An informal school-based peer-led intervention for smoking prevention in adolescence (ASSIST): a cluster randomised trial

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Summary

Background Schools in many countries undertake programmes for smoking prevention, but systematic reviews have shown mixed evidence of their effectiveness. Most peer-led approaches have been classroom-based, and rigorous assessments are scarce. We assessed the effectiveness of a peer-led intervention that aimed to prevent smoking uptake in secondary schools.

Methods We undertook a cluster randomised controlled trial of 10 730 students aged 12–13 years in 59 schools in England and Wales. 29 schools (5372 students) were randomly assigned by stratified block randomisation to the control group to continue their usual smoking education and 30 (5358 students) to the intervention group. The intervention (ASSIST [A Stop Smoking In Schools Trial] programme) consisted of training influential students to act as peer supporters during informal interactions outside the classroom to encourage their peers not to smoke. Follow-up was immediately after the intervention and at 1 and 2 years. Primary outcomes were smoking in the past week in both the school year group and in a group at high risk of regular smoking uptake, which was identified at baseline as occasional, experimental, or ex-smokers. Analysis was by intention to treat. This study is registered, number ISRCTN55572965.

Findings The odds ratio of being a smoker in intervention compared with control schools was 0·75 (95% CI 0·55–1·01) immediately after the intervention (n=9349 students), 0·77 (0·59–0·99) at 1-year follow-up (n=9147), and 0·85 (0·72–1·01) at 2-year follow-up (n=8756). The corresponding odds ratios for the high-risk group were 0·79 (0·55–1·33) (n=3561), 0·75 (0·56–0·99) (n=3483), and 0·85 (0·70–1·02) (n=3294), respectively. In a three-tier multilevel model with data from all three follow-ups, the odds of being a smoker in intervention compared with control schools was 0·78 (0·64–0·96).

Interpretation The results suggest that, if implemented on a population basis, the ASSIST intervention could lead to a reduction in adolescent smoking prevalence of public-health importance.

Funding MRC (UK).

Introduction Tobacco use by adolescents is a public-health problem worldwide. The Global Youth Tobacco Survey\(^1\) noted that 17·3% of children aged 13–15 years reported using tobacco products and 8·9% were present smokers, with highest rates of smoking in the Americas (17·5%) and Europe (17·9%). Although tobacco use in adolescence takes time to translate into tobacco-related morbidity and mortality in middle-to-old age,\(^1\) evidence shows that nicotine addiction is established rapidly during adolescence.\(^1\) Additionally, early smoking uptake is related to the number of cigarettes smoked every day in adulthood\(^2\) and might also be associated with decreased quit rates in later life.\(^3\) Addressing smoking uptake is of relevance for both developed and developing countries, and the need to expand comprehensive and effective tobacco prevention and control programmes is well established.\(^4\)

Schools are potentially valuable settings for smoking prevention because of the consistent access to students over several years. Systematic reviews have, however, provided varied evidence of effectiveness of school-based programmes for smoking prevention.\(^5\)\(^–\)\(^10\) One review reported little to no evidence of long-term effectiveness because only one of the eight randomised controlled trials that were included showed significantly decreased smoking prevalence in the intervention group 6 years after the intervention.\(^10\) As schools continue to expend substantial time and resources on ineffective interventions, innovative programmes for smoking prevention need to be rigorously assessed and the findings translated into practice. Peer-led approaches have been suggested as one way forward.\(^1\)

Whether a young person smokes is strongly associated with their friends’ smoking behaviour.\(^11\) Peer pressure is often used to explain this finding,\(^11\) although evidence suggests that peer selection, whereby young people choose to associate with like-minded people engaging in similar behaviours, is also a cause.\(^12\)\(^–\)\(^15\) However, peer influence can be protective,\(^16\) leading to attempts to harness this effect through peer education.\(^12\) Most peer-led health promotion tends to use peers of the same age or
Training of peer supporters

• Parental consent for training course participation sought by investigators

Recruitment of peer supporters

• Recruitment meeting held with nominees to explain the role of peer supporter, in which potential peer supporters were invited to a recruitment meeting

Nomination of peer supporters

• Presentation of gift vouchers to peer supporters who handed in their diary

Acknowledgment of peer supporters’ contribution

• Four follow-up school visits by trainers to meet with peer supporters to provide support, troubleshooting, and monitoring of peer supporters’ diaries

