hospital but could continue after hospital discharge. We excluded studies of patients admitted to facilities that primarily treat psychiatric disorders or substance abuse, studies that did not report abstinence rates and studies with follow-up of less than six months. Both acute care hospitals and rehabilitation hospitals were included in this update, with separate analyses done for each type of hospital.

Data collection and analysis—Two authors extracted data independently for each paper, with disagreements resolved by consensus.

Main results—Fifty trials met the inclusion criteria. Intensive counselling interventions that began during the hospital stay and continued with supportive contacts for at least one month after discharge increased smoking cessation rates after discharge (risk ratio (RR) 1.37, 95% confidence

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Contributions of authors

NR and CC extracted data for the 2012 update, with input from LS. NR and CC wrote the update, with input from MM and LS. All authors except CC were involved in the conception, data extraction and writing of the original review.

interval (CI) 1.27 to 1.48; 25 trials). A specific benefit for post-discharge contact compared with usual care was found in a subset of trials in which all participants received a counselling intervention in the hospital and were randomly assigned to post-discharge contact or usual care. No statistically significant benefit was found for less intensive counselling interventions. Adding nicotine replacement therapy (NRT) to an intensive counselling intervention increased smoking cessation rates compared with intensive counselling alone (RR 1.54, 95% CI 1.34 to 1.79, six trials). Adding varenicline to intensive counselling had a non-significant effect in two trials (RR 1.28, 95% CI 0.95 to 1.74). Adding bupropion did not produce a statistically significant increase in cessation over intensive counselling alone (RR 1.04, 95% CI 0.75 to 1.45, three trials). A similar pattern of results was observed in a subgroup of smokers admitted to hospital because of cardiovascular disease (CVD). In this subgroup, intensive intervention with follow-up support increased the rate of smoking cessation (RR 1.42, 95% CI 1.29 to 1.56), but less intensive interventions did not. One trial of intensive intervention including counselling and pharmacotherapy for smokers admitted with CVD assessed clinical and health care utilization endpoints, and found significant reductions in all-cause mortality and hospital readmission rates over a two-year follow-up period. These trials were all conducted in acute care hospitals. A comparable increase in smoking cessation rates was observed in a separate pooled analysis of intensive counselling interventions in rehabilitation hospitals (RR 1.71, 95% CI 1.37 to 2.14, three trials).

Authors' conclusions—High intensity behavioural interventions that begin during a hospital stay and include at least one month of supportive contact after discharge promote smoking cessation among hospitalised patients. These interventions are effective regardless of the patient's admitting diagnosis and are effective in rehabilitation settings as well as acute care hospitals. lnterventions of lower intensity or shorter duration have not been shown to be effective in this setting. This update found that adding NRT to intensive counselling significantly increases cessation rates over counselling alone. There is insufficient direct evidence to conclude that adding bupropion or varenicline to intensive counselling increases cessation rates over what is achieved by counselling alone.

Plain language summary

Interventions started during hospitalisation to help people to stop smoking

Smoking contributes to many health problems including cancers, cardiovascular disease and lung diseases. Smoking also increases the risk associated with hospitalisation for surgery. People who are in hospital because of a smoking-related illness are likely to be more receptive to help to give up smoking. Our review of fifty trials found that effective programmes to stop smoking are those that begin during a hospital stay and include counselling with follow-up support for at least one month after discharge. Such programmes are effective when administered to all hospitalised smokers, regardless of the reason why they were admitted to hospital, and in the subset of smokers who are admitted to hospital with cardiovascular disease. Adding nicotine replacement therapy to a counselling program increases the success rate of a program for hospitalised smokers.

Background

Smoking contributes to many of the health problems leading to hospitalisation, particularly vascular disease, respiratory illness and many cancers. In addition, smoking increases the risk associated with hospitalisations for surgical procedures. Hospitalisation, especially for a tobacco-related illness, may boost receptivity to smoking cessation messages by increasing perceived vulnerability, a so-called 'teachable moment'. Illness also brings smokers to the healthcare setting, where they have contact with health professionals who can provide a smoking cessation message or intervention. In addition, procedures such as coronary arteriography that provide detail of the patient's cardiac status may minimise subsequent denial of cardiac risk by the patient (Ockene 1992). Many hospitals restrict or prohibit smoking by patients to protect patients and staff from secondhand smoke exposure. This smoke-free environment may also provide an opportunity for smokers to try out tobacco abstinence away from the usual environmental cues to smoke. For these reasons, providing (or at least initiating) tobacco dependence treatments in hospitals may be an effective preventive health strategy.

A number of studies have evaluated smoking cessation services provided or initiated in hospital. The interventions have included behavioural counselling of different forms and intensity (including post-hospitalisation contacts), pharmacological therapies (such as nicotine replacement therapy [NRT], bupropion and varenicline), and combinations of counselling and pharmacotherapy. The aim of this review is to evaluate the effectiveness of smoking cessation interventions initiated during a hospital stay. In order to inform policy, we aimed to identify the components of effective programmes. In addition, we aimed to explore whether there is a difference in effect according to the reason for hospitalisation or whether the effect holds for patients with a variety of admission diagnoses, and whether the effect of interventions in acute care hospitals is also observed in rehabilitation hospitals.

Objectives

The primary objective was to determine the efficacy of any type of smoking cessation programme for hospitalised patients. Our hypotheses were that:

- Systematic behavioural intervention (brief advice, individual counselling, provision of self-help materials, group therapy) increases quit rates more than usual care, and intensive intervention increases quit rates more than brief intervention.
- Interventions that occur both in hospital and after discharge increase quit rates more than interventions limited to the hospital stay, and longer post-discharge follow-up increases quit rates more than short follow-up.
- Adding pharmacotherapy (such as NRT, bupropion or varenicline) to a behavioural intervention increases quit rates more than placebo or no medication, and combining pharmacotherapy with a behavioural intervention increases quit rates more than either alone.

A secondary objective was to explore the possibility that the efficacy of interventions differed for patients with different diagnoses. This was done using subgroup analysis of

trials that recruited patients from more than one specialty, and by indirect comparison of trials that recruited patients from within one disease category. The primary review focuses on interventions for smokers who are admitted to an acute care hospital. Studies of interventions for smokers in rehabilitation hospitals have now been published. This update includes a new separate review of the efficacy of smoking interventions initiated during a stay in a rehabilitation hospital.

Methods

Criteria for considering studies for this review

Types of studies—Randomized or quasi-randomized controlled trials.

Types of participants—Participants were patients who were hospitalised and who were currently smoking (defined as having smoked within one month of hospital admission) or had recently quit (defined as having quit more than one month before hospital admission). We excluded trials of secondary prevention or cardiac rehabilitation that did not recruit on the basis of smoking history, and trials in patients hospitalised in facilities that primarily treated psychiatric disorders or substance abuse (including inpatient tobacco addiction programmes). We included interventions that began in either acute care hospitals or rehabilitation hospitals. We included trials that recruited all hospitalised smokers and those limited to patients who planned to quit smoking after hospital discharge. Trials in which 'recent quitters' were classified as smokers were included, but a sensitivity analysis was performed on these data to determine whether they differed from trials that excluded such individuals.

Types of interventions—Any intervention that was initiated during hospitalisation and that aimed to increase motivation to quit, to assist a quit attempt, or to help recent quitters avoid relapse was included. Interventions that began in hospital and continued after discharge were included. The intervention could be delivered by physicians, nursing staff, psychologists, smoking cessation counsellors or other hospital staff. The intervention could include advice, more intensive behavioural therapy, or smoking cessation pharmacotherapy, with or without continued contact after hospital discharge. The control intervention could be any less intensive intervention, such as brief advice to quit, or it could be usual care. Studies that provided identical treatment consisting of more than usual or minimal care during the hospital stay and then randomly assigned participants to different post-discharge interventions were analysed separately in a sensitivity analysis. We included studies of smoking interventions that were part of a broader risk reduction or rehabilitation programme only if it was possible to extract data on the outcome effects of the smoking cessation component specifically, and if details of the nature of the intervention and control were explicitly stated. We included studies that reported the use of NRT, bupropion, varenicline, or other pharmacotherapy for smoking cessation.

We categorised behavioural interventions during the hospital stay according to whether they included follow-up after discharge. Within these categories we further defined both the hospital and follow-up interventions by level of intensity. This led to four categories of intervention intensity:

1. Single contact in hospital lasting <= 15 minutes, no follow-up support.
2. One or more contacts in hospital lasting in total > 15 minutes, no follow-up support.
3. Any hospital contact plus follow-up <=1 month.
4. Any hospital contact plus follow-up > 1 month.

Types of outcome measures—The principal outcome measure was abstinence from smoking at least six months after the start of the intervention. We used the most conservative measure of quitting at the longest follow-up, i.e. we preferred a biochemically validated quit rate to self-reported abstinence, and preferred continuous or sustained abstinence to point prevalence abstinence. We used abstinence at 12-month follow-up in preference to abstinence at six-month follow-up. We counted participants lost to followup as continuing smokers.

Search methods for identification of studies

We searched the Tobacco Addiction Group trials register in December 2011. This specialised register is regularly updated by electronic searches of databases including CENTRAL (2011 Issue 4), MEDLINE (via OVID to update 20111104.ud), EMBASE (via Ovid to update 20111104.em), PsycINFO (via OVID to 2011 November week 4) and handsearching of conference abstracts. Searches for the register cover smoking cessation, nicotine dependence, nicotine addiction and tobacco use. To identify papers potentially relevant to this reivew we searched for (hospital and patient*) or hospitali* or inpatient* or admission* or admitted in the title or abstract. In addition, we searched CINAHL (EBSCO to March 2012, search strategy in Appendix 1). We searched the Centers for Disease Control Smoking and Health database for the original review but since it did not retrieve any additional studies we did not use it for the update. We asked individuals with expertise in the area of smoking cessation for details of conference abstracts and studies in press. We hand-checked bibliographies of studies generated by the search for further studies.

Data collection and analysis

Identification of studies and data extraction—Three authors checked studies identified by the search strategies for relevance. Two authors extracted data independently. Disagreements were resolved by consensus. We noted reasons for the exclusion of studies. For each study we extracted the following data:

i. author(s) and year of publication,
ii. methods (country of origin, recruitment, randomization and participants),
iii. description of intervention(s) and control, including a designation of intensity for behavioural interventions (1–4),
iv. outcomes (length of follow-up, definition of abstinence, validation technique).

If necessary we contacted the original authors for clarification of data.

We reported the following information about each trial in the Characteristics of included studies table:

- Country
- Reasons for hospitalisation or specialty of admission
- Criteria for recruitment (e.g. current smokers only or recent quitters) and whether selected according to willingness to make a quit attempt
- Method of randomization and adequacy of concealment
- Smoking behaviour and characteristics of participants
- Therapist types
- Description of experimental and control interventions and classification by length of in-hospital contact and post-discharge support
- Outcome measures (definition of abstinence used in review, use of biochemical validation), number of deaths.

Assessment of risk of bias in included studies—We judged risk of bias on the basis descriptions of the randomization and allocation concealment procedure, as this is the main source of bias which has been empirically associated with over-estimation of treatment effects (Schulz 1995). We also assessed whether the studies reported validation of self-reported smoking cessation, and assessed the studies for attrition bias, including how they handled patients lost to follow-up, since these are possible sources of bias in smoking cessation studies. We also assessed the extent to which study populations consisted of current smokers and recent quitters.

Analysis of the data—We used statistical methods for pooling using a Mantel-Haenszel fixed-effect method, with 95% confidence intervals. This summary statistic replaced the Peto method (Yusuf 1985) used in earlier versions of this review, since the Mantel-Haenszel method is now recommended for Cochrane reviews (Higgins 2011). Differences in results using the two methods are small, and most likely to be apparent where numbers are unbalanced between groups, in which case the Peto method may give biased results. Where there was substantial heterogeneity between studies we explored possible reasons using sensitivity analyses or considered the impact of outliers. We express results as a risk ratio (intervention risks/control risks) for achieving abstinence from smoking together with the 95% confidence interval for this estimate. To investigate statistical heterogeneity we used the I^2 statistic, given by the formula $[(Q - df)/Q] \times 100\%$, where Q is the Chi^2 statistic and df is its degrees of freedom (Higgins 2003). This describes the percentage of the variability in effect estimates that is due to heterogeneity rather than sampling error (chance). A value greater than 50% may be considered to indicate moderate to substantial heterogeneity.

We calculated quit rates based on the numbers of patients randomized to an intervention, excluding any deaths. Those who dropped out or were lost to follow-up were counted as continuing smokers. Most studies verified self-reported smoking status with a biochemical test. In these studies, self-reported nonsmokers who did not pass the verification procedure

were counted as smokers. We noted the number of deaths in Characteristics of included studies.

We analysed data according to our pre-determined classification of four levels of intensity (see Types of interventions, above). Where we included studies that were judged to be more prone to bias, we planned sensitivity analyses to assess whether their inclusion altered our findings. We also planned sensitivity analyses to explore, where possible, the contribution of different components to an overall effect (for example, the role of NRT in a multicomponent intervention) and to determine whether the effects were different when the study population was restricted to those wishing to stop. Another sensitivity analysis explored the efficacy of interventions that differed only after hospital discharge. In these studies participants received an identical intervention in the hospital and were randomly assigned to different post-discharge treatments.

In an exploratory analysis, we evaluated the effects of interventions in patients admitted to hospital because of the following diagnoses: cardiovascular disease, respiratory disease and cancer. We also assessed the effects of interventions that were designed to be delivered to all (or nearly all) of the smokers who were admitted to hospital regardless of the smoker's admitting diagnosis. Where there were insufficient data for meta-analysis, the results were tabulated. In cases where a single study reported data on patients from different categories, we pooled the data only when it was possible to extract data by disease category. Otherwise we included only those studies reporting data from patients in a single disease category. A separate analysis included studies that met inclusion criteria but were conducted in rehabilitation hospitals rather than acute care hospitals. These studies were not included in the main analysis.

We include the Tobacco Addiction Group glossary of tobacco-specific terms (Appendix 2).

Results

Description of studies

Fifty trials conducted in the United States, the United Kingdom, Australia, Belgium, Brazil, Canada, Denmark, Germany, Israel, Japan, the Netherlands, Norway, and Spain between 1990 and 2011 met the inclusion criteria and contributed to the review. The previous version of this review included 33 trials published between 1990 and 2007; this update includes 17 new studies. All but 12 of the 50 studies contributed to the main comparison of a behavioural counselling intervention, classified by intensity, versus control. Eight that did not contribute (Campbell 1991; Campbell 1996; Ortega 2011; Rigotti 2006; Planer 2011; Simon 2009; Smith BJ 2011; Steinberg 2011) did not include a control group of usual care or less intensive counselling; the intervention tested in those studies was pharmacotherapy as an adjunct to behavioural support. Three studies that were performed in rehabilitation hospitals (Floter 2009; Haug 2011; Metz 2007) were also analysed separately from the studies conducted in acute care hospitals. Twenty-six studies (Bolman 2002; Borglykke 2008; Campbell 1991; Campbell 1996; CASIS 1992; Chouinard 2005; Cossette 2011; Croghan 2005; DeBusk 1994; Dornelas 2000; Feeney 2001; Froelicher 2004; Hajek 2002; Miller 1997; Mohiuddin 2007; Ortigosa 2000; Pedersen 2005; Pederson 1991; Pelletier

1998; Planer 2011; Quist-Paulsen 2003; Reid 2003; Reid 2007; Rigotti 1994; Rigotti 2006; Smith 2009; Taylor 1990) provided separate data by disease and contributed to the comparison of intervention versus control in different disease categories. We describe each intervention in Characteristics of included studies. We excluded 66 studies which appeared relevant but did not meet all inclusion criteria (see Characteristics of excluded studies). We did not include two studies (Brunner-Frandsen 2010; Jimenez 2007) for which there was insufficient data to make a decision, despite our efforts to contact the authors for additional information; these remain in the Characteristics of studies awaiting classification.

Counselling interventions—Advice to quit smoking and/or behavioural counselling was provided in all 50 studies. In 48 of them, a nurse or counsellor provided stop-smoking advice and/or behavioural counselling. Twelve studies included physician advice to quit (Campbell 1991; Campbell 1996; Croghan 2005; DeBusk 1994; Feeney 2001; Froelicher 2004; Hennrikus 2005; Lacasse 2008; Lewis 1998; Miller 1997; Ortigosa 2000; Pelletier 1998;), and in one study physician advice was offered prior to admission (Pederson 1991). In three studies, the patient chart was stamped with a prompt to remind the physician to offer smoking cessation advice (Rigotti 1997; Smith 2009; Smith PM 2011). Counselling ranged in duration from less than five minutes to two hours. In nine studies, counselling was delivered on more than one occasion during the hospitalisation period (Borglykke 2008; CASIS 1992; Cossette 2011; Floter 2009; Metz 2007; Nagle 2005; Ortega 2011; Pederson 1991; Rigotti 1994). Most studies also included materials such as self-help booklets, relaxation audio tapes and video tapes. In Haug 2011, participants were provided with access to an internet-based smoking cessation program and no face-to-face counselling was performed. In Smith BJ 2011, patients were referred to a quitline and were called by a quitline counsellor.

Forty-two of 50 studies (all except Bolman 2002; Croghan 2005; Hajek 2002; Hennrikus 2005; Molyneux 2003; Nagle 2005; Pederson 1991; Pelletier 1998) offered follow-up support following discharge. Of these, 29 offered support by telephone (Caruthers 2006; CASIS 1992; Chouinard 2005; Cossette 2011; de Azevedo 2010; DeBusk 1994; Dornelas 2000; Floter 2009 ; Froelicher 2004; Hasuo 2004; Hennrikus 2005; Lacasse 2008; Lewis 1998; Metz 2007; Miller 1997; Ortigosa 2000; Quist-Paulsen 2003; Rigotti 1994; Rigotti 1997; Rigotti 2006; Simon 1997; Simon 2003; Simon 2009; Smith 2009; Smith BJ 2011; Smith PM 2011; Stevens 1993; Stevens 2000; Taylor 1990), nine provided in-person support in various settings (Borglykke 2008; Campbell 1991; Campbell 1996; Meysman 2010; Mohiuddin 2007; Pedersen 2005; Reid 2003; Steinberg 2011; Vial 2002), and two offered support by telephone and/or in-person (Ortega 2011; Planer 2011). Two studies used newer technologies to contact patients after discharge: Haug 2011 provided individual feedback letters, an internet-based smoking cessation program and offered email support and Reid 2007 used an Interactive Voice Response (IVR) system. The duration of extended support ranged from one week to 12 months from discharge.

