School-based interventions to prevent the uptake of smoking among children and young people: effectiveness review- Executive summary

Introduction and aims

This systematic review examines the effectiveness of interventions delivered in schools and designed to prevent the uptake of smoking in children and young people. The systematic review also considers specific sub-questions related to the factors that might influence effectiveness and quantitative information on barriers to implementation.

Methods

A comprehensive literature search was conducted. Cochrane Library (Wiley) (CDSR, DARE, HTA and CENTRAL) Issue 4 , York CRD database (DARE and HTA) October 2008, MEDLINE (Ovid) , MEDLINE In Process, EMBASE (Ovid), ERIC (CSA), PsycINFO (Ovid), ASSIA (CSA), and HMIC (Ovid) databases were searched to November 2008. Reference lists of systematic reviews were checked and selected websites were searched. Experts were contacted for additional research. 10625 titles and abstracts were screened, 632 full papers were examined and 61 RCTs (128 papers) were selected for inclusion. A second reviewer independently checked 10% of the records and found good agreement. Inclusion criteria were studies conducted on schoolchildren and young people less than 19 years of age, who received interventions principally delivered in schools designed to prevent uptake of tobacco smoking compared to do nothing, usual education or any other suitable comparators. The principal outcome was smoking prevalence. Studies conducted in non-OECD countries, published before 1990 or not in English were excluded. Quality of included RCTs was assessed using the NICE public health checklist and data extracted on to a

spreadsheet and into evidence tables. One reviewer conducted data extraction which was checked by a second. Meta-analyses, on outcomes from school-based only versus usual education or no intervention RCTs, were conducted using STATA version 10.1.

Summary of findings

Sixty-one RCTs (including 53 cluster RCTs) were included, having between 500 and 17,446 participants and follow up between 6 months and 13 years. Additionally, 37 references for controlled before-and-after studies (non-randomised controlled trials) met all the selection criteria except for the study design. These studies were not included given the large volume of RCTs available. There was a wide variety of school-based interventions described in the studies; six also included the family, two included the community and three included family, community and mass-media interventions. Thirty two RCTs had more than one intervention group. All except four RCTs had comparators of usual education. Smoking outcomes reported included weekly or monthly smoking rates, never smoking children becoming occasional or regular smokers, smoking initiation, lifetime involvement in cigarettes and smoking onset rates.

Evidence Statements

1. Are any school-based interventions more effective than usual practice, minimal or no intervention? This category includes aspects of study design that can influence the apparent effectiveness results seen. Findings include the following:

- There is strong evidence from subgroup analysis that interventions show more pronounced effectiveness in studies with lower quality (as measured by ++, + and – grades).

- There is no evidence of the intervention having a differential effect according to whether a study used biochemical validation or not. Evidence from subgroup analysis shows that the intervention does not have a more pronounced effect when self-reported smoking behaviour was validated using biochemical methods (by saliva thiocyanate or cotinine or expired air carbon monoxide levels) compared to questionnaire completion only.

- There is good evidence about the differential effect according to type of outcome measures (prevalence of regular or experimental smoking). Results from 16 RCTs that used prevalence of regular smokers provided evidence that interventions may be effective in reducing smoking uptake among children. However, pooled result from 10 RCTs that used experimental smoking as the main outcome also found that interventions could be marginally effective in preventing smoking uptake. Programmes that used prevalence of regular smoking tended to produce statistically significant results but the size of combined effect was very similar to that for programmes that used experimental smoking as an outcome measure. The main difference between the two was the width of the confidence intervals, giving one as statistically significant but not the other, so this difference may be a statistical artefact.

- There is good evidence of the intervention having a differential effect according to the way the results were presented. It may be that adjusted results tended to produce more significant programme effectiveness, i.e. when RCTs adjusted for potential confounders such as baseline smoking rates, sex, and socioeconomic status. However, many of the studies with adjusted results were of low quality.

1a. When appropriate interventions can be compared, which are most effective?

- There is conflicting evidence about the effectiveness of different conceptual models of school-based prevention programmes (social influence, social competence, information giving and combined interventions) and the interventions in many RCTs were not effective in preventing or delaying uptake of smoking in comparison with no programmes or in comparison to other forms of prevention programmes. Therefore there is no clear evidence to suggest that any particular conceptual model intervention is more effective than any other conceptual model intervention compared usual education. There is evidence from 15 RCTs (two ++, Canada; two ++, USA; three +, UK; four +, USA; one -, Norway; one -, The Netherlands; and two -, USA) that social influence curricula may be effective in preventing smoking but the size of effect is small. Four RCTs (three -, The Netherlands and one -, USA) provided evidence that information giving curricula may be effective with a larger effect size. However, social competence (one -, UK) and combined (one +, USA and three -, USA) curricula detected no difference in smoking prevalence between those students in experimental and control conditions. These results may be confounded by RCT quality.

