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Charles Darwin University

## Mass media interventions for preventing smoking in young people (Review)

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[Intervention Review]

# Mass media interventions for preventing smoking in young people

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## ABSTRACT

### Background

The mass media have been used as a way of delivering preventive health messages. They have the potential to reach and to modify the knowledge, attitudes and behaviour of a large proportion of the community.

### Objectives

To evaluate the effectiveness of mass media interventions to prevent smoking in young people in terms of reduced smoking uptake, in addition to secondary outcomes including improved smoking outcomes, attitudes, behaviours, knowledge, self-efficacy and perception.

### Search methods

We searched the Cochrane Tobacco Addiction Group Specialised Register and conducted additional searches of MEDLINE and EMBASE in July 2010.

### Selection criteria

Randomized trials, controlled trials without randomization and time series studies that assessed the effectiveness of mass media campaigns (defined as channels of communication such as television, radio, newspapers, bill boards, posters, leaflets or booklets intended to reach large numbers of people and which are not dependent on person to person contact) in influencing the smoking behaviour (either objective or self-reported) of young people under the age of 25 years.

### Data collection and analysis

Information relating to the characteristics and the content of media interventions, participants, outcomes, methods of the study and risk of bias was abstracted by two independent reviewers. Studies were combined using qualitative narrative synthesis.

### Main results

Seven out of a total of 84 studies reporting information about mass media smoking campaigns met all of the inclusion criteria. All seven studies used a controlled trial design. Three studies concluded that mass media reduced the smoking behaviour of young people. All of the effective campaigns had a solid theoretical basis, used formative research in designing the campaign messages, and message broadcast was of reasonable intensity over extensive periods of time.

## Authors' conclusions

There is some evidence that mass media can prevent the uptake of smoking in young people, however the evidence is not strong and contains a number of methodological flaws.

## PLAIN LANGUAGE SUMMARY

### Can mass media campaigns (television, radio, newspapers, billboards and booklets) deter young people from starting to smoke

Campaigns which researched and developed their message to reach their target audience had a higher success rate than those which did not. Overall, effective campaigns lasted longer with a minimum of three consecutive years, and were also more intense than less successful ones for both school based lessons (minimum eight lessons per grade) and media spots (minimum 4 weeks' duration across multiple media channels with between 167 and 350 TV and radio spots). The timing and type of broadcast made a difference to their success, with older youths in one study preferring radio to television. Implementation of combined school based curriculum/ components (i.e. school posters) and the use of repetitive media messages delivered via multiple channels (i.e. newspapers, radio, television) over a minimum period of three years contributed to successful campaigns. Changes in attitudes, knowledge or intention to smoke did not generally seem to affect the long-term success of the campaigns.

## BACKGROUND

Reducing the prevalence of tobacco use amongst adolescents remains a key public health priority (BMA 2008). Addiction to nicotine usually begins during adolescence and young people who start to smoke at an early age have more difficulty in quitting in later years (Reed 1993). Experimentation with cigarettes has been reported to start early with 19.1% of school students who had never smoked cigarettes indicating they were susceptible to initiate smoking during the next year (MMWR 2008). An estimated one in five young teenagers smoke regularly worldwide, with approximately 30 million children taking up the habit every year (GYTSC 2002). Approximately 9.5% of students are current cigarette smokers in the developed world. However, a disturbingly higher trend (above 30%) is occurring in underdeveloped countries (MMWR 2008). The New Jersey Youth Tobacco Survey estimated that 90-million cigarettes, or 4.2 million packs of cigarettes were consumed by high-school students annually in 2006 (UMDNJ 2007).

Smoking behaviour among adolescent girls is increasing over that of boys (Mackay 2006; Warren 2009). Smoking prevalence in 1994 was 10% for boys and 13% for girls aged between 11 and 15 years (Walters 1996). However a 2006 survey in Scotland demonstrated that smoking prevalence amongst boys decreased from 29% to 12% but the rate of decline for girls was significantly less with 26% to 18% (BMA 2008).

A systematic review of the literature has identified a number of different environmental, socio-demographic, behavioural and per-

sonal factors associated with the onset of smoking (Tyas 1997). The peer group, in particular, has been thought to play an important role in influencing smoking behaviour. A key theoretical perspective used to explain the association between peer smoking and adolescents' smoking is the 'social influences' or Social Learning Theory approach, which predicts that young people will anticipate, initiate and adopt smoking as part of the socialisation process (Cleary 1988). Social Learning Theory not only explains how people acquire and maintain behaviours but also provides the basis for intervention and behaviour change.

The Social Learning Theory approach has frequently been adopted in schools-based health prevention programmes. It has also been used as a basis for designing programmes delivered by the mass media. These campaigns are designed to influence behaviour by presenting positive role models who reject smoking in typical situations where smoking is encouraged, in the hope that the rejecting behaviour will be modelled by the target audience. Whether or not the target audience pays attention to the model depends upon the characteristics of both the model and the individual observer. In order to develop an effective prevention programme it is necessary to both develop the capacity to respond to social pressure and to provide a model of alternative behaviour. Programmes based on Social Learning Theory address the motivations behind smoking and provide options for alternative behaviour. This approach is in contrast to early attempts at smoking prevention which assumed that young people lacked information about the negative effects of smoking and if that information gap was filled they would then make rational decisions not to smoke. Hence the term 'rational

approach' which is frequently used for this type of intervention. However, lack of awareness of the adverse effects of smoking does not seem to be a major problem.

Other theoretical approaches that have been used in smoking prevention research include the developmentally-oriented affective approach where the focus is on increasing self-esteem and self-worth, decreasing feelings of alienation and developing decision-making and interpersonal skills. A basic assumption within this approach is that information specific to smoking is not considered necessary for preventing the onset of smoking. The social norms approach has also been used, where the focus is on reducing alienation and increasing self-esteem, often through active participation in activities.

The mass media (TV, radio, newspapers, billboards) have increasingly been used as a way of delivering preventive health messages. A review by [Kremers 2004](#) argued that smoking prevention should aim at influencing the image of non-smoking (i.e. positively influencing the identity of non-smokers) by using mass media interventions and restrictive policies. Mass media has the potential to reach a large proportion of the population, particularly groups that may be difficult to access through more traditional approaches, and are a relatively inexpensive way of exposing the population to information regarding their health. They also have the potential to modify the knowledge or attitudes of a large proportion of the community simultaneously ([Redman 1990](#)). It has been suggested that the mass media is particularly appropriate for delivering anti-smoking messages to young people because they are exposed to and often greatly interested in the media ([US DHHS 1994](#)).

Young people are estimated to spend almost twice as many hours watching TV (22,000 hrs) as they spend in formal education (12,000 hrs) ([Worden 1988](#)). By the age of 18 years a young person will have spent more time being entertained by the media than doing any other activity except sleeping ([Davies 1993](#)). The mass media, particularly TV, can influence young peoples' perceptions of what constitutes the real world, acceptable social behaviour, and help to mould cultural norms and convey important and believable messages about the behaviours it depicts ([Strasburger 1995](#)).

Previous reviews of the literature have assessed the effectiveness of mass media campaigns in influencing smoking behaviour in young people. They have however, included other types of intervention such as schools-based programmes or community initiatives, and as such have not included all relevant studies in any one area ([Michell 1994](#); [US DHHS 1994](#); [Reid 1995](#); [Reid 1996](#); [Stead 1996](#); [Silver 2001](#); [Friend 2002](#); [Farrelly 2003](#)). Overall, these reviews have reported mixed results concerning the effectiveness of the mass media, particularly for smaller community level campaigns. Regardless of this, the potential to influence youth smoking rates has still been demonstrated. There have been other reviews of the literature which have concentrated exclusively on the mass media, but smoking cessation with adult smokers has

been the focus ([Flay 1987b](#)). These reviews of smoking cessation have concluded that mass media campaigns can reduce smoking rates, particularly campaigns that are more intense in terms of reach, frequency and duration ([Flay 1987b](#); [Flay 1987c](#)).

## OBJECTIVES

Search and critically appraise the relevant literature in order to determine the strength of the evidence, that mass media interventions to prevent smoking in young people may:

- 1) reduce smoking uptake among youths (<25 years),
- 2) improve smoking attitudes, behaviour and knowledge,
- 3) improve self-efficacy/self-esteem,
- 4) improve perceptions about smoking including the choice to follow positive role models.

Studies which did not report smoking behaviour were excluded.

## METHODS

### Criteria for considering studies for this review

#### Types of studies

Any study which evaluated the effectiveness of mass media campaigns in influencing the smoking behaviour in young people using one of the following designs:

- 1) randomized controlled trial in which the unit of randomization was the school, community or geographical region,
- 2) controlled trial without randomization allocating schools, communities or geographical regions,
- 3) time series (i.e. data collection for one subject at regular intervals over a period of time).

Uncontrolled before and after studies and uncontrolled studies with post intervention measurements only (no baseline measurement) were excluded.

#### Types of participants

Young people aged less than 25 years.

#### Types of interventions

Mass media is defined here as channels of communication such as television, radio, newspapers, bill boards, posters, leaflets or booklets intended to reach large numbers of people and which are not dependent on person to person contact. The purpose of the

mass media campaign must be primarily to prevent the uptake of smoking in young people. Studies of mass media campaigns combined with school-based programmes designed to influence smoking behaviour in young people were also included.

## Types of outcome measures

### Primary measures:

Smoking/ tobacco use status: daily, weekly, monthly, ever, non-smoker, smokeless tobacco user, smoker (frequency/quantity unspecified).

Young people may be classified as smokers or non-smokers in different ways; where possible the strictest definition was used, in which young people with any history of cigarette use were defined as smokers.

### Intermediate measures (for studies reporting a smoking outcome):

Smoking attitudes: attitude toward smoking (total), advantages/positives, disadvantages/negatives, perceived peer attitudes, 'smokers look better', 'smokers more popular', 'non-smokers aren't affected', 'smokers are thinner', 'okay for young people to smoke'.

Smoking behaviours: intentions to smoke, rules on smoking.

Smoking knowledge: smokeless tobacco addictive, first use harmful, effects of mild cigarettes, ease of quitting, tobacco companies target kids.

Self esteem/self-efficacy

Smoking perception: perceived norms, perceived adult smoking, perceived peer smoking, perceived sibling smoking.

### Process measures:

Media reach

Mass media campaigns whose impact has been assessed only in terms of intermediate outcomes or process measures were excluded.

## Search methods for identification of studies

We searched the Cochrane Tobacco Addiction Group Specialized Register of trials. This is derived from regular systematic searches of bibliographic databases including CENTRAL, MEDLINE, EMBASE, PsycINFO and Science Citation Index (see [Tobacco Addiction Group Module](#) for search strategies and dates). Reports of trials of mass media interventions to prevent smoking uptake are identified as potentially relevant when new reports are added to the Register. As a check that all reports of mass media prevention studies had been identified we re-searched MEDLINE and EMBASE using a combination of topic related terms, age limiting

terms, and the tobacco and study design terms used for the main searches. Topic related terms included the following; mass media, videotape recording, telecommunications, radio motion pictures, audiovisual aids radio, television, TV, campaign, advertising. Full search strategies are given in [Appendix 1](#). Searches for the update were run in October 2009 and updated again in July 2010. The search dates were limited to 1997 onwards to identify new reports since the last update.

The register contains a variety of studies published in foreign languages. We did not exclude trials on the basis of language.

Searches for the first version of this review covered a larger range of databases; we did not find that the scope of the other databases or their indexing terms helped to retrieve additional study reports. Databases and strategies for the original version of this review are listed in [Appendix 2](#). Some communication journals were also searched individually via the Social Science Citation index; we did not continue this.

## Data collection and analysis

From the title, abstract, or descriptors, two of the authors (MB and KC) reviewed the literature searches. We excluded all studies that were clearly not RCTs (randomized controlled trials), CCTs (controlled clinical trials) or interrupted time-series or that clearly did not fit the inclusion criteria. All other citations were then reviewed independently (by MB and KC) in full text, assessing for inclusion based on study design, population, intervention and outcome.

The decision not to attempt a quantitative synthesis of the study results was determined by an a priori assessment of the large number of sources of possible heterogeneity amongst studies likely to be eligible. These include features of the programme under evaluation, such as type of media used, target audience and duration and intensity of the intervention. Study variables including design, measures of smoking behaviour reported and length of follow up would also contribute to potential variation in outcome.

Where necessary, authors have been contacted for clarification. Information relating to each study is presented in the '[Characteristics of included studies](#)'. Individual study results, regarding statistically significant differences in outcomes between intervention and control groups, are indicated in the '[Data and analyses](#)' table.

## Data extraction and management

Two authors (MB and KC) independently extracted data for the trials using a standardised data extraction form before data was entered into The Cochrane Collaboration software program Review Manager 5.0. KC and the previous review authors corresponded with authors of included studies to obtain missing and raw data. Additional data were obtained from the authors of [Flynn 1995](#), [Hafstad 1997](#) and [Worden 1983](#).

## Assessment of risk of bias in included studies

We assessed the risk of bias in line with the recommendations made in the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2008) which include allocation sequence generation, allocation concealment, blinding of participants, personnel and outcome assessors, incomplete outcome data, selective outcome reporting, and other potential threats to validity in the studies. In addition, four supplementary categories were included as recommended by the Effective Practice and Organisation of Care (EPOC) guidelines due to the nature of the intervention, and the potential increase to risk of bias in this study population (EPOC 2009). These include imbalance of outcome measures at baseline, comparability of intervention and control group characteristics at baseline, protection against contamination and selective recruitment of participants.

## Data synthesis

Data were entered in to Review Manager software. As there were insufficient data to conduct a meta-analysis, the studies were analysed using narrative synthesis.

# RESULTS

## Description of studies

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

## Results of the search

Reports relating to seven studies met all of the inclusion criteria from 707 articles (see 'Characteristics of excluded studies' section for details of excluded studies and reasons for exclusion). All of the included studies used a controlled trial design.

## Included studies

See [Characteristics of included studies](#). All studies investigated the effect of a mass media prevention effort directed at young people, <25 years, using a parallel group RCT or CCT design. The seven papers were published between 1983 and 2010. Six studies originated from the USA (Worden 1983; Bauman 1991; Flay 1995; Flynn 1995; Longshore 2006; Flynn 2010) and one from Norway (Hafstad 1997).

A total of approximately 49,398 participants were included from these seven studies. Clusters were reported in two different ways, one was at the level of community (n=6), which included SMSAs (Standard Metropolitan Statistical Areas) and counties, studies in

this classification included Bauman 1991, Flynn 1995 and Hafstad 1997. The other method of clustering was at the school level (n=338), ranging from middle to high school and was used by Worden 1983; Flay 1995, Longshore 2006 and Flynn 2010.

Participants varied across studies; some studies targeted specific high-risk groups such as girls (Hafstad 1997) or young people at higher risk of becoming smokers, as defined by parental education and income level (Flynn 1995). The age of targeted participants also varied, and ranged from nine to eighteen years across the different studies.