Pharmacotherapy—No studies tested the efficacy of pharmacotherapy with nicotine replacement therapy (NRT), bupropion, or varenicline versus placebo in the absence of a counselling intervention. However, six studies tested the marginal value of adding NRT to a

counselling intervention (Campbell 1991; Campbell 1996; Lewis 1998; Molyneux 2003; Ortega 2011; Vial 2002), three studies tested the marginal value of adding bupropion to a counselling intervention (Planer 2011; Rigotti 2006; Simon 2009), and two trials tested the marginal value of adding varenicline to a counselling intervention (Smith BJ 2011; Steinberg 2011). One trial (Simon 2003) tested the marginal value of adding counselling to pharmacotherapy with NRT. In a number of other studies, particularly the newer ones, pharmacotherapy was allowed as part of the intervention or available to participants in the trial but was not specifically offered to all participants in one group and to none in another. Fourteen studies that reported providing NRT to a subgroup of patients did not specify the extent of its use (Borglykke 2008; Caruthers 2006; Chouinard 2005; DeBusk 1994; Froelicher 2004; Lacasse 2008; Pedersen 2005; Quist-Paulsen 2003; Reid 2003; Reid 2007; Rigotti 1997; Simon 1997; Simon 2003; Taylor 1990). Two studies included bupropion in a similar fashion (Chouinard 2005; Mohiuddin 2007) and in one study NRT, bupropion or varenicline were suggested during hospitalisation and follow-up (Cossette 2011).

Other study characteristics—Three studies compared two durations of post-discharge follow-up with a usual care control (Chouinard 2005; Hennrikus 2005; Miller 1997). Results from each arm of these studies were included separately in the analysis by intervention intensity. In four other studies that compared two intervention arms to a usual care control, the behavioural support offered in the two arms was comparable and results of the two intervention arms were combined in the analysis by intensity subgroups (Floter 2009; Lewis 1998; Molyneux 2003; Vial 2002). In Lewis 1998 and Molyneux 2003, the two intervention arms differed by the presence or absence of nicotine replacement, and these arms were directly compared in the pooled analysis of the effect of NRT. In Vial 2002, both intervention arms included the use of NRT, and compared follow-up from either a hospital or community pharmacist. In Floter 2009, both intervention arms included group counselling sessions during hospitalisation and follow-up with proactive telephone calls but the post-discharge intervention differed in style. In one study the smoking cessation intervention was part of a multicomponent risk intervention for patients with cardiovascular disease (DeBusk 1994); in this case the smoking cessation intervention was well-defined and met our inclusion criteria. Two studies had a third arm consisting of control patients who were not assigned randomly (de Azevedo 2010; Ortega 2011). We excluded the nonrandomised patients from analyses of these studies.

Most studies (37 of 50) assessed cigarette abstinence 12 months after hospital discharge. Thirteen studies reported a shorter follow-up period of six months (Caruthers 2006; Cossette 2011; Croghan 2005; de Azevedo 2010; Floter 2009; Haug 2011; Lewis 1998; Meysman 2010; Pedersen 2005; Pederson 1991; Rigotti 1997; Simon 2009; Steinberg 2011). Fewer than half of the studies (20 of 50) used the preferred outcome measure, sustained abstinence. Twenty-eight studies used point prevalence abstinence as the outcome measure and two studies did not specify how abstinence was defined (Cossette 2011 ; Ortega 2011). One study reported sustained abstinence rates for overall cessation but point prevalence rates by diagnosis (Miller 1997).

All but two studies included both males and females; the exceptions (Floter 2009; Froelicher 2004) included only females. All studies included adults who smoked cigarettes currently or

recently (e.g., within the past month). Seven studies included recent quitters as well as current smokers (CASIS 1992; DeBusk 1994; Haug 2011; Nagle 2005; Rigotti 1994; Stevens 1993; Stevens 2000).

Risk of bias in included studies

Fifteen of the fifty studies reported procedures for both random sequence generation and allocation concealment that we judged likely to avoid selection bias (Cossette 2011; de Azevedo 2010; DeBusk 1994; Froelicher 2004; Hajek 2002; Hasuo 2004; Lewis 1998; Nagle 2005; Reid 2003; Reid 2007; Rigotti 2006; Smith BJ 2011; Steinberg 2011; Taylor 1990; Vial 2002). Seventeen studies did not report the method of randomization and concealment in enough detail to judge the risk of selection bias, nine studies had low risk of selection bias for random sequence generation but unclear risk for allocation concealment, and three studies had unclear risk for random sequence generation and low risk for allocation concealment. Six studies did not allocate treatment at the individual patient level (Borglykke 2008; Bolman 2002; Haug 2011; Pelletier 1998; Stevens 1993 ; Stevens 2000). Two of them allocated treatment by alternating the intervention condition between hospitals over time (Stevens 1993, Stevens 2000) and one study employed a quasi-experimental design with one intervention and two control hospitals (Pelletier 1998). One study used a quasi-experimental design and assigned participants to intervention or control group according to bed availability in two wards of the same hospital (Borglykke 2008) while another used a quasirandomized design where participants were assigned to control or intervention groups based on the calendar week of admission (Haug 2011). One other study (Bolman 2002) was not fully randomized; seven of 11 participating hospitals were randomized to condition, but four others selected their study arm. All six of these studies share the potential problems of recruitment bias and of underestimation of confidence limits due to intracluster correlation. Therefore, we conducted sensitivity analyses on the effect of excluding them.

The majority of studies (33 out of 50) reported numbers lost to follow-up and methods for addressing incomplete outcome data that we judged at low risk of attrition bias. Fourteen studies did not report enough information to be assessed for incomplete outcome data and were hence rated as unclear. Three studies were rated at high risk of attrition bias: Feeney 2001 assessed only those participants who attended a follow-up programme and hence had a large and unequal percentage of losses to follow-up; in Metz 2007, sensitivity analysis excluding losses to follow-up removes the significance of the study findings due to differential drop-out rates between study arms; and differential drop-out rates in Taylor 1990 increased the apparent effect of the intervention when using an intent-to-treat approach.

Most studies (41 of 50) used a method to validate subjects' self-reports of quitting at the follow-up assessment. Biochemical validation of smoking status was done in 32 studies, using expired air carbon monoxide in 15 studies (Campbell 1991; Campbell 1996; Caruthers 2006; CASIS 1992; Croghan 2005; DeBusk 1994; Hajek 2002; Lewis 1998; Mohiuddin 2007; Molyneux 2003; Ortigosa 2000; Reid 2003; Steinberg 2011; Taylor 1990; Vial 2002), and using plasma, salivary, or urinary cotinine in 17 studies (Chouinard 2005; DeBusk 1994; Feeney 2001; Froelicher 2004; Hajek 2002; Hasuo 2004; Hennrikus 2005; Lacasse 2008;

Miller 1997; Nagle 2005; Quist-Paulsen 2003; Rigotti 1994; Rigotti 1997; Rigotti 2006; Simon 1997; Simon 2003; Simon 2009). Two studies used "corroboration by significant other" as the only validation method (Dornelas 2000; Smith 2009), and five other studies used "corroboration by significant other" in cases where a plasma or salivary cotinine measure was not available (Froelicher 2004; Lewis 1998; Miller 1997; Simon 2003; Smith 2009). Thirteen studies (Bolman 2002; Cossette 2011; de Azevedo 2010; Floter 2009; Haug 2011; Metz 2007; Meysman 2010; Pedersen 2005; Pelletier 1998; Planer 2011; Reid 2007; Stevens 1993; Stevens 2000) did not validate self-reported quitting at the follow-up assessment for any participants. Five others (Borglykke 2008; Ortega 2011; Pederson 1991; Reid 2003; Vial 2002) did not validate the smoking status of all participants who self-reported abstinence. Four studies used more than one means of validation other than corroboration by significant other (Chouinard 2005; DeBusk 1994; Rigotti 2006; Taylor 1990). In one study (Smith BJ 2011), validation of smoking abstinence with expired air carbon monoxide was performed only in a subsample but we used self-reported smoking abstinence rates in the analyses.

Most studies recruited participants on the basis of a convenience sample, with randomization being to group (intervention or control) rather than to initial inclusion. Participation rates (i.e., the proportion of those approached who agreed to take part in the trial) were also seldom recorded. Most studies recorded those lost to follow-up as continuing smokers. In one study (Stevens 2000), the intervention was offered inconsistently, with only 68% of those eligible for the intervention actually being approached.

Effects of interventions

Effect of counselling interventions categorised by intensity Figure 1—Only one included study (Hennrikus 2005) reported on the effect of a brief intervention in hospitalised patients with no followup after discharge (intensity 1). That study had a large sample size (>650 subjects per study arm). The brief intervention was no more effective than usual care (RR 1.14, 95% CI 0.82 to 1.59) although the confidence limits did not exclude the possibility of a benefit. Nine studies (Bolman 2002; Chouinard 2005; Croghan 2005; Hajek 2002; Meysman 2010; Molyneux 2003; Nagle 2005; Pederson 1991; Pelletier 1998) used a more intensive intervention in hospital but had no follow-up intervention component after discharge (intensity 2). There was no evidence of a significant benefit from pooling these studies and the confidence intervals suggest that any effect is likely to be small (RR 1.10, 95% CI 0.96 to 1.25, I^2 = 44%). Similar lack of statistically significant benefit was observed in a pooled analysis of the six studies that tested the effect of an intervention that began during hospitalisation and continued for up to 1 month after discharge (intensity 3). The risk ratio and confidence interval for the estimate of the effect of this level of intervention (RR 1.07, 95% CI 0.93 to 1.24, I^2 = 11%) is almost identical to that produced by the intensity 2 intervention.

In this update, we added eight new included studies that tested the highest intensity intervention (intensity 4), consisting of counselling that began in the hospital and continued for more than one month after discharge. The pooled estimate showed a statistically significant increase in quit rates that was similar to the previous review (RR 1.37, 95% CI

1.27 to 1.48, 25 studies) and heterogeneity remained relatively low (I^2 = 32%). This estimate excludes one study (Feeney 2001) which was an extreme outlier reporting a very large effect. In this trial amongst 198 patients admitted to a coronary care unit there was a very high drop out rate (79%) and low quit rate (1%) at 12 months in the usual care condition whilst the dropout rate was 55% and the quit rate 34% in the intervention group. The intervention group quit rate was comparable to that of other trials in the intensity 4 subgroup, but control group quit rates in the other trials were typically over 10%. This suggested that the difference in relative effect might have been due to characteristics of the support given to the control group and we decided to exclude this trial from the meta-analysis.

Three of the eight newly identified studies testing the most intensive intervention had a different design from the other trials (Caruthers 2006; Cossette 2011; Reid 2007). In these studies, all participants received the same intervention while in the hospital but were randomly assigned to interventions that differed after hospital discharge. We conducted a subgroup analysis limited to these trials in order to isolate the specific effect of a post-discharge intervention. The pooled estimate was a statistically significant 51% increase in smoking cessation rates (RR 1.51, 95% CI 1.03 to 2.22, I^2 = 44% Analysis 2.1) with the addition of a post-discharge counselling intervention.

The studies included in the preceding analyses were all conducted in acute care hospitals. We also identified three trials conducted in rehabilitation hospitals (Floter 2009; Haug 2011; Metz 2007), where patients are less acutely ill and length of stays are longer. Because of these differences, we chose to analyse studies from rehabilitation hospitals separately from studies in acute care hospitals. The interventions provided by studies based in the rehabilitation hospitals were of similar intensity; each provided over one month of follow-up contact after discharge (intensity 4), allowing us to pool the results. The pooled estimate was a statistically significant 71% increase in smoking cessation rates (RR 1.71, 95% CI 1.37 to 2.14, I^2 = 0% Analysis 3.1).

Sensitivity analyses—Some studies of behavioural counselling also included the option of pharmacotherapy, principally NRT. A sensitivity analysis excluding eighteen studies that reported the use of NRT within the highest intervention intensity did not suggest that the efficacy of these interventions was due to the use of NRT. The result from pooling only the seven trials that did not include the option of pharmacotherapy (CASIS 1992; de Azevedo 2010; Dornelas 2000; Hasuo 2004; Hennrikus 2005; Smith 2009; Smith PM 2011) though smaller, remained statistically significant (RR 1.24, 95% CI 1.09 to 1.41, I^2 = 0%).

Another sensitivity analysis excluded studies that did not randomly assign subjects to condition. Within studies that did not provide follow-up (intensity 2) we performed a sensitivity analysis excluding data reported by two studies that did not fully randomise patients (Bolman 2002; Pelletier 1998). The conclusion did not change (RR 1.03, 95% CI 0.87 to 1.22, I^2 = 44%). Within the group of studies that delivered an intervention with minimal follow-up (intensity 3) a sensitivity analysis excluding the data reported by two studies that did not randomise patients (Stevens 1993, Stevens 2000) slightly modified the point estimate, but did not substantially affect the confidence intervals (RR 1.01, 95% CI

0.83 to 1.21, I^2 = 0%). Within the group of studies with highest level of intensity of intervention (intensity 4), a sensitivity analysis excluding the data from one study that used a quasi-experimental design (Borglykke 2008) did not change the effect estimate (RR 1.35, 95% CI 1.25 to 1.46, I^2= 28%).

Approximately half of the studies that delivered the highest intervention intensity (intensity 4) excluded smokers who were not willing to attempt cessation after discharge. We performed a sensitivity analysis excluding the data reported by 13 studies in which participants were selected on the basis of their willingness to make a quit attempt (Caruthers 2006; Cossette 2011; DeBusk 1994; Froelicher 2004; Hasuo 2004; Lacasse 2008; Lewis 1998; Miller 1997; Reid 2003; Simon 1997; Smith PM 2011; Taylor 1990; Vial 2002). An intervention effect persisted in the remaining 12 studies (RR 1.44, 95% CI 1.28 to 1.62, I^2 = 43%).

We performed a sensitivity analysis excluding studies that enrolled former smokers (defined as having not smoked for more than one month before admission) as well as current smokers (CASIS 1992; DeBusk 1994; Nagle 2005; Rigotti 1994; Stevens 1993; Stevens 2000, Taylor 1990;). For intensity 3 (studies delivering a minimal intensity intervention with short-term follow-up), limiting the analysis to current smokers produced little change in the result (RR 1.01, 95% CI 0.82 to 1.24, I^2 = 0%). For studies delivering the highest intervention intensity (intensity 4), a statistically significant increase in quitting remained even after the exclusion of studies that included quitters, and the point estimate changed little (RR 1.35, 95% CI 1.24 to 1.48, I^2 = 35%). In the update, only one new study included both current smokers and recent former smokers who had quit for six months or less (Haug 2011), and this study was performed in a rehabilitation setting. Excluding this study from the analysis did not significantly change the estimate but only two studies remained in the analysis for rehabilitation centres (RR 1.56, 95% CI 1.20 to 2.03, I^2 = 0%).

We performed a sensitivity analysis excluding 15 studies that did not validate self-reported smoking cessation outcomes (Bolman 2002; Borglykke 2008; Cossette 2011; de Azevedo 2010; Floter 2009; Haug 2011; Metz 2007; Meysman 2010; Pedersen 2005; Pelletier 1998; Planer 2011; Reid 2007; Smith BJ 2011; Stevens 1993; Stevens 2000). This did not alter the results. The point estimates for the lower intensity interventions declined, but confidence intervals remained wide and conclusions did not change (intensity 2 RR 0.96, 95% CI 0.81 to 1.14, I^2 = 0%; intensity 3 RR 1.01, 95% CI 0.83 to 1.21, I^2 = 0%). Five studies in the most intensive intervention category (intensity 4) did not validate self-reported smoking cessation (Borglykke 2008; Cossette 2011; de Azevedo 2010; Pedersen 2005; Reid 2007). Excluding them did not alter the point estimate or statistical significance of the effect (RR 1.38, 95% CI 1.28 to 1.50, I^2 = 32%).

Effect of pharmacotherapy—The effect of pharmacotherapy compared with placebo as a single intervention in the absence of counselling has not been tested. Several trials have tested the effect of adding pharmacotherapy to a counselling intervention or, conversely, of adding counselling to a pharmacotherapy intervention.

NRT: Six trials (Campbell 1991, Campbell 1996, Lewis 1998; Molyneux 2003; Ortega 2011; Vial 2002) tested the marginal effect of NRT added to counselling. In these trials, NRT was compared with placebo NRT or no NRT and all subjects received a counselling intervention. Pooled analysis of these studies produced a significant RR of 1.54 (95% CI 1.34 to 1.79, I^2 = 33%, Analysis 4.1.1). This result is consistent with the effect of NRT seen in other settings (Stead 2008b). One trial compared the effect of adding intensive counselling versus minimal counselling to an NRT intervention (Simon 2003). The study had an RR of 1.68 for sustained abstinence, but the confidence limits of that estimate missed statistical significance (95% CI 0.80, 3.53). However, the result was consistent with the impact of intensive counselling observed in the absence of pharmacotherapy.

Bupropion: Three studies systematically compared the use of bupropion with placebo among hospitalised smokers who also received intensive smoking cessation counselling (Planer 2011; Rigotti 2006; Simon 2009). The pooled analysis did not detect a statistically significant effect of the drug over intensive counselling alone (RR 1.04, 95% CI 0.75 to 1.45, I^2 = 29%, Analysis 4.1.2). While the confidence limits were wide, they do not encompass the confidence limits for the effect of bupropion in other settings (OR 1.94, 95% CI 1.72 to 2.19, Hughes 2007), suggesting that bupropion may not be effective, or may be less effective, when started in the hospital.

Varenicline: Two studies of varenicline compared the use of varenicline with placebo (Steinberg 2011) or counselling alone (Smith BJ 2011). The pooled estimate suggested an effect of the drug over intensive counselling alone (RR 1.29, 95% CI 0.95 to 1.76) but the wide confidence limits reflect the small numbers of participants (580) and the result was not statistically significant. There was also heterogeneity between the two studies (I^2= 62%), with Steinberg 2011 reporting lower quit rates in the varenicline group.

Effect of intervention by diagnosis—The included studies were heterogeneous in the types of hospitalised patients who were recruited. Because of this diagnostic heterogeneity, we examined the results of interventions within the following diagnostic groups, keeping the same intensity subgroups where the number of studies justified this approach. Seventeen studies enrolled hospital patients with a wide range of admitting diagnoses. These studies tested smoking intervention programs that were implemented hospital-wide (Caruthers 2006; de Azevedo 2010; Hasuo 2004; Hennrikus 2005; Lewis 1998; Miller 1997; Molyneux 2003; Nagle 2005; Rigotti 1997; Simon 2003; Simon 2009; Smith BJ 2011; Smith PM 2011; Steinberg 2011; Stevens 1993; Stevens 2000; Vial 2002). Twenty-two studies reported on the effects of interventions in patients hospitalised with a cardiovascular diagnosis (Bolman 2002; Campbell 1991; CASIS 1992; Chouinard 2005; Cossette 2011; DeBusk 1994; Dornelas 2000; Froelicher 2004 ; Hajek 2002; Miller 1997; Mohiuddin 2007; Ortigosa 2000; Pedersen 2005; Pelletier 1998; Planer 2011; Quist-Paulsen 2003; Reid 2003; Reid 2007; Rigotti 1994; Rigotti 2006; Simon 2009; Taylor 1990). Five studies reported on interventions in patients with a respiratory diagnosis (Borglykke 2008; Campbell 1991;Campbell 1996; Miller 1997; Pederson 1991). Only one small pilot study was found that recruited hospitalised patients admitted for a cancer diagnosis (Croghan 2005).

