Effectiveness of smoking cessation interventions among adults: a systematic review of reviews

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The objective of this study was to identify the most effective intervention strategies and policies for smoking cessation among adults. The Medline and Cochrane Library databases were searched, limited to publications since January 2000. A 'review of reviews' approach was followed. Systematic reviews and meta-analyses were included. Reviews aimed at adolescents or specific subgroups were excluded. Two reviewers independently assessed titles and abstracts. For every intervention strategy, only the most recent publication was included. Twenty-three studies met the inclusion criteria. The included intervention strategies and policies were ranked according to their effect size, taking into account the number of original studies, the proportion of studies with a positive effect and the presence of a long-term effect. Evidence of effectiveness for the following strategies was found: group behavioural therapy [odds ratio (OR) 2.17, confidence interval (CI) 1.37–3.45], bupropion (OR 2.06, CI: 1.77–2.40), intensive physician advice (OR 2.04, CI: 1.71–2.43), nicotine replacement therapy (OR 1.77, CI: 1.66–1.88), individual counselling (OR 1.56, CI: 1.32–1.84), telephone counselling (OR 1.56, CI: 1.38–1.77), nursing interventions (OR 1.47, CI: 1.29–1.67) and tailored self-help interventions (OR 1.42, CI: 1.26–1.61). A 10% increase in price increased cessation rates by 3–5%. Comprehensive clean indoor laws increased quit rates by 12–38%. These results show and confirm that a wide array of effective smoking cessation intervention approaches and policies can have a large impact on smoking cessation rates. *European Journal of Cancer Prevention* 17:535–544 © 2008 Wolters Kluwer Health | Lippincott Williams & Wilkins.

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Introduction

Smoking remains the biggest preventable cause of disease and premature death. Besides increasing the risk of developing cardiovascular diseases and chronic obstructive pulmonary disorders, it is a well-known risk factor for developing cancers of the lung, oral cavity, larynx, oesophagus, stomach, pancreas, colorectum, bladder and kidney (Doll *et al.*, 1994). Currently about one in three adults worldwide (1.1 billion) are smokers (Mackay, 2001). Although smoking rates fell in the higher income countries during the 1970s and 1980s, there is some evidence that this trend is levelling out (Samet and Yoon, 2001). The importance of developing, evaluating and implementing effective smoking cessation interventions and policies in reducing the public health impact of tobacco use is obvious. The EUROCADET project will assess the impact of cancer prevention activities, including interventions and legislation aimed at smoking cessation, on the future incidence of selected cancers across Europe (www.EUROCADET.org). The potential to reduce exposure to tobacco will be assessed by reviewing evidence of effectiveness of interventions and policies as well as degree of implementation and barriers to successful implementation. At the end, an estimation of the future burden (2040) of tobacco-related cancer across Europe will

be made based on trends and various scenarios of extensiveness of implementation of effective interventions. These estimations may help to underpin European and national policies for cancer prevention, and take away alibis for not implementing effective interventions.

Numerous reviews and meta-analyses have already been carried out regarding the efficacy of a wide spectrum of tobacco cessation intervention approaches. The findings from these reviews and meta-analyses on each distinct intervention approach have to date, however, not been integrated into a mutual comparison regarding the degree of efficacy. Integrating the different areas of intervention approaches will enable policy makers to make evidence-based decisions regarding the funding of the most effective interventions.

The goal of this study was not to provide a complete overview of published reviews, but an identification of the most successful intervention strategies that could possibly be implemented on a large scale in European countries. We carried out a systematic review of systematic reviews and meta-analyses to assess the efficacy of intervention strategies and the effects of policies on smoking cessation among adults.

Methods
Procedure
This review was conducted following a protocol, derived from the one suggested in the Cochrane Collaboration Handbook for systematic reviews of interventions (van Tulder *et al.*, 2003). The key decisions defined in this protocol are described in more detail below.

Definition of outcome measure
Smoking cessation was defined as a discontinuation of tobacco use through inhalation during at least 6 months after the start of the intervention, expressed in effect estimates (odds ratios) of differences in abstinence rates between the intervention and the control groups. Smoking abstinence could be measured by biological markers or self-report.

Inclusion and exclusion criteria
Eligible studies consisted of systematic reviews and meta-analyses only. We used information from reviews of the following types of studies:

1. Randomized clinical trials (also cluster randomized trials)
2. Nonequivalent comparison group design
3. Time-series design.

