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Yan Wang  
*University of Maryland School of Medicine*

Carla L. Storr  
*Johns Hopkins Bloomberg School of Public Health*

Kerry M. Green  
*University of Maryland School of Public Health*

Shijun Zhu  
*University of Maryland School of Nursing*

Elizabeth A. Stuart  
*Johns Hopkins Bloomberg School of Public Health*

*See next page for additional authors*

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**Authors**

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## The Effect of Two Elementary School-based Prevention Interventions on Being Offered Tobacco and the Transition to Smoking

Yan Wang<sup>1</sup>, Carla L. Storr<sup>2,3</sup>, Kerry M. Green<sup>4</sup>, Shijun Zhu<sup>3</sup>, Elizabeth Stuart<sup>2</sup>, Sarah Lynne Landsman<sup>2</sup>, Katherine Clemans<sup>2</sup>, Hanno Petras<sup>2,5</sup>, Sheppard Kellam<sup>2</sup>, and Nicholas S. Ialongo<sup>2,\*</sup>

<sup>1</sup>Division of Growth and Nutrition, Department of Pediatrics, University of Maryland School of Medicine, 737 W. Lombard Street, Room 163, Baltimore, MD 21201

<sup>2</sup>Department of Mental Health, Johns Hopkins Bloomberg School of Public Health, Johns Hopkins University, 624 N. Broadway, 8th Fl., Baltimore, MD 21205

<sup>3</sup>Office of Research, University of Maryland School of Nursing, 655 West Lombard Street, Baltimore, MD 21201

<sup>4</sup>Department of Behavioral and Community Health, University of Maryland, College Park School of Public Health, SPH Building, Valley Drive, Room 2375, College Park, MD 20742

<sup>5</sup>JBS International, Inc. 5515 Security Lane, Suite 800, North Bethesda, MD 20852

### Abstract

**Aims**—This study sought to more precisely delineate the mechanisms by which two early elementary school-based, universal (i.e., applied to the entire population regardless of risk status) preventive interventions increased survival to first tobacco cigarette smoked. Specifically, we examined whether the interventions' effect on survival to first use was via the reduction of offers to smoke and/or through preventing the transition from first offer to smoking.

**Methods**—A total of 678 urban first-graders were assigned randomly to the classroom-centered (CC), or the family-school partnership (FSP), or a control classroom condition. Youth were followed annually until one year beyond their anticipated high school graduation (mean age ~18

\*Corresponding author: Dr. Nicholas S. Ialongo. Department of Mental Health, Johns Hopkins Bloomberg School of Public Health, 624 N. Broadway, 8th Fl., Baltimore, MD 21205, nialongo@jhsph.edu, Phone: (410) 955-0414, Fax: (410) 955-9088.

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### Contributors

Nicholas S. Ialongo and team of Johns Hopkins Center for Prevention and Early Intervention conducted the interventions and followed up the youth. All authors were involved in design of this specific study. Yan Wang reviewed the literature, conducted statistical analyses, and wrote the first draft. Nicholas S. Ialongo, Elizabeth A. Stuart, Carla L. Storr, Kerry M. Green and Hanno Petras advised on the statistical models and operationalization of the variables. Nicholas S. Ialongo and all other authors contributed to revisions of the paper. All authors contributed to and have approved the final manuscript.

### Conflict of Interest

No author on this manuscript has any personal or financial interest that would influence the results.

years). Discrete-time survival analyses on 628 youth evaluated the impact of the CC and FSP interventions on first tobacco offer and initial tobacco smoking once offered.

**Findings**—The risk of being offered tobacco was reduced among both CC and FSP intervention groups relative to the control group, although the reduction was only statistically significant for the CC intervention. Neither intervention condition reduced the transition to smoking once offered tobacco to smoke.

**Conclusion**—The CC intervention appeared to have its effect on survival to first cigarette smoked by delaying the first offer to smoke. Preventive interventions focused on refusal skills during the middle school years may be necessary to reduce the likelihood of the transition to smoking once offered.

### Keywords

smoking initiation; tobacco offer; intervention; aggression; gender

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## 1. Introduction

Prevention of tobacco use among youth remains an important public health issue as individuals who begin smoking in childhood or adolescence are more likely to become daily smokers and are less likely to quit smoking than individuals who begin smoking later (Breslau, 1996; D'Avanzo et al., 1994). Overwhelming evidence of the negative consequences of tobacco use exists, yet rates of smoking among US youth of various racial/ethnic backgrounds remain high (Johnston et al., 2011). Despite knowledge of the risk factors for youth smoking (Juon et al., 2002; Kandel et al., 2004; Melotti et al., 2011; Simons Morton, 2002; Storr et al., 2004; Wang et al., 2009), there is little research on the effects of prevention trials on transitions in stages of tobacco use onset. By understanding the risk for early exposure to tobacco and the transition to tobacco use, preventive interventions can better target these stages.