Overall follow-up time periods ranged from 18 months (Worden 1983) to six years (Flynn 1995) post baseline. However, in some cases the time-line was not clear. In Bauman 1991 the follow up was two years after baseline, 11 to 17 months after the broadcast and two to eight months after the mailed intervention. Hafstad 1997 measured smoking behaviour four years after the baseline survey, one year after the third and final campaign. Worden 1983 had follow up at 12 months from baseline (after two of the three campaigns) and at 18 months from baseline (immediately after completion of all three campaigns). Measurement of smoking behaviour in the Flay 1995 study was immediately after the six-week intervention period, plus one- and two-year follow up (approximately two years, four months after the baseline survey). Flynn 1995 measured smoking behaviour at five points in time after the first baseline survey. The first three measurements took place during the intervention, one immediately post-intervention and the final measurement two years after the four-year intervention had been completed. Longshore 2006 followed up participants for a total of two years, however, the media intervention ran intermittently for the entire duration of the study period. Finally the later Flynn 2010 study measured the population at baseline and then four years later. The intervention continued for the duration of the study period.

## Characteristics of interventions:

Four studies used mass media interventions alone (Worden 1983; Bauman 1991; Hafstad 1997; Flynn 2010) and three studies used mass media together with a schools-based educational component (Flay 1995; Flynn 1995; Longshore 2006). The theories on which the campaigns were based differed between studies, although the majority used aspects of the social influences or Social Learning Theory approach. The intensity and duration of the individual media campaigns varied greatly between studies.

Worden 1983 evaluated smoking prevention messages broadcast on TV, which were based on the social influences approach, for three 13-week periods over an 18-month period overall. Bauman 1991 evaluated the effectiveness of radio messages about the expected consequences of smoking, together with a TV, radio and mailed brochures component to stimulate personal encouragement not to smoke, over a 15-month period. In the Flay 1995 study schools-based programmes that emphasised skills to resist



social influences to smoke were combined with TV segments, which were broadcast over a period of six weeks. Finally Longshore 2006 used a combination of the social influences theory, combined with the health belief model (HBM) and self-efficacy theory of behaviour change, using six months of in-school curriculum plus a campaign which ran intermittently throughout the follow-up period; the campaign went 'national' for one year between July 1998 and July 1999, and during a third phase which ran from September 1999 to Spring 2004.

Hafstad 1997 evaluated the effect of a three-week prevention media campaign shown annually, over a three-year period, based on provocative emotional appeals (where emotional reactions are thought to influence behaviour), which were targeted mainly at girls. Flynn 1995 tested the effectiveness of adding TV and radio spots to schools-based smoking prevention programmes based on the Social Learning Theory approach, at regular intervals over a four-year period, whereas the later Flynn 2010 study utilised the Social Cognitive Theory.

Five of the studies purchased broadcasting time (Worden 1983; Bauman 1991; Flynn 1995; Hafstad 1997; Flynn 2010). Purchased broadcasting time allows more control over when messages are aired and therefore offers more scope for achieving optimal exposure of the message to the target audience.

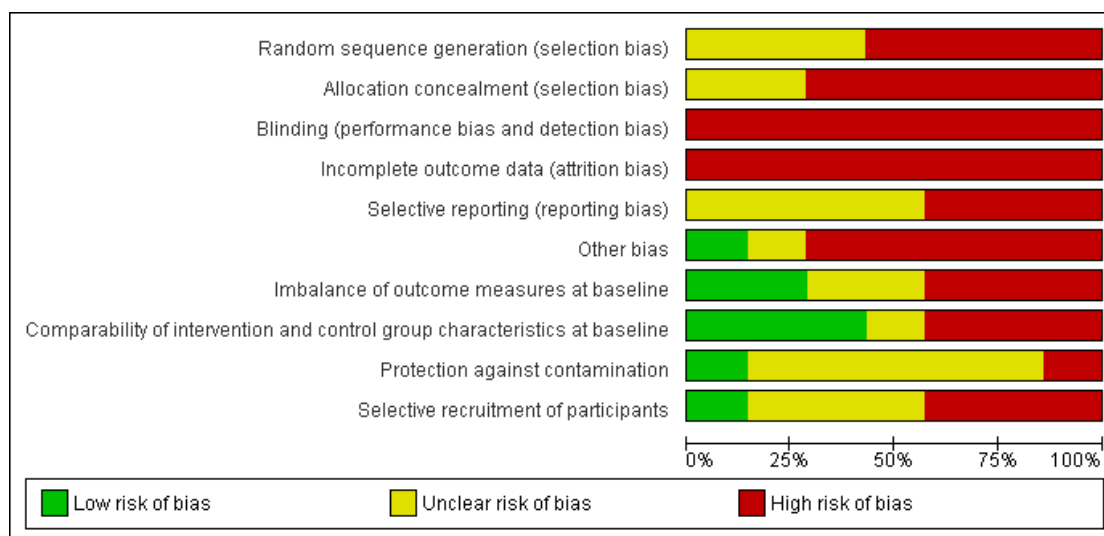
#### Outcomes measured:

Smoking behaviour was assessed in all studies by self-report and in one study was validated biochemically using alveolar carbon monoxide (CO) and saliva thiocyanate levels (Bauman 1991). In two studies, bogus pipeline measures (where participants are told that samples of their saliva will be analysed for thiocyanate levels and may be used to verify self-reports of smoking status) were also used as an addition to self-report data (Flay 1995; Flynn 1995). A number of different intermediate outcomes such as knowledge about the effects of smoking, attitudes towards smoking, and intentions to smoke in the future were assessed in the seven studies. Process measures such as programme reach were recorded in five of the studies (Worden 1983; Bauman 1991; Flynn 1995; Longshore 2006; Flynn 2010).

#### Risk of bias in included studies

The key features for risk of bias in the seven included studies are summarised in Figure 1, in addition to the 'risk of bias' tables at the end of Characteristics of included studies sections. Although the seven studies were assessed as meeting the criteria for inclusion into this review, there were important methodological limitations in all studies discussed below. Agreement for assessment of study quality was reached by the reviewers (MB and KC).

**Figure 1. Methodological quality graph: review authors' judgements about each methodological quality item presented as percentages across all included studies.**



**Sequence generation:**

Sequence generation was unclear in three studies (Flay 1995; Longshore 2006; Flynn 2010) and inadequate in the remaining four (Worden 1983; Bauman 1991; Flynn 1995; Hafstad 1997). Methods for choosing intervention and control areas varied across studies and were influenced by the availability of non-overlapping broadcast regions and by the prohibitive cost of advertising in some areas. Methods for selecting respondents varied between studies also and were largely dependent upon whether a schools-based component was included in the intervention. When interventions were a combination of mass media and schools based programmes respondents were students within the intervention and control schools (Flay 1995; Flynn 1995; Longshore 2006).

In those studies where the mass media campaign was the only intervention, methods of selecting respondents differed. In one study a cluster sampling procedure was used to identify a probability sample of households within each Standard Metropolitan Statistical Area (SMSA). Households were then screened for young people aged 12 to 14 years of age. This resulted in a sample of 2534 eligible respondents of which 83% participated in baseline measurement (Bauman 1991). One study included all young people aged 14 to 15 years from the two communities allocated to intervention and control groups (Hafstad 1997). Another study selected respondents from 93 schools, although no information is given as to how the schools were selected and no intervention was carried out within the schools (Worden 1983). The most recent Flynn 2010 study used Designated Market Areas (DMA) to match four pairs of metropolitan areas across four states, with a total of 98 middle and high school clusters available for evaluation at four-year follow up. These selections were focused on districts serving lower-income and lower-education populations.

**Allocation concealment:**

Allocation concealment was unclear in two studies (Flay 1995; Flynn 2010) and inadequate in the remaining five (Worden 1983; Bauman 1991; Flynn 1995; Hafstad 1997; Longshore 2006).

**Blinding for participants and outcome assessors:**

All studies were inadequate in terms of blinding for participants due to the nature of the intervention. no authors mentioned an attempt to conceal allocation from outcome assessors.

**Incomplete outcome data:**

Incomplete outcome reporting of data could not be excluded in any of the seven included studies.

Rates of attrition varied between studies which could in part be due to differences in the length of follow up. The study with the longest duration and follow up also had a high rate of attrition (62% at six-year follow up) (Flynn 1995). Attrition rates were also higher

in those studies that only included participants in the analysis if they had been present for all of the measurement sessions.

Some studies gave percentages of drop-outs according to reason for non-response, for example in one study 82% of drop-outs left the community or transferred to private schools and three per cent were refusals to participate in further assessments (Flynn 1995). Some studies reported differences between those participants who were lost to follow up and those who were available throughout the intervention period. For example significantly less baseline smoking was reported in those available at follow up compared with those lost to follow up (1.3% versus 5.1%,  $p < 0.01$ ) (Flynn 1995).

**Selective outcome reporting:**

Selective reporting was unclear in four studies ( Worden 1983; Flay 1995; Hafstad 1997; Longshore 2006) and inadequate in the remaining three studies (Bauman 1991; Flynn 1995; Flynn 2010).

**Imbalance of outcome measures at baseline:**

Three studies (Bauman 1991; Flay 1995; Hafstad 1997) failed to address an imbalance in outcome measures at baseline, two studies (Worden 1983; Flynn 1995) were unclear, leaving two studies (Longshore 2006; Flynn 2010) which adequately addressed this outcome.

**Comparability of intervention and control group characteristics at baseline (i.e., similar characteristics of subjects in each study arm):**

Comparability of interventions at baseline for participant characteristics was unclear in one study (Hafstad 1997), inadequate in three (Worden 1983; Bauman 1991; Flynn 1995) and addressed in three (Flay 1995; Longshore 2006; Flynn 2010).

In one study there was substantial variation in baseline smoking rates between SMSAs (smoking levels ranged from 0.6% to 5.2% between SMSAs). This occurred despite selecting regionally matched communities and adjusting statistically for 10 socio-demographic and personality correlates of adolescent cigarette smoking (Bauman 1991). However, in some of the included studies none or small differences were reported between groups at baseline. For example, one study found differences between groups in the percentage of females (52% versus 47%,  $p = 0.02$ ) and in the ages of participants (10.7 versus 10.8 years,  $p = 0.002$ ) but no differences were found on a number of other variables measured at baseline in the same study (Flynn 1995). The likely reason for these statistically significant differences is to do with statistical power of the large sample size, rather than differences of clinical significance. In addition, differences found were adjusted for, in subsequent analyses.

### **Protection against contamination:**

Protection against contamination was unclear in five studies (Worden 1983; Bauman 1991; Flynn 1995; Hafstad 1997; Longshore 2006); one was adequately addressed (i.e. no contamination) (Flay 1995) and one study reported significant contamination within the control populations (Flynn 2010). However, due to the nature of mass media interventions, it is very difficult to find a comparable control group that is not exposed to the intervention media.

In the most recent study, Flynn 2010, authors report significant contamination through state-funded tobacco control programs via the Master Settlement Agreement, (MSA) running for the duration of the study period (2000 - 2005). During 2002, the first campaign year for this research project, these states spent an average of 26% of the Centers for Disease Control and Prevention (CDC) recommended minimum expenditure on tobacco control programming. The CDC estimated that the median number of state-funded anti-tobacco advertising exposures among youth increased from 0.04 per month in 1999 to 0.80 in 2002. In addition, a large national youth-focused anti-tobacco media campaign, also funded by the MSA commenced in 2000. Authors report that this campaign was active in all of the intervention and comparison DMAs at a high level of intensity throughout the intervention campaigns.

### **Selective recruitment of participants (i.e., selection bias &/or representation of community):**

Selective recruitment of participants could not be excluded in three studies (Bauman 1991; Flay 1995; Hafstad 1997), and was unclear in three (Worden 1983; Flynn 1995; Longshore 2006).

### **Other potential threats to validity:**

Finally, five studies had other potential threats to validity (Bauman 1991; Flay 1995; Flynn 1995; Hafstad 1997; Longshore 2006) as described below under 'statistical analysis', one (Worden 1983) was unclear and one was free of other potential threats to validity (Flynn 2010).

### **Statistical Analysis**

All studies allocated either communities, areas or schools to intervention or control groups. In five studies the main analysis was then presented with the individual as the unit of analysis. All these five studies did however take account of the unit of allocation issue in their analyses (Bauman 1991; Flay 1995; Flynn 1995; Longshore 2006; Flynn 2010). For example, one study included the community as a random factor nested within treatment, school a random factor nested within community and the individual a random factor nested within school. Statistical significance associated with the intervention was determined by using community within treatment as the error term (Flynn 1995). Similarly, another study

modelled individual outcomes as three level data (students within classrooms within schools) with differences between schools and differences between classrooms treated as random effects and differences between treatments as fixed effects (Flay 1995). In the study by Bauman (Bauman 1991) data were analysed by area and by individual; the latter examined treatment effects with the area nested within treatment.

## **Effects of interventions**

### **Smoking behaviour**

Seven different mass media programmes have been evaluated as a method of preventing the uptake of smoking in young people. Three of the seven interventions were found to be associated with reductions in smoking behaviour (Flynn 1995; Hafstad 1997; Longshore 2006), whilst the remaining four demonstrated no effect (Worden 1983; Bauman 1991; Flay 1995; Flynn 2010). Campaign components are summarised in Appendix 3.

### **Mass media campaigns versus no intervention:**

The first comparison concerned the effectiveness of mass media campaigns, compared with no intervention in influencing the smoking behaviour of young people. Four of the seven studies made this direct comparison (Worden 1983; Bauman 1991; Hafstad 1997; Flynn 2010) and one study used a factorial design in which this comparison was made (Flay 1995).

A provocative media campaign aimed primarily at girls, designed to create negative affective reactions was carried out in one county in Norway (Hafstad 1997). The effects of newspaper advertisements, posters, TV and cinema spots of three-weeks duration over three consecutive years were compared to a control county receiving no intervention. Comparison areas were matched on variables such as county size, education level, parental income and smoking prevalence. The overall increase in the proportion of female daily smokers at one-year follow-up was four per cent lower in the media county than in the control county (8.6% compared with 12.4% respectively,  $p < 0.01$ ). Although not statistically significant, the same trend was apparent for males; 6.8% in the intervention county compared with 10.5% in the control county. The odds ratio (OR) for being a smoker in the intervention county compared with being a smoker in the control county was 0.74 (95% CI: 0.64 to 0.86) after adjustment for smoking at baseline and gender.

A difficulty with the interpretation of the findings in this study was the difference in survey response rates, between the intervention and the control counties (65% versus 70% respectively). In addition, more of the participants lost to follow up in the intervention county were smokers at baseline than in the control county (18% versus 13%). The odds of being a smoker controlling for smoking habits at baseline were re-calculated taking into account the differences in response rates between the two counties (OR

0.84, 95% CI: 0.76 to 0.95). Also, no adjustment was made in the analyses for the community being the unit of allocation and the individual the unit of analysis.