Methods

Study design and participants

In February, 2001, 223 secondary schools in the west of England and southeast Wales were invited to participate in this open cluster-randomised controlled trial. 127 schools expressed an interest in taking part and a health promotion trainer and a trial coordinator visited each one. They explained the peer-led intervention and the randomised trial to a senior member of the school staff. Positive responses were received from 113 schools. 66 schools were selected from these 113 by random sampling, with stratification by country; type of school including independent or state, mixed-sex or single-sex, English-speaking or Welsh-speaking; size of school; and level of entitlement to free school meals. Of these 66 schools, 59 signed an agreement to continue with their usual smoking education and policies for tobacco control, and to be randomised to either the control group of the trial, or the intervention group in which schools would additionally receive the ASSIST intervention. The panel shows the main components of this intervention. Instead of being classroom-based, ASSIST trained influential students to act as peer supporters during informal interactions outside the classroom to encourage their peers not to smoke. Peer supporters were trained in a standard way by external trainers, instead of school-teachers.

We used stratified-block randomisation, with strata defined by the same criteria as for the random selection procedure.25 One investigator (RC) determined the sequence in which the schools were to be allocated using a randomly ordered list of schools for each stratum. To conceal allocation, another investigator (LM) was at a different location and was unaware of which school was next to be randomised. LM used a random-number generator to establish the group allocation of the next school, which he communicated to RC by telephone.

We obtained written assent to participate in the trial from the students. Data analyses were undertaken according to a prespecified analysis plan that was approved by the independent data monitoring and ethics committee. The Multi-Centre Research Ethics Committee for Wales reviewed the trial protocol and judged it as meeting ethically acceptable standards.

Outcome measures

As a whole-school intervention, the primary outcome was the prevalence of smoking in the past week in the year group of the school. However, evidence from the feasibility study26 that was undertaken in children aged 12–14 years in six schools in south Wales from slightly older to deliver classroom-based lessons, but a systematic review showed variable evidence of effectiveness and a scarcity of assessments that were methodologically sound.27 Informal contacts between peer educators can be as important as the formal work that they are asked to do,28 and the adoption of a more formal teacher role in a classroom setting could even undermine credibility with peers.29,10,20

The ASSIST (A Stop Smoking In Schools Trial) intervention was adapted from the “Popular Opinion Leader” initiative30 for promotion of sexual health.29 With use of the diffusion of innovation theory,23 we targeted the ASSIST intervention at students aged 12–13 years (UK Year 8 children) and aimed to spread and sustain new norms of non-smoking behaviour through social networks in schools.24

Panel: Stages in the ASSIST intervention

Nomination of peer supporters

• Completion of questionnaire by all students aged 12–13 years (UK Year 8) to identify influential peers. Questions asked were “Who do you respect in Year 8 at your school?”, “Who are good leaders in sports or other groups activities in Year 8 at your school?”, and “Who do you look up to in Year 8 at your school?”

• To achieve a 15% critical mass of the year group participating as peer supporters, the 17.5% of students with the most nominations were invited to a recruitment meeting

Recruitment of peer supporters

• Recruitment meeting held with nominees to explain the role of peer supporter, answer questions, and obtain their agreement to attend the training course

Training of peer supporters

• Overall purpose of the training programme was to enable the peer supporters to engage in informal conversations with their peers about the effects of smoking and the benefits of not smoking

• 2-day training event held out of school, facilitated by a team of external trainers who were experienced in youth work, led by health-promotion specialists

• The training aimed to: provide information about short-term risks to young people of smoking and the health, environmental, and economic benefits of remaining smoke-free; develop communication skills, including verbal and non-verbal communication skills, listening skills, expression of feelings and ideas, group work, team building, cooperation and negotiation, ways of giving and receiving information, and conflict resolution; and enhance students’ personal development, including their confidence and self-esteem, empathy and sensitivity to others, assertiveness, decision making and prioritising skills, attitudes to risk-taking, and exploration of personal values

• Methods used to achieve these aims included participatory learning activities such as role plays, student-led research, small group work and discussion, and games

Intervention period

• 10-week intervention period during which peer supporters undertook informal conversations about smoking with their peers when travelling to and from school, in breaks, at lunchtime, and after school in their free time, and logged a record of these conversations in a simple pro-forma diary

