Social influence and advocacy pathways during a web-based program for adolescent smoking prevention

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ABSTRACT

Introduction: Exposure to smokers has been identified as a predictor of adolescent tobacco use. Conversely, adolescents who tend to be advocates against smoking may become less likely to initiate smoking themselves. Several digital tobacco prevention programs have been developed to include social strategies. This study aimed to identify (1) whether programs can motivate adolescents to become advocates against smoking, and (2) if being an advocate against smoking and exposure to friends who smoke can predict smoking while controlling for a program's effect.
Methods: We conducted a non-prespecified secondary analysis using data from a randomized controlled trial (RCT) with 18-month follow-up. High schools were randomized to either receive ASPIRE or a tobacco education booklet. We conducted a cross-lagged linear path model to allow for reciprocal associations, estimating a two-time-points, three-variable panel model with logistic regression.
Results: Receiving ASPIRE was associated with a lower likelihood of smoking, but it did not predict becoming an advocate against smoking or changing adolescents' proportion of friends who smoke. After controlling for the effect of ASPIRE, the study shows that adolescents who were advocates against smoking had a decreased risk of smoking by follow-up, and smoking at baseline significantly predicted having a higher proportion of friends who smoke at follow-up.
Discussion: Being an advocate against smoking can be a key predictor of lower odds of smoking, even when controlling for an individual-based intervention. Future research can study the mechanisms and long-term effects of advocacy and incorporate social strategies that can leverage social networks for tobacco prevention.

1. Introduction

1.1. Tobacco problem

Adolescent tobacco smoking, the most preventable cause of death globally (Hammond et al., 2019; Reitsma et al., 2021; Selya & Foxon, 2021; US Department of Health Human Services, 2014), remains a public health concern. Each day in the United States, approximately 1,600 youth smoke their first cigarette, and nearly 200 youth start smoking every day (Substance Abuse and Mental Health Administration, 2021). Approximately 34.0 % of high school students have tried a tobacco product, and over 28 % of them use nicotine delivery products (Gentzke et al., 2022). According to recent data, about 80 % of adult tobacco smokers started before the age of 18 years and reached nicotine dependence during adolescence (National Cancer Institute, 2012;

Substance Abuse and Mental Health Administration, 2021; US Department of Health and Human Services, 2014). This suggests the need for continuous efforts to prevent smoking among adolescents.

1.2. Friendship influence and selection of friends who smoke

Exposure to smokers is a key predictor of adolescent tobacco use (Can & Kucukoglu, 2023; Henneberger, Mushonga, & Preston, 2021; Leshargie et al., 2019). Supported by the social learning theory (Bandura, 1977a, 1977b; Petraitis, Flay, & Miller, 1995), adolescents initiate tobacco use by modeling other tobacco users to gain social acceptance and form social identity. Research indicates that having friends who smoke increases the likelihood of smoking initiation, and the more friends they have who smoke, the more likely they are to initiate smoking (de la Haye, Shin, Yon, & Valente, 2019; Montgomery et al.,

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2020; Patrick et al., 2016). The influence of smoking friends may outweigh that of smoking family members (Saari, Kentala, & Mattila, 2014). Additionally, there is evidence that smokers are more likely to form friendships with other smokers (Henneberger et al., 2021). This peer selection process is shown to be more influential than peer influence itself (East, McNeill, Thrasher, & Hitchman, 2021; Khalil, Jones, & Fujimoto, 2021; Mercken, Steglich, Sinclair, Holliday, & Moore, 2012).

1.3. Being an advocate against smoking

On the other hand, adolescents who tend to be advocates against smoking (i.e., encourage friends against tobacco when they start smoking) may become less likely to initiate smoking themselves (East et al., 2021). In the context of other health topics, research has indicated that by sharing information that supports healthy behavior with peers, adolescents rehearse what they learn and experience positive social reinforcement of healthy information that allows them to build lasting attitudes against tobacco use and healthy behaviors (Brendtro & Caslor, 2019; Moyer-Guse, 2008; Singhal & Rogers, 1999; Slater & Rouner, 2002; Van Voorhis & Salisbury, 2022). Being an advocate against smoking can play a crucial role in preventing future smoking behavior. In the context of tobacco use, adolescents have previously expressed the importance of being advocates against smoking by holding others accountable for their actions, initiating social conversations against smoking, and attempting to convince others to quit smoking (Khalil, Wang, Calabro, & Prokhorov, 2019; McCrabb et al., 2019; Trisnowati, Ismail, & Padmawati, 2021).