In a second study, TV messages designed to prevent the adoption of smoking were targeted at 10 to 12 year olds within the range of a rural network affiliate TV station in the USA, over an 18-month period (Worden 1983). School districts in adjacent counties, which were out of range of the signal, were matched using census data, and formed the control group. At 18-months follow up no statistically significant differences were found in smoking behaviour between the intervention and control counties.

One study compared three different forms of mass media with a control which did not receive any intervention (Bauman 1991). Radio messages were used to broadcast the negative consequences of smoking, added to this was the promotion of a sweep-stake offer, first using the radio and secondly the television. The sweep-stake offer encouraged young people to recruit friends into the contest in the hope that discussion about not smoking would take place. Cluster sampling procedures were used to identify probability samples of households within each area, from whom data were collected. Smoking prevalence increased from baseline to follow up (ranged from two to eight months post-intervention) in all groups, but no significant differences between groups were detected. There was however substantial variation in baseline smoking between the SMSAs, from which the groups were selected (range from 0.6% to 5.2%). This occurred despite selecting regionally matched communities and adjusting statistically for 10 socio-demographic and personality correlates of adolescent cigarette smoking. The observed rates of adolescent smoking made detection of effects attributable to the campaigns impossible (Bauman 1991; La Prelle 1992).

The most recent study (Flynn 2010) compared four simultaneous campaigns consisting of specially developed messages based on behavioural theory (social cognitive theory) and targeted to diverse age groups of racially and ethnically diverse youth. 30- and 60-second TV and radio messages were broadcast using purchased time with approximately three to four exposures per week. Approximately 10 messages were chosen for each campaign in 2002. Five additional messages were developed annually for each campaign in 2003 to 2005 (60 total). Intervention impact on cigarette use in the past 30 days did not show an effect. The 30-day smoking rates appeared to decline in both groups over the four-year interval between baseline and follow up surveys for participants in both conditions, but this trend was not significant. Similar results were obtained for seven-day prevalence (weekly smoking).

#### **Mass media campaigns combined with schools-based programmes versus no intervention:**

The second comparison concerned the effectiveness of mass media campaigns combined with schools-based programmes compared with no intervention in influencing the smoking behaviour of

young people. No study tested this comparison directly although one study used a factorial design in which this single comparison was made (Flynn 1995) (discussed separately).

#### **Mass media campaigns combined with schools based programmes versus mass media campaigns alone:**

The third comparison concerned the effectiveness of mass media campaigns combined with schools-based programmes compared with media campaigns alone in influencing the smoking behaviour of young people. Only one study addressed this comparison in a factorial design (i.e. a design consisting of two or more factors, whose experimental units take on all possible combinations of these levels across all such factors) expressing combinations of TV only, TV plus CR (classroom curriculum), CR only, and two control groups - treatment as usual and attention control (Flynn 1995) (discussed in detail later).

#### **Mass media campaigns combined with schools-based programmes versus schools-based programmes:**

The fourth comparison concerned the effectiveness of mass media campaigns combined with schools-based programmes compared with schools-based programmes only in influencing the smoking behaviour of young people. Two studies made this direct comparison (Flynn 1995; Longshore 2006) and one study addressed it in a factorial design (Flynn 1995).

In Flynn 1995, students in communities where TV and radio messages were broadcast over a four-year period combined with a schools based programme teaching refusal skills and skills to resist advertising pressure, were found at 2-years follow-up to be at lower risk for weekly smoking than those in communities receiving only the schools-based component (OR 0.62, 95% CI: 0.49 to 0.78). Communities were matched on variables such as size, education level, income and smoking prevalence. There were however, a few significant differences at baseline between the groups, with the media and schools-based group having more females (52% versus 47%,  $p=0.02$ ), more younger participants (10.7 years versus 10.8 years,  $p<0.01$ ) and more participants with an older sibling that smoked (15.8% versus 11.3%,  $p=0.06$ ). These differences were however adjusted for in subsequent analyses.

The findings of preliminary research conducted with high risk youth were used to develop the TV and radio spots in this study. When smoking behaviour was examined separately for high and low risk youth at two-year follow up, a 7.3% difference in weekly smoking prevalence favouring the media and school group was found in the high risk group (28.6% for the media-school group and 35.9% in the school-only group) compared with a 4.3% difference favouring the media and school group in lower risk students (15.9% in the media-school group and 20.2% in the school-only group). Higher-risk youths were found to report more frequent use of both radio and TV (Flynn 1995). The success of this

programme may have been partly due to the experience gained from an earlier study evaluating the effectiveness of a mass media campaign aimed at preventing the onset of smoking in young people (Worden 1983).

Longshore 2006, used a combination of school based curriculums ALERT (middle-schools) and ALERT Plus (high-schools) in addition to an established media intervention, the National Youth Anti-Drug Media Campaign. This was part of an effort by the Office of National Drug Control Policy to combat illegal drug use among America's youth by means of an advertising and social marketing program focusing on the dangers of drug use. This campaign targeted a combination of marijuana, alcohol and tobacco prevention for youth. The ALERT condition was a basic prevention curriculum delivered in seventh and eighth grades, whilst ALERT Plus consisted of the same curriculum with the addition of booster lessons added for ninth and tenth grades (i.e. extra annual lessons), compared to a control condition of no intervention. Overall smoking behaviour favoured both ALERT and ALERT Plus, producing a 19% and 23% reduction respectively in weekly and monthly smokers, ( $p < 0.01$ ) by two-years post-baseline surveys.

Another study (Flay 1995) compared five different programmes; TV only, TV plus classroom programme, classroom only, and two control groups ('attention control' and a 'no intervention control') to influence the smoking behaviour of young people. All programmes were based on the social influences approach for prevention and cessation. A blocked randomized design was used to allocate schools within two counties in the USA to either intervention or control conditions. At two-year follow up there were no significant programme effects on smoking behaviour or smoking intentions in any of the intervention groups (Flay 1995). However, it should be noted that the TV component of the programme did not meet the original objectives, in that social resistance skills were not demonstrated in the way that is necessary for adequate learning to take place. Scripted demonstrations of prevention skills were not allowed to be shown due to commercial news organisation (Flay 1995).

### Intermediate outcomes

Overall, the findings relating to intermediate variables including knowledge (Analysis 2.3), attitudes (Analysis 2.1), intentions to smoke (Analysis 2.2), self-efficacy (Analysis 2.4) and smoking perceptions (Analysis 2.5) were inconsistent across studies. In a few cases they improved relative to control conditions, in some studies they did not differ and in others improvement was found in the control groups. This inconsistency was apparent both between and within studies dependent upon the variable that was measured. For example at two-year follow up, greater knowledge was found in a health information based control group than in the three intervention groups. In the same study one intervention group which

received social-resistance training significantly increased their social-resistance skills knowledge relative to other groups ( $p < 0.01$ ) but actual refusal self-efficacy did not differ significantly between groups (Flay 1995). In the study by Flynn 1995 intermediate variables such as attitudes towards smoking (0.37 versus 0.25,  $p < 0.05$ ) and smoking norms (4.94 versus 5.56,  $p < 0.05$ ) changed in a positive direction in the media and schools group compared with the schools only group. In the study by Hafstad 1997 statistically significant differences were found between the intervention and control groups in intentions to smoke in the future. Nine per cent of the intervention group compared with 13% of the control group reported that they expected to be a smoker within three years ( $p < 0.01$ ). In one study the interventions had no effect on smoking intentions (Flay 1995). Secondary outcomes of attitudes, self-efficacy and perceived norms for Longshore 2006 showed no effect between groups. In the most recent Flynn 2010 study, intentions to smoke declined in both intervention and control groups but this was not significant, however significant favourable changes were identified in both study groups for perceived peer prevalence and peer norms. When analysing attitudes, positive outcome expectation scores increased significantly over time in both study groups, an unfavourable change, whilst negative outcome expectation scores decreased in the comparison but not in the intervention group, although this was not significant.

### Process measures

Programme reach varied in the five studies where it was recorded. In one study 81% of those in the intervention group reported hearing or seeing at least one of the TV or radio messages (Brown 1990; Bauman 1991). In another study (Worden 1983) recall was presented according to whether participants were light or heavy TV viewers. In those youths who were light viewers recall of messages was 32% compared with 57% in those who were heavy users. The Longshore 2006 study reported 77% viewing by young people of at least one anti-drug advertisement per week. More specifically, recall of television advertisements aired by the campaign has increased over time from 37% in 2000 to 76% in 2003. In Flynn 2010, grade seven to eight intervention youth recorded a 41% recall for TV messages and 32% for radio, whilst grade nine to twelve youth recorded 32% recall for TV messages and 37% for radio.

### Costs

Only one of the included studies reported any information about the costs involved in broadcasting a media campaign (Flynn 1995; Secker-Walker 1997). The cost of developing and broadcasting the campaign was US\$759,436 and the cost per student potentially exposed was US\$41. The cost per student averted was US\$754 (95% CI: US\$531 to US\$1296) and the cost per life-year gained discounted at 3% was US\$696 (95% CI: US\$445 to US\$1296).



This cost per life-year gained was reported to compare favourably with other preventive and therapeutic strategies.

## DISCUSSION

Seven studies provided outcomes evaluating the effectiveness of mass media campaigns, that met the criteria to be included in this review. Of these three were associated with a reduction in smoking outcomes (Hafstad 1997; Flynn 1995; Longshore 2006), see Analysis 1.1. One (Hafstad 1997) compared media implementation with TV and cinema spots, newspaper advertisements and posters against no intervention, and found a statistically and clinically significant decrease in smoking uptake by girls, (with the net increase being 8.6 percentage points in the intervention county and 12.4 in the control county) and a non-significant trend in boys at three-year follow up (6.8% to 10.5%). Another study (Flynn 1995) combined its media intervention of TV and radio spots with school based programmes and compared this to school-based programmes alone. At the two-year follow up, students exposed to the combined media and school intervention were at lower risk for weekly smoking than those receiving the school intervention only. The most recent study (Longshore 2006) curbed cigarette initiation in the intervention arm for 'ever users', reducing the proportion of new smokers and also holding down current (past month) and regular (weekly) smokers in both high risk experimenters and even higher-risk baseline smokers.

The theoretical models used in the three successful campaigns were the same for Flynn 1995 and Longshore 2006 but differed for Hafstad 1997. In Hafstad 1997, provocative messages were developed and used to cause affective personal reactions. In turn it was hypothesised that this would lead to discussion and interpersonal communication which would lead to reductions in smoking. Flynn 1995 and Longshore 2006 developed a programme based on the social influences or Social Learning Theory approach. This particular theory has been used extensively in smoking prevention research and was also used in the remaining three studies included in this review, which did not show a benefit in smoking prevention outcomes. In addition to the social influences approach, Longshore also used the health belief model (HBM) and the self-efficacy theory of behavioural change.

It has been suggested that a number of mass media campaigns have failed to achieve their objectives as they were not adequately piloted prior to implementation (Chollat-Traquet 1996). However, the majority of studies included in this review devoted considerable time and resources to the development and refinement of intervention components (formative research). In most studies data were collected from groups of people who represented the potential target audience, for example in both Flynn studies the messages were developed from intensive diagnostic surveys and

focus groups with the target population. Dependent upon the response from group participants, modifications were made to specific components of the campaign. New sets of spots were created on an annual basis to keep pace with the changing interests of the target audience (Flynn 1995; Flynn 2010). Similarly, one study found that the preferences differed for either radio or TV depending upon the age of the participants, with older youths preferring the radio (Worden 1983). The appropriateness of the time of broadcast in reaching the target audience can also be tested during the developmental stage of the programme, as in the study by Worden 1983.

The importance of adequate design and development prior to the launch of any media campaign is emphasised in the Social Marketing Approach. This approach attempts to apply the principles of advertising and marketing to the 'selling' of positive health behaviours (Wallack 1990). Emphasis is placed on the involvement of small groups of representative samples of those at whom the campaign is directed. Such groups for example might be involved in message development. This approach gives a strong focus to consumer needs and differs from other approaches where message development was carried out with little input from the intended audience.

The three successful campaigns were similar in terms of intensity and duration, which was not common across the studies which did not report positive findings. In the study by Flynn 1995 there were averages of 190 TV, 350 cable TV and 350 radio spots purchased in each of the four years during which the campaign was running. Similarly, 167 TV and cinema spots were shown in each of the three annual campaigns described by Hafstad 1997. Longshore 2006 utilised The National Youth Anti-Drug Media Campaign which ran for a total of six and a half years and utilised television (local, cable, and network), radio, web sites, magazines, movie theatres and several other media. In comparison, both the intensity and duration of the campaigns in the other studies were much reduced. Both the intensity and duration of any campaign are likely to be important factors in influencing health-related behaviour. A review assessing the effectiveness of the mass media as a smoking cessation intervention with adults also found that campaigns that were more intense in terms of reach, frequency and duration were the most effective in reducing smoking rates (Flay 1987b).

Two of the three studies reducing smoking behaviour targeted specific populations; Hafstad 1997 targeted girls, while Flynn 1995 targeted higher-risk groups, defined by parental education attainment and income levels. Longshore 2006 also presented data in sub-analysis based around high-risk populations. Another other study (Worden 1983) also targeted girls, who had higher baseline smoking rates than boys. There are large and persistent racial, gender and class differences in smoking rates (Cleary 1988). Rates of smoking have been reported to vary among sub-groups within the teenage population (Badovinac 1995; Babar 2010). In the UK, socio-economic differences in smoking rates have been reported

in the 16 to 24 years old age group. For example, smoking rates among non-manual groups is 25%, compared with 35% for manual groups (HEA 1997). Most media campaigns to date have not specifically targeted high risk groups.

All included studies in this review had at least four significant methodological limitations based on the risk of bias assessment (see Figure 1 and Risk of bias in included studies). As such, the findings of this review should be interpreted with some caution given the general limitations of primary research in this area. A problem common to several of the studies is the allocation of communities, areas or schools to intervention or control, followed by analysis at the level of the individual. Individuals are often used as the unit of analysis because it increases the power of the study, which in turn gives a greater chance of finding positive programme effects. Ignoring the correct unit of analysis may lead to spurious positive findings (Altman 1997). Study participants should not be treated as independent individuals as it is likely that participants within a community will be more alike than a random sample of participants from several communities. Two sources of variation exist: that between individuals in a community and that between communities. The variability between communities must be taken into account in the analysis (Bland 1997). A potential way of overcoming this problem is to correct in the individual level analysis for community or school level variation using multilevel data. Five of the included studies accounted for the unit of allocation in their analyses (Bauman 1991; Flay 1995; Flynn 1995; Longshore 2006; Flynn 2010).