• Four follow-up school visits by trainers to meet with peer supporters to provide support, troubleshooting, and monitoring of peer supporters’ diaries

Acknowledgment of peer supporters’ contribution

• Presentation of certificates to all peer supporters

• Presentation of gift vouchers to peer supporters who handed in their diary
September, 1996, until May, 1997, suggested that the intervention was especially successful with students who were occasional, experimental, or ex-smokers (ie, those who are at high risk of smoking uptake). Prevalence of smoking in the past week in this high-risk group was therefore included as an additional primary outcome, and was used for calculations of trial sample size.

**Procedures**

We gathered outcome data at baseline (Sept 20, 2001–Feb 12, 2002), immediately after the intervention (Jan 30, 2002–May 27, 2002), at 1-year follow-up (Nov 28, 2002–May 15, 2003), and at 2-year follow-up (Nov 18, 2003–May 12, 2004) with a questionnaire that was completed in the classroom, with students required not to confer. At least 2 weeks before every data collection, participating schools posted out letters containing information about the programme to all parents and carers of students who were new to the study, with a reply slip enclosed that was to be returned if they did not wish their child to participate. At every data collection stage, all students in the relevant year group of participating schools were eligible to take part, apart from those who had been withdrawn by their parents or carers. We identified influential students through a nomination questionnaire that was given to all students in both intervention and control schools, with only those in intervention schools invited to train as peer supporters. All participating students were then asked to complete a questionnaire, including a standard set of questions about smoking behaviour that were designed for young people, and to provide a saliva sample, to keep reporting bias to a minimum.

All saliva samples collected at baseline and 1-year follow-up, and those obtained from all students in 12 intervention and 12 control schools at 2-year follow-up (consisting of 39% of the total population), were assayed to measure cotinine concentrations. These 24 schools were purposively selected to ensure that students from a broad range of different types of participating schools were represented. We analysed samples with the ELISA technique. Data from these assays were used to assess the amount of misreporting and not to correct self-reported data.

We undertook a process assessment within the trial to explore teachers’ views of the intervention and to examine what the peer supporters did and what they thought of their role. Data about the young people’s social networks were also gathered to investigate the distribution of the peer supporters within their year groups and the role of social networks in the dissemination of the intervention by the peer supporters. To estimate the cost of the intervention, we recorded resources used—including staff time, travel time and distance, consumables, accommodation, and vouchers for peer supporters—every week.

**Statistical analysis**

On the basis of the analysis of the feasibility study and of data gathered in the 1998 Health Behaviour in School-Aged Children Survey in Wales, we assumed that 30% of students would be in the group at high risk of smoking uptake, of whom 30% were expected to smoke every week at follow-up, with an intraclass correlation coefficient of 0.02. With 80% power and a type I error of 0.05, the planned study (33 schools per group) was powered to detect either a 7.5% or 8.5% difference dependent on loss to follow-up (10% or 15%, respectively). Only 59 of 66 schools agreed to randomisation, but the average size of the year group was much larger than was anticipated (187 students rather than 115).

We estimated confidence intervals for smoking prevalence for all students and for those in the high-risk group by design-weighted survey estimators that were implemented in Stata (version 9.2), to account for clustering of students in schools. We obtained estimates of the intervention effect at 1-year and 2-year follow-up with random effects logistic regression models with school as a random effect, and including as covariates the five school-level stratifying variables and smoking behaviour at baseline. These analyses treated the data as a student-level cohort study. Analysis was by intention to treat.

The primary planned analysis was a three-level model with data from the three follow-up periods modelled, with schools at level 3, students at level 2, and repeated follow-up measurements at level 1. This design of repeated measures used a modelling framework to allow the inclusion of individuals with missing measures, thus keeping bias because of loss to follow-up to a minimum. Models were estimated with first-order penalised quasi-likelihood within MLwiN (version 2.02), with the five school-level stratifying variables and smoking behaviour at baseline included as covariates. In four planned subgroup analyses, the model was extended to include interaction terms to test separately for possible differential effects of the intervention by sex, peer supporter status, deprivation (defined by the school having a free school meal entitlement above and below the median), and whether or not the school was located in a community in the south Wales valleys.

This study is registered, number ISRCTN55572965.

