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Short-Term Effects of a Randomized Computer-Based Out-of-School Smoking Prevention Trial Aimed at Elementary Schoolchildren[1]

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Background. **Smoking prevention programs usually run during school hours. In our study, an out-of-school program was developed consisting of a computer-tailored intervention aimed at the age group before school transition (11- to 12-year-old elementary schoolchildren). The aim of this study is to evaluate the additional effect of out-of-school smoking prevention.**

Methods. **One hundred fifty-six participating schools were randomly allocated to one of four research conditions: (a) the in-school condition, an existing seven-lesson program; (b) the out-of-school condition, three computer-tailored letters sent to the students' homes; (c) the in-school and out-of-school condition, a combined approach; (d) the control condition. Pretest and 6 months follow-up data on smoking initiation and continuation, and data on psychosocial variables were collected from 3,349 students.**

Results. **Control and out-of-school conditions differed regarding posttest smoking initiation (18.1 and 10.4%) and regarding posttest smoking continuation (23.5 and 13.1%). Multilevel logistic regression analyses showed positive effects regarding the out-of-school program. Significant effects were not found regarding the in-school program, nor did the combined approach show stronger effects than the single-method approaches.**

Conclusions. **The findings of this study suggest that smoking prevention trials for elementary schoolchildren can be effective when using out-of-school computer-tailored interventions.**

Key Words: **smoking prevention; smoking initiation; smoking continuation; elementary school; computer-tailored intervention; out-of-school; ASE model; RCT; The Netherlands.**

INTRODUCTION

In 1997, approximately 50% of the Dutch population ages 10–19 years had tried cigarettes; 22% were occasional or daily smokers [*1*]. Smoking Dutch youths had in many cases tried their first cigarette at the age of 11–12 years [*2*]. In The Netherlands, 27 to 36% of 11- to 12-year-old youths have smoked a cigarette [*1*]. Many authors state that smoking prevention programs should be aimed at preventing or delaying tobacco use [*3–6*], implying the need for effective prevention programs targeted at youngsters from the age of 11 years, when they are in the last grade of Dutch elementary schools. The focus of these programs should be to prevent youngsters from starting to smoke and to prevent those youngsters already experimenting from continuing with smoking.

In recent decades, several effective school-based smoking prevention programs for secondary school students were developed worldwide with a special emphasis on social influences [*7*], which represent the most important determinant of smoking initiation [*8–10*]. Similar school-based smoking prevention programs for elementary schools appeared less successful in reducing tobacco use [*11,12*]. Until now, prevention programs for 11- to 12-year-old in The Netherlands have never been evaluated.

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There are various advantages to the use of school settings for smoking prevention; they can reach wide audiences; health education is part of the curriculum in many countries; there are opportunities for interpersonal communication; and last, the school setting is optimal for evaluation studies [*13*]. A potential drawback of school-based smoking prevention programs is that their implementation is subject to limited time and untrained personnel [*11*]. To overcome the disadvantages of in-school interventions, and because of the laborious reach of youngsters who are disaffected with school and who may reject health messages from those whom they regard as unsympathetic authority figures [*14*], an out-of-school program was developed consisting of personalized tailored letters mailed to the students' homes. The idea of personal tailored letters originates in the United States [*15–18*], and has been further developed and tested for several years in The Netherlands [*19,20*]. The goal of this study is to describe the effectiveness of (a) a computer-based tailored out-of-school smoking prevention program; (b) an existing Dutch in-school smoking prevention program; and (c) a combined approach containing the in-school and out-of-school programs. The combined approach was included because research indicates that multiple prevention strategies produce better results for the reduction of tobacco use [*3,21*]. This report describes the effects of in-school and out-of-school smoking prevention on both smoking initiation among those who have never smoked and smoking continuation among those who ever smoked.

METHODS

Design and Procedure

During the spring of 1997, 414 schools from southern, eastern, and central parts of The Netherlands were approached with the assistance of local health departments. Eight local health departments, of which 54 existed in The Netherlands at that time, were asked to participate. Six of them agreed to assist in recruiting schools. The principals of all elementary schools within the local health department's region received an introductory letter, followed by a telephone call to discuss participation in the smoking prevention project. School principals in The Netherlands in 1997 were entitled to decide whether their students would participate in educational programs, provided that the school's representative advisory body, which consists of parents and staff, authorized this participation.