1.4. Entertaining programs as predictors of social factors

Digital tobacco prevention programs, incorporating social influence strategies such as peer pressure management and communication skills, have succeeded applying entertainment and interactivity (Khalil et al., 2017). Yet, it remains unclear (1) if they can motivate adolescents to advocate against smoking, and (2) if advocacy can prevent tobacco use. Program evaluations typically focus on end outcomes (e.g., intention to smoke and smoking initiation) (Khalil et al., 2017). Yet, examining social influence factors (e.g., exposure to smokers and advocacy against smoking) can clarify their prediction of smoking behavior. Some evidence suggests that entertainment-based programs can motivate individuals to promote health and share health information with their social circle (Diddi, Kumble, & Shen, 2021; Khalil & Rintamaki, 2014; Ribeiro, Carvalho, Oliveira, & Marcos, 2023).

One example is a digital program ASPIRE (A Smoking Prevention Interactive Experience). ASPIRE includes interactive videos and activities educating about tobacco consequences, social norms, and other prevention issues (Prokhorov et al., 2010). In a randomized controlled trial at 16 public schools adolescents were assigned to use ASPIRE or receive a tobacco education booklet (Prokhorov et al., 2008). Results showed that fewer ASPIRE users initiated smoking compared to the standard-care group at the 18-month follow-up (Prokhorov et al., 2008). A second ASPIRE study indicated that program entertainment value and interactivity drove a decrease in intention to smoke (Khalil et al., 2017).

While ASPIRE was not primarily designed to drive social outcomes, its modules promoted discussions about tobacco by inviting adolescents to engage with their social circle and advocating against smoking. Covering various prevention topics, ASPIRE equips adolescents with knowledge and skills to share within their social circles. It includes activities to identify supportive individuals and engage with friends and family members who smoke. ASPIRE presents strategies to refuse tobacco, thereby discouraging exposure to others who smoke. Evidence suggests that entertainment-based interventions can promote healthy discussions (Papa et al., 2000; Boulay et al., 2002; Khalil & Rintamaki, 2014). Aligned with the extend-elaboration likelihood model, entertainment programming for health can promote cognitive rehearsal of healthy content fostering positive discussions (Singhal & Rogers, 1999).

Nevertheless, it is still unclear if ASPIRE, as an individual-based program, can have an impact on having friends who smoke and becoming an advocate against smoking.

1.5. Objective

While these studies highlight the success of the program at the individual level, the objective of the current study is to identify (1) whether programs can motivate adolescents to become advocates against smoking, and (2) if being an advocate against smoking and exposure to friends who smoke can predict smoking behavior while controlling for a program's effect. To this end, and based on the literature we described, Table 1 presents a series of hypotheses with (1) ASPIRE as a predictor of social factors, (2) friendship influence and Selection of friends, (3) the preventive effect of being an advocate against smoking, and (4) the relationships between social factors.

2. Materials and methods

2.1. Study design and setting

For this study, we conducted a non-prespecified secondary analysis using data from a pragmatic randomized controlled trial (RCT) with 18-month follow-up. For more details on the methods and trial procedures, see Prokhorov and colleagues (2008). The study was conducted with 16 high schools from socioeconomically disadvantaged communities in the greater Houston area. The high schools were randomized to either receive ASPIRE or the "clearing the air" booklet from the National Cancer Institute, as standard tobacco education. Adolescents were followed from baseline to 18-month follow-up.

In this study, 1,935 students provided informed written consent, and

Table 1
Associations to be tested in the current study.

