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Participant- and Study-Related Characteristics Predicting Treatment Completion and Study Retention in an Adolescent Smoking Cessation Trial

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A B S T R A C T

Purpose: To determine which factors predict smoking cessation treatment completion and retention among adolescents.

Methods: In a multisite, randomized, controlled trial, the efficacy of motivational interviewing was compared with structured brief advice for smoking cessation and reduction in adolescents ($n = 355$) aged 14–18 years (55% female, 45% black, 12% Hispanic). Treatment spanned 12 weeks, with follow-up assessments at 24 weeks. Treatment completion was defined as completion of all five counseling sessions. Study retention was defined as completing the 24-week assessment. Participant and study variables served as predictors of treatment completion and retention.

Results: In all, 79% of participants completed all five counseling sessions and the same percent completed the 24-week assessment. Black race, precontemplation stage to cut back, and shorter length of time between the baseline assessment and the first counseling session were significantly associated with treatment completion. For every 7.5-day delay in starting treatment after the baseline visit, there was a 50% decrease in the odds of completing all five treatment sessions. Retention at 24 weeks was predicted by black race, younger age, greater maternal education, expectations of graduating college, and structured brief advice intervention.

Conclusions: High rates of treatment completion and study retention can be achieved in a multisession, behavioral intervention for adolescent smoking cessation. Findings suggest that treatment should begin soon after the intake session to maximize treatment completion. Enhanced efforts to retain older adolescents and youth with lower academic goals and lower family income will be important in future studies.

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Cigarette use is the leading cause of preventable death in the United States, with the majority of adult smokers (80%) reporting having started before the age of 18 years [1]. One in five adolescents report being current smokers, a number still above the Healthy People 2010 goal of 16% [1,2]. Although more than half of

adolescents report attempting to quit smoking, only one in eight are successful [2,3].

Given the prevalence of smoking among adolescents and the associated health effects of continued smoking, it is critical to provide effective cessation interventions for youth. Although recommendations exist for healthcare providers to assist adolescents with tobacco cessation, these follow guidelines developed for adults [4,5]. Identifying effective interventions for adolescents remains challenging [6,7]. Recruitment and retention of a diverse sample continue to be obstacles when evaluating effective smoking cessation treatment in adolescents [6,8–12].

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Study retention rates are often not reported and when they are, have varied widely. In one review of 66 adolescent smoking cessation studies, 39 studies reported retention rates of 33%–100% (mean: 78%) [7]. The number of treatment sessions attended is less frequently reported, limiting interpretation of an apparent treatment effect [6,7]. In a recent trial of a telephone-delivered intervention for adolescents, 34.7% of participants did not complete any of the calls, whereas only 47.2% completed all the calls [13]. One study of the school-based Not-on-Tobacco program reported 45% of participants attended all the first five treatment sessions and only 34% attended all the last five sessions [14]. Additionally, although participants were more likely to attend if they had more positive perceptions of smoking, higher baseline smoking rate, higher baseline nicotine dependence, and were of white race, attendance was not associated with baseline motivation to quit, perceived stress, previous quit attempts, gender, or age. In another study, 72% of participants completed the multiple-session telephone counseling intervention, with lower baseline smoking frequency and later stage of change to quit being associated with higher treatment completion rates [10].

Factors associated with study retention may be different from those associated with treatment completion. A review of 55 youth smoking cessation studies identified no predictors of end-of-study retention [15]. However, individual and demographic variables were not assessed. Higher number of cigarettes smoked (for study enrollment) [15], level of nicotine dependence [16], and family income [17] have been associated with higher study retention, whereas gender, age, race, ethnicity, alcohol, and drug use have not [9]. Although lower educational aspirations have been found to be predictive of smoking in adolescents [18], this has not been examined with regard to study retention. Green et al reported that young adult smokers who were not college educated, had lower household income, and worked in service or blue-collar jobs had higher smoking rates, whereas those who were college educated were more likely to delay smoking initiation and to have attempted to quit [19]. In an adult smoking cessation study, lower income, but not education, was associated with increased attrition [17].

Literature on retention of minority youth in tobacco cessation programs is sparse. In a review of 95 public health trials, Yancey et al found few studies that focused on retention of minority participants separate from recruitment [20]. In a recent review, only 27 of 64 adolescent smoking cessation trials reported ethnicity of participants [21]. A smoking cessation trial for Latino adults reported lower depression and higher motivation to quit were predictive of intervention completion, whereas unemployment and having more friends who smoke predicted completion of follow-up [22]. Siddiqui et al reported a 35% higher dropout rate among black as compared with white participants in a smoking prevention trial, whereas dropout rates among Hispanic participants were similar to non-Hispanics [23]. Turner et al reported a significantly higher retention among white versus non-white participants [14].