In June 1997, the 156 schools that finally approved participation were randomly assigned within regionally defined blocks to the in-school condition (I), out-of-school condition (O), in- and out-of-school condition (I + O), or control group condition (C). Teachers within the I and I + O conditions were trained by volunteers for instruction in the in-school program. The volunteers supplied the schools with the in-school materials, the pretest questionnaires, and the assessment procedure. Schools participating in the O and I + O conditions distributed consent forms to students' parents, as their children had been selected to receive educational materials sent to their home addresses. Twenty-one parents refused to participate. Schools allocated to the O and C conditions received the pretest questionnaires by mail in July 1997. A letter with instructions regarding the assessment procedure was included. All teachers were instructed to schedule 1 h for completing the pretest questionnaires in September 1997, to collect the questionnaires after students' completion at class level, to put them in a postage-paid envelope, and—having sealed them—to return the envelopes to the researchers.

Objective validation did not apply to this young age group because either the available methods detect only very recent—at most weekly—smoking or having family members who smoke induces elevated readings [*13,22*]. Self-reported results are accurate when confidentiality is assured and an identification coding system is used [*23–27*]. This procedure was used in our study. The front pages of both the pretest and the posttest questionnaires provided information about confidence. An identification code was used in the data file and the researchers replaced students' names before the data entry was done.

The in-school program was implemented from October to December. The out-of-school program started in November 1997 and ended early February 1998. The posttest was in mid-February 1998. At the same time, students in the treatment conditions and teachers who implemented the in-school program completed a process evaluation questionnaire. Table 1 presents a timeline following the sample from approach to follow-up.

The Interventions

The in-school intervention consisted of a school-based social influence program, called "Don't play with Fire," which was developed by the Dutch Foundation on Smoking and Health. This package included the essential components of successful social influence programs [*28*]. Instances of direct pressure were discussed and training in refusal skills was given. Awareness of the smoking behavior of other influencing people was enhanced and the short-term physical and social consequences of smoking were discussed. The package for this study contained a teacher manual and student workbook. The intervention consisted of seven lessons of between 45 and 60 min in length. Each lesson comprised a general explanation by the teacher, a classroom discussion, a workbook task, a preparation part, and a creative activity such as singing a song.

TABLE 1

Number of Schools from Approach to Follow-up

		I	O	I + O	C	Total
May 97	Approach					414
	Approval + Randomization	39	39	38	40	156
September 97	Pretest	36	36	37	34	143
September 97–February 98	Intervention					
February 98	Posttest	34	36	36	34	140

Note. I, in-school intervention; O, out-of-school intervention; I + O, in-school and out-of-school intervention; C, control.

The out-of-school intervention consisted of three tailored letters with smoking prevention messages, which were mailed to students' homes at 3-week intervals, sealed in envelopes addressed to the students. This procedure was used to ensure optimal confidentiality. The letters included the—aforementioned—essential components of successful social influence programs. The contents of the letters, however, were fine-tuned to individual characteristics. Through the means of the pretest questionnaire on attitudes, social norms, self-efficacy, smoking intention, and behavior, a database file was created containing personal information. Pilot testing and revision of concepts resulted in the creation of a message file. The content of the messages was based on the Social Inoculation Theory [*29*], which suggests that providing pupils with necessary information and skills makes them more resistant to pressure to smoke; the Theory of Reasoned Action [*30*], which assumes that behavior results from attitudes and social norms; and Bandura's Social Cognitive Theory [*31*], which describes the operationalization of modeling and self-efficacy. A computer program, developed by the Maastricht University, combined the database file with the message file. The core of the computer program consisted of decision rules that provided the translation of students' answers into personal messages. All successive messages were combined into a letter format. The letters were appended with a picture puzzle and several cartoons to increase attention and attractiveness, and to foster the elaboration and storage of knowledge [*32*]. In order to increase the elaboration of arguments not to smoke, a competition was included in which children could win one of two CD vouchers by answering the question: "I don't want that cigarette because. . . ." The first letter (eight versions) contained information regarding students' beliefs about smoking in general, the short-term consequences of smoking (such as irritated eyes, nausea, bad smell), and social consequences of smoking (such as feeling tough, looking mature). The second letter (32 versions) focused on the influence of the social environment on students' smoking behavior and intentions not to smoke in the future. It included a discussion of the smoking prevalence of the Dutch population. Boys and girls received different messages and cartoons. The third letter (two versions) was based on the score on a self-efficacy scale (low-high), described refusal techniques, and included an exercise about cigarette refusal. For instance, if a student indicated in the pretest questionnaire that s/he had doubts about his/her capacity to refuse cigarettes, the message selected by the computer program explained that the cigarette-refusal capacity would improve through carrying out a simulation exercise. Subsequently, an exercise was described in which students were stimulated to practice cigarette refusal step by step. A child already equipped with high self-efficacy received a message in which the capacities were reinforced, followed by the simulation exercise and an explanation that cigarette-refusal capacity would be improved through practice.

