Are you in or out? Recruitment of adolescent smokers into a behavioral smoking cessation intervention

Johannes Thrul[1,*], **Mark Stemmler**[2], **Michaela Goecke**[3], and **Anneke Bühler**[1]

[1]IFT, Institut für Therapieforschung, 80804 München, Germany

[2]Friedrich-Alexander-University Erlangen-Nürnberg, 91052 Erlangen, Germany

[3]Bundeszentrale für gesundheitliche Aufklärung, 51109 Köln, Germany

Abstract

Even though many adolescent smokers want to quit, it is difficult to recruit them into smoking cessation interventions. Little is known about which adolescent smokers are currently reached by these measures. In this study we compare participants of a group-based, cognitive behavioral smoking cessation intervention with adolescent smokers who decided against participating.

Within a non-randomized controlled trial, data of 1053 smokers (age 11–19) from 42 German secondary schools were analyzed. Of these smokers, 272 were recruited into 47 courses of the intervention. An in-class information session, individually addressing potential participants, and incentives were used as means of recruitment. Personal predictors of participation were analyzed using regression analyses and multivariate path analyses to test for mediation. In the path analysis model, nicotine dependence, quit motivation, and a previous quit attempt were directly positively related to participation. Heavier smoking behavior was indirectly positively associated with participation through nicotine dependence and negatively through quit motivation, yielding an overall positive indirect effect. The positive effect of a previous quit attempt on participation was partially mediated through nicotine dependence and quit motivation. The proportion of smoking friends were indirectly positively related to participation, mediated through nicotine dependence.

Since adolescents with heavier smoking behavior and stronger nicotine dependence are less likely to undertake a successful unassisted quit attempt, the reach of these young smokers with professional cessation interventions is desirable. Further measures to improve the recruitment of those currently not motivated to quit have to be examined in future studies.

*Corresponding author present address: Johannes Thrul, UCSF Center for Tobacco Control Research and Education, 530 Parnassus Ave., Suite 366, San Francisco, CA 94143-1390, Tel +1-415-514-9340, Fax +1-415-514-9345, Johannes.Thrul@ucsf.edu.

1. Introduction

In Germany, 12.0% of adolescents between 12 and 17 years old are current smokers (Federal Centre for Health Education (BZgA), 2013). Although the smoking rates among German teenagers have dropped over the last decade from 27.5% in 2001, this decline may be due to successful prevention of smoking rather than due to success in getting young people to quit once they have started (Orth & Töppich, 2010). Given that 80% of adult smokers have started smoking during adolescence, smoking cessation is important as early in the smoking career as possible (U.S. Department of Health and Human Services, 1994).

Even though a large part of adolescent smokers is motivated to quit and cessation attempts are frequent, only few of these cessation attempts are successful (Bancej, O'Loughlin, Platt, Paradis, & Gervais, 2007). An additional factor hindering successful smoking cessation in adolescence is the fact that young smokers may want to become smoke free, but professional cessation support is neither well known nor well liked among this population (Leatherdale & McDonald, 2007). Therefore, one of the key challenges in behavioral smoking cessation with adolescents is the recruitment of the target group.

We know little about which personal predictors distinguish adolescent smokers who participate in smoking cessation interventions from those deciding against participating. Previous studies have either compared adult participants with non-participants after successful screening for smoking cessation interventions (Dahm et al., 2009) or compared adolescent intervention participants with smokers from general population samples (Horn et al., 2008). Additional potential predictors of adolescent smoking cessation can be identified from a prospective observational study of adolescent smokers with no professional treatment contact (Kleinjan et al., 2009). Taken together the findings of these studies suggest that nicotine dependence may be a strong predictor of intervention participation. Furthermore, adolescents' intentions to quit in the near future are important predictors of quit attempts (Kleinjan et al., 2009) and treatment effectiveness (Thrul, Stemmler, Bühler, & Goecke, 2014), and adolescent smokers participating in a smoking cessation intervention reported more previous quit attempts compared to adolescent smokers from the general population (Horn et al., 2008). The literature is mixed regarding how smokers in the social context of an individual influence the likelihood for intervention participation. Results from a study with young adult smokers suggest that living in a household with another smoker may present a barrier to participation (Audrain-McGovern et al., 2009). However, studies with adolescent smokers found that intervention participants were more strongly embedded in smoking peer groups and families (Horn et al., 2008). In sum, previous findings suggest that a variety of factors related to smoking behavior/nicotine dependence, cognitions and quit motivation, and the social context may be relevant for participant recruitment.