The U.S. Public Health Service and the American Academy of Pediatrics recommend assessing tobacco use and providing a brief intervention at every visit [4,5]. In contrast, school-based interventions require adolescents to adhere to a schedule for treatment. Making substance abuse treatment available on demand, at the time services are sought, is based on shifting the user's motivation from the immediate rewards of substance use toward action to change their behavior [24]. It is not known what

effect immediate versus delayed initiation of a smoking intervention has on treatment completion and retention among adolescents. Adelman et al reported results of an eight-session smoking cessation program, in which participants randomized to begin the intervention within 2 weeks of enrollment completed more sessions than participants who began the intervention 3 months later (4.4 vs. 2.2 sessions) [25]. Pbert et al [26] conducted a smoking prevention and cessation intervention trial in pediatric primary care clinics in which counseling was initiated on the same day as the clinic visit followed by four follow-up telephone counseling sessions over 21 weeks. Treatment completion and study retention both exceeded 99% [26]. It is not known if the immediate initiation of treatment or other factors resulted in these impressive retention rates.

The aim of this study is to determine which participant- and study-related factors predict treatment completion and study retention. The results (1) may help inform researchers in designing interventions that will maximize treatment completion and study retention of a diverse sample of adolescents, and (2) provide researchers and clinicians with information about which adolescents may require additional strategies to engage them in smoking cessation treatment and follow-up.

Methods

The Pennsylvania Adolescent Smoking Study is a multisite, randomized controlled trial comparing motivational interviewing (MI) with structured brief advice (SBA) for enhancing smoking cessation and reduction among adolescents who smoke. Participants in both assignments received five individual counseling sessions over 12 weeks and completed a follow-up assessment at 24 weeks from baseline. Primary outcomes are treatment completion, defined as completion of all five counseling sessions, and study retention, defined as completion of the 24-week assessment.

Recruitment was conducted in three urban centers in Pennsylvania (Philadelphia, Pittsburgh, and Allentown). Participants were actively recruited between October 2007 and November 2008 in hospital- and community-based medical clinics/practices, emergency departments, and schools. Participants were also recruited through friend/peer referrals, bus advertising, Facebook advertising, and flyers posted in medical settings, schools, community centers, and public pools.

Eligibility criteria included age ≥ 14 and < 19 years and self-report of smoking at least one cigarette during the past 30 days and at least 100 in lifetime. Adolescents were excluded if cognitive impairment or lack of English language proficiency posed barriers to informed consent, assent, or treatment. This study was approved by the institutional review boards of the participating institutions. Participants aged < 18 years required parental consent in addition to participant assent. Parental consent forms were translated into Spanish, so that parents' English proficiency did not pose a barrier to participation. Participants were compensated for travel (\$5 for each on-site session attended), time spent completing assessments before the five counseling sessions (\$25 each), two interval assessments (\$25 each), and \$50 for the 24-week assessment. Assessment visits typically lasted 45 minutes.

Although financial incentives were used to maximize retention, it should be noted that participants were not compensated for attending treatment sessions, but were compensated for completing assessments. Participants could choose to leave

without attending treatment sessions. Compensation was based on the wage compensation model [27], with the final payment being higher to encourage completion of the 24-week assessment. In addition, retention efforts included multiple reminder calls, consistent research staff, and flexible scheduling. Nine participants withdrew from the study and 65 were lost to follow-up (could not be contacted).

Measures

Time line follow-back. Time line follow-back interview method, developed to assess alcohol consumption [28] and adapted for smoking [29], was used to assess cigarette smoking (i.e., quantity and frequency), alcohol, and drug use during the 90 days before the baseline interview and at all subsequent meetings. The time line follow-back interview was administered before randomization by on-site research staff and subsequently through phone by an interviewer blinded to treatment assignment.

Demographics. Demographics (gender, race, ethnicity, participant expectations to graduate from college, parents' level of education) were assessed with an interviewer-administered questionnaire created for this project. Parental education was assessed by adolescent's report, which has been shown to be a fair indicator of socioeconomic status [30].