Measurement

Outcome measurement for students. An updated version of the ASE questionnaire (attitude–social influence–self-efficacy) was used to assess both the predictors of smoking—attitudinal beliefs, social influences, self-efficacy expectations, and intentions—and the outcome measure—smoking behavior [*27*,*33*,*34*]. Demographic variables like age, gender, religion, family composition, pocket money, and parents' work were included as predictors as well, although they are assumed to influence smoking via attitudes, social influences, and self-efficacy expectations.

The *attitude* was assessed using various concepts:

(a) Disadvantages of smoking, 11 items (Cronbach's $\alpha = 0.80$) ranging from "positive" (1) to "very negative toward smoking" (5), referring to nausea, coughing, irritated eyes, breathing problems, unwise, expense, bad for your health, disturbing others, causes passive smoking, regret, and bad smell;

(b) Advantages of smoking, 5 items ($\alpha = 0.63$) ranging from "negative" (1) to "very positive toward smoking" (5), referring to growing up, relieving boredom, relieving tension, tasting good, feeling tough;

(c) Social acceptance, 3 items ($\alpha = 0.75$) ranging from "very positive" (−3) to "very negative toward smoking" (3), referring to receiving attention from friends, acceptance by friends, and making contacts;

(d) Long-term physical consequences, 2 items (r = 0.57) ranging from "very positive" (−3) to "very negative toward smoking" (3), referring to risks of cancer and heart diseases.

Social influence was measured by four indices:

(a) Modeling "nuclear network," 4 items ranging from "smoking" (−2), "absent" (−1), and "not smoking" (0), referring to perceived smoking behavior of student's father, mother, brother/sister, and best friend;

(b) Modeling "diffuse network," 4 items ranging from "almost all are smokers" (−4) to, "almost none are smokers" (0), measuring the number of smoking friends, peers, teachers, and family members;

(c) Social norms, 6 items ranging from "very positive" (−3) to "very negative toward smoking" (3), measuring the perceived beliefs of student's father, mother, brother, sister, best friend, and friends;

(d) Social pressure, 10 items ranging from "very often" (−5) to "never" (0), measuring the perceived pressure to smoke from student's father, mother, brother, sister, best friend, friends, peers, teacher, family, and advertisements.

The *self-efficacy* scale consisted of 6 items (α = 0.91) ranging from "very uncertain" (−3) to "very certain" (3), each item referring to the student's expectations regarding refraining from smoking in different situations with increasing magnitude (when others smoke, when friends smoke, or when a cigarette is offered by someone, by parents or by friends, or when you are called a coward).

Intention to smoke was measured by one item ranging from "definitely do" (−3) to "definitely do not intent to smoke" (3).

Smoking behavior was based on self-reports, categorizing students as (1) Never-smokers: students who never smoked one (puff of a) cigarette; (2) Non-current smokers: students who have smoked in the past, but not during the past month; and (3) Current smokers: students who have smoked during the past month. For outcome effects on smoking initiation, we assessed the percentage of pretest never-smoking pupils (category 1) that indicated having initiated smoking at posttest (categories 2 and 3). For outcome effects on smoking continuation, we assessed the percentage of pretest ever smokers (categories 2 and 3) that indicated at posttest to have smoked during the past month (category 3).