Types of participants in the reviews included in our study were as follows:

Current smokers at the start of the intervention of 18 years and older, of any sex, race or socioeconomic status.

Excluded were reviews aimed at the following:

1. Institutionalized adults
2. Patients with any chronic conditions
3. Relapse prevention
4. Pregnant women
5. Patients in a preoperative smoking cessation setting
6. Invasive medical interventions
7. Pharmacotherapeutical interventions other than nicotine replacement therapy (NRT) and bupropion [Zyban] (only these being approved first-line smoking cessation supporting treatments).

The primary aim of the reviewed interventions had to be smoking cessation. They had to be aimed at reducing smoking prevalence to prevent diseases caused by the active inhalation of tobacco smoke. Combinations of interventions/intervention types were allowed. The intervention could be compared with no intervention control, a usual care group or a group receiving generic smoking cessation information only. Policy or legislative measures were included.

We decided to include studies published in the English language only, studies published since the year 2000 and a literature search using two databases only. These were arbitrary choices to make the analyses manageable, but we expected that all the effective interventions were included in recent systematic reviews, and that the search of other databases would not have contributed to identifying other effective interventions.

Search strategy
The electronic databases of PubMed and the Cochrane Library were searched. The databases were searched from January 2000 onwards. The search strategy for PubMed was as follows:

('Review'[Publication Type] or 'Meta-analysis'[Publication Type] and 'Smoking cessation'[MESH]); Limit: year 2000 onwards.

The search strategy for the Cochrane Library was as follows:

> 'smoking in Title, Abstract or Keywords or cigar* in Title, Abstract or Keywords or tobacco in Title, Abstract or Keywords and cessation in Title, Abstract or Keywords or quit* in Title, Abstract or Keywords'.

Identification of relevant studies
Two reviewers (V.L. and A.O.) independently assessed the retrieved titles (step 1) and abstracts of selected titles (step 2), by assessing the relevant papers for inclusion against the predetermined selection criteria. Data from reviews that met the selection criteria were extracted by one reviewer (V.L.) into structured summary tables and checked by a second reviewer (A.O.). Disagreements if any were resolved by discussion, and if necessary discussed with a third reviewer (H.B.).

In case of equal quality of the reviews, we included the most recent review concerning a particular intervention, as our main goal was to identify as accurately as possible the degree of effectiveness of the various interventions and policies, and not to present an exhaustive list of published reviews. Thus, we would include one review for a particular intervention strategy, except where the reviews focused on clearly different aspects of an intervention.

Data abstraction
We extracted data on (where applicable/documented) the following:

1. Country
2. Number of studies in review
3. Heterogeneity of studies (i.e. intervention design, setting, adjunct therapies)

4. Classification as systematic review or meta-analysis
5. Participants [number, baseline demographic (age: 5-year age group, sex, socioeconomic status) and smoking characteristics]
6. Intervention (focus, type, duration, intensity, delivery format)
7. Primary outcome measure
8. Length and completeness of follow-up
9. Definition of smoking cessation
10. Validation of cessation.

Summarizing/analyzing the study findings

We assessed the number of original studies included in the reviews, in how many of these original studies an actual positive effect of the intervention was confirmed and the presence of a long-term effect. We primarily ranked the efficacy of interventions according to the effect size resulting from the meta-analysis in the selected reviews. As we included only one review for a particular intervention strategy (except where reviews focussed on a clearly different aspect of an intervention), it was not necessary to pool data, but we could extract the effect size from the respective review. We focussed on the effect size of the full intervention versus placebo (in case of pharmaceutical interventions), standard care (in case of nursing interventions) or no intervention. If too few (10 or fewer) studies were carried out, the intervention would be categorized as lack of evidence owing to a small number of studies. If there were methodological problems in the meta-analyses, so that no straightforward conclusion could be reached, we categorized the review as no evidence of effectiveness owing to methodological problems. If the intervention showed evidence of ineffectiveness, we would categorize the intervention as such.