**Role of the funding source**

A representative from the MRC sat on the Trial Steering Group, which approved the study protocol and analysis plan. The sponsor of the study had no involvement in the data analysis, data interpretation, data collection, or writing of the report. RC, LM, JH, and RH had access to all the data in the study and RC and LM had the final responsibility for the decision to submit for publication.

**Results**

Figure 1 shows the trial profile. Two schools withdrew after randomisation, one from the control and one from
the intervention group, because of changes in decisions by school management. These schools were each replaced by one from the same strata in the list of 113 interested schools, and were then randomly allocated to treatment group as a block of size two. Of the 11 043 potentially eligible students in the 59 participating schools, 313 (3%) were withdrawn by their parents or carers before collection of data at baseline. One school in the control group closed after the follow-up undertaken after the intervention, and one school in the intervention group closed after the 1-year follow-up. However, of the 123 students registered at these two schools, 117 transferred to other schools within the trial and were therefore not lost to follow-up. At every data collection point, more than 90% of eligible students provided self-reported data for smoking (figure 1).

We recorded few differences between the characteristics of schools at baseline in both groups, but more students in control schools reported smoking every week than did those in intervention schools (table 1). However, when we restricted this comparison to students who reported smoking at baseline and who also provided data at 1-year follow-up, this difference was smaller (229/4436 [5%] vs 195/4711 [4%]). We noted no differences between intervention and control schools in the proportion of students who were occasional, experimental, or ex-smokers and therefore at high risk of regular smoking uptake (table 1). We recorded very slight differences in the family affluence scores and family ownership of vehicles, suggesting that a slightly larger proportion of students in control schools came from less affluent backgrounds and did not have a family car than did those in intervention schools (table 1).

835 (16%) of 5358 students completed the training and agreed to work as peer supporters, achieving the prespecified target of 15% of the year group. Furthermore, peer supporters were generally representative of the year group in terms of sex, ethnic origin, smoking status, and whether or not they intended to remain in full-time education after 16 years of age (data not shown). Very high retention rates were achieved: 99% (835 of 848) of students who trained agreed to continue to work as peer supporters, and 84% (687 of 816) handed in a completed diary at the end of the intervention period.

Overall smoking rate in the whole year group increased from 5·7% (570 of 10 047) at baseline when

Figure 1: Trial profile
*Reasons for schools withdrawing were the time commitment entailed, involvement in other research projects (one school), concerns about parental reaction to covering the issue of smoking in school (one), and concerns about which students were likely to be identified as influential (one). Three schools did not give clear reasons for withdrawal at this stage. *Schools were excluded if the year group contained fewer than 60 students (three), if they were a special needs school (two), or if they were already involved in a substantial smoking prevention project (three). *Two schools, one intervention and one control, withdrew after randomisation. Each was replaced by a school from the same strata and these two schools were then randomly allocated to treatment group as a block of two. ¶This figure includes students from a control school that was closed subsequent to the follow-up data collection immediately after the intervention who did not transfer to another school in the study. ¶This figure includes students from an intervention school that was closed after the 1-year follow-up data collection were collected, who did not transfer to another school in the study.
the students were aged 12–13 years to 13.8% (1366 of 9909) at 1-year follow-up and 20.3% (1963 of 9666) at 2-year follow-up when the students were aged 14–15 years (table 2). Smoking prevalence was lower in intervention than in control schools at all three follow-up points, even after adjustment for baseline differences (table 3). At 1-year follow-up, the odds ratio of being a smoker in intervention compared with control group was 0.77 (95% CI 0.59–0.99). At 2-year follow-up, the corresponding odds ratio of 0.85 (0.72–1.01) was not significant (p=0.067; table 3), which suggests an attenuation of this intervention effect over time. For the high-risk group, the odds ratios at 1-year follow-up of 0.75 (0.56–0.99) and at 2-year follow-up of 0.85 (0.70–1.02) suggest that, contrary to the findings of the feasibility study, there is no evidence that the intervention had a more beneficial effect on students who were identified as occasional, experimental, or ex-smokers at baseline.