- There is moderate evidence indicating that multi-component interventions incorporating both school and community components (with or without an additional family component) are ineffective in preventing the uptake of smoking compared to usual education. Five RCTs provided evidence comparing a multi-component intervention that incorporates both school and community components to usual education: Sun et al. 2006 (+, USA), Piper et al. 2000 (+, USA), Schinke et al. 2000 (+, USA), Schofield et al. 2003 (-, Australia), Gordon et al. 1997 (-, UK). Four of the studies (Gordon et al. 1997, Schinke et al. 2000, Schofield et al. 2003, Sun et al. 2006) found no significant difference between the multi-component intervention group and the usual education group during a maximum follow-up between 6

months (Gordon et al. 1997) and 5 years (Sun et al. 2006). One study (Piper et al. 2000) found no difference at 3-year follow-up and small, marginally significant positive or negative intervention effects (depending on the school component) at 4-year follow-up.

- There is inconclusive evidence as to the effectiveness of interventions incorporating both school and family components in preventing the uptake of smoking compared to usual education. Thirteen RCTs provided evidence comparing interventions that incorporate both school and family components to usual education: Storr et al. (-, USA), Elder et al. 1996 (+, USA), Nutbeam et al. 1993 (+, UK), de Vries et al. 2006 (-, EU + UK), Perry et al. 2003 (++, USA), Elder et al. 2002 (+, USA), Spoth et al. 2001 (+, USA), Ary et al. 1990 (-, USA), Spoth et al. 2002 (-, USA), Connell et al. 2007 (-, USA), Simons-Morton et al. 1996 (-, USA), Piper et al. 2000 (+, USA) and Schofield et al. 2003 (-, Australia). Three of the RCTs (Simons-Morton et al. 1996, Storr et al. 2002 and Spoth et al 2001) found a significant positive effect of family and schools intervention compared to usual education. Nine RCTs (Elder et al. 1996, Nutbeam et al. 1993, Piper et al. 2000, Schofield et al. 2003, de Vries et al. 2003, Ary et a. 1990, Connel el a. 2007, Elder et al. 2002 and Spoth et al. 2002) found showed no significant difference between family and schools intervention and usual education. One RCT showed a significant effect in boys but not girls (Perry et al. 2003).

1b. Are the interventions delaying rather than preventing the onset of smoking?

- There is conflicting evidence whether school-based smoking prevention programmes are delaying rather than preventing smoking uptake in children. Results from Campbell et al. 2008 (+, UK) and Bond et al. 2004 (+, Australia) RCTs suggested an attenuation of programme effect over time.

Crone et al. 2003 (-, The Netherlands) and Sussman et al. 2007 (-, USA) also provided evidence that a smoking prevention programme may be delaying smoking uptake. Evidence from Klepp et al 1994 (-, Norway) suggested that school-based education could have a positive short-term impact on smoking behaviour, but that these effects tended to disappear over time. Dent et al. (-, USA) provided evidence that the intervention may be effective in preventing smoking uptake, and, Elder et al. 1993 (-, USA) provided evidence that their school-based education programme tended to have a long-term impact on smoking behaviour. However, Nutbeam et al. 1993 (+, UK); Peterson et al. 2000 (++, USA); Eisen et al. 2003 (+, USA); Chatrou et al. 1999 (-, The Netherlands); Ennet et al. 1994 (-, USA) and Schinke et al. 2000 (+, USA) showed that school-based prevention was not effective in preventing smoking at all follow-up periods.

- There is no robust evidence indicating that any school-based intervention has long-lasting effects beyond school leaving age. One US study (Peterson 2000, ++) demonstrated that a comprehensive smoking prevention programme that adopted social influences approach, started at age 8-9 and continued through to age 17-18 was ineffective when smoking prevalence was measured at age 20. Another US drug prevention programme (Lynam 1999, +) targeting children aged 12-13 also found no significant effect on smoking at age 20.

1c. Does effectiveness depend on status of the person (e.g., peer, teacher or external trainer/researcher) delivering it?