Process	Hypotheses	Supportive References
ASPIRE as a predictor of social factors	Hypothesis 1: ASPIRE is related to a higher likelihood of becoming an advocate against smoking by 18-month follow-up. Hypothesis 2: ASPIRE is related to a lower likelihood of having friends who smoke by 18-month follow-up.	(Diddi et al., 2021; Khalil & Rintamaki, 2014; Ribeiro et al., 2023)
Friendship influence and selection of friends based on smoking status	Hypothesis 3: Being a smoker is related to a higher likelihood of making friends who smoke. Hypothesis 4: Having friends who smoke is related to a higher likelihood of becoming a smoker.	(Khalil et al., 2021; Mercken et al., 2012)
The preventive effect of being an advocate against smoking	Hypothesis 5: Being an advocate against smoking is related to a lower likelihood of becoming a smoker by 18-month follow-up.	(Khalil et al., 2019; Trisnowati et al., 2021)
The relationships between social factors	Hypothesis 6: Having friends who smoke is related to a lower likelihood of becoming an advocate against smoking in the future. Hypothesis 7: Being an advocate against smoking is related to a lower likelihood of having friends who smoke by 18-month follow-up.	(Chao, Hashimoto, & Kondo, 2019; Khalil & Prokhorov, 2021)

1,608 of them (83.1 %) completed baseline surveys. The data were obtained from 1,175 participants who completed 18-month follow-up (1,160 of whom had baseline and follow-up data on smoking status), and they were included in this analysis.

2.2. The ASPIRE program

ASPIRE was accessed on a desktop computer in the classroom, and it consisted of five weekly 30-minute sessions, followed by two ''booster'' sessions. During these sessions, ASPIRE offered free online interactive and entertaining content to engage adolescent users through text, animated cartoons, videos, and activities for tobacco-related education. Through a series of activities and videos, users can explore a two-dimensional environment where they can look for hints, click on items or characters, and receive health messages delivered by animated characters. As they progress through the activities, adolescents get to uncover new health information. See Prokhorov and colleagues (2010) for more details about the program.

2.3. Measures

2.3.1. Smoking status

Appendix A details the measures. Smoking status was examined at baseline and follow-up, based on adolescents' answers concerning their smoking behavior, categorized as nonsmokers ("I've never smoked even part of a cigarette", "I've only smoked part of a cigarette", "I've smoked a few times", "I used to smoke regularly, but I quit in the last 12 months", "I used to smoke regularly, but I quit more than 12 months ago") or smokers (from "I smoke about one cigarette every other week" to "I smoke more than a pack a day") (Prokhorov et al., 2010).

2.3.2. Influence measures

Being an advocate against smoking was measured at baseline and follow-up by adding up two dichotomized items (Appendix A), asking about the tendency to discourage friends from tobacco use when they start smoking (e.g., get them information) (Prokhorov et al., 2010). The proportion of friends who smoke (PFS) was measured as a proxy to exposure to friends who smoke by counting the number of friends who smoke out of the respondents' three closest friends (Khalil et al., 2021; Valente, 2005).

2.3.3. Other variables

Baseline measurements for the current study included age (in years), sex at birth (being female), being Hispanic-Latino, being African-American, having a parent or legal guardian who smokes, and school membership. In addition, depression was measured at baseline using the Center for Epidemiological Studies Depression Scale for Children (CES-DC) in order to estimate past-week depressive symptoms in children and adolescents (Fendrich, Weissman, & Warner, 1990; Weissman, Orvaschel, & Padian, 1980).

2.4. Data analysis

We conducted statistical analyses using STATA version 18. We first examined sociodemographic characteristics and their individual prediction of smoking by 18-month follow-up, with the entire sample, using mixed-effect logistic regression models and accounting for clustering by school. These characteristics included smoking at baseline, age, sex, being Hispanic-Latino, being African-American, having a parent who smokes, and depression. The models controlled for baseline smoking. Before hypothesis testing, we needed to examine the predictive roles of our social factors (PFS and being an advocate against smoking). To this end, we conducted four mixed-effect logistic regression models with adolescent nonsmokers at baseline to predict their initiation of smoking at 18-month follow-up, accounting for school clustering. Model 1 examined group allocation (ASPIRE versus control) as a predictor of

smoking. Model 2 and Model 3 examined PFS and being an advocate against smoking, respectively, as predictors of smoking, along with group allocation. Model 4 included both PFS and being an advocate against smoking as predictors of smoking, controlling for group allocation.