A two-stage developmental model for drug initiation has been proposed by Anthony and colleagues (Van Etten et al., 1997; Wagner and Anthony, 2002). Stage 1 consists of initial offers/opportunities, whereas Stage 2 involves the transition to use once given opportunities. The earliest involvement with drugs often begins in an environment of sharing or demonstration; thus, the first chance to try a drug is often an opportunistic offer and reflects the child or adolescent's environmental context (Wagner and Anthony, 2002). In contrast, transition to use once given an opportunity reflects the way an individual reacts to the drug exposure (Wagner and Anthony, 2002). Unique links to these stages have been reported in the literature for drugs other than tobacco (Benjet et al., 2007; Chen et al., 2005; Storr et al., 2011; Van Etten and Anthony, 1999; Van Etten et al., 1997). For example, male-female differences in rates of illegal drug use originate mainly from males having greater drug exposure opportunities than females (Van Etten and Anthony, 1999). Furthermore, youth with high levels of aggressive and delinquent behaviors seem to be more likely to be presented with an opportunity to buy illegal drugs (Rosenberg and Anthony, 2001).

Evidence suggests that universal preventive interventions that target everyone regardless of risk status can reduce the risk of later tobacco and drug use (National Institute on Drug Abuse, 2003; Redmond et al., 1999; Spoth et al., 2007; 2008; 2009). Our prior work described two first grade preventive interventions which sought to reduce early academic failure and aggressive-disruptive behavior in order to prevent later adverse educational and behavioral outcomes, including smoking (Storr et al., 2002; Wang et al., 2009). One intervention (Classroom-Centered, CC) focused on improving teachers' instructional and classroom behavior management practices as a way to reduce child aggressive-disruptive behavior and improve academic achievement. The second intervention (Family-School Partnership, FSP) sought to achieve these goals via improved parent behavior management skills and parent support for child cognitive development. The conceptual basis for both interventions represents an integration of life course, social fields theory (Kellam and Rebok, 1992) with Patterson and colleagues' (Patterson et al., 1992) theory of the development of antisocial behavior and drug use. Briefly, failure in meeting the developmental demands of academic achievement and authority acceptance in early elementary school is hypothesized to lead to drift into deviant peer groups in late childhood and early adolescence where antisocial behavior and drug use may be reinforced. Storr et al. (2002) reported on the impact of these two 1<sup>st</sup> grade prevention interventions on smoking through early adolescence and found both interventions served to delay the age at which youth first smoked tobacco. Wang et al. (2009) found that only the CC intervention resulted in delayed onset through late adolescence.

Importantly, Spoth et al. (2009) found that the effect of their universal preventive interventions on drug use through adolescence was via a reduction in drug use exposure. Accordingly, the present study seeks to determine whether the beneficial effects reported in Storr et al. (2002) and Wang et al. (2009) on smoking onset were through the reduction of the likelihood of being offered a cigarette. In an important extension of Spoth et al. (2009), we also examine whether the interventions' effects on survival to first use were via preventing the transition to smoking once offered tobacco.

Of note, universal intervention effects have been found to vary as a function of gender and pre-intervention levels of the targeted risk behaviors (Ialongo et al. 1999a; Ialongo et al., 2001). Since neither Storr et al. (2002) nor Wang et al. (2009) examined whether the beneficial intervention effects seen on survival to smoking initiation were moderated by gender or pre-intervention levels of aggressive-disruptive behavior, we examine both in this paper.

## 2. Methods

### 2.1 Research design

Data are from a universal preventive intervention trial that was conducted in first grade in nine inner city public schools (Ialongo et al., 1999a). The participants have subsequently been followed-up over 12 years. The Committee on Human Research of Johns Hopkins Bloomberg School of Public Health (JHSPH) approved this research.

**2.1.1 Randomized community prevention trial**—A randomized block design was employed, with schools serving as the blocking factor. Three first grade classrooms in each of nine, urban elementary schools were randomly assigned to one of the two intervention conditions or a control condition. Teachers and children were randomly assigned to intervention conditions with balancing for gender and kindergarten teacher ratings of academic readiness, attention-concentration problems, and aggressive-disruptive behavior when available.

**Independent Variable: Intervention Conditions:** The Classroom-Centered intervention (CC) targeted teachers' behavior management and academic instructional skills (Ialongo et al., 1999a). The percentage of the teacher's implementation of the CC intervention ranged from 30% to 78% (mean=60%, SD=17%). The Family School Partnership intervention (FSP) focused on improving parent-teacher interaction and support for child learning and prosocial behavior (Ialongo et al., 1999a). A major component of the FSP intervention was a series of 7 workshops offered to all parents of children in the FSP condition. These workshops focused on parenting practices relevant to child prosocial behavior and academic achievement. In terms of FSP levels of intervention participation, parents/caregivers attended on average four (SD=2.4, range 0–7) of the seven core parenting sessions with 13% attending none and 35% attending at least six sessions. Children randomly assigned to control classrooms had the benefit of the usual and customary curriculum and parent–teacher communication and interaction.