Given the importance of adolescent smoking cessation, there still is a considerable lack of knowledge on how to recruit young smokers and a need for more research has been

expressed in the literature (Backinger et al., 2008). In this study, we analyze predictors of voluntary participation in a behavioral smoking cessation intervention for adolescents. Based on the reviewed literature we firstly hypothesize that stronger smoking and stronger nicotine dependence will be positively associated with participation. Secondly, we expect that a stronger quit motivation and a previous quit attempt will increase the likelihood to participate. In addition, we will explore how perceived smoking among parents, siblings, and friends of adolescents is associated with participation. Lastly, we will examine whether nicotine dependence and quit motivation are mediators between individual and social predictors and adolescents' decisions to participate.

2. Methods

2.1. Procedure

In 2010, 41 professionals (e.g., social workers) from 13 German states received a 2 day training session in a behavioral smoking cessation manual for adolescent smokers and served as instructors in this study. These professionals recruited basic and intermediate secondary schools (Haupt- & Realschulen) to implement a smoking cessation intervention for interested young smokers in grades 7 to 10 (students' age range approximately 12–17 years). Recruitment was targeted at this age range and these schools because studies have consistently shown that smoking prevalences are high in older teenagers and in basic and intermediate schools in Germany (BZgA, 2012, 2013; Lampert & Thamm, 2007; Orth & Töppich, 2010). Based on recommendations from the previous literature (Sussman & Sun, 2009), mandatory in-class information sessions, individual referral by teachers and school social workers, and incentives for regular participation (3 media vouchers, 10 €each) were used to improve recruitment. All students of classes assigned to receive the mandatory information session were asked to complete a baseline questionnaire before the session. Students participating in the intervention also completed another questionnaire at the beginning of the first course session; this questionnaire was identical to the baseline questionnaire regarding all measures used in the present study. At 42 schools, 273 young smokers were recruited into 47 intervention courses and served as the intervention group (IG). The control group (CG) consisted of 783 currently smoking students who participated in the information session but decided against participating in the intervention. The intervention was based on cognitive-behavioral methods and motivational enhancement and was especially developed for adolescent smokers (Bühler et al., 2012; Thrul et al., 2014; Wegmann, Bühler, Strunk, Lang, & Nowak, 2012). It consisted of 6 sessions (5 group sessions lasting 90 minutes, 1 individual session lasting 15 minutes) within 3 weeks and an aftercare interval of 4 weeks including follow up calls and text messages. All study procedures were approved by the ethics commission of the German Psychological Society. Parental consent of participation in the study was requested beforehand by letters sent to the schools and distributed by teachers.

2.2. Participants

A total of 273 currently smoking intervention participants and 783 currently smoking students in the control group provided data for this study. As several different recruitment methods were use, a substantial part of intervention participants (*n*=109, 40%) did not

participate in the information session and did not complete the baseline questionnaire. Therefore, the information these participants provided in the identical questionnaire completed before the first intervention session was used as baseline data. A comparison within participants that provided data at both of these assessment points showed that quit motivation was biased from baseline to first session (i.e., intervention participants reported being more motivated at the beginning of the first session than at baseline). Values for these variables were imputed using the single imputation command UVIS (Royston & White, 2011) for Stata 12.0 (StataCorp, 2009), which imputes missing data for a single variable as a function of the covariates specified (i.e., quit motivation at first course session was used as predictor for quit motivation at baseline). One observation was excluded because the gender variable was missing and 2 observations were excluded because of more than 50% missing values in total. Remaining missing values (*n*=400 data points; 1.31% of all data) were imputed using multivariate imputation by chained equations (MICE) via the command ICE (Royston & White, 2011; van Buuren, Boshuizen, & Knook, 1999) for Stata. This resulted in an analytical sample of *n*=1053 smoking students (IG=272; CG=781).