The pattern of effect across intervention intensities was similar for the eighteen studies that enrolled patients with all admitting diagnoses (Analysis 5.1). Interventions categorized as intensity 4 were effective in a pooled analysis of twelve studies in this subgroup (RR 1.26, 95% CI 1.12 to 1.42, I^2 = 25%). The risk ratio was lower than the effect of the intensity 4 intervention in the overall analysis, but the confidence intervals overlap and we cannot conclude that intensive interventions are less effective in this subgroup. Pooled analysis of less intensive interventions demonstrated no effect and did not differ from the overall analysis (intensity 2: RR 0.90, 95% CI 0.64 to 1.28, I^2 = 0%, 2 studies; intensity 3, RR 1.10, 95% CI 0.94 to 1.29, I^2 = 28%, 4 studies).

The estimate of the effect for each level of intervention intensity among patients with a cardiovascular diagnosis was also very similar to that for the entire sample of hospitalised patients (Analysis 5.2). Pooled analysis of 14 studies reporting on the effect of the most intensive intervention (intensity 4) found a statistically significant effect (RR 1.42, 95% CI 1.29 to 1.56, I^2 = 32%, CASIS 1992; Chouinard 2005; Cossette 2011; DeBusk 1994; Dornelas 2000; Froelicher 2004; Miller 1997; Mohiuddin 2007; Pedersen 2005; Quist-Paulsen 2003; Reid 2003; Reid 2007; Smith 2009; Taylor 1990). The point estimate of the effect was similar to that for overall analysis (RR 1.37, 95% CI 1.27 to 1.48), the confidence intervals overlap substantially, and we cannot conclude that interventions in patients hospitalised for cardiovascular disease are more effective than in the general hospital population. No statistically significant effect was found for interventions of lower intensity. Pooled analysis of four studies of in-hospital counselling without follow-up after discharge (intensity 2) found no intervention effect (RR 1.10, 95% CI 0.94 to 1.28, I^2 = 58%, Bolman 2002; Chouinard 2005; Hajek 2002; Pelletier 1998). Pooled analysis of three studies that provided in-hospital counselling and brief follow-up contact after discharge (intensity 3) also found no intervention effect (RR 1.04, 95% CI 0.84 to 1.28, I^2 = 0%, Miller 1997; Ortigosa 2000; Rigotti 1994).

One of the trials that tested an intensity 4 smoking intervention in the cardiovascular subgroup (Mohiuddin 2007) also assessed all-cause mortality and hospital readmission rates as endpoints. Over a two-year follow-up, the intervention produced a relative risk reduction of 0.77 (95% CI 0.27 to 0.93, p=.014) in all-cause mortality and a relative risk reduction of 0.44 (95% CI 0.16 to 0.63, p=.007) in hospital readmissions.

Five studies provided interventions to patients hospitalised with a respiratory diagnosis. Two of these studies evaluated NRT (Campbell 1991; Campbell 1996) and three other studies of counselling interventions used different intensity interventions (Borglykke 2008; Miller 1997; Pederson 1991). We estimated a separate pooled effect for the NRT studies (RR 1.29, 95% CI 0.62 to 2.69, I^2 = 65%) and for the counselling studies (RR 1.22, 95% CI 0.93 to 1.60, I^2 = 76%).

One pilot study reported on the effects of a hospital-based intervention for patients with cancer (Croghan 2005). It found no evidence of efficacy but the sample size was very small and the confidence limits were very broad.

Discussion

The results of this review indicate that smoking cessation counselling interventions delivered during a period of hospitalisation and including follow-up support that lasts at least one month after discharge increase smoking cessation rates. The estimated effect of such interventions was to increase the smoking cessation rate by 37% at six to 12 months after hospital discharge. This finding was robust. It remained statistically significant in sensitivity analyses that excluded studies of lower quality (e.g., those that did not validate self-reported smoking cessation at outcome or those that were not randomized). Neither the exclusion of studies that included recent quitters as well as current smokers nor those that included patients selected for motivation significantly affected the relative effect of intervention over control. This review found no evidence to support the efficacy of less intensive counselling interventions, such as those delivered only during hospitalisation or those which include less than one month of follow-up support after discharge. Therefore, post-discharge follow-up support appears to be an important component of interventions that begin during hospitalisation. We caution that the effect sizes observed in all these studies may be artificially modest because in many cases the "control" condition was more intensive than usual care or simply brief advice.

The counselling intervention in these studies was generally delivered by a research nurse or trained smoking cessation counsellor, not by a nurse responsible for other aspects of the patients' clinical care. Physician advice was a component of the intervention in many trials. There is no specific evidence from this review that brief physician advice to quit is effective by itself in the hospital setting, although evidence from trials in primary care settings support the efficacy of physician advice to quit (Stead 2008a). Pharmacotherapy with nicotine replacement therapy (NRT), bupropion, or varenicline was included in some of the counselling studies, especially the more recent ones. In most of these trials, the pharmacotherapy was not systematically provided to all subjects in the intervention arm or excluded from all subjects in the control arm. The efficacy of counselling interventions remained after excluding those studies that reported the use of NRT, suggesting that counselling alone is effective.

This update includes a new finding regarding pharmacotherapy. In hospitalised smokers the effect of pharmacotherapy by itself, compared to placebo or no pharmacotherapy in the absence of counselling, cannot be determined because no such trials have been conducted. However, the marginal effect of NRT, bupropion, or varenicline when added to counselling in the hospital setting has been tested. Pooled analysis of six studies found a statistically significant 54% increase in the smoking cessation rate when NRT was added to counselling alone. This finding is new since the 2007 update, at which time there was a non-significant trend toward finding the addition of NRT to counselling to be efficacious in the hospital setting. The current estimate of the effect of NRT in the hospital setting is within the confidence intervals of the estimated RRs from the Cochrane review of NRT: 1.43 (95% CI 1.33 to 1.53) for nicotine gum and 1.66 (95% CI 1.53 to 1.81) for nicotine patch (Stead 2008b). Hence these data support NRT's usefulness in appropriate patients during and following hospitalisation. Starting NRT before discharge was associated with a higher rate of NRT use two weeks after discharge in a non-randomized observational trial in one

hospital (Regan 2011). The marginal effect of counselling when added to NRT begun in the hospital was tested in only one study (Simon 2003). Intensive counselling increased the rate of smoking cessation over that achieved by NRT alone, but the result was not statistically significant (RR 1.68,95% CI 0.80, 3.53). However, the result was consistent with the pooled estimate from this review of the effect of intensive counselling without pharmacotherapy.

Fewer data are available to assess the benefit of bupropion or varenicline as adjuncts to smoking cessation counselling that starts in the hospital setting. This update identified two new trials of bupropion to add to one previous trial (Rigotti 2006). All three trials tested the marginal efficacy of bupropion over placebo among smokers who all received intensive counselling in the hospital setting. Bupropion was not more effective than placebo in the pooled analysis (RR 1.06, 95% CI 0.68 to 1.63). This finding contrasts with evidence that bupropion is effective for smoking cessation in other populations (Hughes 2007). A possible explanation for the lack of efficacy of bupropion in the context of hospitalisation is the long half-life of sustained-release bupropion. Steady-state bupropion blood levels occur only after five to seven days of drug administration. This is generally after hospital discharge. Consequently, hospitalised smokers may be discharged into an environment filled with cues to smoke before they have sufficient levels of bupropion for it to be effective.

This update also identified the first randomized controlled trials that tested the efficacy of initiating varenicline in the hospital setting. Two trials compared the efficacy of adding varenicline (versus placebo or no drug) to counselling in the hospital setting. The pooled result of these studies produced an estimated 28% increase in the rate of smoking cessation with varenicline, but the result was not statistically significant and confidence intervals were wide due to the small sample sizes of the trials (95% CI 0.88 to 2.26). This contrasts with strong evidence of efficacy and a higher estimate of the effect size of varenicline that has been found in a systematic review of varenicline (RR 2.27, 95% CI 2.02 to 2.55, Cahill 2012).

The analyses by diagnosis demonstrate that the intensive counselling intervention is effective in the subgroup of patients admitted to hospital with a cardiovascular diagnosis, as it is for the overall group of hospitalised smokers who are not selected by diagnosis. The absolute cessation rates amongst smokers admitted with cardiovascular disease tended to be higher than amongst smokers not selected by diagnosis, but the relative effect of an intensive counselling intervention was not significantly greater in CVD patients. The potential benefit of intensive intervention in smokers with CVD was illustrated in the one study that assessed health care utilization and mortality outcomes (Mohiuddin 2007). That study found a large increase in smoking cessation in the intervention group, and at two-year follow-up, a substantial decline in hospital readmission and all-cause mortality rates. There was a possibility of confounding due to better control of blood pressure and cholesterol and better medication compliance in the intervention group. Among smokers hospitalised for myocardial infarction, intensive counselling begun in the hospital is highly cost effective, even when the cost of a course of pharmacotherapy is included in the calculation (Ladapo 2011). The effectiveness of smoking cessation interventions for patients who are admitted to hospital with a respiratory diagnosis is less clear, in part because of a small number of studies in this subgroup. Overall, there is no strong evidence for a differential effect of the

intensive counselling intervention by diagnosis. These data support offering hospital-based interventions to all smokers, regardless of admitting diagnosis.

Determining how to translate these findings effectively and consistently into routine clinical practice is the next challenge for this field. The intervention in most of the trials included in this review was delivered by research staff. The effectiveness of implementing the intervention in routine clinical practice, where interventions will be delivered by clinical staff, needs to be demonstrated. Feasible models that can be readily implemented in hospital settings are needed. Current evidence on this point is limited. Two studies included in this review illustrate this challenge (Stevens 1993; Stevens 2000). Both studies provided a similar counselling intervention in a similar setting, but counselling was delivered by research staff (masters-level psychologists) in the first study and by clinical staff (trained respiratory therapists) in the second study. The intervention efficacy was demonstrated in the first study but did not persist in the second study. The feasibility of maintaining an efficacious intervention after the conclusion of a research trial was investigated for another study included in this systematic review (Miller 1997). The counselling intervention was maintained in the same hospitals for three years after the clinical trial ended. During that time approximately half of the smokers accepted the offer of intervention, and those smokers had a cessation rate comparable to that achieved in the randomized trial. These results suggested that programme effectiveness was maintained (Smith 2002). More studies are needed to demonstrate the feasibility and effectiveness of hospital-initiated smoking cessation interventions in routine practice.

Finally, this update includes the first studies conducted in rehabilitation hospitals. The results of the pooled analysis finds that smoking interventions in these settings are effective and extend the effect from acute care hospitals to a broader group of settings.

Authors' conclusions

Implications for practice

The results support the use of smoking cessation counselling interventions that begin during the hospitalisation period and include at least one month of follow-up supportive contact after discharge. There is no evidence that less intensive counselling interventions, particularly those that do not continue after hospital discharge, are effective in promoting smoking cessation. The efficacy of the counselling intervention does not clearly vary by a smoker's admitting diagnosis, and it is appropriate to offer the intervention to hospitalised smokers regardless of their admitting diagnosis. Adding nicotine replacement therapy to an intensive counselling intervention further increases the efficacy of hospital-initiated interventions and should be routinely offered. There is insufficient evidence regarding the benefit of adding varenicline or bupropion to counselling, although there was a trend toward statistical significance for varenicline and the results are compatible with data which show the effectiveness of varenicline in other settings. Bupropion may not be effective when added to counselling started in the hospital.

Implications for research

The impact of an intensive counselling intervention that continues after hospital discharge is well-established. The efficacy of adding NRT to a counselling intervention in hospitalised patients is now also established, with a relative risk estimate that is consistent with the established efficacy of NRT. Further studies testing the efficacy of adding varenicline to counselling are warranted in view of the results of early studies. They might generate sufficient data to produce a statistically significant result in future pooled analyses. The pooled evidence of studies with bupropion does not provide support for further studies of the drug in this context.

Research is needed to identify effective strategies for implementing and disseminating this evidence into routine practice in health care systems.

Additional research is needed to assess the cost-effectiveness of the intensive counselling intervention and to explore the impact of counselling on health and healthcare utilization outcomes.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Rigotti NA, Munafo MR, Murphy MF, Stead LF. Interventions for smoking cessation in hospitalised patients. Cochrane Database of Systematic Reviews. 2003; (1) Art. No.: CD001837.

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Appendices

1 Details of search strategies for Tobacco Addiction register and CINAHL

Search strategy for the Tobacco Addiction specialised register: (hospital and patient*) or hospitali* or inpatient* or admission* or admitted

Search strategy for CINAHL (EBSCO):

S14	S4 and S5 and S13
S13	S6 or S7 or S8 or S9 or S10 or S11 or S12
S12	MH Placebos

S11	TX RCT
S10	MH (Random assignment OR Clinical Trials+ OR Quantitative Studies)
S9	TX "control group*"
S8	TX "treatment arm"
S7	TX (trial and (control* OR comparative))
S6	TX (random* OR factorial* OR placebo* OR assign* OR allocat*
S5	MJ (smok* OR tobacco OR nicotine)
S4	S1 or S2 or S3
S3	MJ (hospitali* OR inpatient*)
S2	TI (hospitali* OR inpatient* OR admission* OR admitted) or AB (hospitali* OR inpatient* OR admission* OR admitted)
S1	TI (hospital with patient*) or AB (hospital with patient*)

2 Glossary of tobacco-specific terms

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

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

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

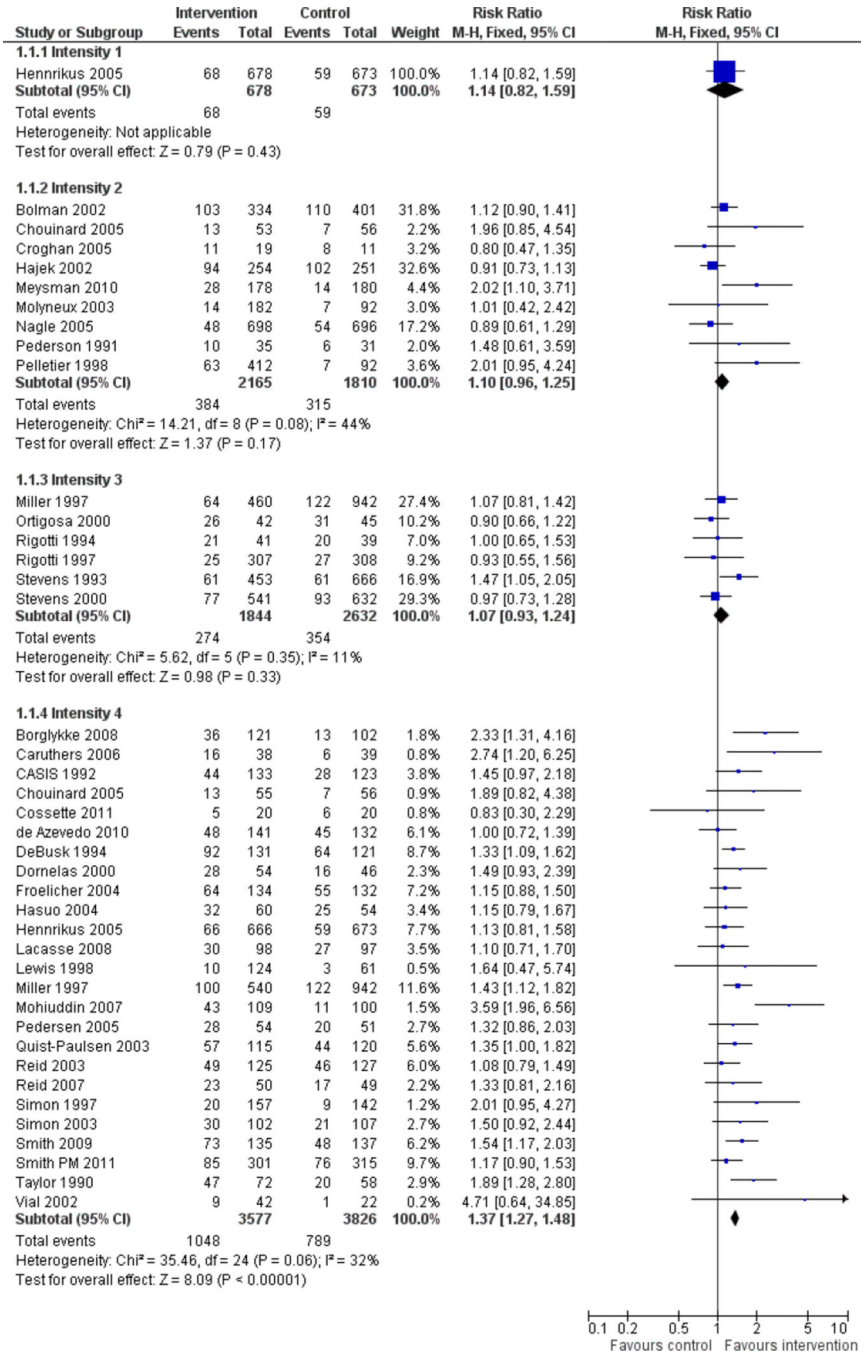


Figure 1.

Forest plot of comparison: 1 Intervention v Control, by intensity of counselling intervention, outcome: 1.1 Quit at longest follow-up (6+ months).