Due to the nature of the intervention it is not possible to blind participants to the intervention they receive. Although the individual student's awareness may not have a direct effect on the outcome, the staff and teachers at schools may introduce a bias into this population as evident in Bauman 1991, where 85% of the population in one school enrolled after a teacher had been assigned by the principal to serve as school coordinator for the local 'Great American Smokeout' sponsored by the American Cancer Society. She heard the sweepstakes offer on the radio, obtained a copy of the broadcast tape from a local radio station, played the tape over the school's electronic announcement system, and then organised the mail-in campaign.

Differences at baseline between control and intervention communities was a problem common to many of the studies, making it difficult to conclude that any differences at follow up were due to the intervention alone. Differences at baseline may cause differential rates of change in the outcome of interest between the groups. Attrition was also a problem common to most studies in this review and ranged from 22% to 62%. When the effect of an intervention is expected to be small and/or the incidence of a behaviour is low, as with adolescent tobacco use, collecting follow-up data from as many participants as possible is vital for achieving adequate statistical power to be able to determine the effectiveness of the intervention (Morrison 1997). The results reported in the

seven studies tended to be based on outcome data relating to a sub-sample of participants rather than on the basis of allocation to groups. Evaluation of effectiveness on the basis of data provided by those participants available at follow up is likely to be biased. For example, in three studies drop-outs were reported to be more likely to be smokers or at risk of becoming a smoker, than those respondents available at follow up (Bauman 1991; Flynn 1995; Hafstad 1997). In addition in one study, significantly less baseline smoking was reported in those available at follow up compared with those lost to follow up (1.3% versus 5.1%,  $p < 0.01$ ) (Flynn 1995). This is particularly problematic when there are more drop-outs who are at risk in the intervention group than in the control group. This was the case in one study (Hafstad 1997) where 18% of those lost to follow up were smokers in the intervention group compared with 13% in the control group. The odds for becoming a smoker were re-calculated controlling for smoking habits at baseline and assuming that the proportion of smokers who were drop-outs in the intervention group was three times higher than among the respondents. The proportion of smokers who were drop-outs in the control group was assumed to be twice as high as among respondents. The OR for being a smoker in the intervention group compared with the control group was 0.84 (95% CI: 0.8 to 0.9).

Other smoking prevention studies have also been subject to the same problem. For example, a meta-analysis of 131 school-based prevention programmes found that only 16% of studies had analysed their data at the correct level (Rooney 1996). This issue is also common outside of the smoking prevention literature, for example a methodological review of non-therapeutic intervention trials, found that half of the trials identified had not used statistical methods which took into account between-cluster variation (Donner 1990). A systematic review of the literature examining the effectiveness of mass media campaigns in influencing cardiovascular risk behaviours also reported that many of the relevant studies failed to meet basic methodological criteria (Redman 1990). For example many did not include a control group and/or did not carry out any baseline measurement.

Despite the problems common to most of the studies which met the inclusion criteria for this review, they represent the most methodologically rigorous set of studies evaluating the effectiveness of the mass media in influencing the smoking behaviour of young people. A large number of studies relating to smoking prevention campaigns had to be excluded due to design issues or simply that no smoking related outcomes were reported (See Table, Characteristics of excluded studies). In particular, one previously included study was excluded due to inadequate comparison between groups. The intervention population was made up of self-selected schools and the control group contained schools which did not respond to the invitation to participate (Flay 1987a), thus affecting the ability to compare groups. Another study by Sly 2001 which examined the 'Florida Truth Campaign' met all the criteria to be included however it was excluded just prior to completion

of this review as no information was presented or able to be obtained for the control population at follow up. Other evaluations of this campaign could also not be included for the same reasons. Campaigns have frequently either not been evaluated, i.e. they are merely described, or evaluation has been in terms of a survey of the number of people who report awareness of the campaign. One of the most expensive media campaigns in the smoking field had to be excluded due to lack of proper evaluation. The California Tobacco Education Media Campaign cost \$28.6 million, funded out of a state-mandated charge on cigarettes. Evaluation consisted of comparing smoking behaviour pre- and post-intervention in different samples, including school-age youths, plus comparisons between students who reported being unexposed and exposed to the campaign (Popham 1994).

Most of the media programmes described in the included studies were made up of several different components, including the use of different media channels such as television, radio, newspapers, etc. However, in the majority of programmes the independent effect of the separate components was not assessed. Therefore, there is little information about which aspect of the campaign had the most impact with which group(s). It is also important to note that any influence mass media may have on the prevention of adolescent smoking may be negated by social, family and peer pressures in each individual's environment, as noted by Wakefield 2003 in a review. In addition, this study also concluded that anti-smoking advertising appeared to have more reliable positive effects on those in pre-adolescence or early adolescence by preventing commencement of smoking. Furthermore, reaching youth through the tried and tested mass media outlets as outlined in this review is becoming more difficult with the rapid advances in communications and technologies such as TIVO, which allows viewers to skip over advertisements. Other media outlets popular to youth need to be targeted for future campaigns such as internet sites including My Space and Facebook, and Twitter.

To summarise, three out of seven studies demonstrated statistically and clinically significant reductions for smoking uptake in young people. Common features to these successful campaigns included multiple channels for media delivery (e.g. newspapers, television, radio, posters, etc.), combined school and media components (through school posters and/or school based curriculum), and repeated exposure to campaign messages consecutively delivered for the same cohort of students over a minimum period of three years. Two of the three successful campaigns were based on the 'social influences' or 'social learning theory' approach, one of which also incorporated the HBM. The other successful campaigns used provocative messages to cause effective personal reactions. However three of the remaining four studies, which did not produce any statistical benefit, also used the social influences approach. Two of the four unsuccessful studies had short campaign durations (two weeks for one study, and four weeks for another) and as such were less intense than the successful campaigns. Only

one of these four studies combined school involvement with media, however the duration of the combined media component was likely too short (two weeks) to produce a positive outcome. The remaining two studies demonstrating no benefit had longer durations (three periods of 13-week television smoking prevention messages - 39 weeks in total, and the other study ran for the full four year study period). However the lack of a structured curriculum component to support these messages, such as those in the combined school based studies, likely accounts for the eventual failure in preventing the uptake of smoking in young people.

Based on an assessment of the most methodologically rigorous set of studies evaluating the effectiveness of mass media campaigns directed at youth, there is some evidence that these media campaigns can be effective in preventing the uptake of smoking in young people, however the evidence is not strong and contains a number of methodological flaws.

## AUTHORS' CONCLUSIONS

### Implications for practice

The following programme characteristics should be considered by individuals involved in planning future mass media campaigns:

- build upon elements of existing campaigns that have shown to be effective rather than repeating methods that have been unsuccessful;
- developmental work with representative samples of the target audience should be carried out so that media messages appropriate to that group can be created;
- campaign messages should be guided by theoretical concepts about how behaviours are acquired and maintained;
- media messages must reach the target audience (via media channels preferred by the target audience at the most appropriate times);
- broadcasting of campaigns should be of sufficient intensity, frequency and duration to have a reasonable chance of being effective (e.g. the addition of booster sessions);
- campaigns should be combined with a structure support curriculum such as those available via school-based collaborations;
- preferences for either radio or TV is likely to depend on age.

### Implications for research

Evaluation of mass media prevention campaigns is methodologically challenging, yet rigorous evaluation of any media campaign



is required in order to demonstrate effectiveness. Careful planning of the evaluation is required, in terms of:

- sample sizes which are adequate to detect significant effects if they exist;
- follow-up data are obtained from a high proportion of initial participants;
- analysis at the correct level, for example, if communities are the unit of allocation then they should also be the unit of analysis or make adequate adjustment if individual level data are used;
- determine which programme components are effective by the use of fully factorial designs;
- outcome measures which measure the outcome of interest, i.e. smoking behaviour in addition to intermediate outcomes such as attitudes to smoking and process measures such as media reach;
- inclusion of control groups which mirror the demographics of

the intervention population;

- the latest media vehicles used by youth need to be evaluated including internet and other communication devices.

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\* Indicates the major publication for the study



## CHARACTERISTICS OF STUDIES

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

#### Bauman 1991

Methods	<p>Design: Controlled clinical trial; nested, cluster (procedures identified probability samples of households within each area screened for adolescent), non-equivalent control group</p> <p>Country: USA</p> <p>Objective: To evaluate the effectiveness of a mass media campaign to prevent cigarette smoking in adolescents</p> <p>Study site: (Schools) Standardised Metropolitan Statistical Areas (SMSAs); Homes in SMSAs in SE USA</p> <p>Method of analysis: Logistic and linear regression (both individual - accounting for unit of allocation - and SMSAs treated as unit of analysis), ANOVA</p> <p>Confounders analysed: Individual respondents, treatments, socio-demographic status, personality predictors of adolescent smoking</p>
Participants	<p>Age: 12-15 yrs</p> <p>Gender: Males and females (further details not provided)</p> <p>Ethnicity: SMSAs with &gt;90% whites excluded.</p>
Interventions	<p>Programme name: RADIO, RPEER, RTVPEER</p> <p>Theoretical basis: Behavioural science theory and research; Formative media research used to develop TV and radio messages</p> <p>Intervention description 1.) RADIO: 8 x 30 sec radio messages about 7 expected consequences of smoking that are related to whether young people become regular smoker, relevant to adolescents, broadcast in 2 SMSAs</p> <p>Intervention description 2.) RPEER: Same as RADIO, plus 60 sec message inviting entry into "I won't smoke" sweepstake, prize \$2,000, with a \$20 incentive to recruit 5 (+) entrants, broadcast in 2 SMSAs. Brochures mailed to respondents and recruits encouraging communication with peers to discourage smoking</p> <p>Intervention description 3.) RTVPEER: Same as RPEER plus TV broadcast of sweep stake offer and only 3 expected consequence messages, broadcast in 2 SMSAs</p> <p>Control description: CONTROL: No media intervention.</p> <p>Duration: Expected consequences messages broadcast during Nov 85, Jan and April 86. TV sweepstake offer Nov 85. Brochures mailed Jan 86-Feb 87</p> <p>Intervention delivery: Messages delivered by adolescent speakers (thoughtful, self confident, casually dressed peer, being most appropriate image suggested by formative media research)</p>
Outcomes	<p>Reported outcomes: Smoking behaviours (weekly and ever smokers), smoking attitudes (overall attitudes towards smoking, perceived peer attitudes),</p> <p>Validation: alveolar CO and saliva thiocyanate levels.</p> <p>Follow-up: time-period: 11-17 months after broadcasts ended, 2-8 months after brochures mailed</p>
Notes	<p>Selection of SMSAs was influenced by cost of advertising, legal restrictions (e.g. sweepstakes illegal in some areas) and need for non-overlapping broadcast areas</p> <p>Random geographic allocation of SMSAs to treatment conditions; 6 intervention, 4</p>

	control Number of subjects across SMSAs ranged from 132 to 232 (2534 eligible)	
<b>Risk of bias</b>		
<b>Bias</b>	<b>Authors' judgement</b>	<b>Support for judgement</b>
Random sequence generation (selection bias)	High risk	Some randomization was attempted, however methods not described, and two of the SMSAs had to be reallocated to different arms of the study
Allocation concealment (selection bias)	High risk	No concealment mentioned and highly unlikely due to nature of the intervention
Blinding (performance bias and detection bias) All outcomes	High risk	No mention of blinding in the study. Blinding not possible due to nature of the intervention
Incomplete outcome data (attrition bias) All outcomes	High risk	Significant departure of follow-up sample, likely to be related to true outcome (this group are smokers or more likely to be smokers); Different recruitment methods resulted in some participants not having data collected
Selective reporting (reporting bias)	High risk	Additional data that was collected was not presented in any of the publications; 1000 adolescents excluded from analysis; Roanoke students excluded from analysis due to teacher recruitment
Other bias	High risk	Sample sizes too small to even observe a .50 significance level; Gender, ethnicity and socio-economic status is not quantified in any of the publications; Gender was not asked, but coded as male or female based on first names producing identification of only 90% of applicants. Authors state that findings could not be generalised to all participants of the mass media to smoking prevention
Imbalance of outcome measures at baseline All outcomes	High risk	Significant differences in smoking rates, once adjustments occurred, these differences were even more significant

Comparability of intervention and control group characteristics at baseline	High risk	Significant inter-community variation; Significant differences in smoking rates and experimentation between communities; Following adjustment for known correlates, the differences were strengthened in every case
Protection against contamination	Unclear risk	Unable to determined level of contamination through communities via teachers or students, however it is possible. Also the sweepstakes involved recruiting friends, who would possibly be from the control or other intervention groups. Hence possible contamination, but not confirmed
Selective recruitment of participants	High risk	SMSAs were selected based on location and community traits to reduce overlap; Students were recruited by phone at random, however selection methods not described; Personal contacts were made for one intervention group (RPEER) more than any other; Participant self-selection, however partly adjusted for

Flay 1995

Methods	Design: Randomized controlled trial, factorial, nested, cluster, non-equivalent control group, (multi attribute blocking approach) Country: USA Objective: To test the independent and combined effects of a classroom curriculum and TV programming for social resistance skills training, smoking prevention, and smoking cessation Study site: Schools, homes and towns in Los Angeles and San Diego, Southern California Analysis: Regression (accounting for school as unit of allocation and individual as unit of analysis)
Participants	Age: 12-14 year olds Gender: At two year follow-up 47.6% of the overall population was male Ethnicity: Whole sample population at pre-test - Hispanic 35.5%, White 33.3%, African-American 13.9%, Other 17.3%; Whole sample population at two year follow-up - Hispanic 36.1%, 33.3% White, 13.9% African-American, and 17.3% Other
Interventions	Programme name: The Television, School and Family Smoking Prevention and Cessation Project, (TVSFP) Theoretical basis: Social influences approach and communications theory. Diagnostic and formative media research with TV staff to develop scripts Los Angeles: Intervention description 1.) CR +TV: Classwork and homework activities between stu-