Results from the multilevel modelling (figure 2) show a 22% reduction (odds ratio 0.78 [95% CI 0.64–0.96]) in the odds of being a regular smoker in an intervention school compared with a control school, with the 95% CIs not including a null effect. Further, results of the planned subgroup analyses provided no evidence of the intervention having a differential effect according to sex (ratio of odds ratios 0.92 [0.70–1.21]), or deprivation measured by free school meal entitlement (0.99 [0.65–1.51]). However, the intervention does seem to have had a more pronounced effect in schools located in south Wales (0.58 [0.36–0.93]; figure 2).

Comparison of the self-reported smoking data and concentrations of salivary cotinine shows that only 125 (1%) of 9282 students who reported not smoking had a salivary cotinine concentration greater than 15 ng/mL at 1-year follow-up (table 4). At 2-year follow-up the corresponding proportion was 3% (101 of 3755). We recorded almost no difference in proportions between intervention and control schools (table 4).

The average cost of the intervention was GB£27 (95% CI 19–48) per student and GB£700 (2408–6786) per school. The trial design involved trainers travelling between Wales and England; however, such distances would be unlikely if the intervention were to be implemented in local areas. The average cost excluding travel was GB£23 (16–43) per student and GB£3937 (2221–5511) per school.

**Discussion**

Our study has shown that the ASSIST training programme was effective in achievement of a sustained reduction in uptake of regular smoking in adolescents for 2 years after its delivery. Furthermore, it was well received by both students and school staff. Confidence in the robustness of this finding is enhanced by the very high response rates achieved (over 90% at every data collection point), the retention of all schools for the duration of the trial, the diversity of schools involved, and the concurrence of self-reported smoking data with salivary cotinine measures. The ASSIST study assessed a peer-led intervention for smoking prevention which with its randomised trial design, clear theoretical basis, and detailed process evaluation has addressed many of the methodological weaknesses that were identified in a systematic review of peer-led interventions.

Some peer-education interventions have had the greatest effect on the target behaviour of the peer educators, fuelling concern that interventions’ effects might be largely explained by how they affect the peer educators themselves. Our analysis showed that the effect of the ASSIST intervention was much the same for peer supporters and non-peer supporters. Interventions for health promotion based on diffusing new behavioural norms might work best in clearly defined, fairly close-knit communities, such as those assumed to exist in the

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**Table 1:** Baseline characteristics of schools and students according to experimental group

| Schools | Control | Intervention |
|---------|---------|--------------|
| Total (N=59) | 29 (49%) | 30 (51%) |
| Independent | 1 (2%) | 2 (7%) |
| State | 28 (47%) | 28 (47%) |
| Welsh language | 2 (3%) | 1 (3%) |
| English language | 27 (93%) | 29 (97%) |
| Free school meals | | |
| >19% student entitlement | 12 (41%) | 14 (47%) |
| ≤19% student entitlement | 17 (59%) | 16 (53%) |
| Size | | |
| ≥200 students | 13 (45%) | 13 (43%) |
| <200 students | 16 (55%) | 17 (57%) |
| Location | | |
| England | 17 (59%) | 15 (50%) |
| Wales | 12 (41%) | 15 (50%) |

| Students | Control | Intervention |
|----------|---------|--------------|
| Total (N=10 730) | 5372 (50%) | 5378 (50%) |
| Smoking behaviour | | |
| Weekly smoker | 327/4960 (7%) | 243/5087 (5%) |
| Occasional, experimental, or ex-smokers | 1913/4960 (39%) | 1964/5087 (39%) |
| Boys | | |
| 0–2 | 1276/4775 (27%) | 1146/4994 (23%) |
| 3–4 | 2661/4775 (54%) | 2779/4994 (56%) |
| 5–6 | 898/4775 (19%) | 1069/4994 (21%) |
| Family vehicle ownership | | |
| No family car or van | 354/4818 (7%) | 295/5018 (6%) |
| One family car or van | 2090/4818 (43%) | 1853/5018 (37%) |
| Two or more cars or vans | 2374/4818 (49%) | 2870/5018 (57%) |

Data are n (%) or n/N (%). *The family affluence score has been specifically designed for use with children aged 11–15 years as part of the WHO’s Health Behaviour in Schools Study. It has been shown to have good criterion validity.* Higher scores indicate greater affluence.
ex-coalfield communities of the Welsh valleys, since peer supporters are in very regular contact with members of a community whose membership is well defined and stable.