2.3. Measures

2.3.1. Demographics—Participants were asked to indicate their age and gender.

2.3.2. Smoking behavior—Smoking behavior was assessed with 2 questions. Smoking frequency ("On how many of the last 30 days have you smoked cigarettes?") and quantity ("How many cigarettes do you usually smoke on a smoking day?"). A quantity-frequency index of cigarettes per day (CPD) was calculated ((quantity*frequency)/30) (Kraus, Piontek, Pabst, & Matos, 2013).

2.3.3. Perceived smoking of others—Perceived smoking of mother and father was assessed with two items ("Does your mother/father smoke?") and responses were recorded dichotomously (*yes-no*). Perceived smoking of siblings was assessed with one item ("How many of your siblings smoke?") and responses were recorded in an open format. For further analyses the variable was dichotomized to no vs. any smoking siblings. Perceived smoking of friends was assessed with one item ("How many of your friends smoke?"). Responses were recorded on a 4-point scale (*all* to *no one*).

2.3.4. HONC score—Strength of nicotine dependence was assessed using the German version of the Hooked on Nicotine Checklist (HONC; DiFranza et al., 2002). The HONC consists of 10 items focusing on loss of control over smoking (e.g.,"Have you ever tried to quit smoking but were not able to?") and responses were recorded dichotomously (*yes-no*). A sum score was calculated over all items. The HONC had high internal consistency (Cronbach's Alpha = .87).

2.3.5. Quit attempt and quit motivation—A previous quit attempt within the last 6 months was assessed with one item ("Have you made a serious quit attempt in the last 6 months?"), responses were recorded dichotomously (*yes-no*). Quit motivation was assessed with one item ("How motivated are you to quit smoking?"). Responses were recorded on a 4-point scale (*very* to *not at all*).

2.3.6. Participation—Intervention participation was coded dichotomously (*no participation - participation*).

2.4. Analytic strategy

Predictors of participation in the intervention were first analyzed using simple logistic regression analyses. These analyses were performed using Stata 12.0 (StataCorp, 2009). Additional mediation analyses were conducted by path analysis with manifest variables using Mplus 6.12 (Muthén & Muthén, 2011). In a first step, a just identified model with zero degrees of freedom was calculated. In a second step, non-significant paths and predictors were deleted which resulted in an over identified model. Model fit of the over identified model was evaluated using the RMSEA (Root mean square error of approximation), the CFI (Comparative Fit Index), and the TLI (Tucker-Lewis Index). Values below .06 for the RMSEA and above .95 for the CFI/TLI signify an acceptable model fit to the data (Hu & Bentler, 1999). All analyses were conducted with standard errors adjusted for the nested structure of the data (students nested in 42 schools).

3. Results

3.1. Bivariate results

Participant baseline characteristics are displayed in Table 1 and bivariate correlations between study variables can be found in Table 2. Participation in the intervention was positively related to more smoking friends, smoking siblings, stronger smoking behavior, stronger nicotine dependence, a previous quit attempt, and higher quit motivation.

As can be seen from the results of the simple logistic regression analyses (Table 1), age and gender did not significantly predict intervention participation. Consistent with hypothesis 1, more smoked CPD and stronger nicotine dependence increased the odds of participating in the intervention. As expected in hypothesis 2, a quit attempt within the last 6 months and stronger quit motivation increased the probability of participating. Regarding hypothesis 3, the odds of participating increased with reports of more friends smoking. Also, the odds of participation were increased for students who reported smoking siblings. Smoking of parents was not related to intervention participation.

3.2. Path analysis results

Significant predictors of the simple logistic regression analyses were then tested in a multivariate path analysis. After deleting the non-significant paths and the non-significant predictor smoking siblings from the model, the evaluated model proved a good fit to the data (RMSEA = .03; CFI = .99; TLI =. 98). The over identified path analysis model can be found in Figure 1.

Similar to the simple regression results, nicotine dependence, quit motivation, and a previous quit attempt were directly and positively related to participation. Nicotine dependence and quit motivation were negatively related to each other. The total variance accounted for by the model was 38% for nicotine dependence, 15% for quit motivation, and 12% for intervention participation.