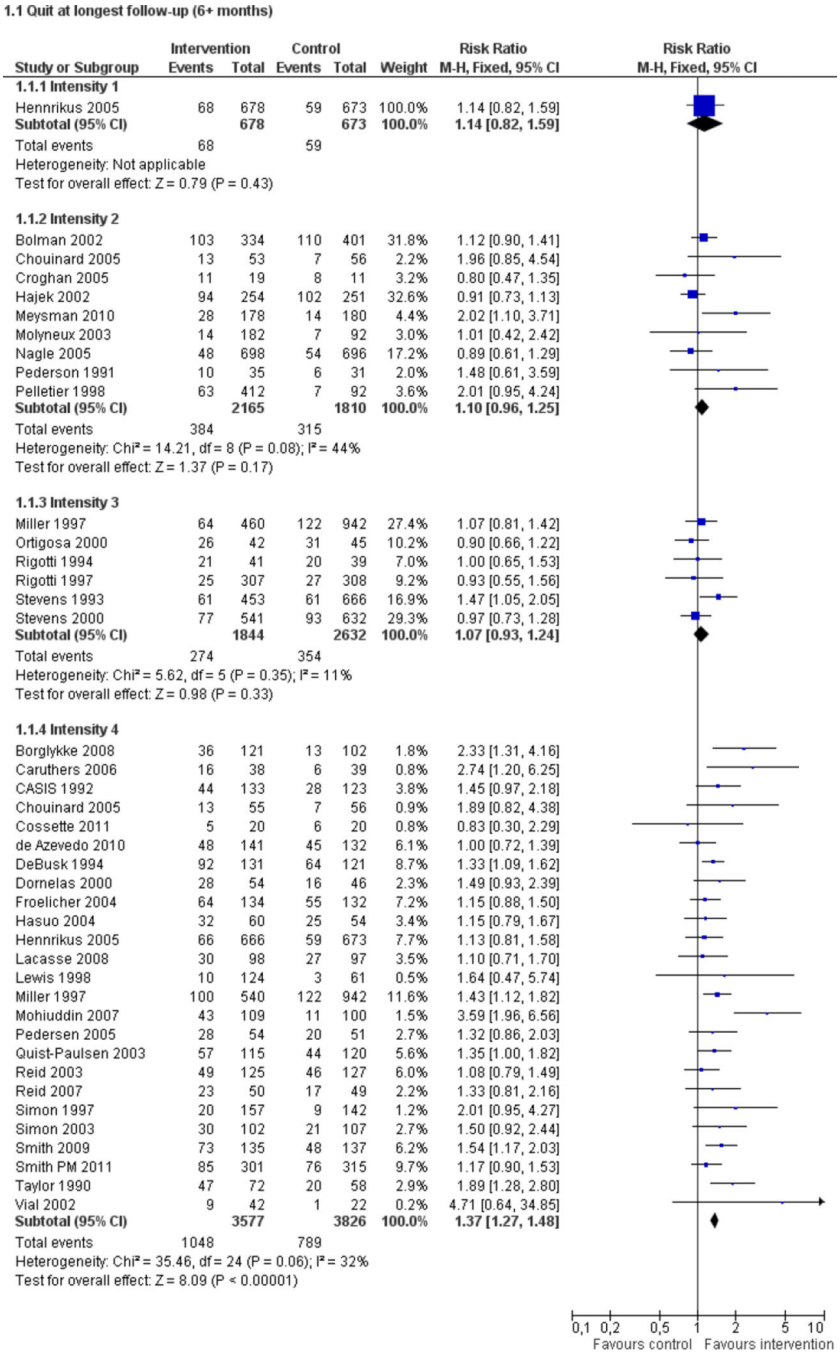


Figure 2.

1 - Intervention v Control, by intensity of counselling intervention

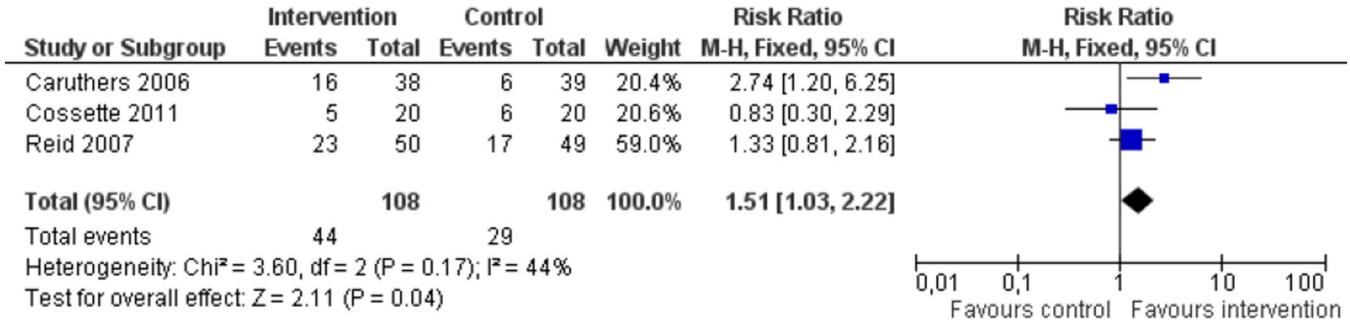


Figure 3.

2 - Intervention v Control, trials with post discharge intervention

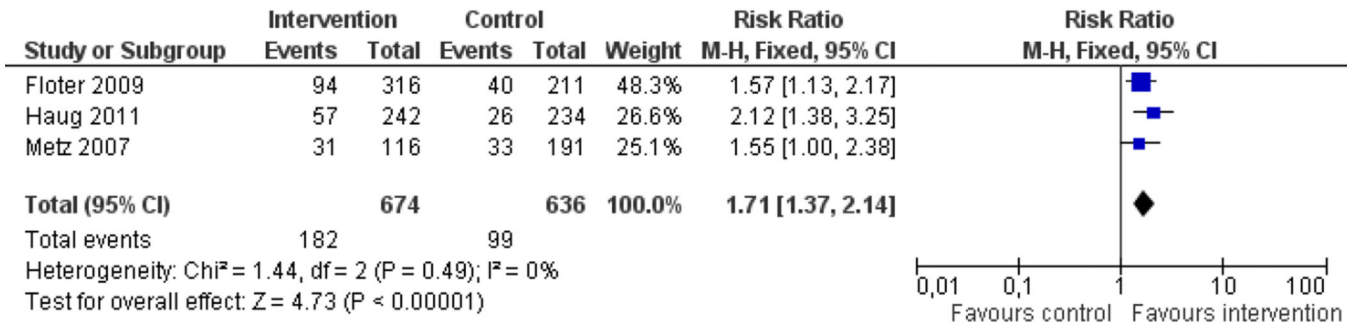


Figure 4.

3 - Intervention v Control, trials in rehabilitation centers

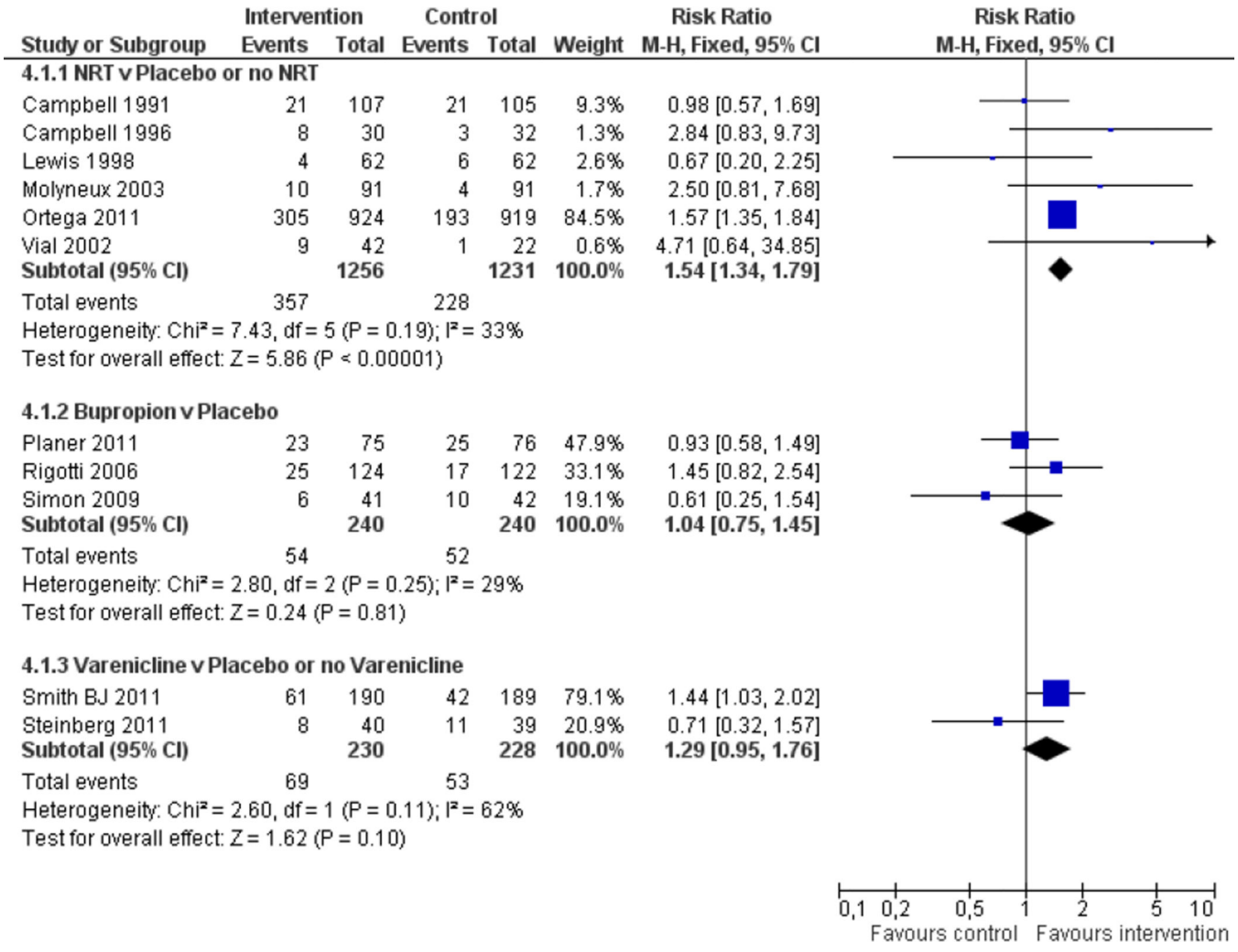
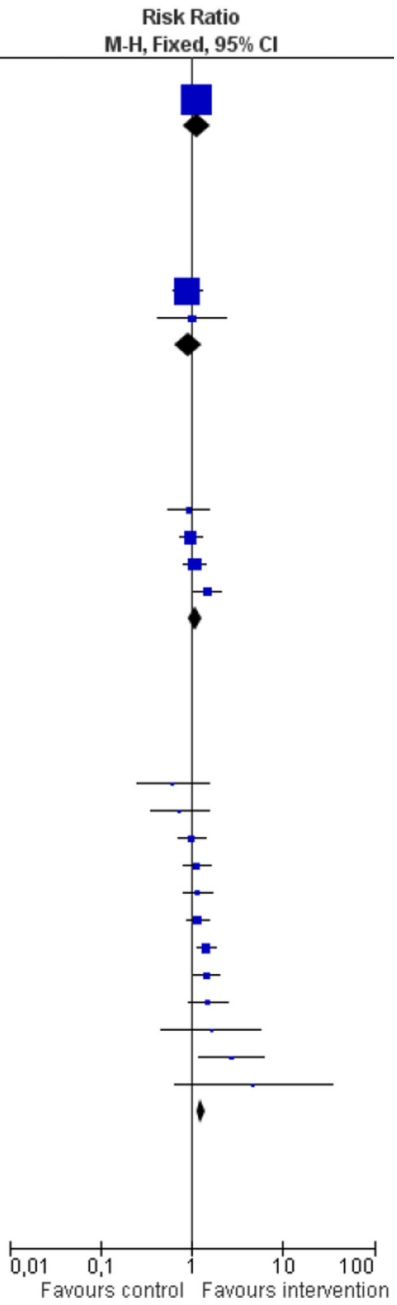


Figure 5.

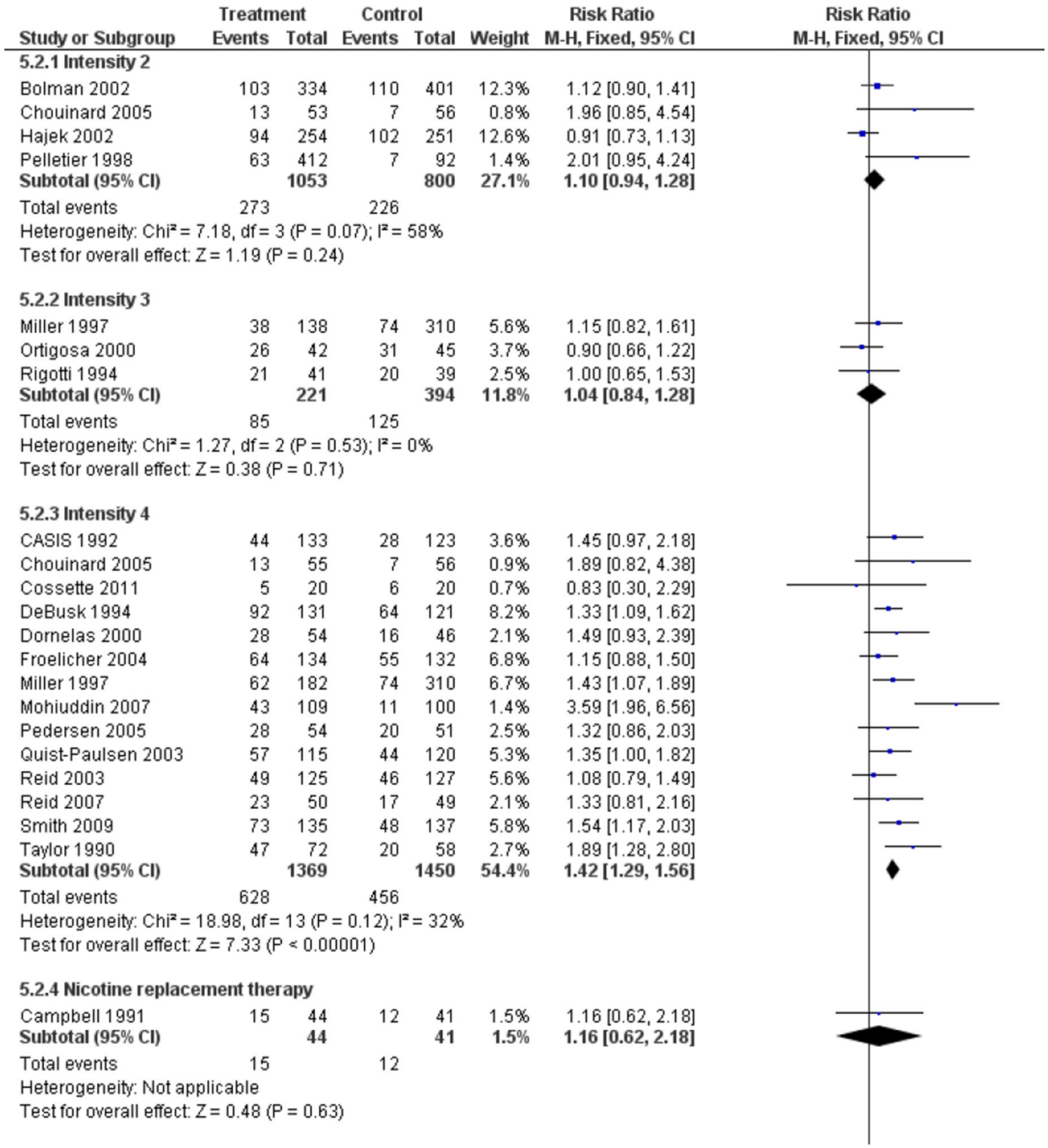
4 - Intervention v Control, trials of pharmacotherapy (pharmacotherapy systematically varied by group)

5.1 All hospital patients, unselected by diagnosis

Study or Subgroup	Treatment Events	Total	Control Events	Total	Weight	Risk Ratio M-H, Fixed, 95% CI
5.1.1 intensity 1						
Hennrikus 2005	68	678	59	673	100.0%	1.14 [0.82, 1.59]
Subtotal (95% CI)		**678**		**673**	**100.0%**	**1.14 [0.82, 1.59]**
Total events	68		59			
Heterogeneity: Not applicable						
Test for overall effect: Z = 0.79 (P = 0.43)						
5.1.2 Intensity 2						
Nagle 2005	48	698	54	696	85.3%	0.89 [0.61, 1.29]
Molyneux 2003	14	182	7	92	14.7%	1.01 [0.42, 2.42]
Subtotal (95% CI)		**880**		**788**	**100.0%**	**0.90 [0.64, 1.28]**
Total events	62		61			
Heterogeneity: Chi² = 0.07, df = 1 (P = 0.79); I² = 0%						
Test for overall effect: Z = 0.57 (P = 0.57)						
5.1.3 Intensity 3						
Rigotti 1997	25	307	27	308	11.1%	0.93 [0.55, 1.56]
Stevens 2000	77	541	93	632	35.4%	0.97 [0.73, 1.28]
Miller 1997	64	460	122	942	33.1%	1.07 [0.81, 1.42]
Stevens 1993	61	453	61	666	20.4%	1.47 [1.05, 2.05]
Subtotal (95% CI)		**1761**		**2548**	**100.0%**	**1.10 [0.94, 1.29]**
Total events	227		303			
Heterogeneity: Chi² = 4.14, df = 3 (P = 0.25); I² = 28%						
Test for overall effect: Z = 1.17 (P = 0.24)						
5.1.4 Intensity 4						
Simon 2009	6	41	10	42	2.5%	0.61 [0.25, 1.54]
Steinberg 2011	9	40	12	39	3.1%	0.73 [0.35, 1.54]
de Azevedo 2010	48	141	45	132	11.9%	1.00 [0.72, 1.39]
Hennrikus 2005	66	666	59	673	15.0%	1.13 [0.81, 1.58]
Hasuo 2004	32	60	25	54	6.7%	1.15 [0.79, 1.67]
Smith PM 2011	85	301	76	315	19.0%	1.17 [0.90, 1.53]
Miller 1997	100	540	122	942	22.8%	1.43 [1.12, 1.82]
Smith BJ 2011	61	190	42	189	10.8%	1.44 [1.03, 2.02]
Simon 2003	30	102	21	107	5.2%	1.50 [0.92, 2.44]
Lewis 1998	10	124	3	61	1.0%	1.64 [0.47, 5.74]
Caruthers 2006	16	38	6	39	1.5%	2.74 [1.20, 6.25]
Vial 2002	9	42	1	22	0.3%	4.71 [0.64, 34.85]
Subtotal (95% CI)		**2285**		**2615**	**100.0%**	**1.26 [1.12, 1.42]**
Total events	472		422			
Heterogeneity: Chi² = 14.65, df = 11 (P = 0.20); I² = 25%						
Test for overall effect: Z = 3.92 (P < 0.0001)						



5.2 Patients with cardiovascular disease



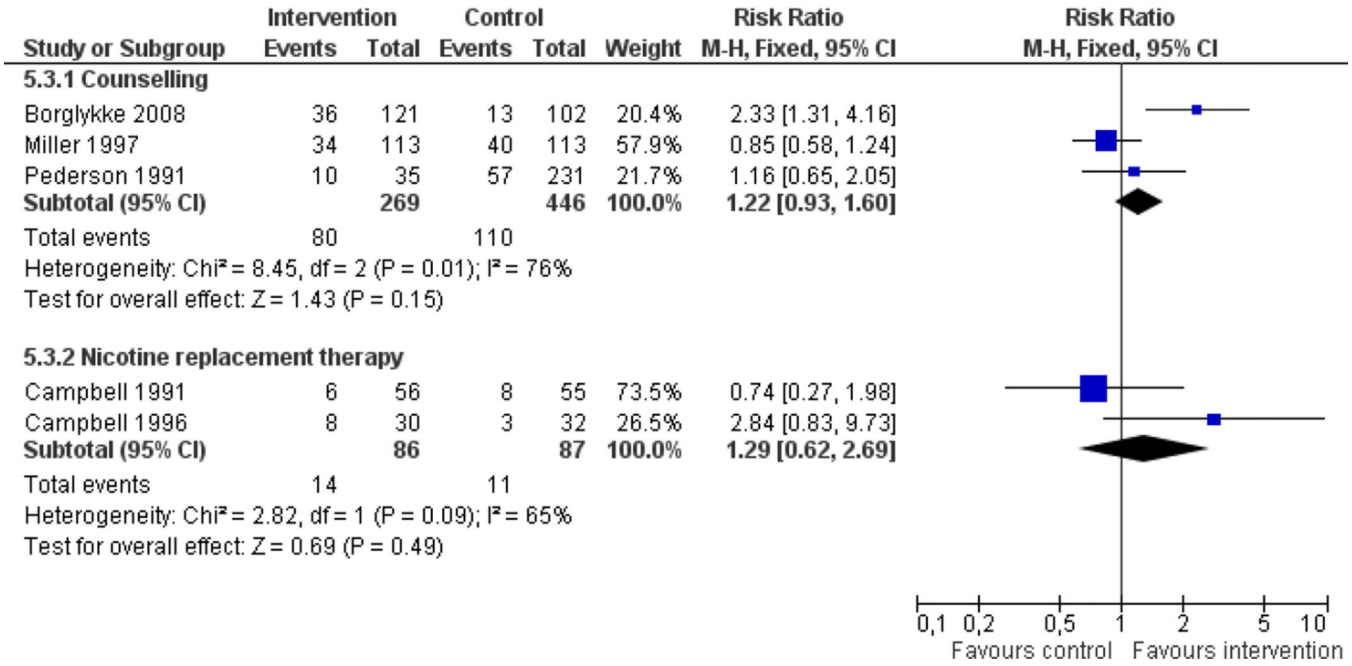


Figure 6.