Results

Our search resulted in a total of 1963 titles. Based on the title, 297 abstracts (or full text, in the case of no abstract) were selected and read. After reading the abstract, 77 full-text articles were selected and read. We identified 23 reviews that met the inclusion criteria (Tables 1 and 2; Fig. 1) (Friend and Levy, 2002; Secker-Walker *et al.*, 2002; White *et al.*, 2002; Hughes *et al.*, 2003a, b; Levy and Friend, 2003; Stead *et al.*, 2003; Cepeda-Benito *et al.*, 2004; da Costa e Silva and Fishburn, 2004; Hajek and Stead, 2004; Lancaster and Stead, 2004; Levy *et al.*, 2004; Park *et al.*, 2004; Rice and Stead, 2004; Silagy *et al.*, 2004; Sinclair *et al.*, 2004; Hey and Perera, 2005; Kaper *et al.*, 2005; Lancaster and Stead, 2005a, b; Moher *et al.*, 2005; Stead and Lancaster, 2005; Ussher, 2005). Of these, five focussed on policies/legislation for smoking cessation among adults. Sixteen of the 23 reviews were Cochrane Collaboration reviews, and a total of 15 reviews pooled data to perform at least a partial meta-analysis. All the

included 23 reviews were considered to be of sufficient quality to be included in our review.

The included reviews had studied the following interventions: NRT, bupropion, physician advice, individual behavioural counselling, group behaviour therapy, telephone counselling, self-help interventions, nursing interventions, community pharmacy interventions, exercise interventions, competitions and incentives, partner support, aversive smoking, acupuncture and related interventions, community interventions and mass media campaigns. For NRT three reviews were included, as these reviews focussed on different aspects of NRT: the efficacy of the various forms of NRT, men–women differences in efficacy of NRT and efficacy of over-the-counter NRT.

The included policy/legislation reviews dealt with health care financing systems, clean indoor laws, taxation, advertising restrictions and product labelling.

Evidence of effectiveness for the following intervention strategies was found, in order of effect size (Tables 1 and 3, Fig. 2): group behavioural therapy [odds ratio (OR) 2.17, confidence interval (CI) 1.37–3.45], bupropion (OR 2.06, CI: 1.77–2.40), intensive physician advice (OR 2.04, CI: 1.71–2.43), NRT [all forms of NRT combined: OR 1.77, CI: 1.66–1.88; more effective for men than women (OR 2.16 vs. OR 1.76)], individual counselling (OR 1.56, CI: 1.32–1.84), telephone counselling (OR 1.56, CI: 1.38–1.77), nursing interventions (OR 1.47, CI: 1.29–1.67) and tailored self-help interventions (OR 1.42, CI: 1.26–1.61). Mass media campaigns seem to be important in supporting other strategies like taxation measures and smoking bans, but as mass media campaigns are often used as such, it is very difficult to disentangle their net effectiveness. A lack of evidence for effectiveness owing to a too small number of studies included in the reviews applied to community interventions and community pharmacy personnel interventions. Nonsignificant (albeit positive) outcomes in the meta-analyses performed applied to competitions and incentives for smoking cessation, and acupuncture. For aversive smoking, the effectiveness was difficult to establish because of methodological problems in the original meta-analysis. Evidence of no effectiveness was shown for exercise interventions and partner support.

Of the policy and legislative measures, the health care financing systems (e.g. through reimbursement of costs for NRT or participation in smoking cessation programmes) seemed to be effective, but this was based on a small number of studies (Tables 2 and 4). Comprehensive clean indoor laws increased the number of smokers who successfully gave up smoking by 12 to 38%. Taxation was effective in increasing the odds of

Table 1   **Included reviews on effectiveness of interventions for smoking cessation**