**2.1.2 Subsequent follow up**—Annual assessments of tobacco involvement started in 6th grade (~11 years of age) with written parent consent and child assent. This analysis also includes follow-up reports up to one year beyond anticipated high school graduation (~18 years of age). At age 18 the youth themselves were asked to provide written consent. As described in Wang et al. (2009), nearly 3/4 of the study participants provided data at 6 or more of the 8 possible assessments from grade 6 through one year beyond high school graduation. In addition, 85% of the first grade cohort participated in the final assessment time point—one year beyond the anticipated year of high school graduation and nearly 95% of the sample was assessed at least once from grade 6 through one year beyond high school graduation.

## 2.2. Sample

In the fall of 1993, 678 students entered first grade in one of nine participating public city schools. These students were representative of all children entering first grade in the city school district (mean age= ~ 6, over 80% African American, 66% received subsidized lunch). Written parental consent was obtained for 97% of the children to participate in the initial evaluation of the interventions in grades 1–3. Parents did not consent to their child's participation in the interventions, as the interventions were implemented universally at the level of the classroom in collaboration with the Baltimore Public City Schools. In grades 6–12, parental consent for their child's participation exceeded 80%. Thirty-seven youth without parental consent were never interviewed in grades 6–12 and were excluded. Thirteen participants had been offered tobacco prior to baseline assessments and were excluded. Except for a higher rate of family tobacco use among these 13 participants (38% versus

19%), no significant differences were found with regard to any other sample characteristics when compared to the remaining 628 youth that comprised the analytic sample of this study. As described in Ialongo et al. (1999), the intervention conditions were equivalent with respect to all potential confounders with the exception of one (Ialongo et al., 1999a). Students in the CC condition had slightly higher teacher ratings of aggressive-disruptive behavior than control youth (*CC, MN = 1.78, SD = 0.98; Control, MN = 1.50, SD = 0.80*).

## 2.3 Measures

### 2.3.1 Dependent Variables: Initial tobacco offer and first tobacco smoking

**once offered**—An audio computer-assisted self interview (ACASI) method (Murphy et al., 2000) was used to measure tobacco involvement. Initial tobacco offer was assessed by the question “Have you ever been offered a chance to try tobacco?” at each annual assessment. If “yes,” the participants were asked, “At what age were you first offered tobacco?” Participants’ age at first “yes” response was used to indicate age at initial tobacco exposure opportunity. First tobacco smoking was assessed by the question “Have you ever smoked tobacco, even just a puff?” at each assessment. If the answer was “yes,” the participants were asked, “At what age did you first try tobacco, even just a puff?” Participants’ age at first “yes” response was used to indicate age at first instance of tobacco smoking. All the participants who had ever responded “yes” to “ever smoked tobacco” also responded “yes” to “offered a chance to try tobacco” at some point. However, 74 (10.9%) reported a younger age at first instance of smoking than at first tobacco offer. For these 74 participants, we set the age of first offer equal to the age of first use. Sensitivity analyses by excluding this subset of youth were also performed.

**2.3.2 Potential cofounders**—Except for age at first tobacco offer, characteristics that might be potential confounders were measured in the Fall of Grade 1 prior to the implementation of the interventions. By confounders we mean characteristics at pre-test or baseline that might be correlated with both the dependent variables (i.e., the study outcomes) and the independent variable (i.e., intervention status). School records provided gender, age at entrance to first grade, race/ethnicity, and subsidized lunch status (“free/reduced-cost” or “paid by child”), which is a proxy for family income. There was only one Hispanic American participant, so ethnicity was categorized as “African American” and “European/Hispanic American.”

Several behavioral and family risk factors of tobacco smoking were taken into account as potential confounders. The Teacher Observation of Classroom Adaptation-Revised (TOCA-R) was used to obtain teacher-ratings of aggressive-disruptive behavior (Werthamer-Larsson et al., 1991). Eleven items inquired how often each student exhibited particular behaviors (e.g., breaking rules, fighting, lying and yelling at others) over the last 3 weeks. A mean score was calculated from responses on a 6-point Likert scale (1 = “almost never” to 6 = “almost always”). For exploratory models, aggressive-disruptive behavior was also categorized into high (highest tertile of mean scores), middle (middle tertile) and low (lowest tertile) levels (Kellam and Anthony, 1998).

The Baltimore How I Feel-Young Child Version, Child Report (BHIF-YC-C, Ialongo et al., 1999b) was used to assess depressive symptoms. Children reported the frequency of 16 symptoms (e.g., feeling sad) over the last two weeks (0 = Never, 1 = Sometimes, 2 = Almost Always). The mean score of the 16 items was calculated with higher scores indicating more symptoms (Cronbach's alpha = 0.77).

During an interview with the participating child's primary caregiver in the fall of first grade prior to the initiation of the interventions, household smoking was assessed via the question "Would you say heavy tobacco use affected your family in the last 12 months?" (National Center for Health Statistics, 1991). Response options were "not at all," "a little," "some," and "a lot." This variable was regrouped to reflect no family tobacco use (not at all) or family tobacco use (a little/some/a lot).