5 - Intervention v Control, by intervention intensity within diagnostic subgroups

Characteristics of studies

Characteristics of included studies

Bolman 2002		
Methods	Country: Netherlands Recruitment: Cardiac ward patients in 11 hospitals Selection: All eligible patients asked to participate by ward nurses	
Participants	Participants: 789 smokers who had smoked in previous week Number smoked: not stated Age: 56 yrs average Therapists: Physician, nurse	
Interventions	**1** Intervention (5 hospitals): Cardiologist advice, 15–30 min counselling from ward nurse. follow-up: Cardiologist prompted to advise at 4–6 wk clinic but no counselling provided by team. Self-help materials. No pharmacotherapy. [Intensity 2] **2** Control: Usual care NRT: No	
Outcomes	Abstinence: Sustained at 12m Validation: None Died: 25 at 12m	
Notes	Included in CVD subcategory Numbers in meta-analysis adjusted to approximate the OR reported from a logistic regression analysis on continuous abstinence (OR 1.17, 90% CI 0.85 to 1.61)	
Risk of bias table		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	High risk	Cluster randomized by hospital, 4/11 self-selected intervention condition, although exclusion of these did not change results.
Allocation concealment (selection bias)	High risk	Participants identified by ward nurses. Possibility of selection bias although control group nurses said to be blind to condition.
Incomplete outcome data (attrition bias)	Unclear risk	25 deaths, 38 refusals, 64 missing baseline data excluded from analysis denominator.
Borglykke 2008		
Methods	Country:Denmark Recruitment: patients admitted with symptoms of acute exacerbation of COPD in 1 university hospital Selection: all eligible patients asked to participate	
Participants	Participants: 223 current smokers Diagnosis: COPD Age: 65.9 yrs av. Gender: 35% male Willingness to quit: not reported Therapists: nurses	
Interventions	**1** Intervention: smoking cessation groups: standard information on the benefits of smoking cessation, weekly sessions of 2 hours during 5 weeks. follow-up session at 3 month. [Intensity 4] **2** Control: usual care (not described) Pharmacotherapy: complimentary NRT when needed in intervention group	
Outcomes	Abstinence: self-reported PP at 12m Validation: CO (in 84% of patients) Died: none reported	
Notes	Category: pulmonary patients Only 48/105 intervention patients received intervention OR adjusted for sex, age and duration of COPD: 2.83 (1.40–5.74)	
Risk of bias table		

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Not randomized. Participants assigned to intervention ward or control ward based on vacancy.
Allocation concealment (selection bias)	Low risk	"On hospital admission, the patients were met by the medical officer in charge of the distribution of patients…who had no knowledge of the study being conducted. The medical officer randomly assigned the patients to one of the hospital wards by … vacancy."
Incomplete outcome data (attrition bias)	Low risk	No loss to follow-up at 1 year.
Campbell 1991		
Methods	Country: UK Recruitment: Inpatients with smoking-related diseases Selected: Invited to participate	
Participants	Participants: 212 current smokers Number smoked: not stated Most had heart or lung disease Therapists: Physician and non-specialist counsellor	
Interventions	**1** Intervention: Physician advice, inpatient counselling (1×, total not stated, type not stated). NRT (gum, dose 2–4 mg, for 3m). follow-up (5× at 2, 3, 5 wks, 3m, 6m in clinic by counsellor) **2** Control: Other (as above, placebo NRT gum) [Intensity 4 for both arms] NRT: Yes	
Outcomes	Abstinence: Sustained abstinence at 6 and 12m Validation: Expired air CO Died: None reported	
Notes	Not included in analysis by counselling intensity because arms differed only by use of NRT Heart disease, lung disease and other given separately in analysis by diagnosis.	
Risk of bias table		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	"those who had agreed were given packages of identical appearance randomly containing either nicotine (2mg) or placebo gum"
Allocation concealment (selection bias)	Unclear risk	No details reported
Incomplete outcome data (attrition bias)	Unclear risk	"Non-attenders were classified as failures"; rate of drop-outs not reported.
Campbell 1996		
Methods	Country: UK Recruitment: Inpatients with respiratory or cardiovascular disease Selected: Prepared to make quit attempt	
Participants	Participants: 62 current smokers Age: not stated Approx. 75% had respiratory disease Therapists: Physician and non-specialist counsellor	
Interventions	**1** Intervention: Physician advice. Counselling (1×, total 30–60 mins, type information). NRT (patch, dose 17.5–35 mg, for 12 wks). follow-up (4× at 2, 4, 8, 12 wks in clinic by counsellor) **2** Control: Other (as above, placebo NRT patch) [Intensity 4 for both arms] NRT: Yes	
Outcomes	Abstinence: Sustained abstinence at 3, 6, 12m Validation: Expired air CO Died: None reported	

Notes	Only data on inpatients extracted from study. Included in respiratory disease subcategory.	
Risk of bias table		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	"randomized," method not described.
Allocation concealment (selection bias)	Unclear risk	No details reported.
Incomplete outcome data (attrition bias)	Unclear risk	ITT analysis, but number lost to follow-up in inpatient-only group not specified.
Caruthers 2006		
Methods	Country:USA Recruitment: smokers admitted to a medical/surgical unit Selection: A convenience sample of 80 participants of 106 individuals screened for participation	
Participants	Participants: 80 smokers (smoking at least one cigarette within 30 days of their hospital admission) Diagnosis: med and surgical Age: 51 yrs av. Gender: 40% male Willingness to quit: 79/80 indicated a desire to quit Therapists: nurses	
Interventions	**1** Intervention: In-hospital counselling and study specific intervention booklet + post discharge phone calls (8 individualized telephone calls in 12 weeks after discharge). [Intensity 4] **2** Control: enhanced usual care during hospitalisation Pharmacotherapy: Smoking cessation pharmacotherapy was not provided as part of the intervention; however, several patients were prescribed such medication during their hospital admission.	
Outcomes	Abstinence: self-reported 7-day PP at 12 and 24 wks (6m) post-discharge Validation: CO confirmed Died: 3 (2 in intervention, 1 in control group)	
Notes	Additional information provided by 1st author 2/2012	
Risk of bias table		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Adaptive randomization by minimization was computer generated via a program which provided stratification by gender, ethnicity, and whether the participant was admitted with or without tobacco related disorder(s)
Allocation concealment (selection bias)	Unclear risk	not described
Incomplete outcome data (attrition bias)	Low risk	10 lost to follow-up in control group and 2 in intervention but ITT analyses conducted
CASIS 1992		
Methods	Country: USA Recruitment: Inpatients with coronary artery stenosis confirmed by catheterization. Selected: Invited to participate.	
Participants	Participants: 267 current smokers or recent quitters (50%, defined as at least 5 cpd at any time in previous 2m) Number smoked: 25 cpd Age: 53 yrs av. 78 had acute MI, 21 recent MI, 152 other symptoms Therapists: Masters level health educators	
Interventions	**1** Intervention: Counselling (2×, total 40 mins, type not stated). Self-help materials, relaxation tapes. Follow-up (4× at 1, 3 wks and 3m if quit or 2,4m if did not quit, by telephone) [Intensity 4] **2** Control: Advice only	

	NRT: No	
Outcomes	Abstinence: Sustained abstinence at 6m, 12m Validation: Expired air CO. Died: None reported.	
Notes	Patients admitted with MI more likely to be quitters at 6m (74%). Evidence of interaction between intervention and illness. Included in CVD subcategory	
Risk of bias table		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Randomized, method not described
Allocation concealment (selection bias)	Unclear risk	No details reported
Incomplete outcome data (attrition bias)	Unclear risk	No mention of losses to follow-up. All survivors included in denominators.
Chouinard 2005		
Methods	Country: Canada Recruitment: Inpatients with cardiovascular disease (MI, angina, CHF) or PVD Selected: Not by motivation	
Participants	Participants: 168 past-month smokers Number smoked: not stated Age: 56 yrs av Therapist: nurse	
Interventions	**1** Intervention 1: Counselling by research nurse (1×, 10–60 mins, av. 40 min, tailored to stage of change), 23% used pharmacotherapy. [Intensity 2] **2** Intervention 2: As 1 plus telephone follow-up, 6 calls over 2m post-discharge [Intensity 4] **3** Control: cessation advice NRT: Yes (partial)	
Outcomes	Abstinence: Sustained abstinence at 2 & 6m Validation: Urine cotinine or expired air CO Died: 3 in 1. 1 in 2. 0 in 3.	
Notes	Two interventions compared separately to control in intensity subgroups Included in CVD subcategory	
Risk of bias table		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	"Cluster randomization was used… by first randomly assigning individuals to predetermined clusters of three to six subjects. The group assignment was then randomly assigned to each of these clusters."
Allocation concealment (selection bias)	Unclear risk	"Individuals not familiar with the study were in charge of the randomization procedure, which included inserting the information into envelopes that were sealed and would be opened by the investigator only at the time of treatment." Comment: no other information on envelopes provided
Incomplete outcome data (attrition bias)	Low risk	4 deaths and 3 not meeting follow-up criteria excluded from meta-analysis; all other dropouts and those lost to follow-up counted as smokers; similar numbers in all arms.
Cossette 2011		
Methods	Country:Canada Recruitment: smokers admitted to 1 specialized cardiac hospital Selection: all smokers who were hospitalised were asked to participate by the study nurse	
Participants	Participants: 40 current daily smokers	

	Diagnosis: cardiovascular diseases Age: 57.1 yrs av. Gender: 60% male Willingness to quit: yes (most in preparation stage, 1 in contemplation stage in control group) Therapists: nurse specialized in smoking cessation	
Interventions	**1** Intervention:usual care during hospitalisation consisting of 1 or more sessions with the study nurse. Follow-up: 6 phone calls by study nurse at wk 1, 2, 3, 4, 8, 12 and then if needed additional phone calls could be arranged between 3 and 6m post discharge. At wk 3 appointment with the study nurse if asked by patient. [Intensity 4] **2** Control: usual care during hospitalisation consisting of 1 and more sessions with the study nurse. Follow-up: referral to a national quitline or a community centre for smoking cessation Pharmacotherapy: NRT, bupropion or varenicline were suggested during hospitalisation and follow-up	
Outcomes	Abstinence: self-reported abstinence at 6m Validation: only for one participant Died: 0	
Notes	Included in post-discharge intervention category (randomization after discharge)	
Risk of bias table		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Not specified, but generated by a centre for randomized controlled trials
Allocation concealment (selection bias)	Low risk	opaque sealed envelopes
Incomplete outcome data (attrition bias)	Low risk	missing data similar in both groups and analyses are ITT, participants lost to follow-up considered smokers
Croghan 2005		
Methods	Country: USA Recruitment: Inpatients having surgical resection of lung or oesophageal cancers Selected: unclear	
Participants	Participants: 30 smokers admitted for surgery for newly diagnosed lung or oesophageal cancer Age: not stated Therapist: doctor, nurse and trained smoking counsellor	
Interventions	**1** Intervention: Physician advice from thoracic surgeons and study nurses. Counselling (1× 45 min. Stage of change assessed, individualized pharmacotherapy) [Intensity 2] **2** Control: Physician advice only NRT: Yes	
Outcomes	Abstinence: 7-day PP at 6m Validation: expired air CO or saliva tobacco alkaloid Died: 1 in 6m	
Notes		
Risk of bias table		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Randomized, method not stated
Allocation concealment (selection bias)	Unclear risk	No details reported
Incomplete outcome data (attrition bias)	Low risk	2 lost to follow-up in control group considered smokers. 1 death in intervention group excluded from MA.
de Azevedo 2010		

Methods	Country:Brazil Recruitment: patients admitted to 1 public university hospital Selection: research team approached all patients admitted to the hospital wards (except for ICU and psychiatric unit)	
Participants	Participants: 273 current smokers (smoked ≥ 1 cpd in month prior to admission) Diagnosis: all (exclude ICU and psychiatric units) Age: not reported Gender: 63.7% male Willingness to quit: any Therapists: trained smoking cessation counsellor (psychologists, nurses, occupational therapist)	
Interventions	**1** Intervention: 30 minutes session of individual counselling with motivational interview + 7 follow-up telephone calls over 4 months at wk 1, 2, 3 and month 1, 2, 3, 4. [Intensity 4] **2** Control: 15 minute session of individual counselling Pharmacotherapy: none provided	
Outcomes	Abstinence:self-reported 7-day PP at 6m Validation: none Died: 28	
Notes	In the article, analyses excluded lost to follow-up and death. Extra control arm not randomized and not included in data extraction.	
Risk of bias table		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	"An allocation sequence based on a random-number table was used to randomly assign all enrolled subjects"
Allocation concealment (selection bias)	Low risk	"The allocation was maintained in a serially numbered, opaque envelope, which was opened at the Phase 2 interview to prevent counsellor bias."
Incomplete outcome data (attrition bias)	Low risk	32% lost to follow-up in intervention and 22% in control but if analysis are done ITT low risk of bias
DeBusk 1994		
Methods	Country: USA Recruitment: Inpatients with acute MI Selected: Invited to participate if prepared to make a quit attempt	
Participants	Participants: 252 current smokers or recent quitters (proportion not stated, defined as any tobacco use in previous 6m). Number smoked: not stated Age: 57 yrs av. First year after MI Therapists: Physician and nurse	
Interventions	**1** Intervention: Physician advice; Counselling (1×, total not stated, type not stated); NRT ('reserved for highly-addicted patients'); Other (self-help materials, relaxation tapes); follow-up (8× at 48 hr, 1 wk, and every month for 6m by telephone) [Intensity 4] **2** Control: Advice only NRT: Yes (partial)	
Outcomes	Abstinence: Sustained abstinence at 6 and 12m Validation: Expired air CO and plasma cotinine Died: None reported	
Notes	Included in CVD subcategory	
Risk of bias table		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	"Patients were randomly assigned using a computer program that achieved a balanced allocation to the two management conditions within each hospital."

Allocation concealment (selection bias)	Low risk	"Randomization was done centrally; nurses were notified of the assignments by telephone calls from the coordinating centre staff."
Incomplete outcome data (attrition bias)	Unclear risk	Unclear what percentage of smokers were lost to follow-up. "Among participants who did not relapse before death or dropout, censoring occurred at the last point at which they reported not smoking."
Dornelas 2000		
Methods	Country: USA Recruitment: Inpatients with acute MI Selected: Invited to participate	
Participants	Participants: 100 current smokers. Number smoked: 29 cpd Age: 54 yrs av. Therapists: Psychologist	
Interventions	**1** Intervention: Counselling (1×, total 20 mins, type behavioural); follow-up (7× at <1, 4, 8, 12, 16, 20, 26 wk by telephone) [Intensity 4] **2** Control: Advice only NRT: No	
Outcomes	Abstinence: PP at 12m Validation: Significant other Died: 5 at 12m	
Notes	Validation by significant other only in 70% of cases. Included in CVD subcategory	
Risk of bias table		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Method of sequence generation not specified
Allocation concealment (selection bias)	Unclear risk	"drawing random numbers from an envelope" Comment: no further details provided
Incomplete outcome data (attrition bias)	Low risk	20 (20%) lost to follow-up included in ITT analysis
Feeney 2001		
Methods	Country: Australia Recruitment: Inpatients admitted for acute MI to coronary care unit of 1 hospital Selected: Invited to participate	
Participants	Participants: 198 current smokers (smoked in past week) Age: 54 yrs av. Therapists: Physician and nurse	
Interventions	**1** Intervention: Physician advice to quit, nurse counselling (time not specified, type cognitive/behavioural); follow-up (8x at 1, 2, 3, 4 wks and 2, 3, 6,12m by telephone) [Intensity 4] **2** Control: In hospital: same as intervention (physician advice to quit, nurse counselling); follow-up counselling available but no proactive contact [Intensity 2] NRT: No	
Outcomes	Abstinence: Sustained abstinence at 1, 3, 12m. Validation: Urinary cotinine (limit not stated) Died: 9 at 12m	
Notes	Very large treatment effect (31/92 vs 1/97) but risk of attrition bias. Excluded from meta-analyses because of heterogeneity.	
Risk of bias table		
Bias	**Authors' judgement**	**Support for judgement**

Random sequence generation (selection bias)	Low risk	"A random list of odd and even numbers was generated and a sequence of 200 sealed envelopes created."
Allocation concealment (selection bias)	Unclear risk	"With patient consent an envelope was opened and they were assigned to either programme." Comment: no other detail on envelopes provided.
Incomplete outcome data (attrition bias)	High risk	Only participants who attended basic ADAU follow-up programme assessed, so large number of drop-outs. More drop-outs in group 2 (79%) than group 1 (51%), so treating drop-outs as smokers may overestimate treatment effect. 9 deaths (4/5) excluded from denominator in analysis.