Process measurement for students. The process evaluation assessed exposure and appreciation. Exposure to the in-school condition was measured by 35 questions on a two-point scale: "yes" (1) or "no" (0), assessing for each of the seven lessons whether students received an explanation, preparation, class discussion, workbook task, or creative activity at the end of the lesson. Appreciation of each lesson was evaluated from "very bad" (0) to "excellent" (10). Exposure to the out-of-school condition was recorded by asking if students had received each of the three letters: "yes" (1) or "no" (0); and by asking the extent to which they had read each letter: "completely" (4) to "not at all" (1). Students furthermore indicated how many times they read the letters. Appreciation of the letters was scored on a 4-point scale: "liked reading it very much" (4) to "not" (1) and students judged the visual appearance of the letters: "very nice" (4) to "not nice" (1). In order to find out how students perceived the essence of tailoring, that is, the personal approach, the degree of personal approach was assessed: "completely personally directed" (4) to "not personally directed" (1). Last, students could indicate which of their parents, siblings, or friends they had allowed to read the letters.

Process measurement for teachers. The teachers' questionnaire assessed the performance of the abovementioned five elements for the seven lessons on a 2-point scale; "yes" (1) or "no" (0). In addition, teachers indicated their appreciation of each lesson from "very bad" (0) to "excellent" (10).

Analyses

Students were nested within schools, and schools were randomly assigned to treatment conditions. Ignoring this nesting may lead to type I errors and too narrow confidence intervals for treatment effects [*35*]. Therefore, almost all analyses were carried out using multilevel regression modeling, i.e., the program MIXREG (linear regression) for continuous outcomes [*36*], and MIXOR (logistic regression) for dichotomous outcomes [*37*].

To check whether the randomization was successful, the treatment conditions were compared on age, gender, pretest ever smoking, and pretest psychosocial variables. Dropout was checked with attrition at posttest as outcome, and pretest demographic, pretest ever smoking, and psychosocial variables and treatment conditions as predictors.

Regarding the program effects, and in line with the two-way design of the study, the factor condition was dummy-coded, comparing main effects of the in-school and out-of-school interventions, plus their interaction. To test the in-school intervention effects, the factor in-school was computed: both in-school conditions (1) versus both not in-school conditions (0). To test the out-of-school intervention effects, the factor out-of-school was computed: both out-of-school conditions (1) versus both not out-of-school conditions (0). To test the additional effects of the in-school intervention on the out-of-school intervention, the interaction term "in-school × out-of-school" was included in the analyses.

Running large regression models with MIXOR might cause problems; therefore logistic regression was first

TABLE 2

Pretest Demographic and Psychosocial (with Ranges) Characteristics of Students by Treatment Condition

	I (N = 1,002) (%)	O (N = 871) (%)	I + O (N = 1,068) (%)	C (N = 793) (%)	Total (N = 3,734) (%)
Male	49	48	50	51	49
Ever smokers	34.0	35.0	36.3	38.4	35.8
	I (mean)	O (mean)	I + O (mean)	C (mean)	Total (mean)
Age	11.6	11.7	11.6	11.6	11.6
Attitude					
Disadvantages (11 → 55)	36.3	36.2	36.4	36.0	36.2
Advantages (5 → 25)	10.6	10.5	10.3	10.9	10.6
Social acceptance (−9 → 9)	0.2	0.3	0.4	0.3	0.3
Long-term consequences (−6 → 6)	2.5	2.6	2.5	2.7	2.6
Social influences					
Modeling "nuclear" (−8 → 0)	−0.9	−1.0	−0.9	−1.0	−1.0
Modeling "diffuse" (−16 → 0)	−3.1	−3.1	−2.9	−2.9	−3.0
Social norms (−18 → 18)	10.0	10.3	10.1	10.3	10.1
Pressure (−50 → 0)	−2.7	−2.4	−2.1	−2.6	−2.4
Self-efficacy (−18 → 18)	9.4	9.5	9.6	8.8	9.4
Intention (−3 → 3)	2.0	2.0	2.0	1.9	2.0

Note. I, in-school intervention; O, out-of-school intervention; I + O, in-school and out-of-school intervention; C, control.