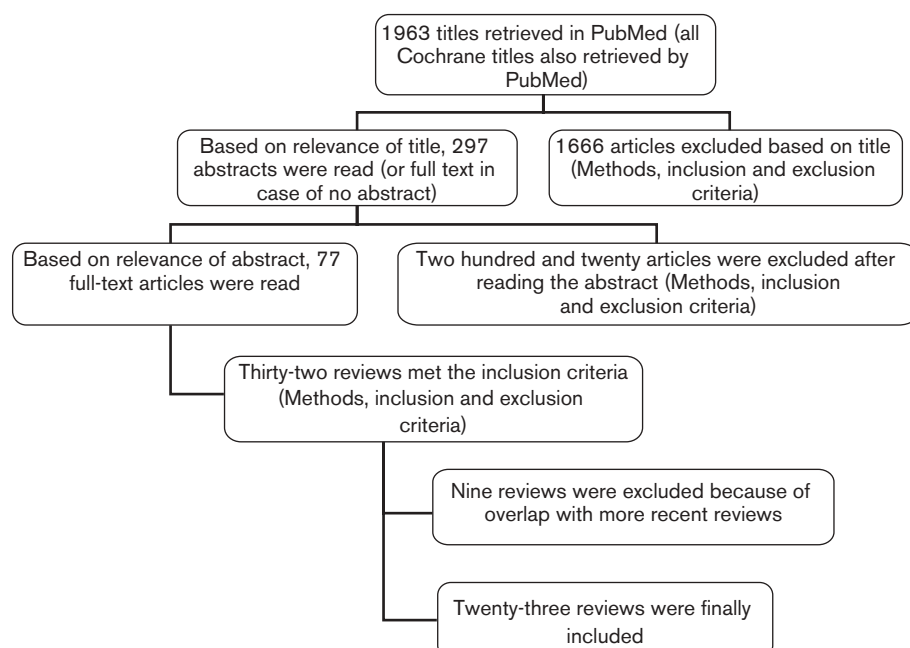| Publication	Intervention	No of studies included	No of participants	Effect size (OR + 95% confidence interval)[a]
Silagy et al. (2004)	NRT for smoking cessation	123	n > 40 000	NRT versus placebo: odds ratio (OR) 1.77 (1.66–1.88); Gum: OR 1.66 (1.52–1.81); Patches: OR 1.81 (1.63–2.02); Nasal spray: OR 2.35 (1.63–3.38); Inhaled nicotine: OR 2.14 (1.44–3.18); Nicotine sublingual tablet/lozenge: OR 2.05 (1.62–2.59) 'Comment: odds independent of duration, intensity of additional support, setting. Higher doses and combinations of NRT may be more effective'
Cepeda-Benito et al. (2004)	NRT; emphasis on sex differences in effectiveness	21	n = 20 175	NRT versus placebo. Women 6 months FU: OR 1.76 (1.48–2.1); 12 months FU: OR 1.24 (0.99–1.56); Men 6 months FU: OR 2.16 (1.79–2.59); 12 months FU: OR 1.75 (1.39–2.21) All: OR 1.90 (1.75–2.06)
Hughes et al. (2003a)	OTC NRT versus placebo and OTC NRT versus prescription NRT	8 (4 OTC NRT versus placebo; 4 OTC NRT versus prescription NRT)	n = 11 597	OTC NRT versus placebo, 6 months FU: OR 2.5 (1.8–3.6); OTC NRT versus prescription NRT, 6 months FU: OR 1.4 (0.6–3.3)
Hughes et al. (2003b)	Bupropion for smoking cessation	24	n > 11 012	Bupropion as single pharmacotherapy versus placebo: OR 2.06 (1.77–2.40) (in most studies both arms received a form of counselling)
Lancaster and Stead (2004)	Physician advice for smoking cessation	39	n = 31 670	Intensive advice (> 20 min + > 1 follow-up meeting) versus no advice control: OR 2.04 (1.71–2.43); Minimal advice versus no advice control: OR 1.74 (1.48–2.05); Intensive advice versus minimal advice: OR 1.44 (1.24–1.67)
Lancaster and Stead (2005a)	Individual behavioural counselling for smoking cessation (not given by nurses or doctors)	21	n > 7 000	Individual counselling versus minimal contact control: OR 1.56 (1.32–1.84); Individual counselling versus control, but all participants on NRT: OR 1.34 (0.98–1.83); Intensive counselling versus brief counselling: OR 0.98 (0.61–1.56)
Stead and Lancaster (2005)	Group behaviour therapy programmes for smoking cessation	55	n = 14 494	Group programme versus self-help programme at longest FU: OR 2.04 (1.60–2.60); Group programme versus individual therapy: OR 0.86 (0.66–1.12); Group programme versus no intervention: OR 2.17 (1.37–3.45)
Stead et al. (2003)	Telephone counselling for smoking cessation	27	n = 32 216	Telephone counselling compared with less intensive intervention at longest FU: OR 1.56 (1.38–1.77)
Lancaster and Stead (2005b)	Self-help interventions for smoking cessation	60	n > 61 000	Self-help versus no intervention (long term): OR 1.24 (1.07–1.45); Tailored materials versus no intervention or standard materials (long term): OR 1.42 (1.26–1.61)
Rice and Stead (2004)	Nursing interventions for smoking cessation	29	n = 40 377	Any nursing intervention versus control, minimum 6 months FU: OR 1.47 (1.29–1.67)
Sinclair et al. (2004)	Community pharmacy personnel interventions for smoking cessation	2	n = 976	OR 3.66 (0.86–10.55)
Ussher (2005)	Exercise interventions for smoking cessation	11	n = 1412	One out of 11 studies offered evidence for exercise aiding smoking cessation in the long term
Hey and Perera (2005)	Competitions and incentives	15 (meta-analysis: 9)	n = 5902	6 months FU: OR 1.44 (0.99–2.10) 12 months FU: OR 1.28 (0.92–1.78)
Park et al. (2004)	Enhancing partner support to improve smoking cessation	9	n = 1735	6–9 months FU: OR 1.08 (0.81–1.44); 12 months FU: OR 1.0 (0.75–1.34)
Hajek and Stead (2004)	Aversive smoking for smoking cessation	25	n = 1167	Rapid smoking versus no intervention: OR 1.98 (1.36–2.90) (however, methodological problems!); Other methods not effective
White et al. (2002)	Acupuncture and related interventions for smoking cessation	24	n = 4749	Acupuncture versus no intervention (long term): OR 1.91 (0.98–3.70); Acupuncture versus sham acupuncture (short term): OR 1.36 (1.07–1.72) (heterogeneity!); Acupuncture versus sham acupuncture (long term): OR 0.99 (0.68–1.44)
Secker-Walker et al. (2002)	Community interventions for reducing smoking among adults (community interventions defined as a coordinated, multidimensional programme aimed at changing adult smoking behaviour, involving several segments of the community and conducted in a defined geographical area)	32	n > 100 000	Limited evidence of an effect on prevalence: net decline in smoking prevalence ranging from −1.0 to 3.0%; quit rates reported in half of the studies, in less than half of them there was a significant intervention effect 'Comment: no significant difference in quit rates of heavier smokers. Of two outstanding studies, one found a significant effect on quit rates for light-to-moderate smokers, the other study found a significant effect on quit rates for men but not for women'
Friend and Levy (2002)	Reductions in smoking prevalence associated with mass media campaigns	6	Unknown (large)	Reduction in net smoking prevalence of 6–12% (this number includes, however, also prevention of initiation)