Floter 2009	
Methods	Country: Germany Recruitment: women admitted in 21 prevention or rehabilitation clinics Selection: all women who smoked were offered a smoking cessation course
Participants	Participants: 527 smokers ≥ 1 cigarette during the 30 days preceding hospitalisation Diagnosis: women hospitalised with their children for medical, psycho physiologic or psychiatric reasons Age: 35.9 Gender: 100% female Willingness to quit: all stages Therapists: social workers, psychologists, physicians or nurses and counsellors
Interventions	**1** Intervention: we pooled the 2 interventions - Intervention 1: 3 sessions (60 min each) in groups during hospitalisation featuring cognitive behavioral therapy and motivational interviewing + 3 proactive telephone calls (10 min duration) post discharge in a structured and directive style - Intervention 2: 3 sessions (60 min each) in groups during hospitalisation featuring cognitive behavioral therapy and motivational interviewing + 3 proactive telephone calls (10 min duration) post discharge in a non directive style [Interventions 1 and 2: intensity 4] **2** Control: 3 sessions (60 min each) in groups during clinic hospitalisation and no follow-up Pharmacotherapy: not reported
Outcomes	Abstinence: self-reported abstinence during the past 30 days at 6m Validation: none Died: none reported
Notes	Category: post discharge intervention and rehabilitation centre OR adjusted for age, single mother (yes/no), education, weight concern, smoking dependence, self efficacy, depression, perceived social support: - 2.0 (95% CI 1.1–3.8) for intervention 1 - 1.3 (95% CI 0.7–2.5) for intervention 2

Risk of bias table		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	not described
Allocation concealment (selection bias)	Unclear risk	not described
Incomplete outcome data (attrition bias)	Unclear risk	According to the text there are 80 lost to follow-up and according to table 2 there are 53 lost to follow-up. Not specified in which group.

Froelicher 2004	
Methods	Country: USA Recruitment: Inpatients with CVD or PVD admitted to 10 hospitals Selected: Willing to make quit attempt

Participants	Participants: 277 current smokers or recent quitters (smoked in past month), willing to make serious quit attempt at discharge Gender: All females Number smoked: 20 cpd Age: 61 yrs av. Therapists: Physician and nurse	
Interventions	**1** Intervention: Physician advice to quit, nurse counselling (30–45 mins, type cognitive/behavioural and relapse prevention); follow-up (5× at 2, 7, 21, 28, 90 days by telephone (5–10 min/call) [Intensity 4] **2** Control: modified usual care (physician advice + booklet) NRT: Patch or gum offered to selected women after discharge who had relapsed and wanted to try to quit (pharmacotherapy used by 20% of intervention and 23% of control group).	
Outcomes	Abstinence: 7-day PP at 12m Validation: Saliva cotinine < 14 ng/ml OR family/friend verification Died: 11 at 12m	
Notes	Included in CVD subcategory	
Risk of bias table		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	"Randomization was by random permuted blocks, stratified by hospital, with an equal chance of assignment to the usual-care group or the intervention group."
Allocation concealment (selection bias)	Low risk	Centralized randomization
Incomplete outcome data (attrition bias)	Low risk	20 participants (13 intervention; 7 control) lost to follow-up included in meta-analysis as smokers. 11 deaths excluded from meta-analysis.
Hajek 2002		
Methods	Country: UK Recruitment: Inpatients with acute MI Selected: Invited to participate	
Participants	Participants: 540 current smokers. Number smoked: 23 cpd Age: 56 yrs av. Therapists: cardiac rehab nurse	
Interventions	**1** Intervention: Nurse advice. Counselling (1×, total 20–30 min). Self-help materials. [Intensity 2] **2** Control: Brief advice and booklet NRT: No	
Outcomes	Abstinence: PP at 12m, with visit to self-reported non-smoker Validation: Expired air CO and salivary cotinine Died: 35 at 12m	
Notes	Included in CVD subcategory	
Risk of bias table		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	"Participants…were randomised to the intervention or control group on a 1:1 ratio by nurses opening a serially numbered… envelope."
Allocation concealment (selection bias)	Low risk	Nurses opened a "serially numbered, opaque, sealed envelope designating the patient's allocation."
Incomplete outcome data (attrition bias)	Low risk	No significant differences in numbers lost to follow-up or patients who had died or moved away. Those who had died or moved away excluded from outcome data; those lost to follow-up counted as smokers.

Hasuo 2004		
Methods	Country: Japan Recruitment: Inpatients (all diagnoses) to 1 hospital Selected: Intending to be quit on day of discharge	
Participants	Participants: 120 current smokers or recent quitters (smoked in past month) Diagnoses include cancer (n=37), cardiac (n=57) Age: not stated Therapists: Nurse	
Interventions	**1** Intervention: nurse counselling (3 × 20 min sessions). follow-up (3× at 7, 21, 42 days by telephone) (5 min/call) [Intensity 4] **2** Control: In hospital: same as intervention (nurse sessions, 3 × 20 min each) but no follow-up contact [Intensity 2] NRT: No	
Outcomes	Abstinence: Abstinence at 12m (type not stated) Validation: urinary cotinine at 12m Died: 6 at 12m	
Notes	Not clear whether results are self-report or cotinine-validated.	
Risk of bias table		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Computerized randomization stratified by smoking status, FTND, and self-efficacy
Allocation concealment (selection bias)	Low risk	Computerized programme randomly assigned individual participants
Incomplete outcome data (attrition bias)	Unclear risk	More control participants missing outcome data at 12m than intervention group (9 versus 5). MA denominators exclude 6 deaths, but include 8 who were still smoking on day of discharge. This gives marginally larger relative effect.
Haug 2011		
Methods	Country: Germany Recruitment: patients admitted in 3 German inpatient rehabilitation centres Selection: all consecutively admitted patients were assessed by a medical doctor or a nursing staff for inclusion criteria	
Participants	Participants: 477 current smokers (at least 1 cpd) and recent former smokers (quit for <= 6 months and used to smoke at least 1 cpd) Diagnosis: various acute or chronic disorders (stroke, CHD, cancer, diabetes, asthma,…) Age: 46.5 yrs av. Gender: 48% male Willingness to quit: all stages of change Therapists: computer expert system	
Interventions	**1** Intervention: access to an internet-based smoking cessation program with 3 complementary modules during 6m: up to 7 individual counselling sessions by a computer expert system, information websites and message board (individual feedback letters) [Intensity 4] **2** Control: usual care (assessment only) Pharmacotherapy: not reported	
Outcomes	Abstinence: self-reported 7-day point prevalence smoking abstinence at 6m Validation: no Died: 1 (in control group)	
Notes	Category: rehabilitation centres Not clear if intervention began during hospitalisation but probably OR (Intention to treat analyses) adjusted for rehabilitation centre, baseline stage of change and baseline self-efficacy: 2.0 (95% CI 1.1–3.7)	
Risk of bias table		
Bias	**Authors' judgement**	**Support for judgement**

Random sequence generation (selection bias)	High risk	Quasi randomized study. Randomly assigned to intervention or control group based on the calendar week of admission.
Allocation concealment (selection bias)	High risk	See above
Incomplete outcome data (attrition bias)	Low risk	Similar in both groups and ITT analyses
Hennrikus 2005		
Methods	Country: USA Recruitment: Inpatients (all diagnoses) admitted to 4 hospitals Selected: Invited to participate	
Participants	Participants: 2095 current smokers (smoked in past week and considered self to be regular smoker in month before admission) Age: 47 yrs av. Therapists: Physician and nurse.	
Interventions	**1** Intervention: Physician advice to quit (60 seconds) + smoking cessation booklet + additional mailed booklet after discharge. [Intensity 1] **2** Intervention: Physician advice to quit (60 seconds) + nurse counselling (motivational interviewing and relapse prevention) for 20 min. av. (note: 43% of counselling sessions conducted after discharge by telephone rather than at bedside). Follow-up: 3–6 phone calls over 6m (10 min/call median). [Intensity 4] **3** Control: modified usual care: smoking cessation booklet in hospital NRT: No	
Outcomes	Abstinence: 7-day PP at 12m Validation: Saliva cotinine (<15 ng/ml) Died: 78 at 12m	
Notes	High and differential levels of refusal to provide validation/mis-reporting	
Risk of bias table		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Method of sequence generation not specified
Allocation concealment (selection bias)	Unclear risk	"Research assistants… randomized [participants] to one of three treatment conditions by looking up the next available group assignment on a list on which the three conditions were randomly ordered within blocks of 30 assignments."
Incomplete outcome data (attrition bias)	Low risk	78 deaths and ineligible (too ill) for follow-up excluded from denominators; all other participants missing data at final follow-up counted as smokers. Similar numbers lost to follow-up in all groups.
Lacasse 2008		
Methods	Country: Canada Recruitment: patients with expected LOS >=36 hours in 1 tertiary cardiopulmonary centre Selection: Eligible patients who accepted to participate were immediately assigned to one group	
Participants	Participants: 196 current smokers Diagnosis: Mainly cardiology (63%) and pneumology (27%) Age: 52 yrs av. Gender: 64–68% male Willingness to quit: yes, patients in the precontemplation stage of change were excluded Therapists: counsellors (no further definition)	
Interventions	**1** Intervention: strong quit smoking message from the treating physician, self-help material, brief cessation counselling with counsellor, pharmacology adjuncts. Follow-up: 4 telephone calls within 6 wks post discharge. [Intensity 4] **2** Control: usual care, no specific instructions on how to quit smoking Pharmacotherapy: NRT offered to all patients in the intervention group (18 patients used)	
Outcomes	Abstinence:7-day PP at 6 and 12 months	

	Validation: urinary cotinine (<200 ng/ml) but non validated quit rates used in the meta-analysis Died: 1 in intervention group	
Notes	Study stopped early because of lack of efficacy. Non validated quit rates used in this meta-analysis instead of cotinine validated because only half of participants had validation. Mainly cardiac and pulmonary patients but can't separate results.	
Risk of bias table		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	"table of random numbers"
Allocation concealment (selection bias)	Unclear risk	"Those who were eligible and who accepted to participate were immediately assigned to either the intervention or the control group by one of the hospital pharmacists." Comment: Method not specified
Incomplete outcome data (attrition bias)	Low risk	Similar numbers lost in both groups (14/99 intervention, 13/97 usual care), "analyses were run according to the intention-to-treat principle."
Lewis 1998		
Methods	Country: USA Recruitment: Inpatients excluding certain cardiac conditions Selected: Prepared to make quit attempt	
Participants	Participants: 185 current smokers. Number smoked: 24 cpd Age: 43 yrs av. 12 ICD-9 diagnostic categories Therapists: Physician and nurse	
Interventions	**1** Intervention: Physician advice. Counselling (1×, total 2–3 mins, type information). NRT (patch, dose 22mg, for 3 wks + 11 mg, for 3 wks). Self-help materials. follow-up (4× at 1, 3, 6 wks, 6m by telephone). [Intensity 4] **2** Intervention: Physician advice. Counselling (1×, total 2–3 mins, type information). Placebo patch. Self-help materials. follow-up (4× at 1, 3, 6 wks, 6m by telephone). [Intensity 4] **3** Control: Advice only NRT: Yes	
Outcomes	Abstinence: PP at 6m Validation: Expired air CO Died: None reported	
Notes	1 vs 2 for effect of NRT. 1+2 vs 3 for behavioural counselling intervention analysis. Highest quit rates found in patients with respiratory disease.	
Risk of bias table		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	"using a predetermined computer-generated randomization code"
Allocation concealment (selection bias)	Low risk	Central allocation
Incomplete outcome data (attrition bias)	Unclear risk	Drop-out rates not reported, but analyses conducted as ITT
Metz 2007		
Methods	Country: Germany Recruitment: patients with length of stay of at least 3 weeks in 13 rehabilitation hospitals treating respiratory diseases, CVD, cancer or DM Selection: not reported	
Participants	Participants: 307 smokers ≥1 cigarette during the past month	

	Diagnosis: Diverse disease (stroke, CHD, cancer, pulmonary disease diabetes, etc) Age: not reported Gender: 58.6% male Willingness to quit: all stages (12.5% precontemplation, 54.6% contemplation, 17.9% preparation, 15% action) Therapists: therapeutic staff with 3-day training performed the in-hospital interventions and 2 specially trained psychologists performed the telephone sessions	
Interventions	**1** Intervention: 7 sessions lasting 60 min of either cognitive-behavioral or a motivational treatment during hospitalisation + 5 proactive telephone booster sessions after discharge (2 during first week after discharge, third during 3rd wk, fourth during 5th wk and 5th between 6th and 10th wk). [Intensity 4] **2** Control: 7 sessions lasting 60 min of either cognitive-behavioral or a motivational treatment during hospitalisation Pharmacotherapy: not reported	
Outcomes	Abstinence:self-reported 7-day PP at 3, 6 and 12m Validation: none Died: none reported	
Notes	Category: Rehabilitation centres and postdischarge intervention OR (not ITT): 2.18 (95% CI 1.21–3.93)	
Risk of bias table		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Randomized, 1:2 ratio, method not described
Allocation concealment (selection bias)	Unclear risk	Allocation method not specified
Incomplete outcome data (attrition bias)	High risk	17/316 randomized to I excluded, no contact post discharge. Differential drop-out from remainder, 17% Int, 40% Cont. No detected differences in characteristics of drop-outs. Sensitivity analyses excluding losses to follow-up removes significance.
Meysman 2010		
Methods	Country: Belgium Recruitment: patients admitted on surgical wards in 4 university hospitals Selection: inpatients admitted on surgical wards, recruited within 24 hours of admission	
Participants	Participants: 358 current smokers of > 10 cpd Diagnosis: surgical patients (orthopaedics, traumatology, ENT, head and neck surgery and neurosurgery) Age: 43.2 year av. Gender: 63% male Willingness to quit: all stages of change (precontemplation 25%, contemplation 56%, preparation and action 19%) Therapists: nurse and counsellor	
Interventions	**1** Intervention: brief nurse-delivered intervention (5 A's) and referral to smoking cessation counsellor for smokers in the preparation/action stage [Intensity 2] **2** Control: booklet with information on smoking cessation Pharmacotherapy: not reported	
Outcomes	Abstinence:self-reported continuous abstinence at 6m Validation: none Died: none reported	
Notes	category: surgical patients	
Risk of bias table		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Participants stratified by stage of change. Method of randomization not specified.

Allocation concealment (selection bias)	Unclear risk	Not stated
Incomplete outcome data (attrition bias)	Unclear risk	Patients lost to follow-up counted as smokers, exact numbers not provided.
Miller 1997		
Methods	Country: USA Recruitment: Inpatients excluding obstetric and psychiatric patients Selected: Prepared to make quit attempt, those wishing to do so alone excluded	
Participants	Participants: 1942 current smokers. Number smoked: 20 cpd Age: 51 yrs av. 32% with cardiovascular, 12% pulmonary diagnosis Therapists: Physician and nurse counsellor	
Interventions	**1** Intervention: Physician advice. Counselling (1×, total 30 mins, type behavioural). Self-help materials, relaxation tapes, video. follow-up (4× at 48hr, 1, 3 wks, 3m by telephone) [Intensity 4] **2** Intervention: Physician advice. Counselling (1×, total 30 mins, type behavioural). Self-help materials, relaxation tapes, video. follow-up (1× at 48 hr by telephone) [Intensity 3] **3** Control: Advice only NRT: No	
Outcomes	Abstinence: Sustained abstinence at 3, 6 & 12m Validation: Plasma cotinine or family member corroboration Died: 82 at 12m	
Notes	1 vs 3 in intensive comparison, 2 vs 3 in minimal comparison 12 months abstinence (PP) 1+2 vs 3 separately for cardiovascular, pulmonary and other diagnosis.	
Risk of bias table		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Method of sequence generation not specified
Allocation concealment (selection bias)	Low risk	"Nurses opened sealed envelopes in front of patients to determine patients' assignments."
Incomplete outcome data (attrition bias)	Low risk	Deaths excluded from MA denominator; all others lost to follow-up considered smokers; similar loss to follow-up across all groups (10%).
Mohiuddin 2007		
Methods	Country: USA Recruitment: Inpatients with diagnosis of acute coronary syndrome (including MI) or decompensated CHF, admitted to CCU of 1 hospital Selected: Invited to participate.	
Participants	Participants: 209 current smokers who had smoked for 5+ yrs, FTND>7 Number smoked: 24 cpd Age: 55 yrs av. Therapists: Physician and trained tobacco counsellor or nurse	
Interventions	**1** Intervention: Counselling (30 mins, type not specified). Self-help booklet. Free NRT and/or bupropion. follow-up: weekly group meetings (60 min session for up to 3m) with trained tobacco counsellor (content: behavioural counselling, social support, relaxation training, risk factor management). [Intensity 4] **2** Control: same inpatient component as intervention group: counselling (30 mins, type not specified). Self-help booklet. Free NRT and/or bupropion. No follow-up offered. [Intensity 2] NRT: NRT or bupropion offered on individualized basis to both groups	
Outcomes	Abstinence: Sustained abstinence at 3, 6, 12m. (note: sustained abstinence to 24m reported but not used in pooling) Validation: CO Died: 15 at 12m (12 control, 3 intervention)	

Notes	1 vs 2 in intensity 4 subgroup. Same in-hospital intervention; differed in follow-up component only. Included in CVD subcategory	
Risk of bias table		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	"Consenting patients were then randomly assigned using simple randomization without block assignment." Comment: method not specified
Allocation concealment (selection bias)	Unclear risk	Method not specified
Incomplete outcome data (attrition bias)	Low risk	Similar number lost to follow-up in both groups (5/109 intervention, 4/100 control). Participants lost to follow-up counted as smokers.
Molyneux 2003		
Methods	Country: UK Recruitment: Medical and surgical inpatients admitted to 1 hospital Selected: Invited to participate.	
Participants	Participants: 274 current smokers (smoked in past month) Number smoked: 17 cpd Age: 50 yrs av. Therapists: Physician or nurse	
Interventions	**1** Intervention: brief counselling + booklet, no NRT. No follow-up. [Intensity 2] **2** Intervention: brief counselling (20 mins) + booklet + offer of open label NRT×6 wks (choice of gum, patch, inhalator, lozenge, nasal spray); 96% used some NRT. No follow-up. [Intensity 2] **3** Control: usual care NRT: Yes	
Outcomes	Abstinence: Sustained abstinence at 3, 12m Validation: CO <10 ppm at 12m Died: not stated	
Notes	1+2 vs 3 for intensity 2 comparison, 2 vs 1v for NRT comparison. Deaths not stated so not excluded from main analysis.	
Risk of bias table		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	"Patients were randomised … using a list generated for each centre, allocating equally in random permuted blocks of nine".
Allocation concealment (selection bias)	Unclear risk	Not stated
Incomplete outcome data (attrition bias)	Low risk	Large number lost to follow-up but similar across all groups. Losses to follow-up counted as continuing smokers. All losses fully detailed in flow chart.
Nagle 2005		
Methods	Country: Australia Recruitment: Inpatients (all diagnoses) admitted to 1 teaching hospital (excluded intensive care units) Selected: Invited to participate	
Participants	Participants: 1422 current smokers or quitters (smoked in past 12m) Age: not stated Therapists: nurse	
Interventions	**1** Intervention: Nurse counselling (2 × 10 min sessions, type: withdrawal symptom management, coping skills) + booklet + offer of NRT in hospital and for 5 days post-discharge (3% received in hospital). follow-up: none. [Intensity 2] **2** Control: modified usual care (Physician advice + booklet)	