conducted using SPSS 9.0 [*38*] to determine the final model containing significant covariates and interaction terms for the prediction of posttest ever and current smoking. The following strategy was used: posttest ever and current smoking were predicted from treatment factors (in-school, out-of-school, and their interaction). Furthermore, pretest psychosocial measures and demographic variables were entered as covariates, as previous research showed that these were predictors of smoking [*27*]. Nonsignificant predictors and interactions were deleted stepwise ($\alpha = 0.05$), with the restriction that predictors were never removed from the model if they were involved in some interaction term in the model. The two treatment factors (in-school, out-of-school) were never removed, as their effects are the focus of this study. The final models were entered in the multilevel analyses to test the intervention effects.

The results of the process measurements were first calculated for each student or teacher, averaging across letters and lessons, respectively, and subsequently for each school, averaging across students and teachers, respectively.

RESULTS

Sample Characteristics

The pretest questionnaires were returned by 143 schools (91.7%). The most frequent reason for nonparticipation was teachers' perceptions of inexperience of their students concerning smoking. Table 2 shows the pretest characteristics of the students in the four conditions. At pretest, no differences were found between the conditions with respect to demographic and psychosocial variables.

The posttest questionnaires were returned by 140 schools (I, n = 843 students; O, n = 807; I + O, n = 984; C, n = 715). Attrition, at student level, from pretest to posttest was 10.3%. Apart from three schools that did not return the questionnaires, absenteeism and difficulties with matching pretest and posttest data were the main causes of attrition. Logistic regression with attrition as dependent variable suggested that younger children were more likely to drop out compared to older students (OR = 0.82; 95% CI = 0.68–0.98). Students in the out-of-school conditions (O, I + O) were less likely (although not significantly) to drop out compared with students in the not out-of-school conditions (O, C) (OR = 0.80; 95% CI = 0.64–1.01).

Program Effects on Smoking

Changes in smoking prevalence at posttest are shown in Table 3. Regarding the pretest "never smoked" sample, smoking initiation was lowest in the out-of-school condition (10.4%) and highest in the control condition (18.1%). In the "ever smoked" sample, the lowest rates of smoking continuation was found in the out-of-school condition (13.1%) and the highest rates were in the control group (23.5%).

SPSS logistic regression analyses assessed modeling "nuclear network," pressure, attitude "disadvantages," intention, and age to be significant predictors of posttest smoking initiation. No significant interaction between the in-school and out-of-school factors was

TABLE 3

Smoking Initiation, Percentage with 95% Confidence Intervals among the Pretest Never Smokers and Smoking Continuation, Percentage with 95% Confidence Intervals, among the Pretest Ever Smokers, by Treatment Condition with Schools as Unit of Analysis

	I (N = 34)	O (N = 36)	I + O (N = 36)	C (N = 34)
Smoking initiation among pretest never smokers	14.9 (11.2–18.7)	10.4 (6.8–14.0)	15.2 (10.2–20.3)	18.1 (12.5–23.7)
Smoking continuing among pretest ever smokers	21.6 (15.4–27.8)	13.1 (9.2–19.3)	14.2 (7.4–18.9)	23.5 (17.0–30.1)

Note. I, in-school intervention; O, out-of-school intervention; I + O, in and out-of-school intervention; C, control group.

found. Table 4 presents the results of multilevel analyses of the final regression model regarding posttest smoking initiation. The out-of-school program tended to prevent pretest never smokers from initiating smoking at posttest ($P = 0.08$). Furthermore, students with a positive intention toward smoking, students who felt under stronger pressure to smoke, and older students had a significantly increased risk of being an initial smoker at posttest ($P < 0.05$). Students who perceived fewer disadvantages and who had more smokers in their immediate environment tended to be at higher risk of being an initial smoker at posttest ($P < 0.1$).

SPSS logistic regression analyses assessed modeling "nuclear network," pressure, attitude "disadvantages," attitude "advantages," intention, and age to be significant predictors of posttest smoking continuation. Table 5 shows the results of the multilevel analyses using the final regression model of posttest smoking continuation. No interaction between the treatment factors turned up. The out-of-school treatment was effective in preventing pretest ever smokers from continuing smoking ($P < 0.05$). The in-school treatment effect was not significant. Also, students who perceived more advantages of smoking were more likely to continue smoking at posttest ($P < 0.05$).

