Int. J. Epidemiol. Advance Access published July 25, 2015

International Journal of Epidemiology, 2015, 1–9
doi: 10.1093/ije/dyv145
Original article

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Effects of the X:IT smoking intervention: a school-based cluster randomized trial

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Accepted 26 June 2015

Abstract

Background: Uptake of smoking in adolescence is still of major public health concern. Evaluations of school-based programmes for smoking prevention show mixed results. The aim of this study was to examine the effect of X:IT, a multi-component school-based programme to prevent adolescent smoking.

Methods: Data from a Danish cluster randomized trial included 4041 year-7 students (mean age: 12.5) from 51 intervention and 43 control schools. Outcome measure 'current smoking' was dichotomized into smoking daily, weekly, monthly or more seldom vs do not smoke. Analyses were adjusted for baseline covariates: sex, family socioeconomic position (SEP), best friend's smoking and parental smoking. We performed multilevel, logistic regression analyses of available cases and intention-to-treat (ITT) analyses, replacing missing outcome values by multiple imputation.

Results: At baseline, 4.7% and 6.8% of the students at the intervention and the control schools smoked, respectively. After 1 year of the intervention, the prevalence was 7.9% and 10.7%, respectively. At follow-up, 553 students (13.7%) did not answer the question on smoking. Available case analyses: crude odds ratios (OR) for smoking at intervention schools compared with control schools: 0.65 (0.48-0.88) and adjusted: 0.70 (0.47-1.04). ITT analyses: crude OR for smoking at intervention schools compared with control schools: 0.67 (0.50-0.89) and adjusted: 0.61 (0.45-0.82).

Conclusions: Students at intervention schools had a lower risk of smoking after a year of intervention in year 7. This multi-component intervention involving educational, parental and context-related intervention components seems to be efficient in lowering or postponing smoking uptake in Danish adolescents.

Key words: Smoking prevention, intervention study, cluster randomized controlled trial, adolescents, multilevel analyses, multiple imputation

Key Messages

- Previous evaluations of school-based programmes for smoking prevention among adolescents have shown mixed results, and in Denmark so far no interventions have been shown to be effective.
- In a large cluster randomized trial among Danish 13- to 15-year-olds we demonstrated an effect in ITT analyses for smoking among students in intervention schools (OR = 0.61, 0.45-0.81).
- Carefully developed school-based multi-component programs can be effective in preventing adolescent smoking.

Background

Strategies to prevent uptake of adolescent smoking are still important to prioritize in public health. In Europe, 18% of 15-year olds smoke at least weekly, ranging from 1% of girls in Armenia to 61% of girls in Greenland.[1] In Denmark, one-fourth of the 13-year-olds have tried smoking, and almost half of the 15-year olds indicate that they have tried smoking; 8% of the 13-year-olds smoke regularly. Among 15-year-olds, 23% of the boys and 24% of the girls report that they smoke on a daily, weekly or monthly basis.

Evaluations of school-based programmes for smoking prevention show mixed results, but comprehensive strategies using several widespread components, including environmental strategies, are generally more effective than information-based interventions.[2] Few school-based smoking prevention programmes have been conducted in Denmark. Over 1998-2001, Denmark participated in the international European Smoking Prevention Framework Approach (ESFA).[3] ESFA was a school- and community-based, randomized controlled trial which targeted four settings: adolescents in school, school policies, parents and the community. Across countries, ESFA showed a small but overall positive effect, with a 6% lower increase in weekly smokers in the intervention groups over a 30-month period. ESFA had the strongest effect in Portugal and smaller effects in Finland and Spain. Unfortunately, ESFA showed none or the opposite effect in Denmark, The Netherlands and the UK. In Denmark, this result was argued to be mainly due to schools dropping out of the project. Time constraints as well as a negative attitude of teachers towards the ESFA smoking prevention activities were argued to be the reasons for the lack of effect. Two nationally based interventions, Smoke-free Classes and Tackling, were also not effective.[4] Therefore, it was necessary to develop a well-designed, comprehensive and multi-component intervention aimed at Danish schools, acceptable to and adopted by teachers and followed by careful implementation and thorough evaluation.