- It is not clear whether effectiveness of school-based smoking prevention programme depend on the status of the person delivering it. There is conflicting evidence whether peer-led programmes produced most effective intervention effects on smoking initiation. However, it is

important to note that a peer-led programme may be differentially effective based on how leaders are selected and how groups are formed, and may be curriculum dependent. There is some evidence that teacher-led, health educator-led, and peer-led programme tend to be equally effective. Eight RCTs examined whether effectiveness of school-based smoking prevention programmes depend on the status of the person delivering it. One RCT (Campbell et al. 2008 +, UK) showed that effectiveness of peer-led school-based smoking prevention programme was the same as non-peer led programme. However, three other studies (one + and two -) provided evidence that peer-led interventions tend to enhance smoking prevention programmes. For example, results from Telch et al. 1990 (+, USA) showed a marked suppression in the onset of both experimental and regular smoking among those students exposed to the resistance training with peer involvement. Similarly, Botvin et al. 1990 (-, USA) found that a cognitive-behavioural approach when carried out by peer-leaders and when additional boosters are provided can reduce tobacco use. Yet Valente et al. 2006 (+, USA) provided evidence that a peer-led programme will be differentially effective based on how leaders are selected and how groups are formed, and this effect may be curriculum dependent. In one RCT (Ellickson et. al. 1993 -, USA), there was no statistically significant difference in regular smoking rates among students taught by health educators and those taught by adult teachers assisted by older teens. Similarly, Armstrong et al. 1990 (-, Australia) confirmed non-superiority of peer-led programmes to teacher-led programmes. However, this result was gender-specific. Both the teacher-led and peer-led programmes reduced, to about the same degree, the uptake of smoking by girls while only the teacher-led programme appeared to be effective in boys. Cameron et al. 1999 (++, Canada) provided evidence that teachers and nurses were equally effective providers regardless of delivery

method. While, Sussman et al. 2003 (-, USA) reported that students exposed to interactive health educator-led interventions were less likely to use tobacco compared those not exposed to health educator-led instruction.

1d. Does site/setting influence effectiveness?

- . Evidence shows that site or setting may influence effectiveness. One UK RCT tended to have had a more significant effect in rural schools. Otherwise, there is conflicting evidence of interventions having a differential effect according to location (rural or urban) or country of the study. Evidence from one RCT (Campbell et al. 2008; +, UK) indicated that students from schools located in the South Wales were less likely to be regular smokers. Another RCT (Sussman et al. 1993 -) conducted in USA found that trial of cigarette smoking use was higher in the rural schools than in the urban schools. However, weekly use of tobacco products did not differ by place of residence. Yet another study (Elder 1996; +, USA) found that Louisianans were more likely to be ever smokers than students from Texas State. Noland et al. 1998 (++, USA) provided limited evidence of significant treatment effects for 30-day, 7-day, and 24-hour smoking for those involved in smoking. One RCT (Ausems et al. 2004 -, The Netherlands) specifically compared in-school and out-of-school smoking prevention. These RCTs found that smoking initiation was lowest in the out-of-school and highest among students in control condition. The European Smoking Prevention Framework Approach (ESFA) found evidence of the intervention differential effect according to the location (country) of the study (de Vries et al. 2005 -, EU). ESFA was effective in prevention uptake of smoking Spain, Finland, and Portugal and ineffective in Denmark and UK. However, ESFA showed more smoking in the intervention group in The Netherlands. However, our planned

subgroup analyses provided of evidence of no differential effect according to the country.

1e. Does effectiveness depend on the intensity of the intervention?

- There is clear evidence that the addition of booster sessions enhanced effectiveness of main programmes Four studies (one ++ and three -) analysed effectiveness of booster sessions. Evidence from Perry et. al., 2003 (++, USA) suggests that addition of booster sessions significantly enhanced the effectiveness of the main programme and was more effective than the delayed programme controls. Dijkstra et. al., 1999 (-, USA) found that boosters can be an effective tool for maintaining or increasing the effectiveness of smoking prevention programmes. Botvin et. al., 1990(a) (-, USA) revealed that addition of booster sessions to cognitive-behavioural approach can reduce tobacco use. Another study (Eckhardt et. al., 1997 -, USA) showed that continued intervention students reported significantly less smoking than lapsed intervention and continued control students.

1f. How does effectiveness vary according to the age, sex, ethnicity, sexual orientation, baseline risk factors or socioeconomic status of the target audience?