Parental monitoring was assessed using the Structured Parent Discipline Interview (Capaldi and Patterson, 1989) that consisted of four items (e.g., likelihood of being aware of their child's problem in school, 1= not at all likely to 4 = very likely, Cronbach's alpha = 0.67). The mean score of the four items was calculated. About three-fourths of the parents reported "very likely" for all items, suggesting high reported levels of parent monitoring. Note that we recoded scores on this scale so that higher scores reflected lower levels of parental monitoring.

## 2.4 Statistical analyses

Analyses used the child's intent to treat condition. Separate analyses were conducted for initial tobacco offer and transition to smoking once offered. A plot of the Kaplan–Meier (KM) estimate of the hazard function illustrated the change in risk of tobacco offer and transition to smoking over time by intervention status. Log-rank tests were used to assess whether the hazard function varied by intervention condition. To test our hypotheses, separate discrete-time survival analysis (DTSA; Muthén and Muthén, 1998–2010; Singer and Willett, 1993) compared 1) the hazard of the youth's being offered tobacco (time defined as years from birth until age at first tobacco offer with censoring of participants who were never offered tobacco at the age of their last assessment) and 2) the hazard of smoking tobacco onset conditioned on being offered (time defined as years between age first offered tobacco and age initiating tobacco smoking with censoring of nonsmokers at the age of their last assessment). Hazard ratio estimates (HR) were obtained via DTSA models that included potential confounders. Standard errors were adjusted using a sandwich estimator to account for the clustering of youth within classrooms. Likelihood Ratio Tests (LRTs) assessed the proportional hazard assumption across age (or time since the first offer) and models under the proportional hazard assumption fit better than models with the assumption relaxed.

A small percentage of participants had missing information on lunch status (1%), depressive symptoms (4%), parental monitoring (17%), or familial tobacco use (7%). Multiple imputation was used to avoid bias caused by list-wise deletion (Little and Rubin, 2002). The "ICE" command in STATA was used to generate five imputed datasets (Royston, 2004), which were then analyzed in Mplus.



### 3. Results

#### 3.1. Initial tobacco exposure opportunity

In terms of descriptive analyses, by one year beyond high school graduation (~18 years of age), 91% of the participating youth had been offered tobacco (median age at first offer was ~ 11, range = 6–18). The proportion of those being offered tobacco by intervention condition, gender, age, and level of aggressive-disruptive behavior can be found in Table 1.

With respect to the intervention impact analyses, the hazard of first offer peaked at about age 13 and dropped sharply afterwards (Figure 1). The hazard was consistently lower among the CC and FSP intervention conditions than the control group over time (log rank test  $p = 0.034$ ). HR estimates from the DTSA models indicated only the CC intervention significantly reduced the chance of being offered tobacco by age 18 (CC, adj. HR = 0.76, 95% CI: 0.62–0.94,  $p = 0.012$ ) after controlling for the potential sociodemographic, familial, and behavioral confounders in grade 1. The effect of the FSP intervention was in the hypothesized direction, but was not significant (Table 2). The chance of being offered tobacco was also found to be greater for males and for those receiving subsidized lunch.

Turning to our subgroup exploratory models, significant interactions were found between the level of aggressive-disruptive behavior in the fall of 1<sup>st</sup> grade and intervention status in association with tobacco offer in the DTSA models, whether aggressive-disruptive behavior was treated as a continuous variable ( $-2LL = 7.378$ ,  $df=2$ ,  $p = 0.025$ ) or a categorical variable ( $-2LL = 6.856$ ,  $df=2$ ,  $p = 0.033$ ). Among participants in the lowest tertile of pre-intervention aggressive-disruptive behavior, both interventions significantly reduced the chance of being offered tobacco ( $p < 0.05$ ). Among participants in the middle tertile of aggressive-disruptive behavior, the CC intervention marginally (adj. HR: 0.63, 95% CI: 0.37–1.06,  $p = 0.083$ ) reduced the chance of being offered tobacco. However, neither intervention reduced the chance of being offered tobacco among the youth in the highest pre-intervention tertile of aggressive-disruptive behavior.

Stratified analysis by gender and aggressive-disruptive behavior tertiles yielded intervention effects that were somewhat stronger among males than females within each of the aggressive-disruptive behavior tertiles (FSP, adj. HR = 0.46,  $p=0.014$  for males vs. adj. HR = 0.69,  $p=0.297$  for females in the low aggressive-behavior tertile; CC, adj. HR = 0.43,  $p=0.011$  for males vs. adj. HR = 0.96,  $p=0.902$  for females in the middle tertile).

#### 3.2. Tobacco smoking onset conditioned on having had an offer

Of the 572 participants who were offered tobacco, 434 (76%) reported that they had smoked tobacco at least once. As shown in Table 1, no significant differences were found in the proportion of ever smoking tobacco among the control (77.1%), CC (73.7%) and FSP (76.8%) intervention groups once tobacco was offered. In comparison to the youth who never smoked despite being offered, the smokers had higher pre-intervention levels of aggressive-disruptive behavior (1.69 vs. 1.48,  $p = 0.014$ ).