The X:IT study is a multi-component, school-based smoking prevention programme based on formative research among municipalities and schools and mainly inspired by two Nordic programmes.[5] The Norwegian school-based smoking-prevention programme Be smokeFREE' was based on the social influence approach and included three components: numerous classroom sessions, teacher training and parental involvement. Effects of the intervention on becoming a smoker were found after the first, second and third years of intervention, with odds ratios between 0.31 and 0.74.[6] The Swedish school-based community intervention Tobacco Free Duo also consisted of several components: a number of lessons and a contract signed by the student and an adult committing the student to stay smoke free. By signing the contract, the adult promised to have a smoke-free dialogue with the student. The study found a decrease in overall smoking of nearly 50% in the intervention schools between 1994 and 1999 and a lower smoking prevalence of 12.5 percentage units in the intervention schools compared with national reference data.[7] An earlier Danish study has found teachers' smoking outdoors in school grounds to be associated with higher prevalence of smoking among students.[8] When the X:IT study was designed, teachers were allowed to smoke in school grounds in special smoking areas with access restricted for students. In August 2012, a national law concerning smoke-free environments banned all smoking in Danish public institutions, which made one of the intervention components obsolete.

The X:IT study combined effective environmental and educational components based on previous research[6,7] and evidence from an international review on school-based programmes to prevent smoking.[2] We adapted these components to a Danish context: (i) a contextual component; (ii) a parental component; and (iii) a curricular component. The effects of the intervention were tested in a large-scale, cluster randomized controlled trial design.

The purpose of this paper is to examine the effect of X:IT on prevalence of student's smoking after a year of intervention among available cases and in intention-to-treat (ITT) analyses with multiple imputation of missing values at follow-up. The reporting of this study's findings will comply with the CONSORT statement for cluster randomized trials.[9]

Methods

X:IT is a multi-component school-based intervention, the effects of which are tested in a cluster randomized trial including participating schools all over Denmark. X:IT was developed by the Danish Cancer Society. It is an intervention among students from years 7 to 9, including three main intervention components: (i) completely smoke-free school grounds; (ii) parental involvement comprising two dimensions: (a) smoke-free contract between the student and an adult, preferably one of the parents, and (b) smoke-free dialogues; and (iii) smoke-free curriculum based on self-efficacy training and addressing outcome expectancies.[5]

Smoke-free school grounds for students meant completely smoke-free indoor school facilities and outdoors during school hours. Although not part of the original design of the interventions, an outdoor area used for teachers smoking had to be accepted in order to include a sufficient number of schools. By signing a smoke-free contract, the adolescents promised to stay smoke free for the next year. Signing the contract was intended to be a manifestation of an active choice of non-smoking. Students who remained smoke-free for 1 year were able to win a prize. By signing the contract, the adult signatory promised to conduct a smoke-free dialogue with the adolescent and to support the adolescent's choice of staying smoke free. The smoke-free curriculum included eight lessons a year. The teachers were free to choose methods of teaching as well as supplementary exercises and materials. The actual educational material, 'Gå op I røg' (Up in Smoke), was developed in conjunction with scholars who had educational experience. It was designed to be used in diverse subjects such as science, the humanities and social science.

All 98 municipalities in Denmark were invited to join the study, and 17 agreed to participate (17.3%). In the 17 municipalities, 302 schools with year-7 students were eligible for the trial. Before randomization, all schools had agreed to participate in the study. Randomization of the 97 schools (32.1%) accepting to participate (the clusters) was stratified by municipality. The Danish Cancer Society recruited municipalities and schools and conducted the randomization by drawing lots. We used a stratified simple randomization procedure meaning that randomization was stratified by municipality. Within municipalities, each school had an equal probability of being either a control or an intervention school throughout the randomizing procedure. Three schools withdrew after randomization, leaving: 51 schools in the intervention group, with an average number of 49.6 students per school; and 43 schools in the control group, with an average number of 45.0 students per school (Figure 1). All year-7 students ($n = 4468$) were invited to participate. Students answered internet-based questionnaires in the classroom after a standardized instruction given by the teacher. Absentees were asked to answer questionnaires later, either at home or at school. Baseline was conducted in the autumn 2010, and follow-up was conducted in the spring 2011. This study reports the effectiveness of the intervention at follow-up as prespecified and registered in Current Controlled Trials, ISRCTN77415416.