Stages of change to cut back/quit. Stages of change to cut back/quit were assessed with the Staging to Assess Readiness to Cut Back and Quit Smoking self-report questionnaire, created in conjunction with Carlo DiClemente, based on the stages of change theory [31]. Precontemplation stage of change to cut back/quit was defined as "I am not thinking at all about cutting back (quitting) on the number of cigarettes I smoke right now." All other stages (contemplation, preparation, action, and maintenance) were combined from the remaining response selections.

Nicotine dependence. Nicotine dependence was assessed with the modified Fagerstrom Tolerance Questionnaire (mFTQ) [32]. The mFTQ is a 7-item measure designed to assess adolescent nicotine dependence (scoring range: 0–9; score of 0–2 is "no nicotine dependence," 3–5 is "moderate nicotine dependence," and 6–9 is "substantial nicotine dependence") [33]. The mFTQ has demonstrated adequate reliability and validity [32,34].

Motivation to cut back/quit. Motivation to cut back/quit was assessed using the Importance, Confidence, and Readiness self-report rulers that were adapted for this study [35]. Two scores (range: 0–30) were developed; one for cutting back and one for quitting. Two separate analyses were run for quitting and cutting back and they each clustered together under a single factor, as expected. Cronbach's coefficient alphas were acceptable (motivation to cut back $\alpha = .67$, motivation to quit $\alpha = .70$).

Smoking cessation treatment

Participants were randomized to receive either MI or SBA. Randomization was stratified on readiness to change and dichotomized on precontemplation versus all other stages. MI is a brief, client-centered, therapeutic style intended to reduce harmful behaviors through targeting and advancing the individual's specific stage of readiness to change by developing the discrepancy between current behavior and future goals, values, and beliefs

[36]. SBA is a scripted, brief smoking cessation intervention based on the U.S. Department of Health and Human Services Public Health Service-sponsored Clinical Practice Guideline [5].

Data analysis

All analyses were conducted using SAS/STAT (Statistical Analysis System) version 9.2 [37]. For treatment completion, the outcome was a binary variable representing completion of all five sessions or less than all five. Retention at 24 weeks was assessed with one binary variable representing completing the assessment or not. Bivariate associations were evaluated using χ^2 and t -test analyses. For categorical comparisons, a χ^2 analysis was used. For associations with continuous characteristics, t -tests were used. In examining treatment completion, variables were selected for inclusion in the multivariate model if their association had a probability value $p \leq .25$ [38]. Retention variables were selected for inclusion in the multivariate logistic regression analysis model if the p values in the bivariate analysis were $\leq .25$ [38]. Additional analysis was performed on associations with site and race at 24 weeks using cross-tabulations and analysis of variance.

Results

Table 1 presents sample characteristics. The study sample was diverse, with adolescents recruited fairly evenly from three geographically distinct urban areas, with 55% female, 45% black, and 12% Hispanic participants. Participants smoked a mean of one-half pack of cigarettes per day and were moderately nicotine-dependent (mean mFTQ score = 4.26). The majority of participants were beyond the precontemplation stage of change to quit (73%) or cut back (80%). Socioeconomic status of participants was diverse, as measured by mother's and father's education (41% with mothers and 54% with fathers with high school education or less). In addition, participants were engaged in significant levels of other substance use (77% reported use of alcohol and 67% reported use of marijuana in the past 90 days).

Overall, the percentage of participants completing treatment, as defined by completion of all five treatment sessions of either MI or SBA, was high (79%), as was the percentage of participants retained at 24-week follow-up (79%). Of the 76 participants who did not complete five sessions, 14 did not complete any sessions, 43 completed one to three sessions, and 19 completed four sessions. Although completion rates varied between sites (72% Allentown, 74% Pittsburgh, and 91% Philadelphia), this did not reach statistical significance in the multivariate analysis.

Bivariate and multivariate associations with treatment completion

Table 2 presents bivariate associations between treatment completion and participant characteristics. The following eight variables met criteria for inclusion: race ($\chi^2_{(2)} = 14.92, p = .001$), intervention assignment ($\chi^2_{(1)} = 2.95, p = .09$), site ($\chi^2_{(2)} = 15.50, p = .0004$), stage of change to cut back ($\chi^2_{(1)} = 6.12, p = .01$), age ($t_{(353)} = 1.42, p = .16$), number of cigarettes smoked in the past 30 days ($t_{(353)} = 1.57, p = .12$), nicotine dependence ($t_{(96)} = 1.24, p = .22$), and days between baseline and session 1 ($t_{(76)} = 4.97, p < .0001$), the latter two results based on unequal sample t tests as equality of variance were rejected.