The median time of transition to use since first tobacco offer was 1 year (range=0–10 years). Figure 2 illustrates the hazard of transition was greatest within the first two years after the

offer and then gradually decreased. No difference was detected between the control and intervention (CC/FSP) groups ( $p = 0.498$ ) or among the three groups ( $p = 0.679$ ) via the log rank tests. Furthermore, DTSA models also found that neither intervention reduced the risk of smoking tobacco once it was offered before or after adjusting for the potential sociodemographic, familial, and behavioral confounders and age at first tobacco offer (Table 3). A higher risk of smoking was associated with more aggressive-disruptive behavior (adj. HR = 1.23, 95% CI: 1.10–1.37,  $p < 0.001$ ). In addition, the older the youth was when s/he was offered tobacco for the first time, the less likely it was that s/he initiated smoking (adj. HR = 0.93, 95% CI: 0.87–0.99,  $p = 0.019$ ).

Sub-group exploratory models suggested no significant interaction between intervention and pre-intervention levels of aggressive-disruptive behavior. After further stratifying by gender, the CC intervention significantly reduced the hazard of transition to use only among males within the lowest tertile of aggressive-disruptive behavior (adj. HR = 0.40, 95% CI = 0.22–0.73,  $p = 0.003$ ).

#### 4. Discussion

This study sought to more precisely delineate the mechanisms by which two early elementary school-based preventive interventions increased survival to first tobacco cigarette smoked in adolescence. Storr et al. (2002) reported that both the CC and FSP interventions increased survival to first tobacco cigarette smoked through early adolescence; whereas Wang et al. (2009) reported increased survival through late adolescence for the CC intervention. The results of the present study suggest that effects of these interventions were via their impact on reducing the likelihood of being offered a cigarette. No intervention effect was noted for the transition to smoking in the main effect analyses, although stratifying by pre-test level of aggressive-disruptive behavior and gender yielded a significant effect on the transition to use for the CC intervention among males in the lowest tertile of aggressive-disruptive behavior in the fall of first grade.

Our findings are consistent with Spoth et al. (2009), who found that their universal interventions in middle school reduced illegal drug use in adolescence via a “protective shield” of reduced exposure. However, in an important extension of Spoth et al. (2009), we also examined the impact of our interventions on transition to use once offered. This study appears to be the first to distinguish the two stages of earliest involvement with tobacco by evaluating whether universal preventive interventions are effective across both stages. Given the results of this study suggesting that early school-based preventive interventions like ours are more likely to have their impact on being offered tobacco, more work is necessary to identify the mechanisms by which early preventive interventions can reduce the likelihood of transition to use once offered. One potential area for future study is the refusal skills of those youth who transition to use once offered versus those who do not. Unfortunately, we can only recommend that future research address this issue since we did not assess refusal skills in the present study. Clearly, there may be other factors than refusal skills that influence the transition to use once offered, including sensation seeking (e.g., Yanovitzky, 2005).

This study found that over half of the youth have been offered tobacco by age 11 and the hazard of tobacco offer peaked at age 13, which supports the fielding of preventive interventions in the elementary school years. However, the combination of early elementary and complementary preventive intervention components in middle school focusing on intensive behavioral mentoring and refusal skill development might represent the optimal approach to preventing youth smoking, along with better enforcement of laws against retailers selling cigarettes to minors and fining adults who distribute tobacco to children and adolescents (Forster et al., 1998; Levy and Friend, 2000).

Our exploratory analyses yielded findings similar to those of Kellam and Anthony (1998). More specifically, the interventions were least effective in delaying first offers to use tobacco among youth who manifested relatively high first grade levels of aggressive-disruptive behavior. This makes sense in that universal preventive interventions are likely to be most effective with those who manifest mild to moderate levels of risk. More intensive indicated preventive interventions (e.g., Todd, 2008; Walker, 1996) coupled with universal interventions, such as those described here, may yield greater impact on those youth not only demonstrating higher levels of risk in terms of aggressive-disruptive behavior, but also low self-esteem and poor academic achievement—both of which have been linked to smoking (Carvajal and Granillo, 2006; Croghan et al., 2006).

It merits mention that our exploratory analyses revealed that males benefitted more than females. Ialongo et al. (1999a; 2001) also found greater preventive intervention impact for males for a wide range of behavioral and academic outcomes. This raises the question of whether early aggressive-disruptive behavior and poor academic achievement are relevant targets for females when it comes to not only preventing tobacco use, but negative outcomes in the behavioral and academic realms, generally. Thus, further study of gender differences in the pathways to tobacco use and other untoward outcomes in adolescence and young adulthood is in order.

This study also found other novel findings that might enlighten the future design of effective tobacco prevention strategies. Consistent with illegal drug use (Van Etten and Anthony, 1999), we found that males are more likely to be offered tobacco than females. However, males and females similarly accept the offer and transition to use. Also consistent with illegal drug research (Van Etten et al., 1997), the younger the age at which youth are first offered tobacco, the more likely that they are to accept the offer.