The school intraclass correlation coefficient reflects the proportion of unexplained outcome variance that was accounted for by the schools. With regard to posttest smoking initiation, the intraclass correlation was 0.07, and for posttest smoking continuation, 0.14, as obtained with the regression models in Tables 4 and 5, respectively.

Because attrition at posttest could be predicted by age and possibly also by treatment, selective dropout might influence the results. To check for this effect, analyses were repeated in two ways [*39*]. First, the missing data of dropouts were replaced by their pretest observation, the so-called "last observation carried forward" analyses. Second, dropouts were treated as smokers, "worst case" analyses. Both analyses were performed for all students (n = 3,734) and no relevant differences compared with the previous analyses were found.

Process Evaluation

Of the intervention schools, 91% (n = 64) returned the teacher process questionnaires. In five schools, the implementation of the school program was realized by two teachers, hence 69 questionnaires were returned. The response rates of the students' process questionnaire were identical to those from the outcome measurement questionnaire, as data collection was combined.

With respect to the in-school exposure, 87% of the teachers carried out the explanation activities of all

TABLE 4

Significant Predictors of Posttest Smoking Initiation Using the Final Regression Model

Pretest never smokers ($N_{students}$ = 2,130, $N_{schools}$ = 140)	Odds ratio	95% CI
Age (years)	1.31****	1.04–1.64
Pretest attitude disadvantages (11 → 55)	0.99*	0.97–1.01
Pretest modeling "nuclear" (−8 → 0)	0.93*	0.86–1.01
Pretest pressure (−50 → 0)	0.96***	0.93–0.99
Pretest intention (−3 → 3)	0.79****	0.71–0.88
In-school program (ref, not in-school program)	1.09	0.77–1.56
Out-of-school program (ref, not out-of-school program)	0.73*	0.50–1.03

* $P < 0.10$.
** $P < 0.05$.
*** $P < 0.01$.
**** $P < 0.001$.

TABLE 5

Significant Predictors of Posttest Smoking Continuation Using the Final Regression Model

Pretest ever smokers ($N_{students}$ = 1,190, $N_{schools}$ = 137)	Odds ratio	95% CI
Age (years)	1.01	0.77–1.32
Pretest attitude advantages (5 ← 25)	1.06**	1.01–1.12
Pretest attitude disadvantages (11 → 55)	0.99	0.97–1.01
Pretest modeling "nuclear" (−8 → 0)	0.96	0.87–1.04
Pretest pressure (−50 → 0)	1.01	0.99–1.03
Pretest intention (−3 → 3)	0.95	0.86–1.06
In-school program (ref, not in-school program)	0.86	0.57–1.30
Out-of-school program (ref, not out-of-school program)	0.65*	0.42–0.99

** $P < 0.05$.

seven lessons; the preparation activities were implemented by 72% of the teachers; 80% of the teachers used the class discussions; 87% used the workbook tasks; and the creative end-of-session activity was carried out by 55% of the teachers. Student responses were similar. Teachers rated the seven lessons with a grade of 7.5 (95% CI, 7.3–7.6) on a scale from bad (0) to excellent (10); students gave them a 7 (95% CI, 6.8–7.2).

With respect to the out-of-school exposure, 85% of the students received the letters, and the students read them, on average, 1.3 times; 70% read them (almost) completely; 51% liked reading the letters; and 48% liked the appearance of the letters. Furthermore, 59% of the students felt more or less personally addressed by the letters; 58% of the mothers, 41% of the fathers, 12% of students' siblings, and 6% of their friends were allowed to read the letters.

DISCUSSION

The goal of this study was to describe the effectiveness regarding smoking prevention for Dutch elementary schoolchildren (11–12 years old) of a computer-tailored out-of-school program, an in-school program, and a combined approach containing both in-school and out-of-school programs. The out-of-school program was effective in preventing ever smokers from continuing to smoke at posttest. Furthermore, pretest never smokers in the out-of-school program were better able to resist smoking initiation, although this effect had only borderline significance. No significant effects were found for the in-school program regarding smoking initiation and continuation. The combined approach did not result in additional effects. Smoking initiation in the combined approach was comparable with the in-school condition; more specifically, the out-of-school program seems only to have a preventive effect if no in-school program is run simultaneously.