Following these models and for the entire sample, we investigated our hypotheses using path analysis. For all participants, we conducted a cross-lagged linear path model to allow for reciprocal associations, estimating a two-time-points, three-variable panel model (Fig. 1) (Newsom, 2015). With a dichotomous outcome (i.e., smoking status), we used generalized structural equation modeling (GSEM) with Bernoulli logistic regression and school clustering, investigating PFS and being an advocate against smoking as predictors of smoking status. In this model, we included group allocation (ASPIRE versus control) as a predictor of smoking status, PFS, and being an advocate against smoking. With path analysis, we can estimate cross-lagged models that include test–retest, synchronous, and cross-lagged correlations (Newsom, 2015). The direction of the correlations between PFS and smoking and between being an advocate against smoking and smoking can be effectively examined using this method. The model specified unstandardized coefficients for continuous outcomes and odds ratios for binary outcomes. The GSEMs controlled for being Hispanic-Latino and being African-American. We did not compute covariances between exogenous variables at baseline because Stata's GSEM "takes observed exogenous variables as given and so cannot estimate the covariances between them" (StataCorp, 2021, p. 16). Nevertheless, in GSEM, we computed direct relationships between exogenous variables with PFS and being an advocate against smoking as potential predictors of smoking at baseline. For model fit, we included the Akaike's information criterion (AIC) in the GSEM model (Nylund, Asparoutiov, & Muthen, 2007). As GSEM with Bernoulli logistic regression requires numerical integration, it is unable to estimate typical goodness-of-fit statistics (StataCorp, 2021). Therefore, model fit indices are calculated based on a path model with a continuous outcome variable, a common practice (e. g., (Simons, Burt, Barr, Lei, & Stewart, 2014; Tostlebe & Pyrooz, 2022). In this path model, covariances between exogenous variables, and between outcome variables were included, and the model was conducted by bootstrapping with 1,000 replications. The fit indices included: (1) a nonsignificant chi-square goodness-of-fit, (2) a comparative fit index (CFI) of 0.90 or greater, (3) a root mean square error of approximation (RMSEA) less than or equal to 0.06, and (4) a standardized root mean square residual (SRMR) lower than 0.08 (Hooper, Coughlan, & Mullen, 2007).