The number of CPD was indirectly positively related to participation via nicotine dependence (*Beta*=.15; *t*=5.6; *p*<.001) and negatively via quit motivation (*Beta*=−.04; *t*= −3.5; *p*<.001), which signifies an inconsistent mediation, since the two mediation effects are opposing each other (MacKinnon, Fairchild, & Fritz, 2007). Overall, smoking behavior had a significantly positive indirect effect on participation (*Beta*=.11; *t*=4.2; *p*<.001). In absence of a significant direct effect, this means that the effect of smoking behavior on participation was fully mediated by nicotine dependence and quit motivation. In addition to the direct positive effect on participation, a previous quit attempt was indirectly related to participation via nicotine dependence (*Beta*=.06; *t*=4.7; *p*<.001) and via quit motivation (*Beta*=.04; *t*=3.4; *p*=.001), signifying a partial mediation. There was a significant positive indirect effect of smoking friends on participation via nicotine dependence (*Beta*=.04; *t*=3.0; *p*<.01), again signifying a full mediation.

4. Discussion

This study compared smoking students voluntarily participating in a behavioral smoking cessation intervention with smoking students who decided against participating.

In our study, stronger nicotine dependence, a previous quit attempt, and higher quit motivation was positively related to intervention participation. These findings are consistent with previous research reporting that heavy smoking and high nicotine dependence was common among participants of a smoking cessation intervention (Horn et al., 2008) and related to quit attempts among adolescent smokers (Kleinjan et al., 2009). Furthermore, our findings confirm and extend previous research on the role of readiness to quit and previous quit attempts for adolescent smoking cessation (Horn et al., 2008; Kleinjan et al., 2009) and show that cognitive and behavioral variables related to the cessation process play an important role in the recruitment of adolescent smokers into professional cessation interventions. Interestingly, others have found that nicotine dependence, quit motivation, and a previous quit attempt are also predictors of treatment retention (Turner, Mermelstein, Berbaum, & Veldhuis, 2004), indicating that the same factors that may make adolescents interested in joining an intervention, may also keep them attending. Overall, these results suggest that the youths who responded to our recruitment efforts may acknowledge that they are heavier and more dependent tobacco users and may need professional support to successfully quit smoking, and as a consequence self-select into the intervention.

Our study partially confirmed previous findings that adolescent smoking cessation participants are strongly embedded in smoking peer groups and families (Horn et al., 2008), since intervention participation was more likely among adolescents with more smoking friends and this effect was mediated by nicotine dependence in the path analysis model. On the other hand, parental smoking did not predict intervention participation and the significant positive effect of smoking siblings on participation disappeared in the multivariate model. These findings suggest that while smoking among friends may have an impact on voluntary intervention participation, smoking in the family may not play such a prominent role. Overall, our results contradict findings from the adult literature that living in a household with other smokers may present a barrier to intervention participation (Audrain-McGovern et al., 2009).

The indirect effect of smoking friends on participation mediated by nicotine dependence is furthermore consistent with the findings from Kleinjan et al. (2009), who reported that friends' smoking was indirectly related to the number of quit attempts and to smoking cessation, mediated by nicotine dependence. The association between smoking friends and nicotine dependence may be an indicator for peer group influence or youth associating with substance using peers through socialization and selection effects (Simons-Morton & Farhat, 2010).

In order to estimate if the program was successful at reaching those adolescent smokers more in need of professional smoking cessation support, it is important to compare the predictors of participation identified in our study with factors that have been found to hinder successful smoking cessation in adolescence (Bühler & Thrul, 2012) as well as predictors of self-initiated smoking cessation from longitudinal studies (Sussman, 2002). The most important predictors of successful self-initiated quitting reported this research are less nicotine dependence, a social context that consists of fewer smokers, positive attitudes towards tobacco control, as well as a positive perspective on the own future. Since our study was successful in recruiting young smokers with heavier smoking behavior and a stronger nicotine dependence, it seems that the intervention was partially successful in reaching those young smokers more in need of professional help.