FU, follow-up; NRT, nicotine replacement therapy; OR, odds ratio; OTC, over-the-counter.
[a]Unless stated otherwise, effect sizes based on 6–12 months of follow-up.

Table 2 Included reviews on effectiveness of policies/legislations for smoking cessation

Publication	Policy/legislation	No of studies included	No of participants	Effect size/smoking cessation rate/prevalence rate
Kaper *et al.* (2005)	Health care financing systems for increasing the use of tobacco dependence treatment	6	$n=26\,132$	Full benefit versus no benefit: OR 1.48 (1.17–1.88) (4 studies, all self-reported abstinence); Full benefit versus partial benefit: OR 2.49 (1.59–3.90) (2 studies, all self-reported abstinence)
Moher *et al.* (2005)	Workplace interventions (only policies/legislation, not including the individual interventions) for smoking cessation	14	Large	Consistent evidence that workplace tobacco policies and bans decrease tobacco use during working day, but conflicting evidence whether this is also true for overall consumption (effect size not stated)
Levy *et al.* (2004)	Taxes, clean indoor laws, advertising restrictions, product labelling, mass media policies	80	Unknown (large)	10% increase in cigarette prices produces increase in quit rates of 3–5%; middle-income countries show greater response to price, as do individuals aged 18–24 and low-income groups Comprehensive clean indoor laws lower per capita cigarette consumption by 5–20%; effect on cessation rates 12–38%; strong long-term effect; larger effect on high-income groups No statistically significant effects of advertising restrictions No effect of health warnings, although large, graphic warnings estimated to increase cessation rates by 2%; effect may be larger in low-income countries where people are less well informed about health risks Mass media campaigns result in reductions of 4% per capita consumption; 7% decrease in prevalence rates when sufficiently funded and combined with other policies
Levy and Friend (2003)	The effects of clean indoor air laws	43	Includes large population-based studies	Long term: 6% reduction of overall adult smoking population
Da Costa e Silva and Fishburn (2004)	Tobacco control measures to reduce demand [taxation (1 study), information dissemination (1 study)]	2	Unknown	Taxation: 1% rise in relative cigarette price results in 0.4% fall in the amount consumed 10% increase in tobacco prices reduces consumption in short term by 3–5% in high-income, developed countries and by 8% in low-income and middle-income countries

OR, odds ratio.

Fig. 1

Flow chart of selection of relevant reviews.