3. Results

3.1. Participant characteristics

Table 2 presents sociodemographic characteristics among those who reported their characteristics. Respondents were on average 15 years of age, and the majority were female. The sample exhibited a relatively large proportion of Hispanic or Latino and African-American participants. Respondents exhibited an average score of 18.91 (SD = 10.84) out of 53 on CESD-C. At baseline, 50.63 % of respondents reported being advocates against smoking. On average, participants reported that 24 % of their friends smoke (M = 0.24, SD = 0.32). By examining predictions of smoking for each factor, we found that being a smoker at baseline (OR: 17.34, CI:9.10,33.03, p < 0.001) and having a higher PFS (OR:2.89, CI:1.21,6.92, p = 0.017) significantly predict higher odds of smoking by 18-month follow-up. Being African-American (OR:0.10, CI:0.04,0.28, p < 0.001) and being an advocate against smoking (OR:0.41, CI:0.23,0.74, p = 0.003) significantly predict lower odds of smoking by 18-month follow-up.
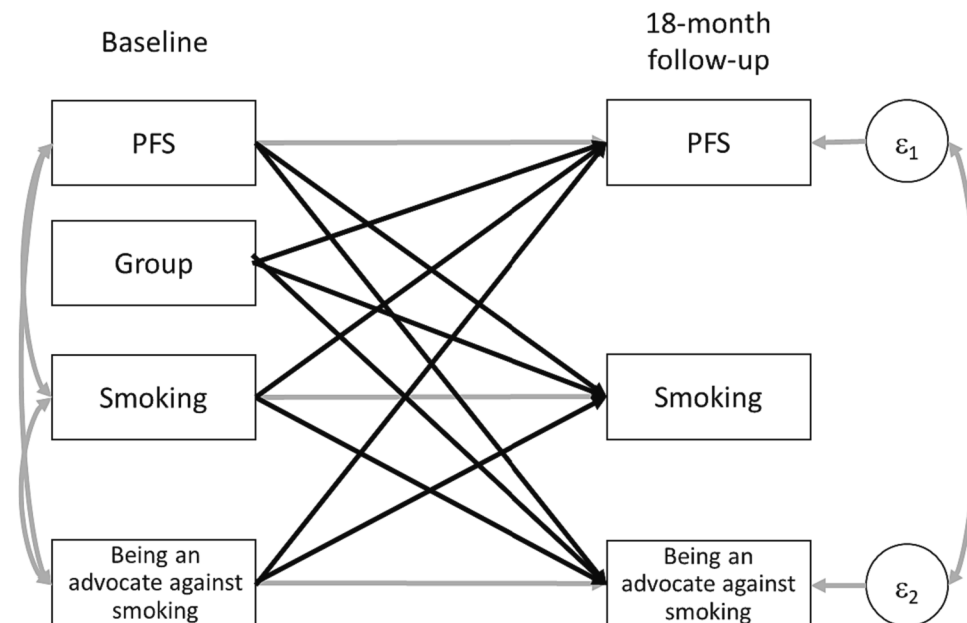
Fig. 1. Generalized structural equation modeling with logistic regression. Smoking is measured as a dichotomous variable. The figure presents the hypothesized relationships in black. The model controls for being Hispanic/Latino, and being African-American, as predictors of being a positive influencer, the proportion of friends who smoke, and smoking at follow-up.

3.2. The predictive role of social influence factors

Table 3 presents four models that introduce the two social factors predicting smoking initiation among nonsmokers. Controlling for demographic factors, the results show that adolescent non-smokers in the ASPIRE group were less likely to initiate smoking by 18-month follow-up than those in the control condition (Model 1; OR:0.40; CI:0.18,0.86; p = 0.019). When the PFS is introduced to the model (Model 2), being in the ASPIRE group lost significance in predicting smoking initiation, reaching marginal significance (OR:0.45; CI:0.20,1.01; p = 0.055). Nonetheless, in this model, a higher PFS at baseline was not significantly related to future smoking initiation (OR:2.67; CI:0.89,8.03; p = 0.080). While controlling for being in the ASPIRE group, being an advocate against smoking significantly predicted lower odds of smoking initiation at follow-up (Model 3; OR:0.28; CI:0.13,0.61; p < 0.001). In this model, being in the ASPIRE group remained a significant predictor of lower odds of smoking initiation (OR:0.36; CI:0.16,0.80; p = 0.012). When including all three variables to the model, being in the ASPIRE group (OR:0.42; CI:0.18,0.96; p = 0.040) and being an advocate against smoking (OR:0.31; CI:0.14,1.74; p = 0.006) significantly predicted smoking initiation, but the PFS was not a significant predictor of smoking initiation (OR:1.68; CI:0.53,5.31; p = 0.376). In all four models, being Hispanic or Latino was related to greater odds, and being African-American was related to lower odds of initiating smoking (Table 3).

3.3. Social influence pathways

Within the cross-lagged GSEM (Fig. 2), being in the ASPIRE group significantly predicted smoking by 18-month follow-up (OR:0.48; CI:0.30,0.79, p = 0.004). However, group allocation did not significantly predict adolescents' PFS or being an advocate against smoking at follow-up. Adolescents' PFS did not significantly predict future smoking. However, smoking at baseline significantly predicted a higher PFS at follow-up (B = 0.15, SE = 0.06, p = 0.010). On the other hand, being a smoker at baseline did not significantly predict being an advocate against smoking at follow-up. However, being an advocate against smoking at baseline predicted future smoking (OR:0.39; CI:0.22,0.72, p = 0.002). In this model, being an advocate against smoking did not

significantly predict PFS at follow-up, and the PFS did not significantly predict becoming an advocate against smoking at follow-up (Fig. 2). A path analysis treating smoking as a continuous variable shows a good fit ($\chi2(3) = 4.59$; p = 0.20; CFI = 0.997; RMSEA = 0.026; CI:0.00,0.07; SRMR = 0.011). Appendix B presents the models in detail.