	<p>dents and parents for both prevention and cessation in the home, supplemented by TV segments to provide convincing resistance skill models for students and cessation strategies for adults. A workbook identical to that sent from the TV station to requesters was also sent home with students</p> <p>Intervention description 2.) CR-Only: Classwork and homework activities between students and parents for both prevention and cessation in the home. The workbook for the CR-Only condition made no reference to the TV program, but in all other respects was the same as that of the TV condition</p> <p>Intervention description 3.) TV-Only: TV segments to provide convincing resistance skill models for students and cessation strategies for adults, with a supplemented workbook identical to that sent from the TV station to requesters</p> <p>Control description 1.) Attention control placebo: A health information based attention-control curriculum. Outcome expectancies that were equivalent to the treatment conditions, but which was not expected to change smoking behaviour. It was thought that a health-information-based program would increase students' tobacco and health knowledge without increasing their social-resistance skills or subsequently decreasing their smoking, thus providing an effective control for expectancy effects</p> <p>Control description 2.) No-treatment control: Usual practice</p> <p>San Diego:</p> <p>Intervention description 4.) CR-Only: Social resistance classroom curriculum only</p> <p>Control description 3.) No treatment control: Usual practice</p> <p>Duration: 6 weeks:- weeks 1 and 6, classroom curricula delivered and TV smoking prevention messages broadcast.- week two, TV cessation messages for adults broadcast in same area as TV prevention messages</p> <p>Intervention delivery: Physician host of regular prime time TV health news programme, presented smoking prevention messages based on filmed classroom sessions; Usual classroom teachers for school programme, with parental involvement in homework</p>	
<p>Outcomes</p>	<p>Reported outcomes: Smoking behaviour (smoking - no quantity); Smoking attitudes (disadvantages/negatives toward parental smoking); Intentions to smoke; Smoking knowledge about tobacco and health; self-efficacy; Smoking perceptions (perceived adult smoking, and peer smoking)</p> <p>Expired air samples collected as a bogus pipeline procedure to encourage more accurate self-reports. (No process measures stated)</p> <p>Follow-up time-period: immediately post intervention, 1 year, 2 years</p>	
<p>Notes</p>	<p>Students in 47 schools (340 classrooms) in 6 school districts</p>	
<p><b>Risk of bias</b></p>		
<p><b>Bias</b></p>	<p><b>Authors' judgement</b></p>	<p><b>Support for judgement</b></p>
<p>Random sequence generation (selection bias)</p>	<p>Unclear risk</p>	<p>Graham <i>et. al's</i> randomized multi-attribute blocking design; however methods of sequence generation not described</p>
<p>Allocation concealment (selection bias)</p>	<p>Unclear risk</p>	<p>Schools randomized to conditions which were open label, however, method of allocation concealment not described</p>

**Flay 1995** (Continued)

Blinding (performance bias and detection bias) All outcomes	High risk	Due to the nature of the intervention, it is highly unlikely that participants, investigators and outcome assessors were blinded. No efforts to do so were mentioned
Incomplete outcome data (attrition bias) All outcomes	High risk	Departure of over 50% of the original sample at 2-year follow up. Those more likely to drop out were from Los Angeles, African-American and had lower school grades; missing data and attrition problems decreased by methods of analysis, but still a concern; coping effort outcome data had fewer responders
Selective reporting (reporting bias)	Unclear risk	Insufficient data to determine selective outcome reporting.
Other bias	High risk	TV program design issues - do not meet research objectives fully; Low stability values for results due to length of time between measures and circumstances of an intervention; design issues, this is an incomplete factorial design, which may introduce bias when entering data as such into generic statistical software analysers; Program poorly executed, sample size too small, 'floor effects' could be related to true outcome
Imbalance of outcome measures at baseline All outcomes	High risk	Control group more likely not to commence smoking at baseline
Comparability of intervention and control group characteristics at baseline	Low risk	No substantial pre-test differences requiring adjustment.
Protection against contamination	Low risk	Media controlled for by replicating these conditions in a second metropolitan site (San Diego)
Selective recruitment of participants	High risk	n values vary depending on number of subjects available for each outcome, i.e. those with data in one outcome but not in another will still be included in that one outcome

**Flynn 1995**

Methods	<p>Design: Controlled clinical trial; nested, non-equivalent control group; interrupted time-series design</p> <p>Country: USA</p> <p>Objective: To test the effectiveness of mass media interventions to enhance school smoking prevention programmes</p> <p>Study site: Homes with TV and schools in Standardised Metropolitan Statistical Areas (SMSAs), two SMSAs in Northeastern United States and two in Montana</p> <p>Method of analysis: Logistic regression (unit of allocation community, unit of analysis individual, adjusted for in analysis)</p> <p>Confounders analysed: Treatment group, gender, grade.</p>
Participants	<p>Age: 9-17 year olds</p> <p>Gender: Intervention - Girls 51.8% Boys 48.2%; Control - Girls 47% Boys 53%</p> <p>Ethnicity: Intervention Caucasian 97.2%; Control Caucasian 95.6%</p>
Interventions	<p>Programme name: Not provided.</p> <p>Theoretical basis: Social learning theory and related behaviour change theories. Diagnostic and formative media research with student focus group</p> <p>Intervention description: Specifically designed 30 and 60 second TV and radio spot messages broadcast as a campaign averaged 190 TV broadcasts, 350 cable TV, and 350 radio exposures purchased in each of the 4 years in each of the two targeted media SMSAs. Paid media time was increased by 50% by donated media time. Media exposure modified to match changing media use of maturing cohort. Survey data informed the timing and placement of advertisements</p> <p>Control description: Schools only programme - grade specific educational materials used in 3 - 4 class period with 10 - 15 yr olds: information about smoking and health, refusal skills, skills to resist advertising pressures, and awareness of social support for non-smoking was included</p> <p>Duration: 4 years</p> <p>Intervention delivery: (For intervention) Diagnostic and formative media research used to identify most appropriate media, time placement and images. (For control) Usual class teacher, trained by project staff during four annual day long teacher training workshops</p>
Outcomes	<p>Reported outcomes: Smoking behaviour, (daily, weekly and smoke-less tobacco), smoking attitudes, (attitude toward smoking - total, advantages/positives, disadvantages/negatives), Intentions to smoke, stress, smoking perceptions (perceived norms, adult smoking, peer smoking and sibling smoking)</p> <p>Saliva samples from school group, as a bogus pipeline procedure to encourage more accurate self-reports</p> <p>Follow-up time-period: annually over 4 year intervention and 2 years post-intervention, (6 total)</p>
Notes	<p>School and mass media intervention linked only by educational objectives - intended to be seen as independent sources of information</p> <p>Four demographically matched study communities selected to provide two pairs of SMSAs, targeting high risk populations indicated by adult educational attainment and income. 50 schools selected from census tracts, indicating higher risk for smoking</p>

***Risk of bias***

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Not random selection. Geographical allocation based on census tracts
Allocation concealment (selection bias)	High risk	Participants and investigators are aware of student assignment. No randomization occurred
Blinding (performance bias and detection bias) All outcomes	High risk	No outcome assessor or investigator blinding has been mentioned
Incomplete outcome data (attrition bias) All outcomes	High risk	The missing outcome data from the 2918 students whose data was not available for comparison is likely to be related to the true outcome; furthermore, excluded subjects had a less stable family environment, which may be predisposed to higher smoking prevalence
Selective reporting (reporting bias)	High risk	P828 <sub>B</sub> "A supplemental analysis is presented in which the community is the unit, although the original design was not intended to support this analytic strategy." These primary outcomes were not pre-specified
Other bias	High risk	Design bias; subject communities were selected due to high risk, not randomization; baseline imbalance in intervention arm statistically significant, may have affected outcome; and control group had a higher prevalence of smoking; design concern: low statistical power to determine meaningful results
Imbalance of outcome measures at baseline All outcomes	Unclear risk	None of the baseline outcomes differed significantly for the two groups, except that the school-only group reported perceiving more peer smoking. The degree to which this occurred and its significance is unclear
Comparability of intervention and control group characteristics at baseline	High risk	Intervention group had a younger population, ( $p < 0.01$ ) and a larger proportion of females, ( $p < 0.01$ )

Flynn 1995 (Continued)

Protection against contamination	Unclear risk	Insufficient information to assess this outcome.
Selective recruitment of participants	Unclear risk	Insufficient information to assess this outcome.

Flynn 2010

Methods	<p>Design: Randomized controlled trial, cluster, cross sectional time series</p> <p>Country: America</p> <p>Objective: Decrease perception of smoking prevalence among young people, increase perceptions of disapproval, increase confidence in ability to refuse cigarettes, decrease positive outcomes expectations for smoking, increase negative outcome expectations, and decrease prevalence of self reported smoking</p> <p>Study Site: Clustered media campaigns (Home) with data collection at school</p> <p>Method of Analysis: General linear mixed models</p> <p>Confounders analysed: At baseline and completion (grade, gender, race/ethnicity)</p>
Participants	<p>Age: Grades 7-12</p> <p>Gender: Baseline control male (n=4765) control female (n=5612); intervention male (n=4391) intervention female (n=5114); Follow-up control male (n=5345) control female (n=6008); intervention male (n=5345) Intervention female (n=6140)</p> <p>Ethnicity: Baseline <i>control</i> African-American 23.6%, Hispanic/Latino 13.2% Non-Hispanic Cuacasian 58.3% Other, unknown 4.9%; <i>intervention</i> African-American 22.8%, Hispanic/Latino 14.1% Non-Hispanic Cuacasian 57.2% Other, unknown 5.8%; Follow-up <i>control</i> African-American 26.8%, Hispanic/Latino 14.5% Non-Hispanic Cuacasian 53.7% Other, unknown 10.0% <i>intervention</i> African-American 24.2%, Hispanic/Latino 14.8% Non-Hispanic Cuacasian 53.2% Other, unknown 7.7%</p>
Interventions	<p>Programme name: Not provided</p> <p>Theoretical basis: Social cognitive theory</p> <p>Intervention description: Four separate media campaigns running simultaneously. 30- and 60-second TV or radio messages were broadcast using purchased time with approximately 3-4 exposures per week. Approximately 10 messages were chosen for each campaign in 2002. Five additional messages were developed annually for each campaign in 2003-2005 (60 total)</p> <p>Control description: No intervention</p> <p>Duration: Four years</p> <p>Intervention delivery: Media only, (TV, radio, newspapers, billboards and magazines)</p>
Outcomes	<p>Reported outcomes: 30-day smoking prevalence, 7-day smoking prevalence; intentions to smoke; perceived community smoking prevalence; peer smoking norms; confidence in refusing cigarette measures; negative outcome expectations; positive outcome expectations</p> <p>Follow-up-time-period: 4 years</p>
Notes	



<i>Risk of bias</i>		
<b>Bias</b>	<b>Authors' judgement</b>	<b>Support for judgement</b>
Random sequence generation (selection bias)	Unclear risk	Randomization mentioned by not described
Allocation concealment (selection bias)	Unclear risk	Not Described
Blinding (performance bias and detection bias) All outcomes	High risk	Due to nature of the intervention it is not possible to blind participants to study arm No mention of blinding for outcome assessors
Incomplete outcome data (attrition bias) All outcomes	High risk	No students responded from one baseline school at follow up
Selective reporting (reporting bias)	High risk	Not all analyses were reported only raw SD estimates presented
Other bias	Low risk	No other threats to validity identified
Imbalance of outcome measures at baseline All outcomes	Low risk	No imbalance of outcome measures at baseline evident
Comparability of intervention and control group characteristics at baseline	Low risk	Overall distribution by grade, gender and race/ethnicity did not differ between conditions at either survey
Protection against contamination	High risk	A large national youth focused anti tobacco media campaign was initiated in 2000 and was active in all of the intervention and control DMA's at a high level of intensity throughout the intervention The authors note: "The cumulative effects of these changes most likely reduced the magnitude of tobacco control effects that could be achieved by additional media based intervention campaigns"
Selective recruitment of participants	Low risk	No selective recruitment evident

**Hafstad 1997**

Methods	Design: Controlled clinical trial; cluster; non-equivalent control group Country: Norway Objective: To evaluate 3 provocative mass media campaigns to prevent adolescents smoking Study site: Homes, communities and cinemas in two counties in SE Norway Method of Analysis: Logistic regression (county unit of allocation and individual unit of analysis) Co-founders analysed: smoking at baseline and gender
Participants	Age: All students aged 14-15 eligible for the study, followed-up until aged 17-18 Gender: Intervention - Girls n=1457 Boys n=1285; Control - Girls n=1784 Boys n=1654 Ethnicity: South-eastern part of Norway - same proportion of rural-urban settlement across groups
Interventions	Programme name: Not provided Theoretical basis: Hypothesis that provocative appeals stimulate discussion thereby influencing behaviour. Adolescent focus groups identified the key messages used in the campaign Intervention description: 3 different full page newspaper advertisements; 1 poster, 1 TV and cinema spot. In each 3 week period: TV & cinema spots shown 167 times; each of the 3 newspaper advertisements appeared once in each of the 5 newspapers; posters (1, 140 in total) mailed to all schools, youth organisations and sports clubs Control description: No intervention (not described) Duration: Three annual media campaigns of 3 weeks duration, 1992, 1993 and 1994 (the third campaign was launched for 4 weeks) Intervention delivery: Personnel not clear, however media delivery included - TV, cinema advertisement, newspaper, posters in schools and youth organisations
Outcomes	Reported outcomes: smoking behaviour (daily, weekly, occasional and non) number of cigarettes smoked, and intentions to smoke Follow-up time-period: 1 year post 3rd campaign (3 years)
Notes	2 counties matched for size, education level, income, urban-rural settlement and smoking prevalence and allocated to I and C Girls targeted for intervention; Messages: because more girls than boys smoke, girls are not capable of logical thinking - health consequences of smoking

***Risk of bias***

<b>Bias</b>	<b>Authors' judgement</b>	<b>Support for judgement</b>
Random sequence generation (selection bias)	High risk	Not randomized.
Allocation concealment (selection bias)	High risk	Population selected, not randomized

**Hafstad 1997** (Continued)

Blinding (performance bias and detection bias) All outcomes	High risk	No mention of blinding, due to nature of intervention, blinding highly unlikely for participants
Incomplete outcome data (attrition bias) All outcomes	High risk	Participant data missing as they did not complete both questionnaires, or some parts of their questionnaires; Non-responders more likely to be smokers; 5 surveys in intervention county, and only 2 in control county due to financial constraints
Selective reporting (reporting bias)	Unclear risk	Study protocol not available, unable to determine selective outcome reporting
Other bias	High risk	Generalisability concerns, campaign only targeting girls; Validity concerns due to self-report of smoking behaviour
Imbalance of outcome measures at baseline All outcomes	High risk	Male daily smokers in intervention county higher at baseline than those in control
Comparability of intervention and control group characteristics at baseline	Unclear risk	Insufficient demographic detail to determine differences at baseline
Protection against contamination	Unclear risk	P229 <sub>C</sub> "since local media were used only, the risk of spill-over of media exposure was minimized." Minimised but not eradicated
Selective recruitment of participants	High risk	Participant cluster site selected by study staff.