4.1. Limitations

Our findings have to be interpreted with several limitations in mind. Firstly, this study relied on cross-sectional self-report measures, which may be prone to memory bias, as well as under- or over-reporting. Due to the cross-sectional data, causality should not be inferred, as the direction of effects between variables is unknown (e.g., heavy smoking may result in stronger nicotine dependence, which, in turn may require a person to smoke more). Furthermore, a substantial number of intervention participants did not complete the baseline questionnaire in the information session. Since missing baseline data were replaced or imputed on the basis of the questionnaire participants competed in the first intervention session, these replaced data may be impacted by time effects such as seasonality. However, such effects are likely to be small, since course instructors were advised to start the intervention within one week after the information session. The generalizability of our results may be limited, since only students from basic and intermediate secondary German schools were included in this study. However, since smoking prevalence among students has been repeatedly shown to be higher in these types of schools than in schools of the higher track (BZgA, 2012; Lampert & Thamm, 2007; Orth & Töppich, 2010), one goal of the project was to offer the intervention at types of schools with the highest needs. Lastly, self-efficacy to resist smoking is an important predictor of both adolescents' smoking initiation (Thrul, Stemmler, Bühler, & Kuntsche, 2013) and cessation (Panday, Reddy, Ruiter, Bergström, & De Vries, 2005) and may also be relevant as a predictor of intervention participation but was not assessed in this study.

4.2. Conclusions

The present study provides information on predictors of voluntary participation in behavioral smoking cessation interventions for adolescents. To improve intervention reach,

increased efforts should be undertaken to successfully recruit adolescent smokers who are currently not motivated to quit, or smoke at lower rates and are less dependent on nicotine. In order to achieve this goal, additional recruitment methods could be implemented: By using techniques based on motivational interviewing (Miller & Rollnick, 1991), the discrepancies between desirable things (e.g., money, physical fitness and sports performance, good skin, etc.) and smoking could be highlighted, to enhance young smokers' motivation to participate. Furthermore, the anti-tobacco industry content of the information session could be increased in order to improve quit intentions among attending smokers (Malone, Grundy, & Bero, 2012). Lastly, the negative consequences of low-rate smoking to oneself and others' health (Schane, Ling, & Glantz, 2010; Schane, Prochaska, & Glantz, 2013) should be communicated, in order to improve recruitment among light and less dependent young smokers.

The fact that a large part of intervention participants did not complete the baseline questionnaire during the information session may indicate that they were recruited through other sources. This finding speaks to the relevance of individual-based recruitment strategies (e.g., direct referral by teachers or school social workers) and is consistent with previous reports on the importance of peer referral for recruitment of adolescent smokers (Breland, Colby, Dino, Smith, & Taylor, 2009; Thrul et al., 2014). Overall, in line with recommendations from other researchers (Sussman & Sun, 2009), we argue that the school is a setting well suited to recruit young smokers into professional cessation interventions. As treatment retention is another major challenge for adolescent smoking cessation interventions (Backinger et al., 2008), additional studies should examine, how the predictors of recruitment reported in the present study relate to treatment retention.

ACKNOWLEDGEMENTS

REFERENCES

Audrain-McGovern J, Rodriguez D, Epstein LH, Rodgers K, Cuevas J, Wileyto EP. Young adult smoking: What factors differentiate ex-smokers, smoking cessation treatment seekers and nontreatment seekers? Addictive Behaviors. 2009; 34(12):1036–1041. [PubMed: 19619948]

Backinger CL, Michaels CN, Jefferson AM, Fagan P, Hurd AL, Grana R. Factors associated with recruitment and retention of youth into smoking cessation intervention studies - a review of the literature. Health Education Research. 2008; 23(2):359–368. [PubMed: 17884834]

Bancej C, O'Loughlin J, Platt RW, Paradis G, Gervais A. Smoking cessation attempts among adolescent smokers: a systematic review of prevalence studies. Tobacco Control. 2007; 16(6)

Breland, A.; Colby, S.; Dino, G.; Smith, G.; Taylor, M. Youth Smoking Cessation Interventions: Treatments, Barriers and Recommendations for Virginia. Richmond, Virginia: Virginia Commonwealth University, Institute for Drug and Alcohol Studies; 2009. Retrieved from http://www.t4dev.vcu.edu/cstp-dev/media/cstpdev/projects/vytp/docs/Youth_Smoking_Cessation_Interventions_Report_%28final% 29.pdf

Bühler A, Thrul J. Rauchstopp bei Jugendlichen und jungen Erwachsenen - Grundlagen und Intervention [Smoking Cessation in Adolescents and Young Adults - Scientific Basis and Intervention]. Sucht. 2012; 58(5):297–316.