Comparable tailored out-of-school interventions targeting elementary school children do not exist, as far as is known. However, interventions targeted at adult smokers, who received tailored letters with smoking cessation information, and tailored interventions aimed at promoting healthy fat, fruit, and vegetable intake also showed successful results [*20*,*40*].

Comparably disappointing results of in-school smoking prevention interventions—as found in our study—showed up in a British study [*12*], aimed at schoolchildren ages 11–12 years, although this study was not fully comparable. Schoolchildren in The Netherlands ages 11–12 years have not yet made the school transition, in contrast to British children of that age, who have already passed the stressful school transition, which is assumed to be a predictor of smoking [*13*].

Because the in-school and out-of-school interventions had a comparable theoretical basis (resistance skills, social norms and pressure, short- and long-term consequences of smoking), the tailoring aspect in the out-of-school program might have been an important predictor of success. The assessment of determinants of the target group and the educational fine-tuning of these determinants during the modification phase is regarded to be of great importance. Azjen and Fishbein concluded that if proper individually based instructions are included in educational sessions, a greater level of success can be expected [*30*,*41*]. The out-of-school intervention made use of computerized tailoring as a personalized fine-tuning instrument, and confirms their recommendation.

The out-of-school aspect can also be a reason for the positive effects. The letters were mailed to each student's home and a method of direct personal approach was used, which may result in higher personal involvement with the message and a stronger attitude–behavior relationship. More than half of the students (59%) in the out-of-school group felt personally addressed by the letters. The involvement rate would undoubtedly have improved if the information in the letters had been tuned to students' smoking behavior. However, this option was not used in this study in order to prevent arguments in the students' families. In-school programs lack individual fine-tuning, so lower personal involvement may result in a weaker attitude–behavior relationship [*42*]. Although the letters were addressed to the students themselves, more than half of the mothers and more than one-third of the fathers were allowed to read the letters. This spontaneous parental involvement might stimulate discussions at home about (not) smoking. At the age of 11–12 years, parental influence is still dominant, compared to older children where peers turn out to be more influential. This effective impact of parental influence was demonstrated in a family-linked program [*43*]. Our study shows that through the tailored letters, parental influence on smoking prevention can be activated.

A relationship was found between age, treatment, and posttest attrition. Attrition could mainly be attributed to three schools in the in-school and in-and-out-of-school conditions that did not send back the questionnaires, absenteeism, and difficulties with matching pretest and posttest data. Analyses including all dropouts, either as posttest smokers or with the same pretest smoking-scores, did not yield results very different from those obtained by excluding dropouts from the analyses.

A limitation of the study is that the timing of posttest measurement, 2 months after the end of the in-school intervention and almost immediately after the end of the out-of-school intervention, may have influenced the results of this study. The letters were fresh in students' memory and could therefore have been more effective

than the in-school intervention. However, another argument could be that substantial time is needed to be able to show significant effects, thus making the results of the computer-tailored letters notable. No validation of self-reported smoking behavior was used in this study, because objective measurements for 11- to 12-year-olds are unreliable. These measurements detect only very recent smoking. However, most smokers in our selected age group are experimenting with smoking. Furthermore, self-reports have been demonstrated to be accurate when confidentiality is assured and an identification coding system is used [*23–26*]. In this study these precautions were taken.

Process evaluation results of both in-school and out-of-school programs indicated that there is room for implementation improvements. Concerning the out-of-school intervention, the attractiveness with regard to content and appearance could be further refined. The results discussed in this study are based on short-term assessments. Elementary schoolchildren ages 11–12 years find themselves confronting some stressful life events, such as school transition and puberty. Smoking prevalence at 11–12 years is still low; however, literature indicates that a strong increase in smoking initiation is expected in the years that follow [*2*]. Therefore, long-term assessment should determine whether the tailored out-of-school program remains a promising instrument for the prevention of smoking initiation and continuation, and whether preventive capacities of the in-school program will become evident.

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