**Longshore 2006**

Methods	Design: Randomized controlled trial; cluster; non-equivalent control group Country: USA Objective: To combat illegal drug use among America's youth by means of an advertising and social marketing program focusing on the dangers of drug use Study site: High-schools and middle-feeder schools throughout South Dakota Method of analysis: Logistics regression model with baseline covariate's for dichotomous data, linear regression used for all other outcomes Confounders analysed: gender, race/ethnicity (white/non-white), monthly smoking at baseline, school grades, parental education and monitoring, tobacco use by an important adult, and whether or not the adolescent lives with both biological parents
Participants	Age: between 9-18 years, however in 2002 this was narrowed to 11-17 year olds Gender: Overall sample population 49.4% females. Ethnicity: Overall sample-population - Non-white 11.7%

Interventions	<p>Programme name: Project ALERT (middle-school) or ALERT Plus (high-schools)  Theoretical basis: The health belief model (HBM), the self-efficacy theory of behaviour change, and social influences theory  Intervention description 1.) ALERT: School lessons including lessons on smoking cessation, designed to appeal to more committed and alienated smokers and to highlight student susceptibility to the negative consequences of use; parent involvement activities; a series of home-learning activities that encourage parental involvement in substance-use prevention during 7th and 8th grades. Plus exposure to the National Youth Anti-Drug Media Campaign (NYADMC) with intended degree of campaign exposure of 2.5-youth orientated ads per week  Intervention description 2.) ALERT Plus: Same as for ALERT with the addition of booster lessons in the 9th and 10th grades which seek to reinforce the middle-school curriculum while also strengthening norms against high-risk drug use, enhancing adolescents' capacity to protect themselves against risky drug situations, and helping them develop alternative strategies for coping with stress. Plus exposure to the National Youth Anti-Drug Media Campaign (NYADMC) with intended degree of campaign exposure of 2.5-youth orientated ads per week  Control description: Adolescents in the control condition received other prevention curricula already in place at their schools but were not exposed to any part of the ALERT curriculum in any grades  Duration: 6 months for school curriculum; Media intervention still running at completion of trial (2 years); intention of 2.5-youth orientated ads per week  Intervention delivery: media - television and other media (not specified), entertainment, and sports industries as well as partnerships with civic, professional, and community groups, teachers through schools and parents</p>	
Outcomes	<p>Reported outcomes: ALERT Only - Weekly and Monthly smoking; ALERT and ALERT Plus - Advantages/Positives, Disadvantages/Negatives, Perceived peer attitudes, Intentions to smoke, self-efficacy, perceived norms  Follow-up time-period: 2 years</p>	
Notes		
<b><i>Risk of bias</i></b>		
<b>Bias</b>	<b>Authors' judgement</b>	<b>Support for judgement</b>
Random sequence generation (selection bias)	Unclear risk	Unclear methods of randomization. However, P500A "2 The full study design randomized 48 clusters. However, assignment of three clusters was restricted to the ALERT or ALERT Plus conditions. Those clusters were not included in this analysis."
Allocation concealment (selection bias)	High risk	Not possible to conceal due to the nature of the intervention, though it is possible that the students were unaware of their intervention/control status. No mention of

Longshore 2006 (Continued)

		concealment described
Blinding (performance bias and detection bias) All outcomes	High risk	Not possible to blind due to the nature of the intervention. There is no mention of blinding attempts for outcome assessors or investigators
Incomplete outcome data (attrition bias) All outcomes	High risk	Three clusters excluded from analysis due to lack of randomization; Adolescents who had missing data were more likely to be smokers or have higher risk factors, even after adjustments, authors were concerned that the imbalance was not eliminated
Selective reporting (reporting bias)	Unclear risk	Tobacco data not shown in paper A; Protocol not available, unable to determine if any pre-specified outcomes are missing; Some outcomes not presented stated by authors; 3 studies excluded from analysis due to lack of randomization
Other bias	High risk	Generalisability concerns - more effective with at-risk-girls; outcomes based on self-report
Imbalance of outcome measures at baseline All outcomes	Low risk	Baseline outcome attrition was equal across groups; adjustments for variance conducted
Comparability of intervention and control group characteristics at baseline	Low risk	Subjects are reported as being 'similar' at baseline.
Protection against contamination	Unclear risk	Possible contamination due to allocation within media area/community, however not reported on
Selective recruitment of participants	Unclear risk	Unable to determine selective recruitment. 3 schools were excluded from the analysis due to selection rather than randomization. However, further risk is not clear

**Worden 1983**

Methods	<p>Design: Controlled clinical trial, not randomized.</p> <p>Country: USA</p> <p>Objective: To evaluate the effectiveness of televised messages to prevent smoking in young adolescents</p> <p>Study site: Rural schools in Vermont county.</p> <p>Method of analysis: Repeated measures ANOVA (schools unit of allocation and individuals unit of analysis)</p> <p>Confounders analysed: Not reported</p>
Participants	<p>Age: 10-12 yr olds</p> <p>Gender: male and female, no further details provided.</p> <p>Ethnicity: No details available.</p>
Interventions	<p>Programme name: Not stated</p> <p>Theoretical basis: Social learning theory and related behavioural change theories. Diagnostic and formative media research using teenage focus groups</p> <p>Intervention description: Schools in range of a network affiliate TV station. 7 x 30 sec TV smoking prevention messages, placed as paid advertising during after-school and Saturday morning viewing hours, placed next to the programmes most popular with the target group. TV spots changed in new exposure periods</p> <p>Control description: Adjacent areas out of range of TV signal; No TV messages</p> <p>Duration: Exposure for three 13 week periods, no exposure for two 3 month periods, during an 18 month period overall. 10 TV spots broadcast weekly</p> <p>Intervention delivery: Positive non-smoking role models, reinforcing positive norms and values by depicting young people who refuse cigarettes and enjoy social benefits in a smoke-free life style. Image informed by student focus groups; Television broadcasts</p>
Outcomes	<p>Reported outcomes: Recall of media campaign, perception of friend's approval of smoking, perception of friend's smoking, intention to smoke a cigarette if offered by a friend, smoking behaviour.</p> <p>Follow-up time-period: 1 year (after 2 parts of TV campaign) - 18 months (after all TV broadcasts)</p>

Notes

***Risk of bias***

<b>Bias</b>	<b>Authors' judgement</b>	<b>Support for judgement</b>
Random sequence generation (selection bias)	High risk	Groups selected by investigators
Allocation concealment (selection bias)	High risk	Groups selected, not randomized
Blinding (performance bias and detection bias) All outcomes	High risk	Blinding of participants and outcome assessors not mentioned, due to nature of intervention it is highly unlikely that blinding occurred

**Worden 1983** (Continued)

Incomplete outcome data (attrition bias) All outcomes	High risk	Attrition not described
Selective reporting (reporting bias)	Unclear risk	Insufficient information to permit judgement of yes or no
Other bias	Unclear risk	Insufficient information to permit judgement of yes or no
Imbalance of outcome measures at baseline All outcomes	Unclear risk	Insufficient information to permit judgement of yes or no
Comparability of intervention and control group characteristics at baseline	High risk	Families in the intervention group had slightly higher education and income levels than the controls
Protection against contamination	Unclear risk	Possible contamination as some students from the control group may have been within range of the TV station's broadcast, or visited people during the intervention period that were within the broadcast range
Selective recruitment of participants	Unclear risk	Insufficient information to permit judgement of yes or no

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

Study	Reason for exclusion
Andrade 1991	Multicomponent community wide smoking prevention intervention, with a mass media component; not young people specific, no smoking related outcome measures
Baan 1990	Describes schools-based smoking prevention intervention and an information and education campaign which used posters, advertisements in youth media, booklets, buttons, stickers, and free T-shirts. There were no specific pre-evaluation measures or post-evaluation measures, no control group and effects of advertisements in youth media were not independently reported
Baudier 1991	Besancon smoke-free project Multicomponent community wide intervention, including mass media component, but the effects of mass media not reported separately, no smoking related outcome measures
Becker 1989	Iowa Program Against Smoking (IPAS) Theoretical basis for planning and developing a multicomponent communitywide anti-smoking campaign, including use of the mass media; not young people specific, no results reported

(Continued)

Bergamaschi 2000	“Leave us Clean” prevention campaign in Romagna (Northern Italy), which took place when students were in middle school. However the study population reported on are first contacted in second year high, and as a result there is no baseline data reported
Biener 2000	Massachusetts anti-tobacco media campaign, which included television advertisements produced by public health organisations and by tobacco companies. No control and no baseline data presented
Biglan 1988	School based smoking prevention intervention which used videotaped material for use in individual schools. School based smoking prevention programme, not mass media as defined in this review
Campion 1994	Smoking cessation campaign targeted at pregnant 15-24 year olds, mass media used as part of a multicomponent community wide intervention. No separate results for mass media component alone
Carleton 1995	Pawtucket HHP: Multicomponent community wide intervention, including use of the mass media; no smoking related outcomes
CDC 2004	Minnesota TM (Target Market) campaign - organised around three components 1. paid advertising, 2. youth organisation and 3. website targeted to youth. No control group, no true baseline (evaluation commenced two years into the campaign)
Cernada 1989	Smoking cessation intervention targeted at black smokers. No smoking related results for young people reported
Cowell 2009	The American Legacy Foundation’s ‘Legacy’s truth campaign. Tobacco countermarketing, examining racial/ethnic differences in association to exposure and subsequently youth’s beliefs and attitudes about cigarette companies and their intent to smoke. No control and no baseline data presented
Cragg 1992	Teenage mass media smoking prevention & cessation campaign. No smoking related outcomes reported
Duke 2009	Florida’s truth Campaign: Two arms - ‘truth’ campaign supplemented with additional advertising compared with comparison markets receiving less than the national average exposure of ‘truth’ messages. No true control group
Edwards 2004	Anti-smoking advertisements in cinemas aimed at young women’s perceptions of smoking in movies and their intentions to smoke. Controlled clinical trial, no baseline, control surveyed during week one and intervention during week two
Egger 1983	Multicomponent community wide lifestyle intervention: smoking component cessation only
Evans 1981	Schools-based smoking prevention programme using films, videos and poster messages in schools. School-based, not mass media as defined in this review
Farquhar 1991	Stanford Cardiovascular Disease Prevention Programs: Multicomponent community wide intervention to prevent cardiovascular disease; no results given for mass media component alone



(Continued)

Farrelly 2009	Florida's 'truth' anti-smoking campaign: Cohort longitudinal study in 12-17 year olds followed-up over three years. No control group
Flay 1987a	Previously included study however excluded due to inadequate comparison between groups. The intervention population was made up of self-selected schools and the control group contained schools which did not respond to the invitation to participate
Flay 1987b	Review of mass media campaigns for smoking cessation, prevention excluded: does not report outcomes for young people separately
Flay 1989	Chicago Televised Smoking Cessation Programme Mass media and self-help smoking cessation campaign for supported groups of adults at health maintenance organisations or worksites. No results for young people
Frith 1997	Nationwide No Smoking Day evaluated: no separate results for young people
Hammond 1990	Mass media smoking prevention campaign. No smoking related outcomes reported
Harty 1993	Paper describes the development of the advertisements, processes of the campaign including media reach but no outcomes related to smoking behaviour
Hawkins 1987	Intervention used interactive computer programmes to provide adolescents with confidential, non-judgemental health information, behavioural change strategies, sources of referral and social support. Not mass media as defined in this review
HEBS 1997	Health Education Board for Scotland's anti-smoking campaign. Countrywide multifaceted smoking cessation intervention. No separate results for young people
Hong 2008	In-school anti-tobacco Media campaign in 10 schools, USA. No control
Hornik 2008	National Youth Anti-Drug Media Campaign: three nationally represented samples of US youth aged 9-18 years surveyed at 4 time-points, media included television, radio, web-sites, magazines and movie theatres. No control group
Hunkeler 1990	Richmond quits smoking: Multicomponent community wide intervention, including use of the mass media; no smoking related results given
Jacob 1985	Advertisements in comics and TV advertising; no smoking related outcomes, post-test measures only
Jason 1994	Intervention to increase children's and parent's awareness and knowledge of substance abuse and prevention. No smoking behaviour or smoking related outcomes reported for young people
Jefferys 1963	Primarily a school based smoking prevention study using a TV programme. Not mass media as defined in this review
Jorgensen 1988	School based evaluation of advertisements developed for a mass media campaign; no smoking related outcomes reported

(Continued)

Kaufman 1994	Intervention used mass media as part of a multicomponent community wide smoking prevention programme for Black adolescents, no independent smoking related outcomes for mass media component alone
Lando 1995	Quit and Win Minnesota: Multicomponent community wide smoking cessation intervention, mass media used to encourage smokers to participate; no separate results for young people
Lang 2010	Evaluation of the “smoke-free” youth campaign from the Federal Center for Health Education which included mass media (television/cinema spots, advertisement), internet, and face-to-face communication, with a focus on school. No comparison control group
Marin 1994	Progama Latino para Dejar de Fumar: Multi-component, including mass media, community wide smoking cessation intervention for Spanish-speaking Hispanics; no separate results for young people
Mattey 2003	Knights Against Tobacco: Students at a high school in Detroit USA received a grant for a multi-media campaign including anti-tobacco commercials and posters. No control group, study only conducted in one school
McCaffrey 1998	Description of a planned national youth anti-drug media campaign; no evaluation
McPhee 1995	Multicomponent, including mass media, smoking cessation intervention aimed at Vietnamese men over 18 years of age. No separate results relating to smoking behaviour given for young people
McVey 1998	Multicomponent community wide intervention, including use of the mass media; no separate results given for young people
Mudde 1995	Multi-component community wide smoking cessation intervention. No separate results for young people
Murray 1992	Minnesota-Wisconsin Adolescent Tobacco Use Research Project: Multicomponent statewide intervention, including a mass media component; no independent smoking related outcome measures for the mass media component alone
Nutbeam 1989	Hearbeat Wales: Multicomponent intervention including mass media; no outcomes related to smoking behaviour, no results for mass media component alone
O’Loughlin 1995	Coeur en sante St-Henri, Montreal, Canada: Mass media component included in a multicomponent community wide intervention; no smoking related outcome measures, no results for mass media component alone
Orth 2010	A policy mix comprising various structural and behavioural prevention messages in Germany, which included a smoke-free youth campaign ‘rauchfrei’. No comparison control group
Owen 1995	Multicomponent countrywide smoking prevention and cessation intervention. No smoking related outcome reported
Pentz 1989	Midwestern Prevention Project (selected papers referenced): Multicomponent community wide intervention, including use of mass media; no separate results for the effectiveness of the mass media component alone

(Continued)

Peracchio 1998	Description of the development of the campaign; no evaluation
Perry 1989	Minnesota Heart Health Programme (selected papers referenced): School-based behavioural smoking prevention program, part of a multicomponent community wide intervention to reduce cardiovascular disease, which includes use of the mass media. No separate results for the effectiveness of the mass media component alone
Pierce 1990	Quit and Win Australia: Community wide multicomponent smoking cessation programme, including use of the mass media; evaluated using before and after surveys of smoking prevalence, no separate results for young people
Platt 1997	Multicomponent smoking cessation campaign, including use of the mass media, encouraging smokers to quit. No separate results for young people
Popham 1994	California Tobacco Education Media Campaign Multicomponent, community wide anti-tobacco intervention. No control group
Ramirez 1988	A su salud: Multicomponent community wide smoking prevention and cessation programme; description of intervention, no smoking related results reported
Ramirez 1997	Mirame! [Look at me !]: Multicomponent community wide smoking prevention programme; description of intervention, no results reported
Reis 1994	Examination of perceived impact of anti-drug advertising on aspects of youth drug use, no smoking related outcomes given
Riester 1998	Youth anti-tobacco campaign. No smoking related outcomes.
Rossouw 1993	Coronary Risk Factor Study (CORIS): Multicomponent intervention with a mass media component to reduce coronary heart disease in white South African adults living in South-Western Cape Province; no independent smoking related outcome measures reported for the mass media component alone
Schmidt 2009	Mass media campaign aimed at youth aged 12-18 to prevent smoking and increase awareness of dangers whilst using positive messages. No control
Slater 2006	Randomized controlled trial of in-school and media-based efforts aimed at reducing marijuana and alcohol uptake in younger adolescents, n=8 intervention and n=8 control schools. Media smoking prevention component small and dependent on person-to-person contact
Sly 2001	Florida 'truth' anti-tobacco media evaluation, four data collection time-points for intervention group and two for control. No smoking-related outcomes reported for control population
Sussman 1987	Paper investigates involvement of school-based drug abuse prevention programme on viewing and evaluation of current anti-drug-abuse TV programme. No smoking related outcomes for young people given