Bühler A, Wegmann L, Schmidt A, Thrul J, Strunk M, Lang P. Rekrutierung, Implementation und Aufhörrate eines Rauchstopp-Kurses für Jugendliche [Recruitment, Implementation and Quit Rate of an Adolescent Smoking Cessation Program]. Sucht. 2012; 58(1):23–32.

Dahm JL, Cook E, Baugh K, Wileyto EP, Pinto A, Leone F, Schnoll RA. Predictors of enrollment in a smoking cessation clinical trial after eligibility screening. Journal of the National Medical Association. 2009; 101(5):450–455. Retrieved from http://www.nmanet.org. [PubMed: 19476198]

DiFranza JR, Savageau JA, Fletcher K, Ockene JK, Rigotti NA, McNeill AD, Wood C. Measuring the loss of autonomy over nicotine use in adolescents: the DANDY (Development and Assessment of Nicotine Dependence in Youths) study. Archives of Pediatrics & Adolescent Medicine. 2002; 156(4):397–403. [PubMed: 11929376]

Federal Centre for Health Education (BZgA). Die Drogenaffinität Jugendlicher in der Bundesrepublik Deutschland 2011. Der Konsum von Alkohol, Tabak und illegalen Drogen: aktuelle Verbreitung und Trends [Drug affinity of adolescents in the Federal Republic of Germany in 2011. The use of alcohol, tobacco, and illegal drugs: Prevalences and trends]. Köln: Federal Centre for Health Education; 2012. Retrieved from http://www.bzga.de/

Federal Centre for Health Education (BZgA). Der Tabakkonsum Jugendlicher und junger Erwachsener in Deutschland 2012. Ergebnisse einer aktuellen Repräsentativbefragung und Trends [Tobacco use of adolescents and young adults in Germany in 2012. Results of a representative survey and trends]. Köln: Federal Centre for Health Education; 2013. Retrieved from http://www.bzga.de/

Horn K, Dino G, Branstetter S, Zhang J, Kelley G, Noerachmanto N, Tworek C. A profile of teen smokers who volunteered to participate in school-based smoking intervention. Tobacco Induced Diseases. 2008; 4(1):1–11. [PubMed: 18822158]

Hu L, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. Structural Equation Modeling: A Multidisciplinary Journal. 1999; 6(1):1–55.

Kleinjan M, Engels RCME, van Leeuwe J, Brug J, van Zundert RMP, Van den Eijnden RJJM. Mechanisms of adolescent smoking cessation: Roles of readiness to quit, nicotine dependence, and smoking of parents and peers. Drug and Alcohol Dependence. 2009; 99(1–3):204–214. [PubMed: 18848408]

Kraus L, Piontek D, Pabst A, Matos EGde. Studiendesign und Methodik des Epidemiologischen Suchtsurveys 2012 [Study Design and Methodology of the 2012 Epidemiological Survey of Substance Abuse]. Sucht. 2013; 59(6):309–320.

Lampert T, Thamm M. Tabak-, Alkohol- und Drogenkonsum von Jugendlichen in Deutschland. Bundesgesundheitsblatt - Gesundheitsforschung - Gesundheitsschutz. 2007; 50(5):600–608. [PubMed: 17514444]

Leatherdale ST, McDonald PW. Youth smokers' beliefs about different cessation approaches: are we providing cessation interventions they never intend to use? Cancer Causes & Control. 2007; 18(7):783–791. [PubMed: 17549592]

MacKinnon DP, Fairchild AJ, Fritz MS. Mediation analysis. Annual Review of Psychology. 2007; 58:593–614.