Table 3 presents multivariate logistic regression predictors of treatment completion. The continuous variable "days between

Table 1
General sample characteristics (N = 356)

Variable	Number (%)
Gender	
Female	195 (55%)
Male	160 (45%)
Race	
Black	159 (45%)
White	143 (40%)
Other	52 (15%)
Ethnicity	
Hispanic	41 (12%)
Non-Hispanic	313 (88%)
Intervention assignment	
MI	177 (50%)
SBA	178 (50%)
Recruitment source	
Friends and family	155 (44%)
Adolescent medicine/other medical setting	101 (28%)
Advertisements	60 (17%)
School setting	23 (6%)
Other or multiple sources	16 (5%)
Site	
Philadelphia	114 (32%)
Pittsburgh	131 (37%)
Allentown	111 (31%)
Treatment sessions completed	
=5 sessions complete	280 (79%)
<5 sessions complete	75 (21%)
Alcohol use in past 90 days	
Yes	271 (77%)
No	79 (23%)
Marijuana use in past 90 days	
Yes	236 (67%)
No	114 (33%)
Mother's education	
≤High school education	136 (41%)
>High school education	193 (59%)
Father's education	
≤High school education	134 (54%)
>High school education	112 (46%)
Household member smoking	
Yes	121 (37%)
No	210 (63%)
Plans to graduate from college	
Yes	318 (90%)
No	35 (10%)
Stage of change to cut back	
Precontemplation	69 (20%)
All other stages ^a	283 (80%)
Stage of change to quit	
Precontemplation	95 (27%)
All other stages ^a	260 (73%)
	Mean (SD)
Age (years)	17.02 (1.17)
Cigarettes smoked per day (average for past 30 days) ^b	10.30 (8.68)
Nicotine dependence (mFTQ)	4.26 (1.83)
Motivation to cut back	17.79 (6.99)
Motivation to quit	15.14 (7.66)
Days between baseline and session 1	11.59 (14.92)

Sample sizes for each variable may differ because of missing data.

^a All other stages include contemplation, preparation, action, and maintenance.

^b Range of cigarettes smoked per day was 1–89.

baseline and session one" had a significant effect on treatment completion. Specifically, one-half standard deviation (SD = 14.92) increase in days between baseline and session 1 was associated with a 49% decrease (OR = .51, 95% CI = .38, .68) in the odds of completing treatment. Black adolescents were more than

two times more likely to attend all five treatment sessions as compared with white adolescents (OR = 2.58, 95% CI = 1.07, 6.23). Adolescents in the precontemplation stage of cutting back were more than two times more likely to complete all the treatment sessions as compared with adolescents in other stages (OR = 2.66, 95% CI = 1.04, 6.82).

Bivariate and multivariate associations with retention at 24 weeks

Table 4 summarizes bivariate associations with study retention. Participants receiving SBA were more likely to be retained (87%) than those receiving MI (73%), $\chi^2_{(1)} = 6.97, p = .01$. Black participants had higher retention rates (85%) than white (76%) or other (71%) participants, $\chi^2_{(2)} = 6.33, p = .04$. Having a mother with at least a high school education, $\chi^2_{(1)} = 4.87, p = .03$; having expectations to graduate from college, $\chi^2_{(1)} = 8.50, p = .004$; and younger age also positively affected study retention. Participants retained at 24 weeks were younger (M = 16.93 years, SD = 1.18) than those not retained (M = 17.34 years, SD = 1.08), $t_{(353)} = 2.67, p = .01$.

Multivariate logistic regression analysis results for retention at 24 weeks are presented in Table 5. Several variables were associated with study retention. Black adolescents were more than two times more likely to be retained than white adolescents (OR = 2.32, 95% CI = 1.01, 5.33). Each 1-year increase in participant age was associated with a 35% decrease (OR = .65, 95% CI = .49, .88) in the odds of retention. Having a mother with a high school education or less (OR = .48, 95% CI = .26, .86) reduced the odds of retention by half. Adolescents with expectations of graduating from college were two and one-half times more likely to be retained than those without this expectation (OR = 2.46, 95% CI = 1.03, 5.87). Adolescents who received MI were half as likely to be retained at the 24-week follow-up as adolescents who received SBA (OR = .51, CI = .28, .91).