(Continued)

Sutton 1987	Mass media smoking cessation intervention targeted at smokers; no separate results for young people
Tamir 2001	Mass-media anti-smoking campaign in Israel, randomly targeting adolescents aged 12-18 years. No baseline data and no control
Tilgren 1995	Quit and Win Sweden: Multicomponent nationwide anti-tobacco use intervention aimed at adult cigarette and oral snuff users; mass media used to encourage tobacco users to participate, no separate results for young people
Vallone 2009	Florida's Truth Campaign: 7 waves of data collection from 2000 to 2004. No control group
Valois 1996	Mass media smoking cessation intervention: no separate results for young people
van Teijlingen 1995	Smokebusters: Mass media used to advertise multicomponent smoking prevention intervention aimed at young people, no smoking related outcomes given for mass media component alone
Vartiainen 1983	North Karelia Youth Project: (Selected papers referenced) Multicomponent school and community based intervention to reduce cardiovascular disease risk factors, including a mass media information component; no separate results for the effectiveness of the mass media component alone
Vartiainen 1996	No Smoking Class: National competition to promote no smoking classes of 13 year old students, no-smoking classes were then eligible to enter a lottery to win financial prizes. Mass media aspect related to publicity, no results for effectiveness of mass media alone
Vicary 1996	Multicomponent community wide intervention including use of the mass media; no separate results for young people
Wewers 1991	Mass media smoking cessation campaign; no separate results for young people, no control group
Wheeler 1988	Community-wide smoking cessation campaign using self-help manual. No control group
Winkleby 1993	Stanford 5-City Project: Multicomponent community wide cardiovascular disease risk factor reduction campaign, one element of which was a smoking prevention and cessation campaign for young people; no smoking related outcomes given for mass media component alone
Woods 1991	Mass media - youth magazines - used to promote antismoking message. No smoking related outcomes given
Yoffe 1992	Multicomponent community wide anti-smoking intervention targeted at 11 - 13 year olds, local newspapers and radio provided widespread coverage of the program; no independent outcome measures for the mass media component

## DATA AND ANALYSES

### Comparison 1. Primary outcomes for Mass media smoking prevention programmes

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

### Comparison 2. Intermediate outcomes for Mass media smoking prevention programmes

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Smoking Attitudes			Other data	No numeric data
2 Smoking Behaviours			Other data	No numeric data
3 Smoking Knowledge			Other data	No numeric data
4 Self-esteem / Self-efficacy			Other data	No numeric data
5 Smoking Perceptions			Other data	No numeric data

#### Analysis 1.1. Comparison 1 Primary outcomes for Mass media smoking prevention programmes, Outcome 1 Smoking Outcomes.

##### Smoking Outcomes

Study	Sample size at follow-up	Outcomes analysed	Results
Bauman 1991	Clusters n=2 (SMSAs) Individuals n=1637	Weekly and Ever Smoking	Overall outcome - No effect Means of all smoking variables changed significantly in the direction of more smoking. No p-values are significant Data consistent with the conclusion that the campaign did not influence smoking
Flay 1995	Clusters n=47 (schools) Individuals n=4134	Smoker (No quantity)	Overall outcome - No effect There were no consistent program effects on smoking outcomes, suggesting that the treatment was not more or less effective for different groups
Flynn 1995	Clusters n=2 (communities) Individuals n=2860	Daily, Weekly and Smokeless tobacco	<b>Overall outcome - Favours intervention</b> Significant difference in the school-

Smoking Outcomes (Continued)

			<p>and-media group only within the final two years, a consistent trend toward less smoking was noted prior to this</p> <p>In the fifth year the relative differences for daily smoking was 34% and for weekly smoking 35% between school-and-media and school-only groups</p> <p>For smokeless tobacco behaviour the two groups did not differ significantly except in the fourth year when the school-only group was more likely to report use</p>
Flynn 2010	Clusters n=98 (schools) Individuals n=23246	Weekly and Monthly	<p>Overall outcome - No effect</p> <p>The 30-day smoking rates appeared to decline over the 4-year interval between baseline and follow-up surveys for participants in both conditions, but this trend was not significant? Similar results were obtained for 7-day prevalence</p>
Hafstad 1997	Clusters n=2 (counties) Individuals n=6234	Daily, Weekly, Monthly, Non-smoker and Smoker (No quantity)	<p><b>Overall outcome - Favours intervention</b></p> <p>Among non-smokers, a significantly lower proportion of adolescents of both genders had started to smoke in the intervention county compared to the proportion in the control county</p> <p>Among those who were smokers at baseline, a significantly more girls in the intervention county had stopped than in the control county, while no significant differences were detected among boys</p>
Longshore 2006	Clusters n=100 (schools) Individuals ALERT n=4276 ALERT Plus n=4015	Weekly and Monthly	<p><b>Overall outcome - Favours intervention</b></p> <p>ALERT Plus held down current (past month) and regular (weekly) smoking producing a 23% reduction in both measures of use, <math>p &lt; 0.01</math></p> <p>Project ALERT curbed current use among the high-risk experimenters and the even higher-risk baseline smokers (users) by approximately 20% (<math>p &lt; 0.03</math>). And cut regular</p>

**Smoking Outcomes** (Continued)

			(weekly) cigarette use across all three groups by anywhere from 19% (p<0.06) to 39% (p<0.02)
Worden 1983	Clusters n=93 (schools) Individuals n=4005	Weekly	Overall outcome - No effect There were no significant differences in smoking between intervention and control groups. A trend (non-significant) favouring the intervention group toward a lower level of smoking was noted

**Analysis 2.1. Comparison 2 Intermediate outcomes for Mass media smoking prevention programmes, Outcome 1 Smoking Attitudes.**

**Smoking Attitudes**

Study	Sample size at follow-up	Outcomes analysed	Results
Bauman 1991	Clusters n=2 (SMSAs) Individuals n=1637	Attitudes toward smoking (total), perceived peer attitudes.	Overall outcome - No effect No statistically significant post-campaign differences in attitudes suggesting that the peer-involvement component did not impact on those characteristics
Flay 1995	Clusters n=47 (schools) Individuals n=4134	Disadvantages/negatives (toward parental smoking)	<b>Overall outcome - Favours intervention</b> Marginally significant overall effect (p<0.06), however there was a significant interaction between television and social resistance conditions at immediate post-test, (p<0.03). In San Diego there was more positive change in the social resistance condition, (p<0.003) toward disapproval of parental smoking (Intervention description 4 in <a href="#">Characteristics of included studies</a> table).
Flynn 1995	Clusters n=2 (communities) Individuals n=2860	Attitude toward smoking (total), advantages/positives, disadvantages/negatives	<b>Overall outcome - Favours intervention</b> A significant difference in change over time was found between girls in the two treatment groups with scores increasing less among girls in the media-school communities, for positive attitudes toward smoking, (p<0.02)

**Smoking Attitudes** (Continued)

Flynn 2010	Clusters n=98 (schools) Individuals n=23246	Advantages/positives, disadvantages/negatives	Overall outcome - No effect Positive outcome expectation scores increased significantly over time in both study groups, an unfavourable change. Negative outcome expectation scores may have decreased in the comparison but not in the intervention group, although this difference was not significant
Longshore 2006	Clusters n=100 (schools) Individuals ALERT n=4276 ALERT Plus n=4015	Advantages/positives, dis- advantages/negatives, perceived peer attitudes	Overall outcome - No effect Neither males nor females exhibited significant differences for tobacco cognitions

**Analysis 2.2. Comparison 2 Intermediate outcomes for Mass media smoking prevention programmes, Outcome 2 Smoking Behaviours.**

**Smoking Behaviours**

Study	Sample size at follow-up	Outcomes analysed	Results
Flay 1995	Clusters n=47 (schools) Individuals n=4134	Intentions to smoke	Overall outcomes - No effect There was no significant condition-related differences at any wave in Los Angeles or San Diego. No consistent program effects on behaviours
Flynn 1995	Clusters n=2 (communities) Individuals n=2860	Intentions to smoke	<b>Overall outcomes - Favours intervention</b> A significant difference in change over time was found between girls in the two treatment groups with a lower increase among girls in the media-school communities in intentions to smoke cigarettes (p<0.01)
Flynn 2010	Clusters n=98 (schools) Individuals n=23246	Intentions to smoke	Overall outcomes - No effect Intentions to smoke appeared to decline over the 4-year interval between baseline and follow-up surveys for participants in both conditions, but this trend was not significant
Hafstad 1997	Clusters n=2 (counties) Individuals n=6234	Intentions to smoke	<b>Overall outcomes - Favours intervention</b> A significant difference between the intervention and the control county was detected regarding expectation of future smoking habits measured in 1995. In the intervention county, 9% expected to be smokers in 3 years, with 13% in the control county (p<0.01). No significant gender difference was revealed



**Analysis 2.3. Comparison 2 Intermediate outcomes for Mass media smoking prevention programmes, Outcome 3 Smoking Knowledge.**

**Smoking Knowledge**

Study	Sample size at follow-up	Outcomes analysed	Results
Flay 1995	Clusters n=47 (schools) Individuals n=4134	Tobacco and health knowledge (overall)	<p><b>Overall outcome - Favours control</b></p> <p>Tobacco and health knowledge was significantly higher in the attention control group than that in any of the other conditions in Los Angeles at the immediate post-test, (<math>p &lt; 0.00001</math>) 1-year follow-up, (<math>p &lt; 0.00001</math>) and 2-year follow-up, (<math>p &lt; 0.00014</math>). However, both smokers and non-smokers in the attention control condition learned more than students in any of the other conditions</p> <p>Unexpectedly, tobacco and health knowledge also increased in the social resistances program in San Diego at the immediate post-test (<math>p &lt; 0.00001</math>) . However, this effect was not statistically significant at the 1- and 2-year follow-ups</p> <p>There were significant differences in the social influences and resistance skills knowledge scale between conditions in Los Angeles at the immediate post-test, (<math>p &lt; 0.00001</math>) 1-year follow-up, (<math>p &lt; 0.00001</math>) and 2-year follow-up, (<math>p &lt; 0.0008</math>)</p> <p>The combined television and social resistance condition did not improve as much, relative to the control conditions, as the social resistance condition</p>

**Analysis 2.4. Comparison 2 Intermediate outcomes for Mass media smoking prevention programmes, Outcome 4 Self-esteem / Self-efficacy.**

**Self-esteem / Self-efficacy**

Study	Sample size at follow-up	Outcomes analysed	Results
Flay 1995	Clusters n=47 (schools) Individuals n=4134 (whole sample) n=2245 for control sample only.	self-efficacy	<p><b>Overall outcomes - Favours control</b></p> <p>In Los Angeles, there were no significant condition-related effects at any of the waves. In San Diego, refusal/self-efficacy was unexpectedly improved in the control condition, relative to the social resistance condition, at the immediate post-test, (<math>p &lt; 0.</math></p>

Self-esteem / Self-efficacy (Continued)

			004)
Longshore 2006	Clusters n=100 (schools) Individuals ALERT n=4276 ALERT Plus n=4015	self-efficacy	Overall outcomes - No effect Neither group exhibited significant differences for tobacco cognitions

**Analysis 2.5. Comparison 2 Intermediate outcomes for Mass media smoking prevention programmes, Outcome 5 Smoking Perceptions.**

**Smoking Perceptions**

Study	Sample size at follow-up	Outcomes analysed	Results
Flay 1995	Clusters n=47 (schools) Individuals n=4134	Perceived adult smoking, perceived peer smoking	<b>Overall outcome - Favours intervention</b> There were significantly lower prevalence estimates, (peer) for the social resistance, (p<0.00001) and television (p<0.006) conditions, and at 2-years the main effect of the social resistance conditions remained. However, the presence of a significant interaction between the television and social resistance conditions (p<0.05) indicated that the lower prevalence estimates of the social resistance condition was increased in the television plus social resistance condition There were significant differences in adult prevalence estimates between conditions in Los Angeles at the immediate post-test (p<0.00001), and the specific condition comparisons revealed lower prevalence estimates for social resistance (p<0.011) conditions. Similarly, the estimates were lower in the social resistance condition in San Diego at the immediate post-test (p<0.00002) but only marginally significant at the 2-year follow-up (p<0.09)
Flynn 1995	Clusters n=2 (communities) Individuals n=2860	Perceived norms, perceived adult smoking, perceived peer smoking, perceived sibling smoking	<b>Overall outcome - Favours intervention</b> A significant difference in change over time was found between girls in the two treatment groups with scores increasing less among girls in

## Smoking Perceptions (Continued)

			the media-school communities, for perceived peer smoking, ( $p<0.01$ ). (This difference was likely due to the slightly older age and greater male representation in the school-only group) A significant difference was evident at grades five to seven, that persisted at grades eight to ten, for perceived norms ( $p<0.01$ ), and sibling smoking but only differed at one of these surveys for adult smoking
Flynn 2010	Clusters n=98 (schools) Individuals n=23246	Perceived norms, perceived peer smoking	Overall outcome - No effect Significant favourable changes in both study groups for perceived prevalence and peer norms, however there was no between group differences
Longshore 2006	Clusters n=100 (schools) Individuals ALERT n=4276 ALERT Plus n=4015	Perceived norms	Overall outcome - No effect Neither group exhibited significant differences for tobacco cognitions

## APPENDICES

### Appendix I. Current search strategies

#### MEDLINE (most recent search via OVID, July week 3 2010)

- 1 exp Mass Media/
- 2 (mass adj1 media).ab,ti.
- 3 (radio or television or tv or campaign or advert\$).ab,ti.
- 4 Newspapers/
- 5 advertising as topic.sh.
- 6 adverti#ing.mp.
- 7 Videotape Recording/
- 8 exp Telecommunications/
- 9 Radio/
- 10 Motion Pictures/
- 11 exp Audiovisual Aids/
- 12 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 [Review topic terms]
- 13 exp Smoking/ or exp Smoking Cessation/ or exp "Tobacco Use Disorder"/
- 14 exp Tobacco Smoke Pollution/ or exp Tobacco, Smokeless/
- 15 exp Tobacco Industry/
- 16 (smok\$ or tobacco or cigarette\$).mp.