	NRT: Yes (partial)	
Outcomes	Abstinence: 7-day PP at 12m (Continuous self-reported abstinence also given) Validation: Saliva cotinine <=15 ng/ml Died: 28 at 12m	
Notes	Study includes recent quitters (smoked in past year but not in past month); results not stratified by baseline smoking status.	
Risk of bias table		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Computerised. "Randomization was based on blocks of 20 patients… Stratification into recent smoker and recent quitter categories occurred prior to randomization."
Allocation concealment (selection bias)	Low risk	"Patients who reported smoking within the last 12 months were entered by the research assistant at the patient's bedside into the LAPSMOKE program on a laptop computer, which gave an immediate random allocation to either control or intervention that could not be changed."
Incomplete outcome data (attrition bias)	Low risk	"At 12 months no difference for completed surveys or for loss to follow-up existed between the intervention group and the control group." 28 deaths at 12m excluded from denominator, all other participants missing data counted as smokers.
Ortega 2011		
Methods	Country: Spain Recruitment: patients admitted in 1 hospital Selection: all hospitalised smokers were asked to enter in the smoking cessation protocol	
Participants	Participants: 1843 current smokers (smoked > 100 cigarettes lifetime) Diagnosis: medicine and surgery patients Age: 61–66 Gender: 83–88% males Willingness to quit: all stages Therapists: nurse	
Interventions	**1** Intervention: cognitive behavioral intervention (30–45 min sessions every 3 days during hospitalisation) + NRT (patches or chewing gum) free during hospital for 12 wks + post discharge follow-up: Smoking cessation outpatient clinic or telephone calls (patient could chose) at 1, 2 wks, 1, 2, 3, 6, and 12m **2** Control: cognitive behavioral intervention (30–45 min sessions every 3 days during hospitalisation)+ post discharge follow-up: Smoking cessation outpatient clinic or telephone calls (patient could chose) at 1, 2 wks, 1, 2, 3, 6, and 12 month [Both arms: intensity 4] Pharmacotherapy: NRT (patches or chewing gums) in intervention group	
Outcomes	Abstinence: smoking abstinent at 1 year (not more specified) Validation: CO in subgroup only Died: none reported	
Notes	Category: pharmacotherapy 1 extra arm = control who refuse to enter study but not eligible for this meta-analysis No blinding, no placebo. Used in NRT comparison only as both arms offered same counselling.	
Risk of bias table		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Participants were randomized using a "computerized algorithm."
Allocation concealment (selection bias)	Unclear risk	Not described
Incomplete outcome data (attrition bias)	Unclear risk	Number not specified. Participants lost to follow-up included as smokers in outcome data.

Ortigosa 2000		
Methods	Country: Spain Recruitment: Inpatients with acute MI Selected: Invited to participate	
Participants	Participants: 90 current smokers Number smoked: 25 cpd Age: 57 yrs av Therapists: Physician	
Interventions	**1** Intervention: Physician advice. follow-up (3× at 2, 3, 4 wks by telephone). [Intensity 3] **2** Control: Usual care NRT: No	
Outcomes	Abstinence: PP at 12m. Validation: Expired air CO. Died: 3 at 12m.	
Notes	Intervention not delivered by specialist counsellor. Included in CVD subcategory.	
Risk of bias table		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Stratified randomization, method of sequence generation not specified
Allocation concealment (selection bias)	Unclear risk	Method not specified
Incomplete outcome data (attrition bias)	Low risk	No participants lost to follow-up. 3 deaths excluded from the analysis.
Pedersen 2005		
Methods	Country: Denmark Recruitment: Inpatients with cardiac disease Selected: Invited to participate	
Participants	Participants: 105 current smokers (not defined) Age: not stated Therapists: not stated	
Interventions	**1** Intervention: usual hospital protocol: advice to quit + information about NRT + NRT available. follow-up: visits 5 times after discharge (30 min/meeting) [Intensity 4] **2** Control: usual care: advice to quit + information about NRT + NRT available. NRT: Yes (partial)	
Outcomes	Abstinence: Abstinence (probably PP) at 12m Validation: none Died: not stated	
Notes	Included in CVD subcategory	
Risk of bias table		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Not specified
Allocation concealment (selection bias)	Unclear risk	After enrolling, patients drew an envelope containing an allocation. No further details about the envelope provided.
Incomplete outcome data (attrition bias)	Low risk	10 participants lost to follow-up (7 intervention, 3 control) counted as smokers in final analysis.

Pederson 1991		
Methods	Country: USA Recruitment: Inpatients with COPD. Selected: Invited to participate	
Participants	Participants: 74 current smokers Number smoked: 25 cpd Age: 53 yrs av. 43% chronic bronchitis, 57% emphysema Therapists: Non-specialist trained in counselling	
Interventions	**1** Intervention: Physician advice (prior to admission). Counselling (3–9×, total 45–160 mins, type information). Self-help materials. No follow-up. [Intensity 2] **2** Control: Advice only NRT: No	
Outcomes	Abstinence: PP at 6m Validation: Serum COHb (in sample) Died: 8 at 6m	
Notes		
Risk of bias table		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation selection bias)	Unclear risk	Details not provided
Allocation concealment (selection bias)	Unclear risk	Details not provided
Incomplete outcome data (attrition bias)	Low risk	8 deaths excluded, 8 lost to follow-up included and counted as smokers. Similar number lost to follow-up in both groups.
Pelletier 1998		
Methods	Country: Canada Recruitment: Inpatients with acute MI Selected: Invited to participate	
Participants	Participants: 504 current smokers Age: not stated Therapists: Nurse	
Interventions	**1** Intervention: Physician advice. Self-help materials [Intensity 2] **2** Control: Usual care NRT: No	
Outcomes	Abstinence: self-reported PP at 12m Validation: None Died: Not stated	
Notes	Included in CVD subcategory	
Risk of bias table		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	High risk	Quasi experimental design. 2 control hospitals, 1 experimental hospital.
Allocation concealment (selection bias)	High risk	See above
Incomplete outcome data (attrition bias)	Unclear risk	Number lost to follow-up not stated.

Planer 2011		
Methods	Country: Israel Recruitment: patients hospitalised for ACS in 2 separate campuses in Jerusalem Selection: all smokers hospitalised for acute coronary syndrome were approached on their 2nd day of hospitalisation by the study nurse	
Participants	Participants: 151 smokers of > 10 cpd Diagnosis: acute coronary syndrome Age: 51.9 yrs av. Gender: 79.9% male Willingness to quit: yes, patients required to exhibit intention to quit smoking Therapists: study physician and research nurse	
Interventions	**1** Intervention: counselling (at least 15 min of motivational support) during hospitalisation and continued after discharge (at least 2 visits with physician and nurse at 1 and 2m and weekly telephone call by nurse during first and second month, then monthly telephone calls during rest of the year) + Bupropion for 2m **2** Control: counselling as per 1 + Placebo for 2m [Both arms: intensity 4] Pharmacotherapy: Bupropion during 2m in the intervention group	
Outcomes	Abstinence: self-reported continuous abstinence at 12m Validation: none Died: none reported	
Notes	Category: pharmacotherapy and cardiac patients Study stopped early after interim analysis indicated no benefit OR adjusted for age, sex, invasive procedure, risk factors, Fagerstrome score, cpd: 0.90 (95% CI 0.39–2.09)	
Risk of bias table		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	"Randomized," method not specified
Allocation concealment (selection bias)	Unclear risk	not specified
Incomplete outcome data (attrition bias)	Low risk	1 lost to follow-up in each group
Quist-Paulsen 2003		
Methods	Country: Norway Recruitment: Inpatients admitted to cardiac ward of 1 general hospital (Diagnoses: MI, unstable angina, post-CABG care) Selected: Invited to participate	
Participants	Participants: 240 current smokers (smoked daily before symptoms began). Number smoked: 15 cpd Age: 57 yrs av. Therapists: Nurse	
Interventions	**1** Intervention: Nurse counselling (1–2 times, time not specified, type: fear arousal, advice on using NRT); follow-up (5× at 2, 7, 21 days, 3m, 5m) by telephone, clinic visit to cardiac nurse at 6 wks); NRT: Gum or patch encouraged for subjects with strong urges to smoke in hospital. [Intensity 4] **2** Control: usual care (advice to quit + booklet) NRT: Yes	
Outcomes	Abstinence: PP at 12m Validation: Urine cotinine <2.0 mmol/mol creatinine Died: 5 at 12m	
Notes	Included in CVD subcategory	
Risk of bias table		
Bias	**Authors' judgement**	**Support for judgement**

Random sequence generation (selection bias)	Unclear risk	"Randomization was in blocks of varying sizes." Method not specified.
Allocation concealment (selection bias)	Low risk	"The nurses were given a serially numbered sealed envelope from a secretary who was otherwise uninvolved in the study."
Incomplete outcome data (attrition bias)	Unclear risk	Meta-analysis does not include 5 deaths; all other losses to follow-up considered to be smoking but differential loss to follow-up (15 in intervention group, 2 in control group).
Reid 2007		
Methods	Country: Canada Recruitment: patients admitted in 1 tertiary care cardiac facility Selection: current smokers who met eligibility criteria were recruited within 24 hours of admission. Patients living > 1 hour away were excluded	
Participants	Participants: 99 current smokers ≥ 5 cpd Diagnosis: ACS, elective PCI or diagnostic catheterization related to CHD Age: 54 Gender: 61–75% male Willingness to quit: not assessed Therapists: nurse	
Interventions	**1** Intervention: standard in-hospital treatment for smokers (personalized advice to quit smoking, access to NRT, brief bedside counselling and self-help guide) + interactive voice response system (IVR) follow-up on days 3, 14 and 30 post-discharge [Intensity 3] **2** Control: standard in-hospital treatment for smokers (personalized advice to quit smoking, access to NRT, brief bedside counselling and self-help guide) Pharmacotherapy: access to NRT during hospitalisation for both arms	
Outcomes	Abstinence: 7-day PP at 12m Validation: none Died: 1 in control group	
Notes	Category: post discharge intervention	
Risk of bias table		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	"mediated through the Clinical Epidemiology Unit's data centre, using a computer generated randomization list"
Allocation concealment (selection bias)	Low risk	"Research staff were unaware of the treatment allocation prior to randomization"
Incomplete outcome data (attrition bias)	Low risk	~15% lost to follow-up, similar between groups. 1 Control death excluded, others included
Rigotti 1994		
Methods	Country: USA Recruitment: Inpatients scheduled for CABS Selected: Invited to participate	
Participants	Participants: 87 current smokers or recent quitters (38%, defined as at least 1 pack/cigarettes in previous 6m) Number smoked: 33 cpd Age: 58 yrs av. 82% of all CABG surgery Therapists: Nurse	
Interventions	**1** Intervention: Counselling (3×, total 60 mins, type behavioural). Self-help materials, video. follow-up (1× at 1 wk by telephone). [Intensity 3] **2** Control: Advice only NRT: No	
Outcomes	Abstinence: Sustained abstinence at 4, 8, 12m.	

	Validation: Salivary cotinine Died: 7 at 12m	
Notes	Abstinence rates include smokers who had quit prior to surgery. Included in CVD subcategory.	
Risk of bias table		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	"Patients were randomly assigned to control or intervention groups after surgery." Method not specified.
Allocation concealment (selection bias)	Unclear risk	Not specified
Incomplete outcome data (attrition bias)	Low risk	7 deaths not counted in final meta-analysis. No other patients lost to follow-up at 12m.
Rigotti 1997		
Methods	Country: USA Recruitment: Inpatients in medical or surgical services. Selected: Invited to participate	
Participants	Participants: 615 current smokers or recent quitters (proportion not stated, defined as at least 1 cigarette in previous month) Number smoked: 24 cpd Age: 48 yrs av. 23% had cardiac or pulmonary diagnosis Therapists: Research assistant and nurse	
Interventions	**1** Intervention: Physician advice (prompt on chart). Counselling (1×, total 15 mins, type behavioural). Self-help materials. Follow-up (1–3× at 1–3 wks by telephone); [Intensity 3] **2** Control: Usual care NRT: 'some' (around 4%).	
Outcomes	Abstinence: PP at 6m. Validation: Salivary cotinine Died: 35 at 12m	
Notes	50% of patients could recall being given physician advice.	
Risk of bias table		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Each day's list of eligible smokers put in random order and patients recruited consecutively in this order. Randomized by research assistant.
Allocation concealment (selection bias)	Unclear risk	See above
Incomplete outcome data (attrition bias)	Low risk	73 (22.4%) lost to follow-up included in ITT analysis, no evidence of differential loss. 35 (5.4%) deaths excluded.
Rigotti 2006		
Methods	Country: USA Recruitment: Inpatients with cardiovascular disease (MI, unstable angina, CHF) or PVD admitted to 5 hospitals Selected: Invited to participate	
Participants	Participants: 254 current smokers (smoked in past month) and willing to consider smoking cessation at discharge (no commitment required) Number smoked: 23/21 cpd Age: 56 yrs av. Therapists: Nurse	

Interventions	**1** Intervention: Bupropion SR 300 mg/day × 12 wks, started in hospital. Nurse counselling (30–45 min, type cognitive/behavioural and relapse prevention) in hospital + booklet + follow-up telephone calls (10 min/call) 5× at 2, 7, 21 days, 2m, 3m. Total counselling time: 85–90 mins. **2** Control: As above, but placebo pill NRT: No	
Outcomes	Abstinence: Continuous abstinence at 2, 4, 12, 52 wks. Validation: Saliva cotinine at 12 and 52 wks, CO at 2 and 4 wks Died: 2 at 12m	
Notes	Used for bupropion comparison and CV diagnosis, not for comparison of counselling intensity because both groups had same counselling.	
Risk of bias table		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	"Using a computer program, the study statistician generated a sequence of randomly-permuted blocks of 4 within strata formed by study site and daily cigarette consumption (10 vs 10)."
Allocation concealment (selection bias)	Low risk	"The study pharmacist used this sequence, concealed from enrolment staff, to assign participants to study arm. Subjects and study personnel, except the statistician and pharmacist, were blind to treatment assignment."
Incomplete outcome data (attrition bias)	Low risk	"Subjects were considered smokers if they were lost to follow-up…"; same percentage lost to follow-up in both groups
Simon 1997		
Methods	Country: USA Recruitment: Inpatients undergoing non-cardiac surgery Selected: Prepared to make quit attempt	
Participants	Participants: 299 current smokers Number smoked: 20 cpd Age: 54 yrs av. Most cardiovascular or respiratory disease Therapists: Public health educator	
Interventions	**1** Intervention: Inpatient counselling (1×, total 30–60 mins, type behavioural). Self-help materials, video. NRT if no contraindications (gum, dose not stated, for 3m). follow-up (5× at 1–3 wks, 2m, 3m by telephone). [Intensity 4] **2** Control: Advice only NRT: Yes	
Outcomes	Abstinence: PP at 12m Validation: Serum or salivary cotinine or corroboration by significant other Died: 25 at 12m	
Notes	Appro× 65% intervention and 17% control used NRT. Not associated with quitting in either group.	
Risk of bias table		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	"Random list of assignments"
Allocation concealment (selection bias)	Low risk	"Sealed opaque envelopes opened on formal enrolment"
Incomplete outcome data (attrition bias)	Low risk	28 lost to follow-up included in ITT analysis, 25 deaths excluded from denominator.
Simon 2003		
Methods	Country: USA	

	Recruitment: Inpatients (all diagnoses) admitted to 1 hospital for military veterans Selected: Invited to participate
Participants	Participants: 223 current smokers (smoked >=20 cigarettes in wk before admission), contemplation or action stage of change, able to use NRT. Number smoked: 23 cpd Age: 55 yrs av. Therapists: Nurse or health educator
Interventions	**1** Intervention: Nurse or health educator counselling (30–60 mins; type cognitive/behavioural) + booklet + NRT patches × 8 wks. follow-up: 5× at 1,3 wks and 1m, 2m, 3m (<30 min/call) [Intensity 4] **2** Control: brief counselling (10 mins) + booklet + NRT patches × 8 wks. No follow-up contact. NRT: Yes
Outcomes	Abstinence: 7-day PP at 12m Validation: Saliva cotinine <15 ng/ml OR spousal corroboration Died: 14 at 12m.
Notes	Study tests marginal efficacy of counselling in setting of NRT.

Risk of bias table

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	"Randomly assigned using computerized algorithm"
Allocation concealment (selection bias)	Unclear risk	No details provided
Incomplete outcome data (attrition bias)	Low risk	7 (3%) lost to follow-up included in ITT analysis, 14 (6%) died & excluded from denominator

Simon 2009

Methods	Country: United States Recruitment: patients admitted in 1 VA hospital Selection: all smokers hospitalised ≥ 24h screened for eligibility (exclusion criteria: CI to Bupropion, admitted for ACS, terminally ill, serious unstable psychiatric illness, family history of seizure, women pregnant or lactating, history of drug abuse consumption of >= 3 alcoholic beverages/d)
Participants	Participants: 85 smokers ≥ 5cpd during previous year and smoking the week prior admission Diagnosis: not specified Age: 56 yrs av. Gender: 96% male Willingness to quit: not assessed Therapists: public health educator
Interventions	**1** Intervention: Bupropion during 7wks + counselling (1 cognitive behavioral intervention of 30–60 minutes during hospitalisation) + telephone counselling after discharge at wk 1, 3, month 1, 2, **2** Control: Placebo + counselling as above [Both arms: intensity 4] Pharmacotherapy: Bupropion in intervention group
Outcomes	Abstinence: 7-day PP at 6m Validation: salivary cotinine Died: 2 (1 in each group)
Notes	Category: pharmacotherapy Not used in primary meta-analysis by counselling intensity as both arms received same counselling.

Risk of bias table

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	"computer algorithm to generate a random list of treatment assignments."