Malone RE, Grundy Q, Bero LA. Tobacco industry denormalisation as a tobacco control intervention: a review. Tobacco Control. 2012; 21(2):162–170. [PubMed: 22345240]

Miller, WR.; Rollnick, S. Motivational interviewing: Preparing people to change addictive behavior. New York: Guilford Press; 1991.

Muthén, LK.; Muthén, BO. Mplus User's Guide. Vol. 6. Los Angeles, CA: Muthén & Muthén; 2011. Retrieved from http://www.statmodel.com/

Orth D-PB, Töppich J. Veränderungen von Wissen, Einstellungen und Rauchverhalten bei Jugendlichen in Deutschland. Ergebnisse wiederholter Repräsentativbefragungen der Bundeszentrale für gesundheitliche Aufklärung [Changes in knowledge, attitudes, and smoking behavior among young people in Germany. Results of repeated, representative surveys by the

BZgA]. Bundesgesundheitsblatt - Gesundheitsforschung - Gesundheitsschutz. 2010; 53(2):133–143. [PubMed: 20098974]

Panday S, Reddy SP, Ruiter RAC, Bergström E, De Vries H. Determinants of smoking cessation among adolescents in South Africa. Health Education Research. 2005; 20(5):586–599. [PubMed: 15772246]

Royston P, White IR. Multiple Imputation by Chained Equations (MICE): Implementation in Stata. Journal of Statistical Software. 2011; 45(4):1–20. Retrieved from http://www.jstatsoft.org/v45/i04.

Schane RE, Ling PM, Glantz SA. Health Effects of Light and Intermittent Smoking A Review. Circulation. 2010; 121(13):1518–1522. [PubMed: 20368531]

Schane RE, Prochaska JJ, Glantz SA. Counseling nondaily smokers about secondhand smoke as a cessation message: a pilot randomized trial. Nicotine & Tobacco Research: Official Journal of the Society for Research on Nicotine and Tobacco. 2013; 15(2):334–342. [PubMed: 22592447]

Simons-Morton BG, Farhat T. Recent Findings on Peer Group Influences on Adolescent Smoking. The Journal of Primary Prevention. 2010; 31(4):191–208. [PubMed: 20614184]

StataCorp. Stata Statistical Software: Release 11. College Station, TX: StataCorp LP; 2009.

Sussman S. Effects of sixty six adolescent tobacco use cessation trials and seventeen prospective studies of self-initiated quitting. Tobacco Induced Diseases. 2002; 1(1):35–81. [PubMed: 19570247]

Sussman S, Sun P. Youth tobacco use cessation: 2008 update. Tobacco Induced Diseases. 2009; 5(1): 3. [PubMed: 19183452]

Thrul J, Stemmler M, Bühler A, Goecke M. The role of participants' self-selected future smoking goals in adolescent smoking cessation interventions. Drug and Alcohol Dependence. 2014; 141:118–123. [PubMed: 24928478]

Thrul J, Stemmler M, Bühler A, Kuntsche E. Adolescents' protection motivation and smoking behaviour. Health Education Research. 2013; 28(4):683–691. [PubMed: 23766453]

Turner LR, Mermelstein R, Berbaum ML, Veldhuis CB. School-based smoking cessation programs for adolescents: What predicts attendance? Nicotine & Tobacco Research. 2004; 6(3):559–568. [PubMed: 15203789]

U.S. Department of Health and Human Services. Preventing Tobacco Use Among Young People: A Report of the Surgeon General. Atlanta, GA: U.S. Department of Health and Human ServicesPublic Health Service, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health; 1994. Retrieved from www.cdc.gov

Van Buuren S, Boshuizen HC, Knook DL. Multiple imputation of missing blood pressure covariates in survival analysis. Statistics in Medicine. 1999; 18(6):681–694. [PubMed: 10204197]

Wegmann L, Bühler A, Strunk M, Lang P, Nowak D. Smoking cessation with teenagers: The relationship between impulsivity, emotional problems, program retention and effectiveness. Addictive Behaviors. 2012; 37(4):463–468. [PubMed: 22273584]

Highlights

- We examine a behavioral smoking cessation intervention for adolescents.

- We investigate participant baseline predictors of intervention participation.

- Participation is predicted by nicotine dependence and quit motivation.