17 (tobacco or cigarette\$.mp.  
 18 17 or 13 or 15 or 14 [Smoking related terms]  
 19 18 and 12  
 20 limit 19 to ("child (6 to 12 years)" or "adolescent (13 to 18 years)" or "young adult (19 to 24 years)") [Limiting to young people]  
 21 limit 20 to yr="1997 -Current"  
 22 from 21 keep 1-1131  
 23 RANDOMIZED-CONTROLLED-TRIAL.pt.  
 24 CONTROLLED-CLINICAL-TRIAL.pt.  
 25 CLINICAL-TRIAL.pt.  
 26 Meta analysis.pt.  
 27 exp Clinical Trial/  
 28 Random-Allocation/  
 29 randomized-controlled trials/  
 30 double-blind-method/  
 31 single-blind-method/  
 32 placebos/  
 33 Research-Design/  
 34 ((clin\$ adj5 trial\$) or placebo\$ or random\$).ti,ab  
 35 ((singl\$ or doubl\$ or trebl\$ or tripl\$) adj5 (blind\$ or mask\$)).ti,ab  
 36 (volunteer\$ or prospectiv\$).ti,ab  
 37 exp Follow-Up-Studies/  
 38 exp Retrospective-Studies/  
 39 exp Prospective-Studies/  
 40 exp Evaluation-Studies/ or Program-Evaluation.mp  
 41 exp Cross-Sectional-Studies/  
 42 exp Behavior-therapy/  
 43 exp Health-Promotion/  
 44 exp Community-Health-Services/  
 45 exp Health-Education/  
 46 exp Health-Behavior/  
 47 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or  
 45 or 46 [Design related terms]  
 48 22 and 47

#### **EMBASE (most recent search via OVID, 2010 week 32)**

1 random\$.ti,ab  
 2 factorial\$.ti,ab  
 3 (cross over\$ or crossover\$ or cross-over\$).ti,ab  
 4 placebo\$.ti,ab  
 5 (double\$ adj blind\$).ti,ab  
 6 (single\$ adj blind\$).ti,ab  
 7 assign\$.ti,ab  
 8 allocat\$.ti,ab  
 9 volunteer\$.ti,ab  
 10 CROSSOVER PROCEDURE.sh  
 11 DOUBLE-BLIND PROCEDURE.sh  
 12 RANDOMIZED CONTROLLED TRIAL.sh  
 13 SINGLE-BLIND PROCEDURE.sh  
 14 or/1-13 [Design related terms]  
 15 smoking cessation.mp  
 16 exp smoking cessation/  
 17 exp smoking-/

18 ((quit\$ or stop\$ or ceas\$ or giv\$ or prevent\$) adj smok\$).mp  
 19 exp passive smoking/  
 20 exp smoking habit/  
 21 exp cigarette smoking/  
 22 or/15-21 [Smoking related terms]  
 23 14 and 22  
 24 exp Mass Media/  
 25 (mass adj1 media).ab,ti  
 26 (radio or television or tv or campaign or advert\$).ab,ti  
 27 Newspapers/  
 28 adverti#ing.mp  
 29 Videotape Recording/  
 30 exp Telecommunications/  
 31 Radio/  
 32 Motion Pictures/  
 33 exp Audiovisual Aids/  
 34 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 [Review topic terms]  
 35 exp Smoking/ or exp Smoking Cessation/ or exp "Tobacco Use Disorder"/  
 36 exp Tobacco Smoke Pollution/ or exp Tobacco, Smokeless/  
 37 exp Tobacco Industry/  
 38 (smok\$ or tobacco or cigarette\$).mp  
 39 (tobacco or cigarette\$).mp  
 40 39 or 35 or 37 or 36 [Smoking related terms]  
 41 40 and 34  
 42 limit 41 to (infant <to one year> or child <unspecified age> or preschool child <1 to 6 years> or school child <7 to 12 years> or adolescent <13 to 17 years>) [Limiting to young people]  
 43 limit 42 to yr="1997 -Current"  
 44 23 and 43

## Appendix 2. Search strategies for earlier versions of the review

### Databases searched

Medline (1966-1998), Healthstar (1975-1998), Sociofile (1974-1998), Econlit (1969-1998), Psyclit (1967-1998), CAB health (1973-1998), DHSS-Data (1983-1998), Directory of Published Proceedings (1990-1998), Management and Marketing Abstracts (1975-1998), ABI Inform (August 1971 to 1998), ASSIA (Applied Social Sciences Index and Abstracts) (1987-1998), Cancerlit (1963 to 1998), NTIS (1964-1998), Diogenes (1976-1998), Business and Industry (July 1994-1998), PAIS (1972-1998), Harvard Business Review (1971-1998), Dissertation Abstracts (1861-1998), Embase (1974-1998), ERIC (1966-1998), AV-online (1964-1998), LC-MARC (1968-1998), IBSS (1980-1998), ECRI's International Health and Technology Assessment database (1990-1998), British Humanities Index (1984-1998), SIGLE (1980-1998), CINAHL (1982-1998), Conference Papers Index (1973-1998), ASH (Action on Smoking and Health) Database (1987-1998).

### Search strategies

The following search strategy was used via Dialog OneSearch (Knight-Ridder-Info) on these databases: MEDLINE, Cancerlit, HealthSTAR, NTIS, DIOGENES, Business & Industry, Criminal Justice Periodical Index, PAIS INT (Public Affairs Information Service), Harvard Business Review, EMBASE:

S1 SMOKING!/DE  
 S2 SMOKING/DE  
 S3 SMOKING OR TOBACCO OR TOBACCO USE DISORDER/DE  
 S4 CIGARETTE?

S5 TOBACCO/DE OR DC=I1.825.710.810?  
 S6 S1-S5  
 S7 YOUNG()PEOPLE OR CHILDREN OR JUVENILES OR GIRLS OR BOYS OR TEENAGER?  
 S8 ADOLESCEN? OR MINORS OR UNDER()AGE  
 S9 CHILD/DE OR ADOLESCENCE/DE OR DC=G1.360.35.20?  
 S10 TC=0017 OR TC=0016 OR TC=0022  
 S11 DC=G1.360.35.150? OR DC=L3.30? OR DC=L1.10.40? OR DC=L1.40-  
 S12 DC=L3.10? OR DC=L1.10? OR DC=L1.40?  
 S13 S7-S12  
 S15 RADIO OR TELEVISION OR TELEVISED OR AUDIOVISUAL OR MULTI()MEDIA  
 S16 TELECOMMUNICATIONS OR TV OR FILMS OR BROADCAST OR BROADCASTING  
 S17 MASS()MEDIA OR COMMUNICATIONS()MEDIA OR MOTION()PICTURES  
 S18 BROADCAST OR VIDEO?  
 S19 S15-S18  
 S20 S6 AND S13 AND S19

The following basic search strategy was used on DataStar for these databases: PsycLit, CAB Health, ABI Inform, DHSS-DATA, ASSI (Applied Social Science Index and Abstracts), Directory of Published Proceedings, Management and Marketing Abstracts.

1 smoking OR tobacco OR cigarette\$ S  
 2 smokeless ADJ tobacco.DE. S  
 3 smoking ADJ cessation.DE. S  
 4 tobacco ADJ smoking.DE. S  
 5 nicotine.DE. S  
 6 1 OR 2 OR 3 OR 4 OR 5 S  
 7 children.DE. S  
 8 school ADJ age ADJ children.DE. S  
 9 adolescence.DE. S  
 10 adolescents.DE. S  
 11 preadolescents.DE. S  
 12 young ADJ people OR juveniles OR girls OR boys OR teenager\$ OR kids S  
 13 adolescen\$ OR minors OR under ADJ age S  
 14 7 OR 8 OR 9 OR 10 OR 11 OR 12 OR 13 S  
 15 mass ADJ media OR communications ADJ media OR motion ADJ pictures S  
 16 printed ADJ communications ADJ media OR radio OR television OR televised ADJ in  
 struction S  
 17 audiovisual ADJ instruction OR educational ADJ audiovisual ADJ aids OR educational ADJ television OR telecommunications  
 ADJ media S  
 18 tv OR media OR multi ADJ media OR films S  
 19 television OR broadcast OR broadcasting S  
 20 15 OR 16 OR 17 OR 18 OR 19 S  
 21 6 AND 14 AND 20

The following search was used on ERIC via DIALOG

S1 (SMOK??? OR CIGARETTE? OR CIGAR? OR TOBACCO) (5N)(CESSATION OR PREVENT??? OR REDUCE OR RE-  
 DUCATION OR DETER OR DETERRENCE)  
 S2 (SMOK??? OR CIGARETTE? OR CIGAR? OR TOBACCO)(5N)(AVERT OR AVOIDANCE OR QUIT OR QUITTING OR  
 STOP OR STOPPING)  
 S3 (SMOK??? OR CIGARETTE? OR CIGAR? OR TOBACCO) (5N)(MODIFYING OR MODIFY OR MODIFICATION)  
 S4 S1 OR S2 OR S3  
 S5 ADOLESCENT? OR TEENAGER? OR CHILDREN OR CHILD OR YOUNG()PEOPLE OR YOUNG()ADULT?  
 S6 S4 AND S5

Similar combinations of tobacco and smoking related, child and age related, and media related free text and keyword terms were used for the other individual databases listed.

### Additional searches

Some journals identified from the original review's reference lists of retrieved papers or books were searched individually on the Social Science Citation Index (on the BIDS service) (1981 to July 1998) as special case journals. The journal title was searched and results were combined with the following search terms: smoking or cigarette or tobacco. The special case journals included: Health Communication; Journal of Consumer Research; Journal of Broadcasting and Electronic Media; Journal of Communication; Media, Culture and Society. The journal Tobacco Control was hand searched (1992 to Summer 1997). References were also located through the bibliographies of related papers, and through personal contact with content area specialists.

### Appendix 3. Summary of intervention effectiveness

Study ID/ n-values	Intervention description:	Outcome Results:					
		<i>Smoking</i>	<i>Behaviours</i>	<i>Attitudes</i>	<i>Perceptions</i>	<i>Knowledge</i>	<i>Self-efficacy</i>
<b>Bauman 1991</b> Clusters n=2 (SMSAs) Individuals n=1637	RADIO: 30-second radio messages (4 times during 4-weeks) covering 7 consequence messages RPEER: 60-second radio messages and sweepstakes covering 7 consequence messages RTVPEER: 60-second radio messages and TV broadcast of sweepstakes covering 3 consequence messages	No effect	-	No effect	-	-	-
<b>Flay 1995</b> Clusters n=47 (schools) Individuals n=4134	CR+TV: two, 1-week TV segment (during evening news)	No effect	No effect	Favours campaign	Favours campaign	Favours control	Favours control

(Continued)

	<p>separated by a 3-week gap, plus classroom and homework activities for 2-weeks plus brochure from TV station</p> <p>CR-Only: classroom and homework activities for two, 1-week blocks separated by a 3-week gap</p> <p>TV Only: two, 1-week TV segment (during evening news) separated by a 3-week gap plus brochure from TV station</p>						
<p><b>Flynn 1995</b> Clusters n=2 (communities) Individuals n=2860</p>	<p>4-year duration of 15 different TV spots, 8 different radio spots. (average of 190 TV, 350 cable and 350 radio broadcasts)</p> <p>Plus school based curriculum in Fall of each year</p>	Favours campaign	Favours campaign	Favours campaign	Favours campaign	-	-
<p><b>Flynn 2010</b> clusters n=98 (schools) Individuals n=23, 246</p>	<p>4-year duration of 30- and 60-second TV or radio messages were broadcast using purchased</p>	No effect	No effect	No effect	No effect	-	-



(Continued)

	time with approximately 3-4 exposures per week. Approximately 10 messages were chosen for each campaign in 2002. Five additional messages were developed annually for each campaign in 2003-2005 (60 total)						
<b>Hafstad 1997</b> Clusters n=2 (counties) Individuals n=6234	Three annual blocks, first 2-years for three weeks, third year for 4-weeks of media messages via TV spots, cinema advertising (167 times), 3 different full time pages of newspaper adds and school posters (1140)	Favours campaign	Favours campaign	-	-	-	-
<b>Longshore 2006</b> Clusters n=100 (schools) Individuals ALERT n=4276 ALERT Plus n=4015	ALERT: 6 months of intermittent school curricula, with 8 lessons in 7th grade and 3 lessons in 8th grade (2 more lessons were	Favours campaign	-	No effect	No effect	-	No effect

(Continued)

	later added in 8th grade). Plus exposure to the NYADMC media campaign running from Jan-June 1998 and Sept 1998 to Spring 2004 ALERT Plus: Same school and media components as for ALERT, but with the addition of 5 booster class lessons in 9th grade and 5 in 10th grade						
<b>Worden 1983</b> Clusters n=93 (schools) Individuals n=4005	Three blocks of 13-week periods with 3-month breaks in between delivering seven different 30-second smoking prevention messages during after-school hours and Saturday mornings, (10 TV spots were purchased)	No effect	-	-	-	-	-

## WHAT'S NEW

Last assessed as up-to-date: 2 August 2010.

Date	Event	Description
22 June 2011	Amended	Additional table converted to appendix to correct pdf format

## HISTORY

Protocol first published: Issue 1, 1998

Review first published: Issue 4, 1998

Date	Event	Description
8 November 2010	Amended	Contributions of Authors section edited to reflect equal contribution of first two authors
4 August 2010	New search has been performed	Literature search conducted, two new studies identified for inclusion, one original study excluded, 18 new studies excluded. Background updated; Risk of bias for all included studies added. Narrative synthesis re-formatted. New summary of interventions table added
4 August 2010	New citation required but conclusions have not changed	Update conducted by new author team.
4 August 2008	Amended	Converted to new review format.
19 August 1998	New citation required and conclusions have changed	Substantive amendment

## CONTRIBUTIONS OF AUTHORS

Malcolm P Brinn: Protocol, assessment of studies for inclusion, study quality assessment, data extraction and manuscript review.

Kristin V Carson: Protocol, assessment of studies for inclusion, study quality assessment, data extraction and manuscript review.

Malcolm P Brinn and Kristin V Carson contributed equally to the review.

Anne B Chang: Manuscript review

Adrian J Esterman: Statistical assistance, manuscript review.

Brian J Smith: Manuscript review

## DECLARATIONS OF INTEREST

None

## SOURCES OF SUPPORT

### Internal sources

- NHS Centre for Reviews and Dissemination, UK.

### External sources

- NHS Research and Development National Cancer Programme, England, UK.

## INDEX TERMS

### Medical Subject Headings (MeSH)

\*Health Education; \*Mass Media; Age Factors; Health Promotion; Smoking [\*prevention & control]

### MeSH check words

Adolescent; Humans; Young Adult