Analysis showed this notion to be true, with a substantially greater effect in students from valley schools than in those from other areas. The achieved sample size of 59 schools resulted in estimates of effect size that were of borderline significance. The a priori planned primary analysis that used multilevel modelling achieved the best possible statistical efficiency available, yet in hindsight confidence in the study findings would have increased if the planned sample size of 66 schools had been maintained. A non-significant difference in smoking uptake between the two trial groups was still apparent at 2 years after the intervention but, since we did not obtain further follow-up data, we do not know whether this effect was sustained thereafter. Although a recent systematic review of school-based trials for smoking prevention with an average of 6 years of follow-up noted little evidence of long-term effectiveness,10 the trials that were included all used predominantly formal, classroom-based methods. By contrast, the ASSIST intervention sought to use the medium of the informal culture of the school.

Evidence from the process assessments suggests that several elements were crucial to this intervention's success. Asking students rather than school staff to name influential students seemed to aid the credibility of the peer supporters with their peer group, thus enhancing...
the intervention’s effectiveness. Furthermore, Kelly and Stevenson have contended that at least 15% of the target group should be trained as peer supporters to maintain a so-called critical mass. ASSIST achieved this percentage and the findings suggest that this proportion is sufficient.

Use of external trainers rather than teachers to deliver the training programme, and holding the training in venues outside school, were greatly appreciated by students and school staff, and we believe that these methods contributed to the young people having a sense of ownership of the intervention. The nature of the intervention also seemed to be important. By contrast with most school-based initiatives for health promotion, it was not teacher-led. Additionally, unlike most peer-led education interventions, the peer educators themselves were not asked to deliver formal classroom-based sessions. The intervention deliberately sought to exploit informal channels of information exchange and peer influence outside the classroom, and included the peer supporters themselves making pragmatic decisions to intervene with the young people whom they identified as potentially susceptible to the non-smoking messages, and whom they could have influence over. Furthermore, the intervention was informed by a theoretical approach that was proven to be effective when applied in other health-promotion domains (ie, to behaviour other than smoking).22

If smoking prevention succeeds, nearly all the morbidity associated with smoking is avoided. Smoking cessation in adulthood is highly socially patterned, with more people of middle socioeconomic status succeeding in quitting than lower socioeconomic status succeeding in quitting. Therefore, increasing resources to prevention in adolescence rather than entirely focusing on cessation could help to avoid further widening health inequalities.

Although systematic reviews have shown mixed evidence that school-based approaches for smoking prevention are effective, the results presented here, combined with those of a community intervention trial of a school-based programme for smoking prevention based in six European countries (ESFA), suggest that abandoning interventions for smoking prevention in schools would be premature. Since schools in many countries are required to include activities for smoking prevention as part of their curriculum, the issue is not whether this work should be done but rather how it can be done most effectively. The ASSIST intervention seems to be effective, and if implemented on a UK-wide basis could potentially reduce the number of 14–15-year-old school students taking up regular smoking by 43 289 (95% CI 18 386–68 192) (on the basis of the absolute risk difference in ASSIST at 2-year follow-up). Furthermore, the ASSIST trial implemented the intervention with only one year group in every school. If the programme was repeated every year with successive year groups, it would probably have an effect on the cultural norms surrounding smoking behaviour in the whole school, magnifying the effect of the intervention.

### Contributors

LM and RC led the design and conduct of the trial. RC led the trial team in Bristol and with assistance from FS wrote the first draft of this paper. LM was the trial statistician and led the Cardiff team. The idea for this trial came from MB, who led the application to the MRC for funding and the conduct of the trial in its initial stages. As project coordinator, FS developed methods for collecting data in the outcome evaluation and managed the trial data collection in Bristol. JH and SA undertook the process evaluation that they designed in conjunction with RC and NPL. RH assisted with the data analysis. All authors contributed to redrafts of this report.

### Conflict of interest statement

We declare that we have no conflict of interest.