The baseline survey was conducted at the beginning of year 7 and first follow-up at the end of year 7 after 1 year of intervention. The final baseline data file included 4161 students, response rate = 93.1%, and the follow-up data file included 3764 students, response rate = 84.9% of students invited to follow-up (Figure 1).The combined baseline-follow-up data file included 4041 students, as 120 students included in the baseline survey changed school and therefore did not attend the included classes at follow-up. Loss of these 120 students was completely at random, meaning that they could be left out without compromising ITT standards. Information from both baseline and follow-up was obtained from 3488 students; 553 students only completed the baseline questionnaire.

Analyses treated students' current smoking at follow-up as the dependent variable, and attending intervention vs control schools as the independent variable. The students' responses to: 'How often do you smoke?' were dichotomized into 'current smoking' (daily, weekly, monthly or more seldom) vs 'do not smoke'. The purpose of the X:IT intervention is to prevent smoking, meaning that all students can participate in the intervention no matter their smoking status at baseline. Consequently, the outcome measure in the effect analyses was 'current smoking' which included the incidence of smokers, experimenters and quitters from baseline to follow-up.

To increase precision of the effect estimate, we included the following covariates: sex, socioeconomic position (SEP), parental smoking and best friend's smoking, as these factors are strong predictors of smoking among adolescents.[10–13] Parental and best friend's smoking were measured by frequency of mother's, father's and best friend's smoking (every day + sometimes vs no). SEP was measured as family social class based on students' responses to two items on father's and mother's occupations. The students' information on parental occupation was coded from (I) high to (V) low social class, and (VI) indicating parents receiving social benefits. Family social class was determined by the highest ranking parent. Family social class was categorized into three SEP groups: high (I/II), medium (III/IV) and low (V/VI).[14]

Statistical methods

Analyses were based on available cases ($n = 3488$) and using an intention-to-treat (ITT) approach with multiple