Additional analysis was performed on associations with site and race at 24 weeks using cross-tabulations and analysis of variance. There were no significant associations with site, but black race was significantly associated with lower mFTQ scores at baseline as compared with white or other race participants.

Discussion

The present study sought to identify key predictors of adolescent smoking cessation treatment completion and study retention. Black race, precontemplation stage of change to cut back on smoking, and shorter length of time between the baseline appointment and the first treatment session were associated with higher treatment completion. Variables such as black race, younger age, maternal education greater than high school, participant expectations of graduating college, and SBA intervention assignment predicted study retention.

Time between baseline assessment and the first treatment session showed the greatest effect on treatment completion, suggesting that early initiation of treatment may result in more successful engagement of youth in smoking cessation interventions. Completion of treatment in a research study is critical for analysis of dose effect. The present study adds to the literature by quantifying decrements in treatment completion attributable to delay in starting treatment. Future adolescent tobacco cessation researchers, as well as clinicians, should consider treatment initiation as soon as possible after enrollment. Additional research on the effect of treatment initiation delays is warranted.

Table 2
Treatment completion: Bivariate statistics for model variables comparing adolescents completing and not completing the treatment

Variable	Completed treatment (%) n = 280 (79)	Not completing treatment (%) n = 76 (21)	Bivariate statistics ^a	p
Gender			$\chi^2_{(1)} = .22$	.64
Female	152 (78)	43 (22)		
Male	128 (80)	32 (20)		
Race			$\chi^2_{(2)} = 14.92$	.001
Black	139 (87)	20 (13)		
White	99 (69)	44 (31)		
Other	41 (79)	11 (21)		
Ethnicity			$\chi^2_{(1)} = .47$	.49
Hispanic	34 (83)	7 (17)		
Non-Hispanic	245 (78)	68 (22)		
Intervention assignment			$\chi^2_{(1)} = 2.95$	.09
MI	133 (75)	44 (25)		
SBA	147 (83)	31 (17)		
Recruitment source			$\chi^2_{(4)} = 1.32$	.86
Friends and family	123 (80)	32 (20)		
Adolescent medicine/other medical setting	78 (77)	23 (23)		
Advertisements	46 (77)	14 (23)		
School setting	20 (87)	3 (13)		
Other or multiple source	13 (81)	3 (19)		
Site			$\chi^2_{(2)} = 15.50$	.0004
Philadelphia	104 (91)	10 (9)		
Pittsburgh	96 (74)	34 (26)		
Allentown	80 (72)	31 (28)		
Stage of change to cut back			$\chi^2_{(1)} = 6.12$	.01
Precontemplation	62 (90)	7 (10)		
All other stages ^b	216 (76)	67 (24)		
Stage of change to quit			$\chi^2_{(1)} = .81$	.37
Precontemplation	78 (82)	17 (18)		
All other stages ^b	202 (78)	58 (22)		
	Mean (SD)	Mean (SD)	Bivariate statistics ^a	p
Age	16.97 (1.17)	17.19 (1.16)	$t_{(353)} = 1.42$	.16
Cigarettes smoked per day (average past 30 days)	9.92 (8.88)	11.69 (7.82)	$t_{(353)} = 1.57$	.12
Nicotine dependence (mFTQ)	4.18 (1.68)	4.53 (2.30)	$t_{(96)} = 1.24^c$	.22
Motivation to cut back	17.75 (7.08)	17.97 (6.68)	$t_{(352)} = .24$	.81
Motivation to quit	15.33 (7.72)	14.44 (7.45)	$t_{(352)} = -.89$	.37
Alcohol use	19.23 (27.29)	18.40 (26.23)	$t_{(349)} = -.23$	.82
Marijuana use	25.15 (33.51)	21.26 (32.35)	$t_{(353)} = -.89$	.37
Days between baseline and session 1	8.24 (5.28)	24.11 (27.53)	$t_{(76)} = 4.97^c$	<.0001

Sample sizes for each variable may differ because of missing data.

^a χ^2 analysis was used for categorical comparisons; *t*-tests were used in comparing continuous variables.

^b All other stages include contemplation, preparation, action, and maintenance.

^c Unequal sample *t*-test used as equality of variance was rejected.