Several potential limitations merit attention. Contamination is a possibility since randomization was at the classroom versus the school level. However, given that the extensive and costly intervention materials and training could only be obtained from the research team, we believe it unlikely. The age at first tobacco involvement was self-reported and is subject to recall bias, but was minimized with annual assessments. The results should be replicated in other settings and populations as the sample included predominantly African American urban youth who attended public schools. However, considering the adverse health effects of tobacco smoking among minorities, this study still has important public health implications. The sample size limited the power in detecting significant interactions

between intervention status and other sample characteristics. In addition, measures of pre-intervention household tobacco use were relatively limited.

Notwithstanding the limitations, this research has several strengths relative to previous studies. As described earlier, it examined survival to first tobacco offer and transition to use, separately. These findings contribute to our understanding of the mechanisms by which early, school-based, universal preventive interventions reduce the risk for tobacco use. Given the sample represented all youth who entered first grade in the participating 9 elementary schools in 1993, selection biases associated with convenience samples were likely reduced.

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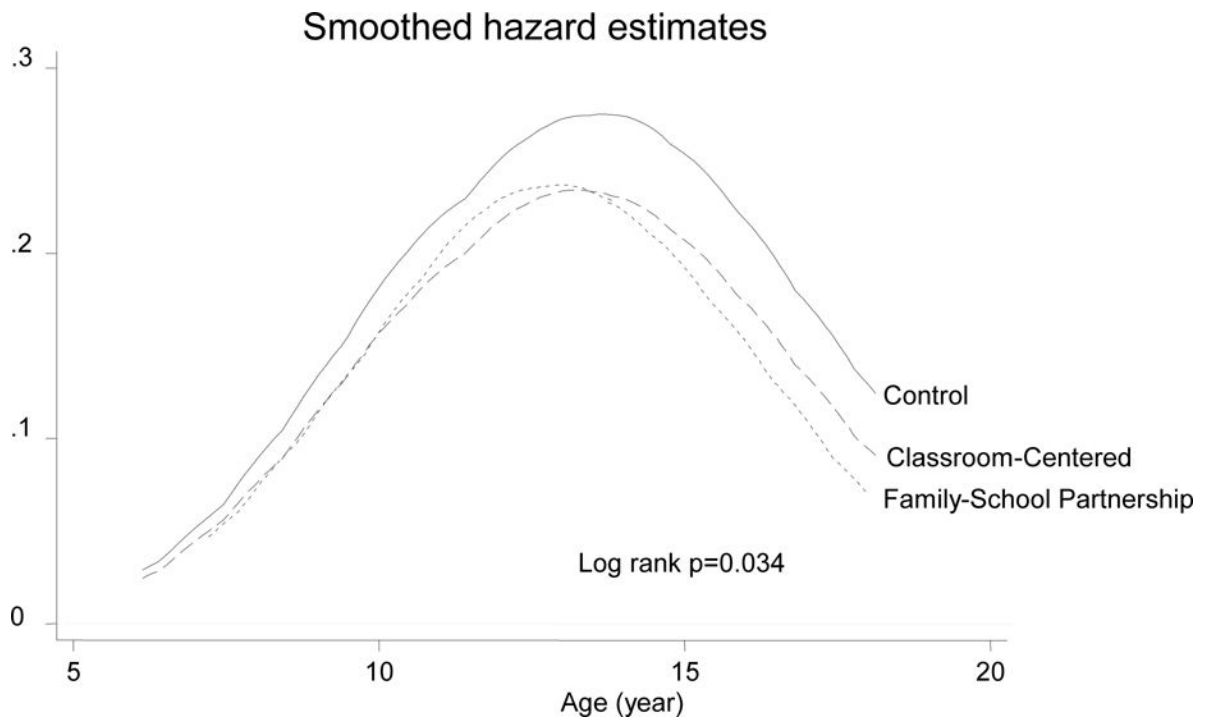
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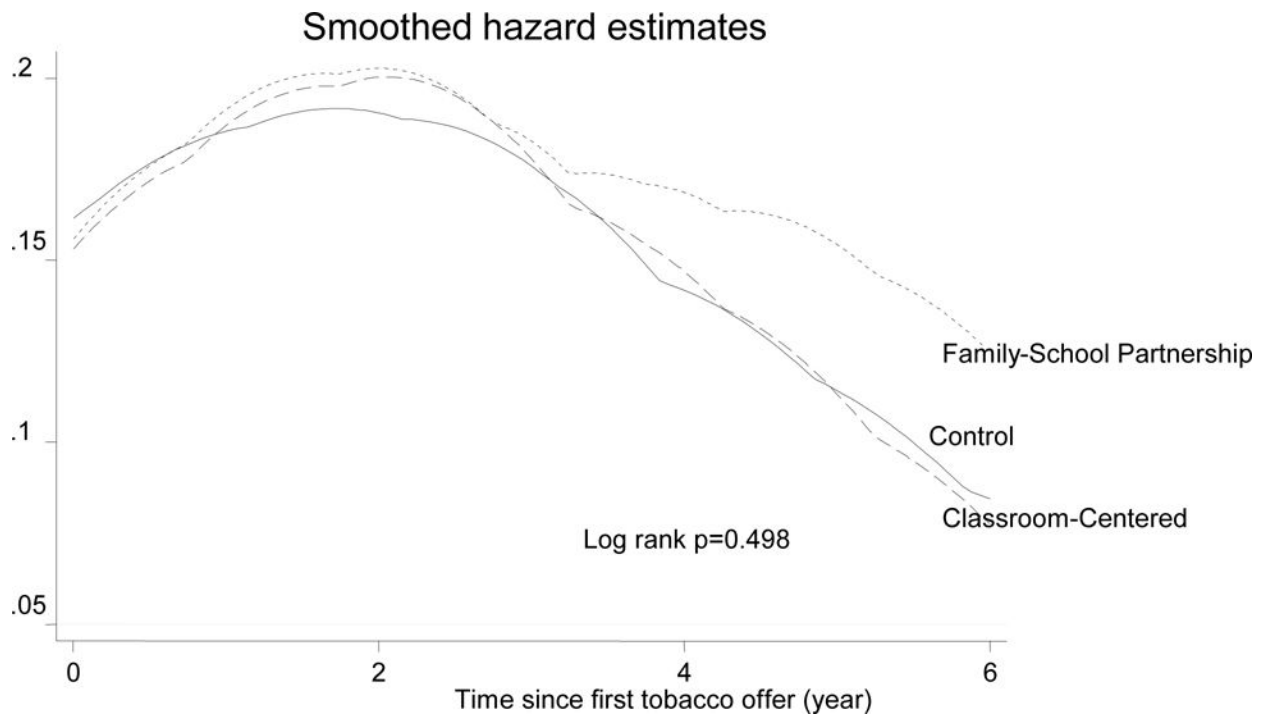
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**Figure 1.** Kaplan-Meier hazard probability of being offered tobacco by intervention status.