Table 3　**Interventions for smoking cessation, ranked according to their effectiveness**

	Intervention	Effect size	No. of studies on which effect size is based	Remarks (made by authors in respective reviews)
Evidence for effect	Group behaviour therapy	Versus no intervention: OR 2.17 (1.37–3.45) Versus self-help: OR 2.04 (1.60–2.60)	55	Limited evidence that the addition of group therapy to other forms of treatment, such as advice from a health professional or nicotine replacement, produces extra benefit Variation in the extent to which those offered group therapy accepted the treatment No evidence that group therapy was more effective than a similar intensity of individual counseling Publication bias cannot be ruled out
	Bupropion	Versus placebo: OR 2.06 (1.77–2.40)	24	In most studies, both arms received a form of counselling Effectiveness of bupropion, an antidepressant, appears to be independent of a history of depression Similar results between trials that recruited community volunteers and trials that recruited patients in health care settings or with specific diagnoses (unlike NRT) No evidence that bupropion is more effective than NRT NRT has, however, a more benign side-effect profile; bupropion causes seizures in about 1 : 1000 individuals Burpropion may be helpful in those who fail in NRT
	Physician advice	Intensive advice versus control: OR 2.04 (1.71–2.43) Minimal advice versus control: OR 1.74 (1.48–2.05) Intensive advice versus minimal advice: OR 1.44 (1.24–1.67)	39	Most common setting studied was primary care Insufficient evidence to establish differences in effectiveness of physician advice between any adjunct interventions Publication bias cannot be ruled out
	NRT	Versus placebo: OR 1.77 (1.66–1.88)	123	Different kinds of NRT more or less equally effective and independent of duration of therapy, intensity of additional support provided or the setting in which NRT was offered Nicotine gum and transdermal patches were more effective when offered to volunteer smokers recruited from the community or those attending specialized clinics than if offered to smokers in primary care Weak evidence that combinations of NRT are more effective In most studies, both arms received some form of counselling Little evidence about the role of NRT for individuals smoking fewer than 10–15 cigarettes a day Over-the-counter NRT not less effective than NRT on prescription Publication bias cannot be ruled out Long-term effectiveness lower for women
	Individual behavioural counselling	Versus no intervention: OR 1.56 (1.32–1.84) Likewise, but all participants on NRT: OR 1.34 (0.98–1.83) Intensive counselling versus brief counselling: OR 0.98 (0.61–1.56)	21	All trials involved sessions of more than 10 min, with most also including further telephone contact for support
	Telephone counselling	Versus minimal intervention: OR 1.56 (1.38–1.77)	27	No evidence (statistical heterogeneity) of increased quit rates when control group received tailored self-help materials No proven additional effect of telephone support to face-to-face interventions or in users of NRT. A reach of 4–6% of the smoking population per year is the upper end of what can be expected, even with the help of mass media campaigns
	Nursing interventions	Nursing interventions versus standard care: OR 1.47 (1.29–1.67)	29	Statistical heterogeneity Effect present in both inpatients and nonhospitalized patients
	Self-help interventions	Tailored materials versus no intervention or standard materials: OR 1.42 (1.26–1.61) Self-help versus no intervention: OR 1.24 (1.07–1.45)	60	Two studies were excluded to prevent statistical heterogeneity Part of the positive effect of tailored materials might be explained by the additional contact or assessment required to obtain individual data

Table 3 (*continued*)

	Intervention	Effect size	No. of studies on which effect size is based	Remarks (made by authors in respective reviews)
Supportive to policy and legislative measures	Media campaigns	Mass media campaigns result in reductions of 4% per capita consumption; 7% decrease in prevalence rates when sufficiently funded and combined with other policies	11	The net effect of mass media campaigns is difficult to establish, as these are mostly guided by other measures such as tax increases Probably there is a synergetic effect of contemporary implementation of tax increases, clean indoor laws and mass media campaigns
Lack of evidence for effectiveness owing to small number of studies	Community pharmacy interventions	Versus no intervention: OR 3.66 (0.86–10.55)	2	Too small number of studies included to judge effectiveness
	Community interventions	Net decline in smoking prevalence ranging between − 1.0 and 3.0%, combined for men and women	10	Less than 2/3 of studies confirm a positive effect No significant difference in quit rates of heavier smokers. Of two outstanding studies, one found a significant effect on quit rates for light-to-moderate smokers (2.3%; main goal of intervention was to decrease smoking rates among heavy smokers!), the other study found a significant effect on quit rates for men but not for women (7% higher quit rates for men in the intervention community versus men in the control group, but large confidence intervals)
	Competitions and incentives	OR 1.28 (0.92–1.78)	9	Statistically insignificant
	Acupuncture and related interventions	Acupuncture versus no intervention: OR 1.91 (0.98–3.70). Other methods ineffective	25 (3 studies for acupuncture vs. no intervention)	Statistical heterogeneity Insignificant effect Too small number of studies included in comparison acupuncture versus no intervention to judge effectiveness
No evidence of effectiveness owing to methodological problems	Aversive smoking	One of the forms of aversive smoking seemed to be effective: rapid smoking versus control: OR 1.98 (1.36–2.90); however, methodological problems Other methods ineffective	25	Less than 2/3 of studies confirm a positive effect Owing to methodological problems, effectiveness cannot be judged adequately
Ineffective	Enhancing partner support	Versus no intervention: 1.0 (0.75–1.34)	9	Ineffective
	Exercise interventions	Too large heterogeneity to pool data; one of 11 studies offered evidence of effect	11	Ineffective