Table 3
Treatment completion: Logistic regression results predicting the likelihood of completing treatment, with OR and 95% CI

Variable	Beta	SE	Wald χ^2	p	OR	95% CI ^a	
						Low	High
Intercept	5.63	2.51	5.03	.02			
Age	-.16	.14	1.33	.25	.85	.64	1.12
Black vs. white	.95	.45	4.46	.03	2.58	1.07	6.23
Other vs. white	.16	.47	.12	.73	1.17	.47	2.93
Pittsburgh vs. Philadelphia	-.85	.49	2.96	.08	.43	.16	1.12
Allentown vs. Philadelphia	-.59	.55	1.13	.29	.55	.19	1.64
Intervention assignment	-.30	.31	.94	.33	.74	.40	1.36
Stage of change to cut back (precontemplation)	.98	.48	4.16	.04	2.66	1.04	6.82
Cigarettes smoked ^b	-.01	.02	.28	.59	.99	.95	1.03
Nicotine dependence (mFTQ)	-.02	.09	.04	.83	.98	.82	1.17
Time from baseline to session 1 (in days)	-.09	.02	21.27	<.0001	.91	.88	.95

Sample sizes for each variable may differ because of missing data.

^a Confidence intervals including 1.00 are not significant ($p < .05$).

^b Cigarettes smoked per day on average for past 30 days.

Table 4
Sample characteristics and bivariate statistics by retention at 24 weeks

Variable	24-week retention		p ^a
	Yes	No	
Gender			.66
Female	156 (80)	39 (20)	
Male	125 (78)	35 (22)	
Race			.04
Black	135 (85)	24 (15)	
White	108 (76)	35 (24)	
Other	37 (71)	15 (29)	
Ethnicity			.82
Hispanic	33 (80)	8 (20)	
Non-Hispanic	247 (79)	66 (21)	
Recruitment Source			.14
Friends and family	125 (81)	30 (19)	
Adolescent medicine/other medical setting	76 (75)	25 (25)	
Advertisements	44 (73)	16 (27)	
School setting	22 (96)	1 (4)	
Other or multiple source	14 (88)	2 (12)	
Site			.09
Philadelphia	98 (86)	16 (14)	
Pittsburgh	99 (76)	31 (24)	
Allentown	84 (76)	27 (24)	
Intervention			.01
MI	130 (73)	47 (27)	
SBA	151 (87)	27 (13)	
Mother's education			.03
≤High school	99 (73)	37 (27)	
>High school	160 (83)	33 (17)	
Father's education			.90
≤High school	105 (78)	29 (22)	
>High school	87 (78)	25 (22)	
Household member smoking			.50
Yes	168 (80)	42 (20)	
No	93 (77)	28 (23)	
Expectations to graduate from college			.004
Yes	258 (81)	60 (19)	
No	21 (60)	14 (40)	
Stage of change to cut back			.25
Precontemplation	58 (84)	11 (16)	
All other stages ^b	220 (78)	63 (22)	
Stage of change to quit			.16
Precontemplation	80 (84)	15 (16)	
All other stages ^b	201 (77)	59 (23)	
	Mean (SD)	Mean (SD)	P ^c
Age	16.93 (1.18)	17.34 (1.08)	.01
Cigarettes smoked ^d	10.26 (9.08)	10.43 (7.05)	.86
Nicotine dependence (mFTQ)	4.25 (1.80)	4.29 (1.98)	.85
Alcohol use	18.80 (26.13)	20.04 (30.46)	.73
Marijuana use	24.82 (33.18)	22.43 (33.76)	.59

Sample sizes for each variable may differ because of missing data.

^a χ^2 test.

^b All other stages include contemplation, preparation, action, and maintenance.

^c *t*-test.

^d Cigarettes smoked per day on average for past 30 days.

In the current study, adolescents in the precontemplation stage of cutting back, but not for quitting, were more likely to complete all the treatment sessions as compared with those in higher stages of change. For adolescents, cutting back and quitting may be distinct behaviors [31]. There may have been some unintentional bias in sample selection for enrolling adolescents with greater interest in participating in and completing the study independent of their desire to change smoking behavior. In addition, the personalized attention participants received as well as

the nonjudgmental approach by study counselors and staff could have played a role in the high treatment completion rates. This finding suggests that clinicians can successfully engage adolescent smokers who have no intention of changing their smoking behavior in treatment. The effect of stage of change to cut back/quit on treatment completion and study retention will be important to examine in future research.