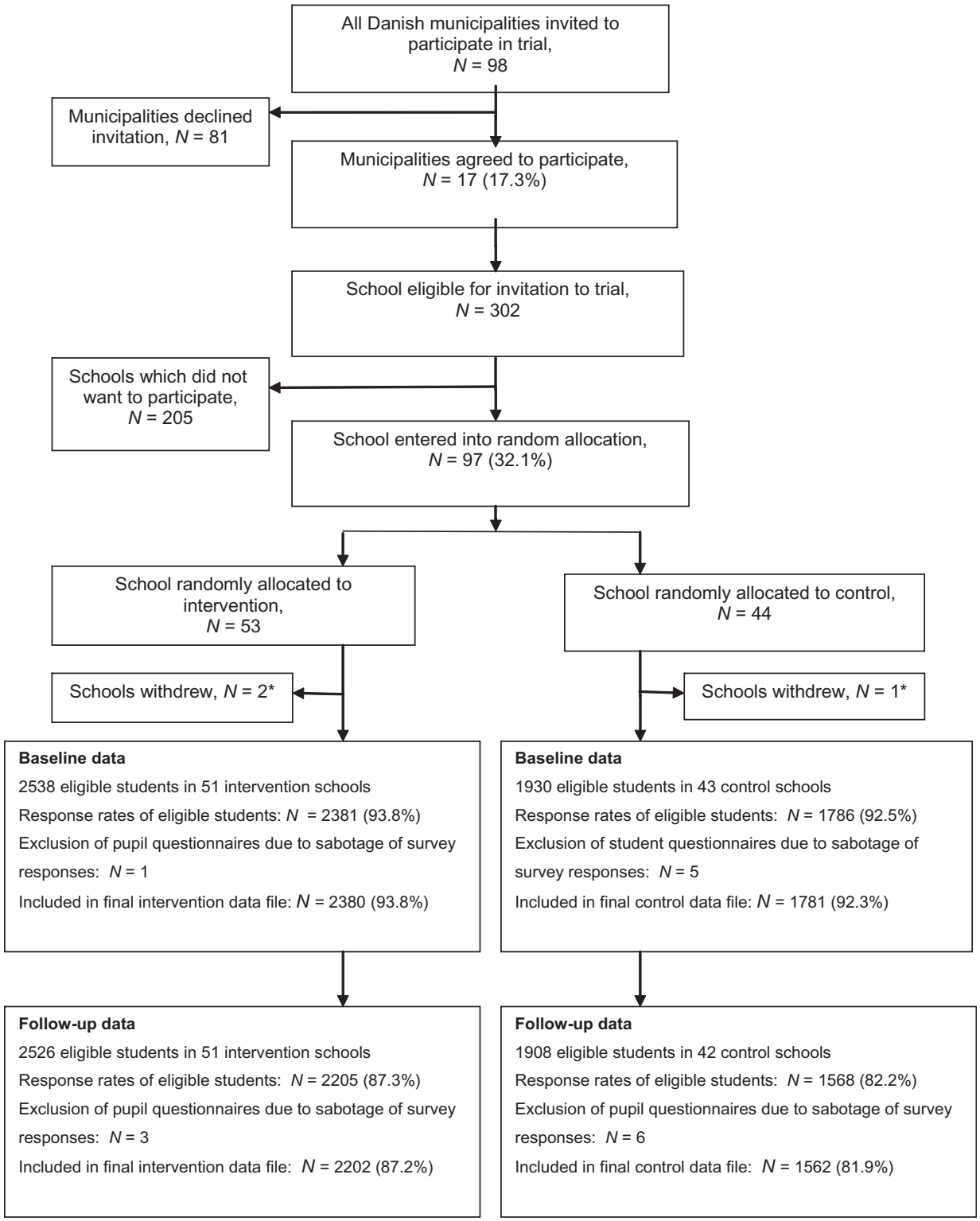

Figure 1. Flow diagram of recruitment, randomization and participation of municipalities, schools and students in the X:IT study.
*Schools withdrew due to lack of time or resources. For the control school it was decided at the municipal level, that all schools should participate. This was considered to be against the self-determination policy of the schools and they refused to participate.

imputation of missing data at follow-up ($n = 4041$). We used the PROC GLIMMIX procedure for all analyses.

The multiple imputation of missing data was based on variables from the baseline questionnaire expected to be associated with smoking, e.g. frequency of smoking, sex, ethnicity, SEP, intention to smoke, parental attitudes towards smoking and exposure to smoking at home and at school. We first imputed the baseline variables to ensure a monotone missing pattern in the baseline data and afterwards imputed the frequency of smoking at follow-up by the regression method (multistage imputation). Because of the intraclass correlation within schools and classes, we performed two rounds of 20 imputations as suggested by Graham (2012).[15] In the first round we included the school and class variables as fixed effects in the imputation model, thereby over-estimating the school and class effects on the standard errors. In the second round we did not include the school and class variables in the imputation effects, thereby under-estimating the school and class effects on the standard errors. Graham (2012) suggested that the analysis of these 40 imputed data sets gives a pragmatic evaluation of the standard error.[15] We used the PROC MI procedure. The 40 imputed data sets were analysed with a random-effect logistic regression model including the same variables as used in the available cases analysis, and the results were collected with the PROC MIANALYZE procedure. We used SAS version 9.3 for the analyses.

Power calculations were conducted according to Donner and Klar, 1996.[16] We used data from a large national representative cross-sectional study among 15-year-olds with similar measures, the Health Behaviour in School-aged Children study (HBSC),[1] to estimate the intra-class correlation for smoking weekly or more often among year 9 students, intra-class correlation (ICC) = 0.053. Assuming an ICC of 0.053 and a power of 80%, the X:IT trial should include 46 intervention schools and 46 control schools to detect a 25% reduction in the prevalence of smokers.

There is no formal institution for ethical assessment and approval of questionnaire-based population studies in Denmark, but we adhered to the national ethical standards for public health research involving schoolchildren. The invitations to schools included written information about the study for the head teachers, and each accepted that invitations could be sent to all students in the relevant classes. After randomization, the students and their parents were informed that participation was voluntary and that their information would be used for research purposes only and treated confidentially. Parents and students were informed of the possibility of withdrawing from the study and the data base at any point in time. The study is registered at the Danish Data Protection Agency, ref: 2010-54-0930.

Results

Table 1 presents the participants and non-participants at follow-up who answered the baseline questionnaire. There were no differences of participants between intervention and control schools in gender composition. At baseline, 4.7% of the 13-year-olds attending the intervention schools were 'current smokers' and among 13-year olds attending control schools the prevalence was 6.8%. The prevalence of pupils from high SEP families was higher in control schools, whereas the prevalence of pupils from low SEP families was similar across schools. More participating students from control schools had a best friend who smoked and more had a father who smoked. At follow-up, the prevalence of 'current smokers' was 7.9% and 10.7% at the intervention and control schools, respectively.

The number of students who did not answer the question on smoking at follow-up was 553 (13.7%), 264 at intervention schools and 289 at control schools. More students, who were smokers at baseline, were from the lowest SEP, whose best friend smoked and whose parents smoked were lost to follow-up.