**Figure 2.** Kaplan-Meier hazard probability of transitioning to use once offered by intervention status.



Table 1

Distribution of potential intervention effect confounders with lifetime tobacco offer and tobacco smoking once offered

	Offered tobacco (n=628)				Used tobacco once offered (n=572)			
	Total	No (n=56)	Yes (n=572)	p-value	Total	No (n=138)	Yes (n=434)	p-value
<b>Intervention status, n(%)</b>								
Control	203 (32)	11 (5.4)	192(94.6)		192 (34)	44 (22.9)	148 (77.1)	
CC	211 (34)	21(10.0)	190(90.1)		190 (33)	50 (26.3)	140 (73.7)	
FSP	214 (34)	24(11.2)	190(88.8)	0.094	190 (33)	44 (23.2)	146 (76.8)	0.688
<b>Gender, n(%)</b>								
Female	291 (46)	36 (12.4)	255 (87.6)		255 (45)	65 (25.5)	190 (74.5)	
Male	337 (54)	20 (5.9)	317 (94.1)	0.005	317 (55)	73 (23.0)	244 (77.0)	0.494
<b>Age at first grade entry (yrs), mean(sd)</b>								
	6.23(0.36)	6.14(0.33)	6.24(0.36)	0.040	6.24(0.36)	6.21(0.29)	6.25(0.38)	0.262
<b>Ethnicity, n(%)</b>								
European	83 (13)	4 (5.0)	79(95.2)		79 (14)	13 (16.5)	66 (83.5)	
Black	545 (87)	52 (9.5)	493(90.5)	0.214	493 (86)	125 (25.4)	368 (74.7)	0.086
<b>Receipt of subsidized lunch, n(%)</b>								
No	191 (31)	22 (11.5)	169 (88.5)		169 (30)	48 (28.4)	121 (71.6)	
Yes	431 (69)	33 (7.7)	398 (92.3)	0.118	398 (70)	90 (22.6)	308 (77.4)	0.142
<b>Aggressive-disruptive behavior, mean(sd)</b>								
	1.62(0.85)	1.41(0.61)	1.64(0.87)	0.055	1.64(0.87)	1.48(0.78)	1.69(0.89)	0.014
<b>Depressive symptoms, mean(sd)</b>								
	0.81(0.35)	0.77(0.35)	0.82(0.35)	0.314	0.82(0.35)	0.85(0.34)	0.81(0.36)	0.280
<b>Parental monitoring, mean(sd)</b>								
	1.15(0.36)	1.18(0.30)	1.14(0.37)	0.457	1.14(0.37)	1.14(0.37)	1.14(0.37)	0.986
<b>Family tobacco use, n(%)</b>								
No	471 (81)	48 (10.2)	423 (89.8)		423 (80)	107 (25.3)	316 (74.7)	
Yes	114 (19)	6 (5.3)	108 (94.7)	0.147	108 (20)	22 (20.4)	86 (79.6)	0.287

Note "CC" indicates Classroom-center intervention and "FSP" indicates Family-School Partnership intervention. p value was for  $\chi^2$  or fisher exact test, whichever appropriate. Aggressive-disruptive behavior, depressive symptoms, parental monitoring and age at first grade entry are continuous variables in this table. Higher parental monitoring score indicates lower parental monitoring level. Pearson  $\chi^2(1) = 2.982$  P=0.084 for difference in proportion between CC and control; Pearson  $\chi^2(1) = 4.552$  P=0.033 for difference in proportion between FSP and control.