In the present study, black participants were more likely to complete treatment and to be retained, whereas Hispanic participants were as likely as non-Hispanic participants to do so. It is not entirely clear which factors resulted in the high treatment completion and retention of minority participants. Black race was associated with lower nicotine dependence, suggesting that the lighter smokers may have been more willing to complete treatment and follow-up. However, nicotine dependence was not associated with treatment completion or study retention overall, suggesting that this association was not the reason. Additionally, procedures to enhance participation of minorities outlined in previous research were in place and may have contributed to the higher retention rate of black participants [20,22].

There is some support in the adult literature for an association between greater attrition and lower socioeconomic status; however, to our knowledge, an association between parental education, socioeconomic status, and study retention has not been examined in the adolescent smoking literature. It is possible that more highly educated parents may instill higher expectations for achievement in their children, making them more likely to follow through with a behavior change program. Similarly, for the association of participant expectation to complete college with higher study retention, it may be that for adolescents with higher personal aspirations, smoking may be inconsistent with future goals, making them more motivated to continue with a tobacco cessation program. This is consistent with previous research on the “protective” effect of education on young adults [19]. These findings may help researchers and clinicians to put in place

Table 5
Logistic regression results predicting the likelihood of retention at 24 weeks with odds ratios and 95% confidence intervals

Variable	24-week retention			
	p	OR ^a	95% CI	
			Low	High
Intercept	.001			
Black vs. white	.05	2.32	1.01	5.33
Other vs. white	.81	.90	.39	2.08
Allentown vs. Philadelphia	.77	.86	.32	2.29
Pittsburgh vs. Philadelphia	.17	.55	.24	1.30
Stage of change to cut back (precontemplation)	.53	1.33	.54	3.23
Age	.004	.65	.49	.88
Maternal education	.01	.48	.26	.86
Expects to graduate college	.04	2.46	1.03	5.87
Stage of change to quit (precontemplation)	.60	1.23	.56	2.72
Recruited by advertisement ^b	.72	.87	.41	1.84
Recruited in medical setting	.16	.58	.27	1.25
Intervention (MI vs. SBA)	.02	.51	.28	.91

Maternal education (1 = high school education or less, 0 = other); expects to graduate college (1 = definitely or probably will graduate, 0 = definitely or probably will not graduate); stage of change variables (1 = precontemplation, 0 = other); intervention (1 = MI, 2 = SBA).

^a Odds of being retained for a unit increase in the predictor variable.

^b For the recruitment dummy variables, all comparisons were made to family and friends.

additional strategies to engage and retain these youth who are at high risk of dropping out of treatment.

Adolescents who received MI were less likely to be retained than those who received SBA. Although retention rates were high for both interventions, we can only speculate as to why the retention was greater for SBA. Although it is not known if the disparate time demands were a factor in the observed difference, it is noteworthy that participants receiving MI were as likely to complete treatment. It may be that the greater time commitment was not as important as the more developed relationship with the counselor and content of the MI intervention. Equalizing the time commitment for treatment and control participants in future studies would eliminate time demands as a factor in retention differences.

The sample had a high rate of other substance use, although these participants were as likely to complete treatment and to be retained. Given that substance users have a high rate of tobacco use, and that tobacco cessation interventions for this population often take a backseat to treatment for the other substance use, this is an important finding. Clinicians should continue to provide smoking cessation counseling and services for this population.

Limitations of this study must also be noted. Some variables were only measured at baseline (stage of change to cut back/quit, motivation to cut back/quit), which limited our ability to assess how change in these variables over time may have affected treatment completion and retention. The measures did not include a withdrawal questionnaire for participants who chose not to complete the study. However, with only nine participants withdrawing, questionnaire results would have been limited. Another limitation is that family income data were not obtained directly. We used a proxy measure for socioeconomic status, which may limit interpretation of an apparent association. Although we cannot ascertain whether adolescents who agreed to participate in the study were from lower income families than those who did not, the data suggest that the financial incentives did not differentially influence lower income participants.

Overall, the sample in this study was racially and ethnically diverse, with impressive treatment completion and study retention rates for understudied populations. This study adds to the understanding of factors associated with treatment completion distinct from study retention. Future trials may benefit from initiating treatment soon after baseline or intake visits to improve treatment completion. Additionally, procedures should be implemented to enhance retention of adolescents who are at higher risk of dropping out of treatment, particularly youth with lower educational aspirations and lower socioeconomic status. Further exploration of the connections between maternal education, socioeconomic status, and future academic orientation with treatment completion and study retention is warranted.

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