Table 2 presents prevalence of the included variables among available cases and among imputed cases. Among the available cases, 6.4% of the students were 'current smokers' at baseline, whereas 7.9% were 'current smokers' at follow-up; 14.3% of the students missed information on smoking at follow-up. Among students with valid answers, 9.2% were 'current smokers'. In the adjusted available case analysis, the ICC for schools was 0.055 (estimate 0.1900, SE 0.1101), meaning that the variation between schools mirrors random variation. Imputing values on smoking resulted in an increase in the prevalence of 'current smokers' at follow-up to 10.0%, consequently decreasing the prevalence of non-smokers from 90.8% to 90.0%.

At follow-up, attending an intervention school showed an effect on 'current smoking', OR = 0.65 (0.48-0.88) among the available cases (Table 3, model 1). Precision of the effect estimate was increased by including sex, SEP, best friend's smoking and parental smoking in the model. The result was robust, OR = 0.70 (0.47-1.04) (Table 3, model 2). Among the imputed cases, the effect of attending an intervention school on 'current smoking' at follow-up was 0.67 (0.50-0.89), an effect which was strengthened when adjusting for sex, SEP, parental and best friend's smoking (Table 3, model 1 + 2).

Discussion

This paper presents the results of the controlled trial testing the effect of the multi-component intervention X:IT to prevent uptake of smoking. The analyses showed at least 30%

Table 1. Participants (P) and non-participants (non-P) at baseline and follow-up in the X:IT study, stratified by type of school: intervention schools and control schools. Numbers (percentages), $N = 4041$

	Intervention schools $N = 2318$			Control schools $N = 1723$		
	P $N = 2054$	Non-P $N = 264$	*P*-value	P $N = 1434$	Non-P $N = 289$	*P*-value
Sex						
• Boys	50.8% (1043)	53.4% (141)		51.1% (733)	51.9% (150)	
• Girls	49.2% (1011)	46.6% (123)	0.421	48.9% (701)	48.1% (139)	0.807
'Current smokers' at baseline						
• Yes	4.7% (97)	12.1% (32)		6.8% (97)	11.8% (34)	
• No	94.6% (1944)	87.9% (232)		92.9% (1332)	88.2% (255)	
Item missing	0.6% (13)	–	<0.001	0.4% (5)	–	0.009
'Current smokers' at 1 FU						
• Yes	7.9% (162)			10.7% (154)		
• No	91.4% (1877)			88.4% (1267)		
Item missing	0.7% (15)	100% (264)	–	0.9% (13)	100% (289)	<0.001
SEP						
• I-II	30.4% (625)	23.5% (62)		35.0% (502)	35.6% (103)	
• III-IV	42.7% (876)	40.5% (107)		39.8% (570)	33.6% (97)	
• V-VI	14.5% (298)	21.6% (57)		15.3% (220)	21.8% (63)	
Item missing	12.4% (255)	14.4% (38)	0.006	9.9% (142)	9.0% (26)	0.033
Best friend's smoking						
• Yes	4.9% (100)	10.6% (28)		6.2% (89)	9.0% (26)	
• No	76.4% (1570)	66.7% (176)		77.6% (1112)	74.1% (214)	
Item missing	18.7% (384)	22.7% (60)	<0.001	16.3% (233)	17.0% (49)	0.196
Father's smoking						
• Yes	30.0% (617)	39.8% (105)		29.0% (416)	32.9% (95)	
• No	58.0% (1191)	47.7% (126)		60.1% (862)	55.7% (161)	
Item missing	12.0% (246)	12.5% (33)	0.003	10.9% (156)	11.4% (33)	0.357
Mother's smoking						
• Yes	28.4% (583)	41.3% (109)		24.8% (355)	31.5% (91)	
• No	62.7% (1288)	46.6% (123)		66.0% (946)	60.6% (175)	
Item missing	8.9% (183)	12.1% (32)	<0.001	9.3% (133)	8.0% (23)	<0.001

1 FU, 1-year follow-up.

lower odds of smoking among students who attended intervention schools compared with students attending control schools. These results were robust to imputation of missing values and precision by adjustment for covariates. This is the first large-scale study of a school-based intervention to prevent adolescents' uptake of smoking in Denmark which shows a positive effect. Other studies carried out in Denmark showed no short-term effects.[3,4]