- It is not clear whether the age of the target audience has any impact on effectiveness of school-based prevention of smoking. There is inconclusive evidence whether the effectiveness of interventions depend on the age at which students were recruited and the age of students at maximum follow-up.There is conflicting evidence that age is an important predictor of smoking in school-based prevention programmes. Three studies (Dijkstra et al. 1999 (+, USA); Gatta et al. 1991; (+, Italy) and Ausems et al. 2004; (-,The Netherlands)) found that the risk of smoking increased linearly with increasing age of the participants. Three studies (Johnson et

al. 2005; (+, USA); Elder et al. 2002; (+, USA); and Chatrou et al. 1999; (-, The Netherlands)) found no significant association between age and prevalence of smoking. One particular study (Ausems et al. 2004; (-,The Netherlands)), found that this associated diminished and became non-significant with longer duration of follow-up. Contrary to this finding, another study (Chatrou et al. 1999; (-, The Netherlands)) found that age did not predict prevalence of smoking regardless of duration of follow-up. We found inconclusive evidence whether effective of intervention depend on the age at which students were recruited and age of students at maximum follow-up. There is limited evidence from subgroup analyses revealed that intervention may be effective when students were recruited at 11 or 12 years old, and when students were 14 or 16 years at maximum follow-up.

- There is weak evidence (Kellam 1998, - USA; Storr 2002, - USA) indicating that school-based interventions that start soon after entry into primary schools and that target behaviour management in the classroom, poor academic achievement, and teacher-parent communication regarding behaviour management may be effective in reducing the uptake of smoking up to age of 14. Evidence for the effectiveness of such interventions beyond this age is lacking.

- Evidence regarding the effectiveness of school-based interventions starting between age 7 and 10 is inconclusive. Studies have report either no significant effect or significant effects immediately post-intervention which diminish over time. Two interventions focusing on smoking prevention demonstrated no significant effects on smoking (Gatta 1991, + Italy; Peterson 2000, ++ USA). Three interventions focusing on drug (substance) use prevention reported either no effect (Ringwalt 1991, + USA); non-significant reduction in smoking prevalence (Schinke 2000,

+USA) or significant reduction in smoking prevalence immediately after intervention period that was not sustained at subsequent follow-up (Ennet 1994, -USA). One health promotion program that included a smoking prevention component found no significant effect (Elder 1996, +USA).

- **Evidence statement** Forty-six RCTs investigated the effectiveness of school-based interventions that started in secondary schools between ages 11 to 14. Quantitative analysis indicated that whilst the observed effect for individual RCTs did not achieve statistical significance in most cases, overall the interventions appear to have modest effect in preventing the uptake of smoking. There is significant heterogeneity in the results between studies, indicating that the findings may be specific to the context of individual studies/interventions.

- Evidence from seven studies conducted in North America regarding the effectiveness of school-based interventions that start from age 14 or later is inconclusive. One RCT (Sussman et al. 2003 -, USA) reported a significant reduction in the odds of smoking for an educator-led intervention whilst two RCTs (Dent et al. 2001 +, USA; Sun et al. 2006, +, USA) evaluating different versions of the same curriculum reported no significant intervention effect. Four other RCTs reported significant effects either for a specific subgroup (Brown et al. 2000 ++, USA) or for outcomes that may be more relevant to smoking cessation than prevention (Brown et al. 2001 +, USA; Werch et al. 2005 +, USA; Winkleby et al. 2004 +, USA).

- There is conflicting evidence of differential effect of intervention according to the sex of the target audience. However, there is moderate evidence that sex is an important predictor of post-test smoking, but direction of effect (either in male or female student) is inconclusive. Furthermore, association of sex with smoking prevalence depends on how the outcome was measured. One recent study (Campbell et al. 2008 +, UK) found no