Table 2

Hazard ratio (HR) estimates of being offered tobacco for intervention and other sample characteristics (n=628).

Characteristics	Crude HR	95% CI	p-value	Adj. HR	95% CI	p-value
<b>Intervention status</b>						
Control	1.00	Ref.		1.00	Ref.	
CC	0.80	0.64–1.00	0.046	0.76	0.62–0.94	0.012
FSP	0.82	0.64–1.04	0.108	0.82	0.65–1.04	0.103
<b>Gender</b>						
Female	1.00	Ref.		1.00	Ref.	
Male	1.44	1.20–1.72	<0.001	1.43	1.19–1.72	<0.001
<b>Age at first grade entry (yrs)</b>						
<6	1.00	Ref.		1.00	Ref.	
>=6	1.10	0.90–1.35	0.353	1.01	0.82–1.25	0.926
<b>Ethnicity</b>						
European	1.00	Ref.		1.00	Ref.	
Black	0.94	0.78–1.14	0.544	0.95	0.74–1.22	0.667
<b>Receipt of subsidized lunch</b>						
No	1.00	Ref.		1.00	Ref.	
Yes	1.30	1.07–1.58	0.010	1.28	1.05–1.56	0.016
<b>Aggressive-disruptive behavior</b>						
Aggressive-disruptive behavior	1.11	1.00–1.23	0.051	1.07	0.95–1.20	0.287
<b>Depressive symptoms</b>						
Depressive symptoms	1.12	0.81–1.53	0.499	1.14	0.83–1.57	0.422
<b>Parental monitoring</b>						
Parental monitoring	1.20	0.87–1.67	0.271	1.23	0.86–1.74	0.256
<b>Family tobacco use</b>						
No	1.00	Ref.		1.00	Ref.	
Yes	1.13	0.89–1.43	0.308	1.13	0.86–1.48	0.386

Note: "CC" indicates Classroom-Center intervention and "FSP" indicates Family-School Partnership intervention. Adjusted HRs (adj. HRs) adjusted for all of the other variables listed in the table. Aggressive-disruptive behavior, depressive symptoms, parental monitoring and age at first grade entry are continuous variables in this table. Higher parental monitoring score indicates lower parental monitoring level.

**Table 3**  
Hazard ratio (HR) estimates of tobacco smoking once offered for intervention and other sample characteristics

Characteristics	Sample including youth with rapid transition				Sample excluding youth with rapid transition				
	Crude HR	95% CI	p-value	Adj. HR	95% CI	p-value	Adj. HR	95% CI	p-value
<b>Intervention status</b>									
Control	1.00	Ref.		1.00	Ref.		1.00	Ref.	
CC	0.93	0.74–1.17	0.534	0.88	0.71–1.10	0.252	0.94	0.75–1.18	0.589
FSP	1.05	0.81–1.37	0.722	0.95	0.79–1.14	0.592	1.02	0.78–1.34	0.866
<b>Gender</b>									
Female	1.00	Ref.		1.00	Ref.		1.00	Ref.	
Male	1.00	0.81–1.22	0.986	0.86	0.70–1.05	0.136	0.88	0.62–1.25	0.464
Age at first grade entry (yrs)	1.33	1.04–1.71	0.025	1.32	1.03–1.69	0.027	1.14	0.74–1.74	0.552
<b>Ethnicity</b>									
European	1.00	Ref.		1.00	Ref.		1.00	Ref.	
Black	0.69	0.46–1.05	0.083	0.73	0.48–1.09	0.125	0.82	0.60–1.14	0.242
<b>Receipt of subsidized lunch</b>									
No	1.00	Ref.		1.00	Ref.		1.00	Ref.	
Yes	1.22	0.98–1.52	0.072	1.19	0.97–1.47	0.092	1.11	0.88–1.39	0.381
<b>Aggressive-disruptive behavior</b>	1.20	1.07–1.3	0.002	1.23	1.10–1.37	<0.001	1.16	0.97–1.38	0.094
<b>Depressive symptoms</b>	0.81	0.56–1.18	0.267	0.76	0.54–1.08	0.125	0.84	0.51–1.40	0.503
<b>Parental monitoring</b>	1.07	0.80–1.42	0.666	1.08	0.79–1.47	0.633	1.10	0.74–1.65	0.640
<b>Family tobacco use</b>									
No	1.00	Ref.		1.00	Ref.		1.00	Ref.	
Yes	1.23	0.93–1.62	0.142	1.17	0.88–1.56	0.272	1.35	0.94–1.96	0.109
<b>Age at first tobacco offer (yrs)</b>	0.93	0.88–0.98	0.011	0.93	0.87–0.99	0.019	0.91	0.85–0.97	0.004

Note. "CC" indicates Classroom-Centered intervention and "FSP" indicates Family-School Partnership intervention. Adjusted HRs (adj. HR) adjusted for all of the other variables listed in the table. Aggressive-disruptive behavior, depressive symptoms, parental monitoring and age at first grade entry are continuous variables in this table. Higher parental monitoring score indicates lower parental monitoring level.