A systematic review of school-based programmes for smoking prevention concluded that there is some evidence that multi-component studies including social influence models show some positive effects in the short term, but that the amount of evidence is still too small.[2] A review by Thomas *et al.* (2013) concluded that effective interventions combined social competence training and social influence models.[17] The X:IT study is based on the social influence approach which among other things includes correcting adolescents' overestimation of smoking prevalence among adults and peers, increasing their awareness of influence from media, peers and family, and making a public commitment not to smoke. X:IT also includes elements of social competence training by including this subject in the curriculum and by practising refusal skills. Furthermore, X:IT is a multi-component programme which includes school policies on smoking and a community aspect: involvement of parents by making them co-sign a smoke-free contract and maintain a dialogue with their children on smoking. These elements have not been included in previous Danish interventions. This may explain the positive intervention effects of X:IT. The lack of effect in Denmark in the ESFA study, which was multi-component, was concluded to be due to a negative attitude towards smoking prevention activities among the Danish teachers. The X:IT study involved schools and teachers in the development of

Table 2. Descriptive information on the baseline cases, the available case data set and the data set with imputed values in the X:IT trial data

Baseline cases $N = 4041$		Available cases $N = 3488$	Imputed cases $N = 161\,640$
Gender			
• Boys	51.2%	51.2%	51.2%
• Girls	48.8%	48.8%	48.8%
'Current smokers' at baseline			
• Yes	6.4%	5.6%	6.5%
• No	93.1%	94.4%	93.5%
• Item missing	0.5%	(18)	–
'Current smokers' at 1 FU			
• Yes	7.9%	9.1%	10.0%
• No	77.9%	90.9%	90.0%
• Missing	14.2%	(28)	–
SEP			
• I-II	32.0%	36.4%	34.7%
• III-IV	40.8%	46.8%	47.1%
• V-VI	15.8%	16.8%	18.2%
• Missing	11.4%	(397)	–
Best friend's smoking			
• Yes	6.0%	6.6%	7.5%
• No	76.0%	93.4%	92.5%
• Item missing	18.0%	(617)	–
Father's smoking			
• Yes	30.5%	33.5%	33.2%
• No	57.9%	66.5%	66.9%
• Item missing	11.6%	(402)	–
Mother's smoking			
• Yes	28.2%	29.6%	30.6%
• No	62.7%	70.4%	69.4%
• Item missing	9.2%	(316)	–

1 FU, 1-year follow-up.

Table 3. OR (95% CI) for 'current smoking' at follow-up by intervention. Analyses of available cases and the imputed data set

	Model 1	Model 2
Available cases	$N = 3467$	$N = 2266$
Control school	1	1
Intervention school	0.65 (0.48-0.88)	0.70 (0.47-1.04)
Sex (girls vs boys)		0.87 (0.63-1.21)
SEP		
• I-II		1
• III-IV		1.43 (0.97-2.12)
• V-VI		1.22 (0.74-2.02)
Best friend's smoking		9.53 (6.26-14.5)
Father's smoking		1.71 (1.21-2.44)
Mother's smoking		2.55 (1.78-3.64)
Imputed data	$N = 4041$	$N = 4041$
Control school	1	1
Intervention school	0.67 (0.50-0.89)	0.61 (0.45-0.82)
Sex (girls vs. boys)		0.85 (0.68-1.07)
SEP		
• I-II		1
• III-IV		1.44 (1.08-1.91)
• V-VI		1.51 (1.08-2.11)
Best friend's smoking		1.97 (1.43-2.70)
Father's smoking		1.62 (1.26-2.08)
Mother's smoking		1.68 (1.21-2.33)

the project, which may have given the staff ownership of the project. Furthermore, in Denmark the public opinion toward smoke-free institutions has become increasingly positive since ESFA was conducted in 1998. Finally, X:IT was developed and implemented by the Danish Cancer Society. They have a positive reputation in Denmark and they have had resources to follow the schools carefully and conduct workshops before and during the interventions period, which also could influence implementation.