Allocation concealment (selection bias)	Unclear risk	"All study personnel engaged in providing interventions to participants were blinded to treatment assignment." Comment: not explicit that this included enrolment staff.
Incomplete outcome data (attrition bias)	Low risk	Similar number lost to follow-up in both groups. All except deaths included in MA.
Smith 2009		
Methods	Country: Canada Recruitment: patients admitted in 4 cardiac units in a large urban hospital Selection: sequential patients admitted for acute MI or CABG who met inclusion criteria were included	
Participants	Participants: 276 patients who used tobacco in the month before admission Diagnosis: acute MI or CABG Age: 54 yrs av. Gender: 82–83% male Willingness to quit: ranged from 3–7, mean 6.8 (on a 1–7 scale, with 7 = full intention) Therapists: nurse	
Interventions	**1** Intervention:minimal intervention + 45–60 minutes of bedside education and counselling, take-home material and 7 telephone counselling sessions at 2, 7, 14, 21, 30, 45, and 60 days after discharge. [Intensity 4] **2** Control: : minimal intervention: research nurse advice smoker to quit, review 2 pamphlets and asked the attending physician to give a scripted nonsmoking message. Pharmacotherapy: not part of the study but available through hospital if requested	
Outcomes	Abstinence: 7-day PP and continuous abstinence at 12m Validation: proxy corroboration at 12m only for 7-day PP only Died: 4 (2 in each group)	
Notes	Category: cardiac patients For the meta-analysis we used validated 7-day PP	
Risk of bias table		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	"… randomization code using a computer random-number generator to select random permuted blocks of 10… stratified by acute MI and CABG."
Allocation concealment (selection bias)	Unclear risk	The nurse "opened the randomization envelope and informed the patients of intervention assignment (intensive or minimal)." Comment: no details of envelope
Incomplete outcome data (attrition bias)	Low risk	Participants lost to follow-up counted as smokers. Similar percentage lost to follow-up in both groups (9.4% control, 8.8% intervention).
Smith BJ 2011		
Methods	Country: Australia Recruitment: patients with smoking-related diseases admitted on pulmonary, cardiology, neurology, vascular or general medicine wards in 3 hospitals Selection: patients who agree to make a serious smoking cessation attempt, plan to return home were included	
Participants	Participants: 392 current smoker (≥ 10 cpd on average in past year) Diagnosis: smoking related in respiratory, cardiology, neurology, or vascular medicine Age: 18–75 Gender: both Willingness to quit: yes (only patients willing to make a serious smoking cessation attempt were included) Therapists: Quitline counsellors at Quit SA (South Australia quitline)	
Interventions	**1** Intervention: initial contact with quitline made in hospital at bedside; also got booklet + Varenicline (standard titration to 1 mg bid × 12 wk) + follow-up: Quitline (Quit SA) - 8 scheduled calls over 12 wks, 5–10 min each call **2** Control: counselling as above [Both arms: intensity 4] Pharmacotherapy: Varenicline in intervention group	
Outcomes	Abstinence: continuous abstinence (2–52 weeks) defined as <=5 cigarettes during 12 months	

	Validation: a random subsample was CO validated, but we use self report Died: 13 (7 in control and 6 in intervention group)	
Notes	Category: pharmacotherapy. Data from abstract and unpublished manuscript only. Open label (varenicline vs. no varenicline). Not included in primary meta-analysis as both arms received same counselling.	
Risk of bias table		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	A pre-defined, central, computer-generated randomisation sequence was used to assign subjects in a 1:1 ratio to either intervention or control
Allocation concealment (selection bias)	Low risk	Allocation concealment was achieved using opaque, sealed envelopes with consecutive numbers
Incomplete outcome data (attrition bias)	Low risk	low risk (>80% follow-up in both groups)
Smith PM 2011		
Methods	Country: Canada Recruitment: patients admitted in 3 community hospitals Selection: study nurses approached eligible patients	
Participants	Participants: 643 current smokers (tobacco use in the last 30 days) Diagnosis: diverse (CVD, pulmonary, other internal medicine, cancer, orthopaedic, gynaecology, non cardiac surgery) Age: 49 yrs av. Gender: 49.3% male Willingness to quit: yes Therapists: nurses	
Interventions	**1** Intervention:brief intervention + in hospital education, take home materials, counselling and post-discharge telephone counselling: post-discharge telephone counselling (5–10 min/call) for the intervention group at 2, 7, 14, 21, 30, 45 and 60 days. [Intensity 4] **2** Control: brief intervention (5 minutes): cessation advice personalized to patient's medical conditions and 2 pamphlets + note in patient's chart for the attending physician to provide a message personalized to patient's medical condition. Pharmacotherapy: not provided	
Outcomes	Abstinence: self-reported 7 day point-prevalence abstinence at 12m Validation: with saliva cotinine (< 15 ng/mL) or proxy confirmation at 1 year only Died: 27 (19 in control and 8 in intervention group)	
Notes		
Risk of bias table		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	computerized random number generator
Allocation concealment (selection bias)	Unclear risk	not specified, randomization envelopes
Incomplete outcome data (attrition bias)	Low risk	Participants lost to follow-up counted as smokers but not specified, deaths excluded from final denominators
Steinberg 2011		
Methods	Country: USA Recruitment: patients admitted in 1 university-based hospital Selection:patients approached within 24–48h after admission, hospital computer system identified all patients	
Participants	Participants: 79 smokers (smoking ≥ 10 cpd within the past month) Diagnosis: various diagnoses (CVD, orthopedic, pulmonary, other) Age: 51 yrs av.	

	Gender: 59 % male Willingness to quit: not specified Therapists: tobacco treatment specialist	
Interventions	**1** Intervention: Varenicline (12 wks) + during hospitalisation: personalized strong quit message, printed information on behavioral change, outpatient quit resources (Quitline, Quitnet, local tobacco dependence program) + brief behavioral treatment after discharge at a local Tobacco Dependence Treatment (weekly follow-up sessions for 6 wks after discharge followed by monthly follow-up sessions × 4 or 5 to get them out to 6m after discharge. **2** Control: Placebo (12 weeks) + same as intervention group [Both arms: intensity 4] Pharmacotherapy: Varenicline in intervention group	
Outcomes	Abstinence: sustained abstinence at 6 months (abstinent at 4w, 12w & 6m visits) Validation: expired CO (<8ppm) Died: 0	
Notes	OR adjusted for age, race, education and level of dependence 0.34 (95% CI 0.10–1.23)	
Risk of bias table		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	"randomized in a 1:1 ratio through centralized telephone randomization process by the study statistician and hospital research pharmacist"
Allocation concealment (selection bias)	Low risk	See above
Incomplete outcome data (attrition bias)	Low risk	ITT analysis conducted; unvalidated smoking status included where ascertained for non-attenders; lost to follow-up the same in 2 groups
Stevens 1993		
Methods	Country: USA Recruitment: Inpatients with stay >36 hrs excluding postpartum and psychiatric patients. Selected: Invited to participate	
Participants	Participants: 1119 current smokers or recent quitters (5%, defined as smoking regularly at any time in previous 3m) Number smoked: 20 cpd Age: 44 yrs av. 17% cardiovascular or respiratory diagnosis Therapists: Masters level cessation counsellors	
Interventions	**1** Intervention: Counselling (1×, total 20 mins, type behavioural). Self-help materials, video. follow-up (1–2× at 1–3 wks by telephone); [Intensity 3] **2** Control: Usual care NRT: No	
Outcomes	Abstinence: Sustained abstinence at 3 and 12m Validation: None (low success in obtaining cotinine returns) Died: None reported	
Notes	No significant baseline differences between patient characteristics in intervention and control.	
Risk of bias table		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	High risk	Not random, intervention alternated between hospitals on a monthly basis in order to avoid contamination
Allocation concealment (selection bias)	High risk	Intervention or control status of hospital known when patients recruited

Incomplete outcome data (attrition bias)	Low risk	6% loss to follow-up, no difference by group, included in ITT analysis
Stevens 2000		
Methods	Country: USA Recruitment: Inpatients with stay >36 hours excluding postpartum and psychiatric patients Selected: Invited to participate	
Participants	Participants: 1173 current smokers or recent quitters (proportion not stated, defined as smoking regularly at any time in previous 3m) Numbers smoked: 19 cpd Age: 47 yrs av. Therapists: Respiratory therapist	
Interventions	**1** Intervention: Counselling (1×, total 20 mins, type behavioural). Self-help materials, video. follow-up (1× at 1 wk by telephone) [Intensity 3] **2** Control: Usual care NRT: No	
Outcomes	Abstinence: Sustained abstinence at 6 and 12m Validation: None Died: None reported	
Notes	Only 68% of intervention group actually offered intervention.	
Risk of bias table		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	High risk	"Eligible smokers in each hospital were assigned to treatment or usual care by a random digit in their HMO member number."
Allocation concealment (selection bias)	High risk	See above.
Incomplete outcome data (attrition bias)	Unclear risk	Number lost to follow-up not specified. All not contacted at 1 year were counted as smokers.
Taylor 1990		
Methods	Country: USA Recruitment: Inpatients with acute MI. Selected: Invited to participate if prepared to make a quit attempt	
Participants	Participants: 173 current smokers (within last 6m) Number smoked: 25 cpd Age: 58 yrs av. 10% previous MI Therapists: Nurse	
Interventions	**1** Intervention: Counselling (1×, total not stated, type behavioural), Self-help materials, relaxation tapes. NRT (gum 'available', dose not stated, period not stated). follow-up (6–7× at 1–3 wks, every month for 4m by telephone); [Intensity 4] **2** Control: Usual care. NRT: Yes (partial)	
Outcomes	Abstinence: Sustained abstinence at 3 and 12m. Validation: Serum thiocyanate, expired air CO Died: 7 at 12m	
Notes	NRT gum prescribed to 5 patients.	
Risk of bias table		
Bias	**Authors' judgement**	**Support for judgement**

Random sequence generation (selection bias)	Low risk	"A random list of odd and even numbers was generated"
Allocation concealment (selection bias)	Low risk	"a sequence of numbers sealed in envelopes was created…the nurse assessing the intervention called the nurse coordinator who opened the next envelope to determine the condition to which the patient would be assigned"
Incomplete outcome data (attrition bias)	High risk	14/86 patients in intervention group and 29/87 patients in control group missing data at 12m follow-up. Higher loss to follow-up in control group increases apparent effect of intervention when using ITT approach, so denominators in MA based on numbers followed-up.

Vial 2002	
Methods	Country: Australia Recruitment: Inpatients (medical and surgical wards) of 1 teaching hospital Selected: Willing to stop smoking
Participants	Participants: 102 current smokers (>= 10 cpd) Number smoked: not stated Age: not stated Therapists: Pharmacist
Interventions	**1** Intervention: Pharmacist consultation about NRT use (30–45 mins)+ booklet + up to 16 wks patches at half-price. Follow-up: weekly visits × <=16 to obtain patches from hospital pharmacist. **2** Intervention as above, but follow-up patches supplied by community-based pharmacist [Arms 1 and 2: intensity 4] **3** Control: usual care: advice to quit + booklet NRT: Yes
Outcomes	Abstinence: Sustained abstinence at 3, 6, 12m. Validation: CO test 'whenever possible' - frequency not stated Died: not stated
Notes	Smoking cessation counselling not clearly done (pharmacist consultation about NRT) ; deletion of study does not change results. 1&2 compared to 3 in both the intensity analysis and the NRT efficacy analysis.

Risk of bias table		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	"consenting patients were randomized in blocks of ten using computer-generated random numbers"
Allocation concealment (selection bias)	Low risk	Centralized, see above.
Incomplete outcome data (attrition bias)	Unclear risk	Follow-up incomplete due to time constraints; analysis therefore does not include all participants randomized. 64 out of 102 participants included in 12m data, 19 of whom lost to follow-up.

Footnotes

Intensity of intervention: 1. Single contact in hospital lasting <= 15 mins, no follow-up support. 2. One or more contacts in hospital lasting in total > 15 mins, no follow-up support. 3. Any hospital contact plus follow-up <=1 month. 4. Any hospital contact plus follow-up > 1 month.

Abbreviations: ACS: acute coronary syndrome; av: average; CABG/S: coronary artery bypass graft/surgery; CCU: coronary care unit; CHD: coronary heart disease; CHF: congestive heart failure; CI: confidence interval; CO: carbon monoxide; COPD: Chronic Obstructive Pulmonary Disease; cpd: cigarettes per day; CVD: cardiovascular disease; FTND: Fagerstrom Test for Nicotine Dependence; m: month(s); MI: myocardial infarction; NRT: nicotine replacement therapy; OR: odds ratio; PCI: percutaneous coronary intervention; PP: point prevalence; PVD: peripheral vascular disease; yrs: years

Characteristics of excluded studies

Agewall 2001	
Reason for exclusion	Multifactorial intervention. No smoking cessation outcomes reported.
Allen 1998	
Reason for exclusion	Intervention not delivered in inpatient setting.
Asfar 2005	
Reason for exclusion	Intervention not delivered in inpatient setting.
Avanzini 2011	
Reason for exclusion	Case control study.
Becker 2003	
Reason for exclusion	Participants admitted to observation unit for less than 24 hour hospital stay. Insufficient data.
Bize 2006	
Reason for exclusion	Not randomized (uses historical controls).
Blom 2005	
Reason for exclusion	Intervention not delivered in inpatient setting.
BTS 1983	
Reason for exclusion	Included both inpatient and outpatient data (results for inpatients alone not available).
Burt 1974	
Reason for exclusion	Not randomized.
Chan 2003	
Reason for exclusion	Intervention not delivered in inpatient setting.
Chan 2010	
Reason for exclusion	Coronary heart disease patients recruited in outpatient clinics.
Choo 2004	
Reason for exclusion	Short follow-up (1m).
Colby 1998	
Reason for exclusion	Short follow-up (3m). Enrolled only adolescents.
Cole 2001	
Reason for exclusion	Review article (no new data).
Dale 1995	
Reason for exclusion	Intervention not delivered in inpatient setting (some participants admitted to inpatient unit for smoking intervention).
Davies 2005	
Reason for exclusion	Insufficient data on cessation outcome.
Elsony 2005	
Reason for exclusion	Intervention not delivered in inpatient setting.
Emmons 2000	
Reason for exclusion	Baseline and pharmacy data from a trial. Main outcomes not reported.
Freund 2009	
Reason for exclusion	Smoking behavior is not measured as outcome.

Fung 2005	
Reason for exclusion	Not randomized.
Gadomski 2011	
Reason for exclusion	Not randomized.
Galvin 2001	
Reason for exclusion	Intervention not delivered in inpatient setting.
Gariti 2002	
Reason for exclusion	Participants were inpatients in a substance abuse treatment unit.
Gies 2008	
Reason for exclusion	Follow-up too short (3 months).
Gritz 1993	
Reason for exclusion	Intervention not delivered in inpatient setting (only recruitment carried out in hospital setting).
Hand 2002	
Reason for exclusion	Included both inpatient and outpatient data (results for inpatients alone not available).
Hanssen 2007	
Reason for exclusion	Intervention after hospital discharge, intervention was secondary prevention (general cardiac rehab intervention), not limited to smokers.
Hasan 2007	
Reason for exclusion	Not randomized (patients could chose their treatment), tested hypnotherapy
Hilleman 2004	
Reason for exclusion	Not randomized.
Holmes-Rovner 2008	
Reason for exclusion	Recruitment after hospital discharge, intervention was secondary prevention, not limited to smokers, and insufficient data in article to calculate quit rates.
Horn 2008	
Reason for exclusion	Intervention in emergency department, not inpatients, teens. No smoking cessation outcome.
Jeong 2002	
Reason for exclusion	Multifactorial intervention with little smoking cessation content.
Johnson 1999	
Reason for exclusion	Not randomized.
Jones 2001	
Reason for exclusion	Intervention delivered after discharge from ITU.
Joseph 2004	
Reason for exclusion	Participants inpatients for substance abuse treatment.
Joseph 2005	
Reason for exclusion	Intervention goal smoking reduction, not cessation (enrolled only smokers who do not plan to quit).
Kalman 2001	
Reason for exclusion	Participants inpatients for alcohol dependence treatment.
Lewis 2009	
Reason for exclusion	Enrolled outpatients and inpatients; inpatients not analysed separately in article.
Lisspers 1999	

Reason for exclusion	Intervention delivered after discharge following PTCA.
McHugh 2001	
Reason for exclusion	Multicomponent intervention delivered prior to hospitalisation for CABG.
Meenan 1998	
Reason for exclusion	Not randomised.
Moller 2002	
Reason for exclusion	Intervention delivered prior to hospital admission.
Mosca 2010	
Reason for exclusion	Does not only recruit smokers; insufficient data to calculate quit rates. Assesses the impact of a systematic hospital-based educational intervention among women hospitalised with CHD.
Nackaerts 2009	
Reason for exclusion	No data for 6m quit rates
Nasell 2010	
Reason for exclusion	Outcome is postoperative complications and not smoking cessation.
Ong 2005	
Reason for exclusion	Not an RCT.
Ranote 2003	
Reason for exclusion	Not an RCT (quasi-experimental design). Abstract only. Insufficient data.
Ratner 2004	
Reason for exclusion	Intervention delivered prior to hospital admission.
Regan 2011	
Reason for exclusion	Follow-up too short (12 wks).
Reid 2006	
Reason for exclusion	Not an RCT (uncontrolled cohort study).
Richman 2000	
Reason for exclusion	Patients not admitted to hospital, follow-up 3m.
Rissel 2000	
Reason for exclusion	Intervention delivered to outpatients. Not randomized.
Schmitz 1999	
Reason for exclusion	No control / usual care group.
Smith 2002	
Reason for exclusion	Not an RCT (evaluates real world effect of intervention used in DeBusk 1994, Miller 1997 and Taylor 1990).
Strecher 1985	
Reason for exclusion	Not randomized.
Sundblad 2008	
Reason for exclusion	Intervention starts before hospital stay; this is a residential smoking cessation program.
Takahashi 2006	
Reason for exclusion	Intervention not delivered in inpatient setting.
Targhetta 2011	
Reason for exclusion	No follow-up assessment after discharge.
Taylor 2005	

Reason for exclusion	Not an RCT (observational study only).
Thomsen 2010	
Reason for exclusion	Does not start in hospital but before hospitalisation.
Wakefield 2004	
Reason for exclusion	Intervention not delivered in inpatient setting.
Warner 2005	
Reason for exclusion	Intervention not delivered in inpatient setting (prior to hospital admission).
Wewers 1994	
Reason for exclusion	Short follow-up (5 wks).
Winickoff 2010	
Reason for exclusion	Subjects are not hospital patients but the parents of hospitalised children.
Wolfenden 2005	
Reason for exclusion	Intervention not delivered in inpatient setting (begun pre-operatively).
Wolfenden 2008	
Reason for exclusion	Not an RCT, starts before hospital admission.

Footnotes

CABG: coronary artery bypass graft; ITU: Intensive Therapy Unit; m: month(s); PTCA: percutaneous transluminal coronary angioplasty; wk(s): week(s)

Characteristics of studies awaiting classification

Brunner-Frandsen 2010	
Methods	
Participants	
Interventions	
Outcomes	
Notes	
Jimenez 2007	
Methods	
Participants	
Interventions	
Outcomes	
Notes	

Footnotes