### Acknowledgments

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### References

1. Warren CW, Jones NR, Eriksson MP, Asma S, for the Global Tobacco Surveillance System (GTSS) collaborative group. Patterns of global tobacco use in young people and implications for future chronic disease burden in adults. Lancet 2006; 367: 749–53.
2. Peto R, Lopez AD. The future worldwide health effects of current smoking patterns. In: Boyle P, Gray N, Henningfield J, Seff rin J, Zatonski W, eds. Tobacco and public health: science and policy. Oxford: Oxford University Press, 2004: 281-86.
3. DiFranza JR, Savageau JA, Fletcher K, et al. Symptoms of tobacco dependence after brief intermittent use. The development and assessment of nicotine dependence in youth—2 study. Arch Pediatr Adolesc Med 2007; 161: 794–10.

| 1-year follow-up | 2-year follow-up |
|------------------|------------------|
| **Concordant: agree smoker** | **Concordant: agree smoker** |
| Control | Intervention | Control | Intervention |
| 9.64% (436/4522) | 8.40% (400/4761) | 16.58% (290/1749) | 14.71% (295/2006) |
| **Concordant: agree non-smoker** | **Concordant: agree non-smoker** |
| Control | Intervention | Control | Intervention |
| 84.17% (3806/4522) | 86.60% (4123/4761) | 75.59% (1322/1749) | 78.66% (1578/2006) |
| **Discordant: self-reported non-smoker, cotinine >15 ng/mL** | **Discordant: self-reported non-smoker, cotinine >15 ng/mL** |
| Control | Intervention | Control | Intervention |
| 1.24% (56/4522) | 1.45% (69/4761) | 3.37% (53/1749) | 2.09% (42/2006) |
| **Discordant: self-reported smoker, cotinine ≤15 ng/mL** | **Discordant: self-reported smoker, cotinine ≤15 ng/mL** |
| Control | Intervention | Control | Intervention |
| 4.95% (224/4522) | 3.55% (169/4761) | 4.46% (78/1749) | 4.54% (91/2006) |

Data are % (n/N).