There are some limitations to the study. First, municipalities and schools were not randomly selected. All municipalities were invited and, among municipalities which agreed to participate, all schools were invited. This may result in selection bias, although the direction is unpredictable. The municipalities and especially the schools may have agreed to participate because they had resources and energy to involve in a comprehensive intervention study. These kinds of schools could be situated in more well-off areas of Denmark and may have fewer smokers. On the other hand, schools might realize that they do have problems with many children starting to smoke, and therefore get involved in the study to meet the need for smoking prevention. We conducted a smaller qualitative study involving five municipalities which declined participation, to examine why they declined. The main reason for municipalities not participating in the study was a common worry that schools in the municipality were overloaded with work. Moreover, some argued against random selection. They found it unethical to ask their schools to be randomly selected to intervention or control. Finally, some municipalities prioritized alternative health promotion initiatives. Thus, we have no reason to believe that motives for declining to participate were related to socio-demographic characteristics of the municipalities. In the Danish HBSC 2010 study, 8% of the 13-year-olds are current smokers, which is the same prevalence as in our study.[18] This indicates that schools in the X:IT study are representative of Danish schools.

Second, there was some attrition from baseline to follow-up, as 13.7% of the students were lost to follow-up. This drop-out seems to be related to both intervention assignment and smoking status at baseline, which bias the

results towards smoking prevalence rates being underestimated at follow-up. The optimum condition is to avoid attrition. We encouraged absent students to answer the questionnaire at home, but very few students used this opportunity. Another way of retaining absent students in future surveys could be to repeat the data collection another school day. We handled the attrition by using multiple imputation of missing values. The analyses showed that the associations between intervention assignment and smoking at follow-up were the same among available cases and in the imputed data. This may reflect that the attrition was rather small and therefore did not influence the results. Third, differences in baseline characteristics between intervention and control schools were observed on all included variables. After municipalities and schools voluntarily enrolled in the study, they were assigned to either the control or the intervention group by drawing lots. As this was a random procedure, the differences observed in baseline characteristics are probably derived by chance.

This study has several strengths. It is a large randomized controlled trial with low attrition. Outcomes, determinants and a range of covariates of smoking behaviour were carefully measured at baseline and follow-up. Data were based on students' self-reports. We regard self-reported data from the students as the best way to get insight into their lives and behaviours. Validation against biochemical measures indicates that questionnaires provide reliable prevalence estimates of adolescent smoking,[19–21] although these validation studies also indicate that some of the self-reported non-smokers actually might be smokers. This under-reporting of smoking status might result in an under-estimation of our associations, and this under-estimation may be larger among students at intervention schools due to the pressure such an intervention may represent. Finally, we used advanced statistical methods to take the clustering structure of the data and the attrition into account.[15,22]

Results from this study add to the evidence that randomized controlled trials of multi-component, school-based interventions based on the social influence approach may be effective in preventing adolescent smoking. We found a positive effect after a year of intervention. Whether this effect is maintained over time and after the students enter high school, remains to be examined. The literature indicates that studies which show short-term effects, and especially studies which include a community component, have the potential to show relatively high long-term effects as well.[23]

Smoking among peers was also in our study a strong predictor of adolescent smoking, as it is in almost all studies.[23,24] School-based studies target some of the peer groups, and students may have other significant peers outside school. Future studies should take this issue into account. Parental smoking was also strongly associated with adolescent smoking. Some countries in the ESFA study proactively offered parents smoking cessation courses,[3] but this might be considered highly controversial in Denmark. The X:IT study is not especially directed at students from lower social backgrounds, although it is well known that smoking prevalence is higher in these groups.[25,26] Research on socioeconomic differential effects of interventions on adolescent smoking is very sparse, as well as knowledge on which intervention components are most effective in this target group.[27,28]

This study does not take the fidelity of implementation into account. Durlak and DuPre (2008) state that studies with a positive effect will benefit from assessing implementation fidelity.[24] A positive effect may be due to an intervention which in practice is very different from what was intended. Conducting per protocol analyses, where effects are estimated for schools which implemented the interventions as intended, may lead to stronger effects. Therefore, knowing what aspects of the intervention were delivered and how well they were conducted is very important. Whether this is the case in the X:IT study needs to be investigated before final recommendation of the X:IT study to the Danish schools and municipalities.

Funding

This work was supported by Trygfonden [61110-1995]. The X:IT study is part of Centre for Intervention Research in Health Promotion and Disease Prevention, National Institute of Public Health, University of Southern Denmark, Øster Farimagsgade 5A, 1353 Copenhagen, Denmark. The Centre is funded by Trygfonden and the Danish Cancer Society.

Acknowledgements

The X:IT project group would like to thank all participating schools, students, parents, teachers and head teachers, as well as coordinators in the municipalities.

Conflict of interest: None declared.

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