4. Discussion

Previous research has concluded that negative influence through exposure to friends who smoke plays a primary role in driving smoking behavior among adolescents (Montgomery et al., 2020). In addition, previous work has highlighted the role of individual-based programs in preventing adolescent tobacco use (Tremblay et al., 2020). The present study expanded on this research by investigating how being an advocate against smoking can prevent tobacco use, regardless of the effects of an individual-based intervention. Our results mainly indicate that (1) being an advocate against smoking predicts lower odds of smoking, and (2) early smoking behavior predicts a higher PFS by 18-month follow-up.

Even after controlling for the effect of ASPIRE, an individual-based intervention, our findings support the role of advocacy in preventing smoking. The study shows that adolescents who tended to discourage their friends from smoking, regardless of their participation in ASPIRE, had a decreased risk of smoking by 18-month follow-up. These findings show that being an advocate against smoking can have a unique role in preventing smoking behavior. We were able to isolate the specific impact of advocacy against smoking on smoking outcomes by controlling for the effect of ASPIRE. Exposure to ASPIRE was not found to predict becoming an advocate against smoking. Our results demonstrate that the impact of being an advocate against smoking is a key promoter of smoke-free behavior, rather than a result of ASPIRE.

In line with the elaboration likelihood model (Petty & Briñol, 2012), adolescents who act as advocates against smoking may develop stronger anti-smoking beliefs and attitudes, thereby reinforcing their commitment to a smoke-free lifestyle. By discouraging friends from smoking, adolescents may become motivated to remain smoke-free. In contrast, being a smoker was not associated with becoming an advocate against smoking at follow-up. This implies that advocating a tobacco-free lifestyle may be driven by factors that are unrelated to one's smoking status.

Future research can further investigate the elements that drive

Table 2

Participant Baseline Characteristics and Their Individual Prediction of Smoking by 18-month follow-up.

Characteristics	Total Sample	OR (95 % CI)	p-value	ASPIRE group	Control group
Age at baseline; in years, Mean (SD), from 1,174 respondents	15.57 (0.83)	1.17 (0.85, 1.62)	0.334	15.47 (0.77)	15.67 (0.88)
Sex at birth, being female at baseline; n (%), from 1,175 respondents	699 (59.49 %)	0.72 (0.41, 1.26)	0.252	366 (59.32 %)	333 (59.68 %)
Being Hispanic or Latino; n (%), from 1,097 respondents	572 (52.14 %)	0.93 (0.49, 1.76)	0.832	355 (61.00 %)	217 (42.14 %)
Being African-American, n (%), from 916 respondents	470 (51.31 %)	0.10 (0.04, 0.28)	<0.001	217 (46.07 %)	253 (56.85 %)
Having at least one parent or legal guardian who smokes, n (%), from 1,175 respondents	503 (42.81 %)	1.52 (0.87, 2.66)	0.143	276 (44.73 %)	227 (40.73 %)
Depression score, Mean (SD), ranging between 0 and 53, from 1,168 respondents	18.91 (10.84)	1.02 (1.00, 1.05)	0.084	18.16 (10.52)	19.74 (11.12)
Being a smoker at baseline, n (%), from 1,160 respondents	62 (5.34)	17.34 (9.10, 33.03)	<0.001	28 (4.59 %)	34 (6.18 %)
Proportion of friends who smoke, Mean (SD)[a], from 1,082 respondents	0.24 (0.32)	2.89 (1.21, 6.92)	0.017	0.22 (0.31)	0.25 (0.32)
Being an advocate against smoking, Mean (SD)[b], from 1,175 respondents	0.54 (0.57)	0.41 (0.23, 0.74)	0.003	0.53 (0.56)	0.57 (0.58)