***Table 4: Concordance and discordance between self-reported smoking behaviour and salivary cotinine findings at 1-year and 2-year follow-up***
4 Taibly E, Wynder EL. Effect of the age at which smoking begins on frequency of smoking in adulthood. N Engl J Med 1991; 325: 968–69.
5 Chassin L, Presson CC, Pitts SC, Sherman SJ. The natural history of cigarette smoking from adolescence to adulthood in a Midwestern community sample: multiple trajectories and their psychosocial correlates. Health Psychology 2000; 19: 223–31.
6 Ferguson J, Bazil L, Chesterman J, Judge K. The English smoking treatment services: one-year outcomes. Addiction 2005; 100 (suppl 2): 59–69.
7 WHO. WHO framework convention on tobacco control. Geneva: World Health Organization, 2003.
8 Thomas R. School-based programmes for preventing smoking. Cochrane Database Syst Rev 2002; 4: CD001293.
9 Sowden A, Arblaster L, Stead L. Community interventions for preventing smoking in young people. Cochrane Database Syst Rev 2003; 3: CD001291.
10 Wiehe SE, Garrison MM, Christakis DA, Ebel BE, Rivara FP. A systematic review of school-based smoking prevention trials with long-term follow-up. J Adolesc Health 2005; 36: 162–69.
11 Harden A, Weston R, Oakley A. A review of the effectiveness and appropriateness of peer-delivered health promotion interventions for young people. London: EPIJ Centre, 1998.
12 Kolbus K. Peers and adolescent smoking. Addiction 2003; 98: 37–55.
13 Denscombe M. Peer group pressure, young people and smoking: new developments and policy implications. Drugs Educ Prev Policy 2003; 10: 7–32.
14 De Vries H, Candel M, Engels R, Merken L. Challenges to the peer influence paradigm: results for 12–13 year olds from six European countries from the European Smoking Prevention Framework Approach study. Tob Control 2006; 15: 83–89.
15 Hoffman BR, Sussman S, Unger JB, Valente TW. Peer influences on adolescent cigarette smoking: a theoretical review of the literature. Subs Use Misuse 2006; 41: 103–55.
16 Maxwell KA. Friends: the role of peer influence across adolescent risk behaviours. J Youth Adolesc 2002; 31: 267–77.
17 Turner G, Shepherd J. A method in search of a theory: peer education and health promotion. Health Educ Res 1999; 14: 235–47.
18 Orme J, Starkey F. Peer drug education: the way forward? Health Educ 1999; 99: 8–16.
19 Green J. Peer education. Promot Educ 2001; 8: 65–68.
20 Backett-Milburn K, Wilson S. Understanding peer education: insights from a process evaluation. Health Educ Res 2000; 15: 85–96.
21 Centers for Disease Control and Prevention. Popular Opinion Leader (POL): a community AIDS/HIV risk reduction program for gay men. http://www.cdc.gov/hiv/topics/prev_gprg/rep/packages/poli.html#intervention (accessed April 21, 2008).
22 Kelly JA, Murphy DA, Sikkena KJ, et al. Randomised, controlled, community-level HIV-prevention intervention of sexual-risk behaviour among homosexual men in US cities. Lancet 1997; 350: 1500–05.
23 Rogers EM. Diffusion of innovations. New York: The Free Press, 1981.
24 Audrey S, Cordall K, Moore L, Cohen D, Campbell R. The development and implementation of a peer-led intervention to prevent smoking among secondary school students using their established social networks. Health Educ J 2004; 63: 266–84.
25 Starkey F, Moore L, Campbell R, Sidaway M, Bloor M and ASSIST (A Stop Smoking in Schools Trial). Rationale, design and conduct of a comprehensive evaluation of a school-based peer-led anti-smoking intervention in the UK: the ASSIST cluster randomised trial [ISRCTN55572965]. BMC Public Health 2005; 5: 43.
26 Bloor M, Frankland J, Parry-Langdon N, et al. A controlled evaluation of an intensive, peer-led, schools-based, anti-smoking programme. Health Educ J 1999; 58: 17–25.
27 Boreham R, Shaw A (eds.) Smoking, drinking and drug use among young people in England in 2000. Norwich: Stationery Office, 2001.
28 Audrey S, Holliday J, Parry Langdon N, Campbell R. Meeting the challenges of implementing process evaluation within randomised controlled trials: the example of ASSIST (A Stop Smoking In Schools Trial). Health Educ Res 2006; 21: 166–77.
29 Audrey S, Holliday J, Campbell R. Commitment and compatibility: teachers’ perspectives on an effective school-based, peer-led smoking intervention. Health Educ J 2008: 67: 74–90.
30 Audrey S, Holliday J, Campbell R. It’s good to talk: adolescent perspectives of an informal, peer-led intervention to reduce smoking. Soc Sci Med 2006; 63: 320–34.
31 Holliday J. Identifying and using influential young people for informal peer-led health promotion. PhD thesis, Cardiff University, 2006.
32 Currie CE. Health behaviour in school-aged children. A WHO cross-national survey (HSBC). Research protocol for the 1997–98 study. Edinburgh: University of Edinburgh, 1998.
33 Holstein B, Parry-Langdon N, Zambon A, Currie C, Roberts C. Socio-economic inequalities and health. In: Currie C, Roberts C, Morgan A, Smith R, Sertottroube W, Samdal O, Rasmussen V, eds. Young people’s health in context. Health Behaviour in School-aged Children Study. International Report from the 2001–02 HBSC survey. WHO Policy series: Health policy for children and adolescents. Issue 4. WHO Regional Office for Europe, 2004: 165–72.
34 Boyce W, Torrseim T, Currie C, Zambon A. The family affluence scale as a measure of national wealth: validation of an adolescent self-report measure. Soc Indic Res 2006: 78: 473–87.
35 Parkin S, McKeagney N. The rise and rise of peer education approaches. Drugs Educ Prev Policy 2000; 7: 293–310.
36 Hart G, Elford J. The limits of generalizability: community-based sexual health interventions among gay men. In: Stephenson J, Imrie J, Bonnell C, eds. Effective sexual health interventions among gay men. New York: Oxford University Press, 2006; 193–22.
37 Kelly JA, Stevenson L. Opinion leader HIV prevention training manual. Milwaukee, WI: Center for AIDS Intervention Research, Medical College of Wisconsin, 1995.
38 Honjo K, Tsutsumi A, Kawachi I, Kawakami N. What accounts for the relationship between social class and smoking cessation? Results of a path analysis. Soc Sci Med 2006; 62: 317–28.
39 De Vries H, Dijkstra F, Wetselaar J, et al. The European Smoking prevention Framework Approach (ESFA): effects after 24 and 30 months. Health Educ Res 2006; 21: 116–32.
40 Department for Education and Skills. Statistics of education: education and training statistics for the United Kingdom. London: Stationery Office, 2005.