NRT, nicotine replacement therapy; OR, odds ratio.

smoking cessation: a 10% increase in price increased cessation rates by 3–5%. For advertisement bans and health warnings there was a lack of evidence of effectiveness.

Discussion

This review provides evidence about the relative effectiveness of various interventions and policies or legislative measures for smoking cessation among adults, by integrating the evidence from previous reviews and meta-analyses. The following intervention strategies were identified to be more effective than placebo, no intervention or minimal intervention: group behaviour therapy, bupropion, physician advice, NRT, individual counselling, telephone counselling, (tailored) nursing interventions and self-help interventions. Furthermore, pricing policy through taxation and comprehensive smoking bans was effective in increasing smoking

cessation rates. Effect sizes for the effective intervention strategies varied between OR 2.17 and OR 1.42.

An integrative approach for studying the efficacy of interventions for smoking cessations has the advantage of facilitating comparisons of the efficacy of the respective interventions, to enable policy makers to make clear-cut, evidence-based decisions regarding the allocation of resources. Several limitations to such straightforward comparisons exist, however, including the ranking of interventions as we present it in our paper. Interventions might have different outcomes among different groups of smokers (heavy vs. nonheavy smokers, different socioeconomic status, etc.) and the settings in which the interventions were tested differed; hence they might not always be representative of the population of smokers at large. Some of the better controlled studies on individual smoking cessation intervention strategies have been studied among volunteers, who are likely to have a higher

Fig. 2
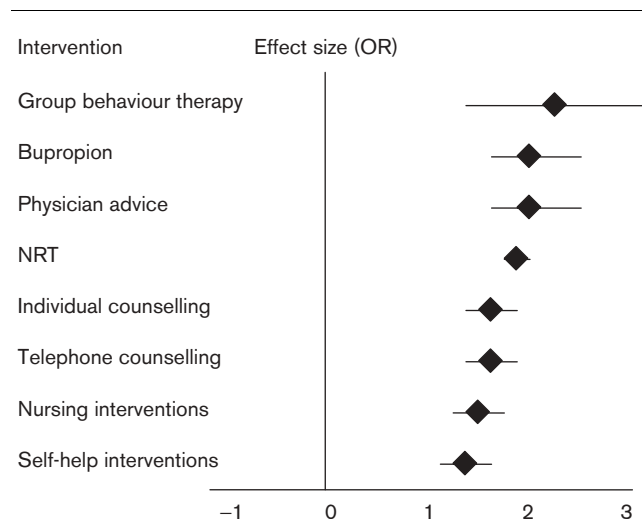
Graphic overview of effect sizes of interventions for smoking cessation. NRT, nicotine replacement therapy; OR, odds ratio.

motivation to quit than the population of smokers at large. Effect sizes presented in our review of reviews might thus be overestimations or underestimations. For smoking cessation efforts such as nationwide campaigns and policy measures such as taxation or smoking bans, randomized controlled trials are difficult or impossible to conduct. Because of this, the positive effects of clean indoor laws and taxation pricing policies on tobacco use (both preventing initiation of smoking and encouraging smoking cessation) were not established in randomized controlled trials, but in trend and cohort studies only. The external validity of these evaluations is, however, high as such studies are truly population-based.