Note. The only single variate model was for being a smoker at baseline predicting future smoking, and all other logistic regression models controlled for being a smoker at baseline; [a]The proportion of friends who smoke ranged from 0 to 1; [b]Being an advocate against smoking ranged from 0 to 2.

advocacy against tobacco use. As adolescents become advocates against smoking, they can build a sense of empowerment, assert their own individuality, and join forces with their peers to combat smoking in their social circle. Researchers have begun to consider such strategies, which deserve further investigation (Lammers, Zhang, Povieriena, & Pipe, 2018). In addition, online programs such as ASPIRE have not yet leveraged social interactivity (i.e., computer-mediated or face-to-face interactions between adolescents) (Tremblay et al., 2020). Future research can introduce social interactivity to promote positive influencing and empowerment, alongside individual-based approaches like ASPIRE, thereby creating a supportive environment for behavior change.

In the current study, we also investigated the role of negative influence and peer selection. In a single variate model, we found that having a PFS was related to future smoking. However, this association was lost within the cross-lagged model. Instead, the outcomes of this study confirmed the process of peer selection, implying that being a smoker predicts forming friendships with other smokers (Khalil et al., 2021; Mercken et al., 2012). Because of similar interests or social norms, smokers may be more likely to befriend peers who already smoke. As the next step, understanding the mechanisms that contribute to the spread of tobacco use within a friendship network could inform the design of more effective social interventions. The finding that smoking predicts having a higher proportion of smoking friends shows that interventions targeting smokers may have a rippling effect within a social network. Public health efforts that provide adolescents with tobacco prevention and cessation support may have an indirect impact on the smoking behavior of others within one's social circle.

Future research can also examine the long-term impacts of advocacy on tobacco use, even if the results focus on outcomes by 18-month follow-up. Although this study shows an association between advocacy and lower odds of smoking, it is crucial to investigate whether these effects last at long-term. Longitudinal research tracing smoking trajectories of adolescents who promote a tobacco-free lifestyle can shed light on the best strategies to design interventions that promote long-term abstinence from smoking.

As limitations, the study lacked exploration into broader social influences (e.g., exposure to tobacco advertising), and a focus on smoking behavior without examining nicotine vaping. The data was collected during the trial of the original ASPIRE program, published in 2008, and we acknowledge the need for caution in generalizing our findings. Future research can expand the investigation to broader populations and explore the impact of advocacy on vaping. Additionally, we could not efficiently assess model fit indices through GSEM in STATA. Nevertheless, we addressed this limitation by examining model fit with continuous outcomes.

In conclusion, our results highlight the importance of advocacy in predicting lower odds of smoking. Successful interventions like ASPIRE, coupled with empowering individuals to be advocates against smoking, could enhance the effectiveness of tobacco prevention efforts. Future research can study the mechanisms and long-term effects of advocacy against tobacco use and incorporate social strategies that leverage social
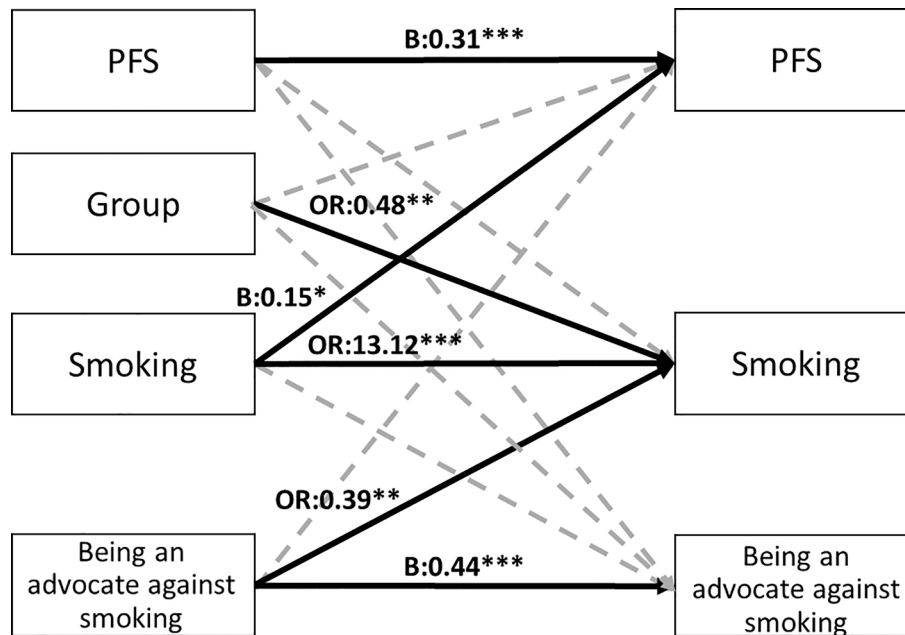
adolescents to become advocates against smoking and explore the mechanisms by which positive influence can impact one's smoking behavior. Supported by the positive deviance approach, we plan to further understand the specific communication strategies used by advocates so that we can explore the design of tobacco prevention interventions that promote positive influence (Dearing & Singhal, 2020; Lapping et al., 2002). In practice, these results suggest that health programs such as social media campaigns, and community-based initiatives, should not only emphasize individual efforts for tobacco prevention but also highlight the role individuals can play as advocates against smoking within their social networks, thereby promoting