significant difference in effectiveness of school-based intervention among males and females students. Another study (Peterson et al. 2000 ++, USA) provided no evidence of Hutchinson Smoking Prevention Project impact on the prevalence of daily smoking, either for girls or for boys. Three studies (Brown et al. 2002 ++, Canada; Abernathy & Bertrand 1992 +, Canada; and Kellam & Anthony 1998 -, USA) demonstrated that the intervention was more effective among male students; while only one study (Shean et al. 1994 -, Australia) found that both teacher-led and peer-led programmes reduced the taking up of smoking by girls to about the same degree. There was also conflicting evidence from nine studies whether sex was an important predictor of post-test smoking. Only one study (Chatrou et al. 1999 -, The Netherlands) provided evidence that sex was not associated with post-test smoking. Two studies (Johnson et al. 2005 +, USA and Simons-Morton et al. 2005 -, USA) found that female students were more likely than male students to have reported smoking at follow-up and only one study (Schofield, Lynagh, & Mishra 2003 -, Australia) found that boys were less likely than girls to have reported smoking at follow-up. Yet, three studies (Elder et al. 1996 -, USA; Sussman et al. 2003 -, USA; Ausems et al. 2004 -, The Netherlands) revealed that males were more likely to be a smoker than their female counterparts. Another two studies (Elder et al. 2002 +, USA and Gatta et al. 1991 +, Italy), demonstrated that compared to male students, female students were less likely to have used tobacco.

- There is moderate evidence that the race is an important predictor of smoking behaviour, such that Whites students were less likely to be a smoker. Similarly, there is moderate evidence that the observed association between race and smoking behaviour depend on how the outcome was measured. Four studies (two +, USA and two - USA) specifically studied whether race or ethnic group is an important factor in

predicting post-test smoking among students exposed to school-based smoking prevention programme. Only one study (Simons-Morton et al. 2005 (-), USA) demonstrated no association between race and smoking status. However, three studies found that race was important factor in predicting post-test smoking behaviour. For example, one study (Elder 1996 (+), USA) provided evidence that White students were less likely to be classified as ever-smoker. Two studies (Johnson et al. 2005 (+), USA and Elder et al. 1993 (-), USA) revealed that race affects smoking prevalence depending on how the outcome was measured. However, one multi-country study (de Vries et al. 2005 -, EU) in six European countries, provided evidence that in The Netherlands there was differential significant effects for adolescents with a Dutch and non-Dutch origin. The Dutch ESFA programme was effective for non-native adolescents with fewer new weekly smokers compared to new weekly smokers in the control group. An opposite effect was found in native Dutch adolescents with more new weekly smokers in the experimental compared to new smokers in the control group.

- There is no conclusive evidence about the variability of programme effectiveness in high risk individuals. Josendal et al. 1997 (++, Norway) showed positive effects of a school-based intervention at six months in certain high risk groups. Snow et al. 1992 (-USA) provided evidence that students from single parent households were less likely to have been positively affected by the intervention than those from two-parent households. The following factors were also found to be associated with post-test smoking: Attitudes and smoking habits of family (Armstrong et al. 1990 -, Australia; Elder 1996 +, USA and Chatrou et al. 1999 , The Netherlands) attitudes and smoking habits of peers,(Armstrong et al. 1990 -, Australia; Chatrou et al. 1999 -, The Netherlands; Elder 1996 +, USA and Schofield, Lynagh, & Mishra 2003 -, Australia) tobacco advertising

(Armstrong et al. 1990 -, Australia), availability of cigarettes at home (Elder 1996 +, USA) involvement of students at school (Schofield, Lynagh, & Mishra 2003 -, Australia) baseline smoking status (Chatrou et al. 1999 -, The Netherlands and Schofield, Lynagh, & Mishra 2003 -, Australia) and future smoking intentions (Armstrong et al. 1990 -, Australia)

- There was no evidence about sexual orientation of participants and the impact of the interventions
- There is limited evidence that socioeconomic status of the participant had no impact on the effectiveness. There is evidence from one RCT (Campbell et al. 2008; + UK) that there is no evidence association between the students' socioeconomic status and programme effect.

1g. Are there any adverse or unintended effects (negative) of the intervention?

- There is limited of evidence on adverse or unintentional effect of school-based prevention of smoking uptake. No studies specifically examined adverse or unintentional effects of school-based smoking prevention programmes. One multi-country study (de Vries et al. 2005 -, EU) in six European countries found that adolescents in The Netherlands exposed to school-based smoking prevention programme were more likely to be a regular smoker than those in control condition. Piper, Moberg, & King 2000 (+, USA) provided evidence that age-appropriate intervention emerged as marginally harmful over the control condition.

2. Barriers and facilitators – Quantitative data

- An obvious barrier to interventions may be poor student attendance so that interventions, regardless of their value, will fail to have positive effects. In one RCT, a dose-response relationship was observed between programme participation and changes in smoking status.

- In one RCT, engagement with the intervention (reported programme interesting/very interesting and useful) was shown to be related to follow-up smoking status; those engaging being less likely to be smokers at 1 year.