Although an array of interventions has proven to increase quit rates among smokers, the absolute probability of abstinence for individuals remains low, irrespective of the intervention used. For example, a 50% increased likelihood of quitting (OR 1.50) results in an increase in the total quitting rate of 2–4%, as the chances of successfully quitting without any help are in the range of 3–6%. Many smokers need to go through several quitting attempts, using different strategies, before they finally succeed. Even small absolute increases in quitting rates, however, may have a significant life and health preserving impact, and when a large number of smokers can be reached with interventions with small effects, a significant impact on public health can be achieved.

Earlier reviews that addressed a wide array of smoking cessation interventions among adults provided conclusions in line with the present review of reviews. A Dutch review of smoking cessation interventions available in the Netherlands provided an overview and comparison of the effect sizes of the various interventions, based on the Cochrane Library data, with comparable results to our present review (Willemsen *et al.*, 2003). A National Health Service evidence briefing also applied a review of reviews approach to smoking cessation interventions and policies to reach evidence-based conclusions on 'what works' to increase smoking cessation, but did not provide a direct comparison between the interventions (Naidoo *et al.*, 2004). The French evidence-based smoking cessation guidelines recommend treatments similar to the interventions we identified as being effective (Le Foll *et al.*, 2005). A recent review from the United States of America also identified an equal array of intervention approaches and policies to be effective, similar to ours (Cokkinides *et al.*, 2006).

Table 4 Policies and legislations for smoking cessation, ranked according to their effectiveness

Policy/legislation	Effect size/smoking cessation rates/ prevalence rates	No. of studies on which effect size/effects on rates is based	Remarks
Taxation/pricing policies	10% increase in cigarette prices produces increase in quit rates of 3–5%	19	Middle-income countries and low-income groups show greater response to price Individuals aged 18–24 are more sensitive
Clean indoor laws	Comprehensive clean indoor laws (public places) lower per capita cigarette consumption by 5–20%; effect on cessation rates 12–38%	20	Strong long-term effect Larger effect on high-income groups Full workplace restrictions lead to 10–15% higher quit rates among workers; evidence of effect of restrictions in workplace only on population prevalence rates is conflicting
Health care financing systems	Full benefit versus no benefit: OR 1.48 (1.17–1.88) Full benefit versus partial benefit: OR 2.49 (1.59–3.90)	4 (full vs. no benefit), 2 (full versus partial)	Too small number of studies included to judge effectiveness
Health warnings	2% increase in quit rates in case of large, graphic warnings	5	Effect may be larger in low-income countries where people are less well informed about health risks, in combination with government sanctioned health reports or media campaigns
Advertising bans	No or small effect	7	Difficult to study net effect of large changes in advertising

OR, odds ratio.

Most of the reviews included in our study were Cochrane reviews, which are considered to be methodologically rigorous, high-quality reviews (Jadad *et al.*, 1998). Like any other review or meta-analysis, however, our review of reviews is liable to publication bias and time lag. Further limitations of our study were inclusion of studies published in the English language only, inclusion of studies published in the most recent years and a literature search using two databases only. These were arbitrary choices to make the analyses manageable, but we expected that all the effective interventions had been included in recent systematic reviews, and that the search of other databases would not have contributed to identifying other effective interventions.

People from lower socioeconomic status groups are more likely to be smokers (Gilman *et al.*, 2003). Nevertheless, none of the included reviews explicitly addressed the issue of differential effects of smoking cessation interventions according to socioeconomic status in their analyses. Consequently, there is a need to reanalyse these studies with the aim of including disadvantaged groups and assessing differential impacts, or direct interventions particularly in groups of lower socioeconomic status. The effectiveness of interventions for smoking cessation is currently being studied within the EUROCADET project. Although price increase through taxation measures was always thought to be most effective among low socioeconomic groups, recent research shows that in countries that are at the third stage of the smoking epidemic, smoking prevalence in poor and less educated women has not changed or has, rather, increased at the same time as tobacco prices have increased. Evidence suggests that increasing tobacco taxation is a regressive measure today and will probably achieve only a moderate reduction in tobacco use in the future, as smoking is becoming a phenomenon associated with poorer and less-educated people (Regidor *et al.*, 2007).

In this review of reviews, we identified the most effective interventions (group behaviour therapy, bupropion, intensive physician advice, NRT, individual behavioural counselling, telephone counselling, self-help interventions and nursing interventions) and policies (smoking bans and taxation policies) for smoking cessation among adults. This information will enable policy makers to make evidence-based decisions regarding the funding of the most effective interventions.

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