Table 3

Factors predicting smoking initiation.

	Model 1		Model 2		Model 3		Model 4	
	OR (95 % CI)	p-value	OR (95 % CI)	p-value	OR (95 % CI)	p-value	OR (95 % CI)	p-value
Being in the ASPIRE group	0.40 (0.18, 0.86)	0.019	0.45 (0.20, 1.01)	0.055	0.36 (0.16, 0.80)	0.012	0.42 (0.18, 0.96)	0.040
Proportion of friends who smoke	–	–	2.67 (0.89, 8.03)	0.080	–	–	1.68 (0.53, 5.31)	0.376
Being an advocate against smoking	–	–	–	–	0.28 (0.13, 0.61)	0.001	0.31 (0.14, 1.74)	0.006
Age	1.34 (1.31, 6.22)	0.186	1.02 (0.63, 1.67)	0.922	1.35 (0.87, 2.09)	0.181	1.05 (0.64, 1.74)	0.836
Being female	1.52 (0.75, 3.08)	0.247	1.21 (0.56, 2.61)	0.621	1.26 (0.61, 2.61)	0.530	0.99 (0.45, 2.17)	0.977
Being Hispanic/Latino	2.86 (1.31, 6.22)	0.008	2.92 (1.27, 6.72)	0.012	2.95 (1.32, 6.61)	0.008	2.89 (1.23, 6.77)	0.015
Being African-American	0.05 (0.02, 0.16)	<0.001	0.03 (0.01, 0.13)	<0.001	0.04 (0.01, 0.14)	<0.001	0.03 (0.01, 0.12)	<0.001
Having a parent who smokes	1.29 (0.62, 2.68)	0.486	1.36 (0.62, 2.97)	0.435	1.14 (0.54, 2.40)	0.731	1.25 (0.56, 2.78)	0.576
Wald Chi-squared	37.81	<0.001	30.45	<0.001	45.51	<0.001	36.78	<0.001

Fig. 2. Generalized structural equation modeling with logistic regression analysis, n = 1,070; The figure presents the hypothesized relationships only. Unstandardized coefficients (B) are presented, unless odds ratios (OR) are specified for the binary variable smoking; Dashed gray arrows indicate nonsignificant relationships; PFS stands for the proportion of friends who smoke; *p < 0.05; **p < 0.01; ***p < 0.001.

networks. By identifying and supporting advocates against smoking, researchers can further contribute to the success of tobacco control efforts.

Declaration of generative AI

During the preparation of this work, the authors used ChatGPT in order to only improve language and readability, with caution, with human oversight and control. After using this tool/service, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

CRediT authorship contribution statement

Georges E. Khalil: . **Meerah Khan:** Data curation, Validation, Visualization, Writing – original draft, Writing – review & editing. **Jeanie Kim:** .

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The authors do not have permission to share data.

Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.abrep.2024.100529.

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