- Heavier smoking behavior is indirectly positively associated with participation.

- Participants in need of professional cessation support were reached.
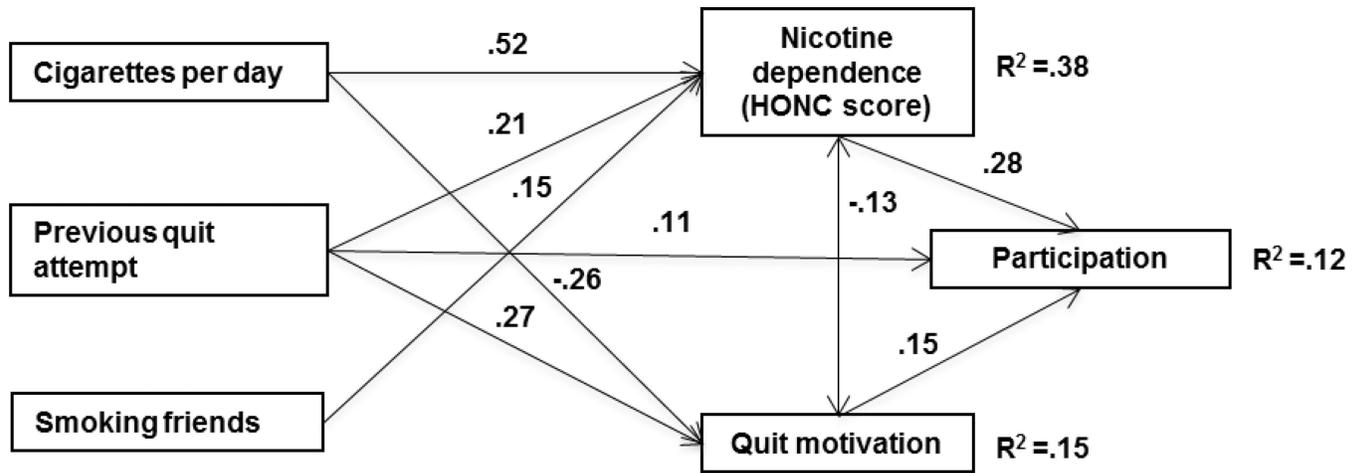
Figure 1.
Standardized estimates of the over identified mediation model of participation (n=1053).
Fit indices: Chi2 = 5.48, df = 3; RMSEA = .03; CFI = .99; TLI =. 98
Note: All solid lines with corresponding estimates are significant at p<.001; HONC Hooked on Nicotine Checklist

Table 1

Variables used in this study for IG and CG and results of bivariate regression analyses to predict participation (*n*=1053)

Variables	Participants (*n*=272)	Non-participants (*n*=781)	Odds ratio (95% CI)[a]
Age (*M, SD*)	14.82 (1.13)	14.82 (1.27)	1.00 (.90–1.12)
Gender female (%)	132 (49%)	368 (47%)	1.06 (.70–1.60)
Smoking friends (*M, SD*)	3.05 (.48)	2.93 (.47)	1.68 (1.15–2.45)**
Smoking family (%)			
Mother	141 (52%)	389 (50%)	1.07 (.78–1.47)
Father	159 (58%)	444 (57%)	1.07 (.77–1.49)
Siblings	137 (50%)	326 (42%)	1.42 (1.04–1.92)*
Smoking behavior CPD (*M, SD*)	8.15 (7.02)	6.23 (6.75)	1.04 (1.01–1.07)**
HONC score (*M, SD*)	6.17 (2.99)	4.54 (3.26)	1.17 (1.11–1.24)***
Previous quit attempt	125 (46%)	227 (29%)	2.08 (1.66–2.60)***
Quit motivation (*M, SD*)	2.68 (.92)	2.50 (.97)	1.22 (1.06–1.40)**

Note: CI = confidence interval; CPD = cigarettes per day; HONC = Hooked on nicotine checklist;

[a] calculated with robust standard errors;

* $p<.05$;

** $p<.01$;

*** $p<.001$

Table 2

Correlations between study variables (*n*=1053)

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. Age	-									
2. Gender female	−.15***	-								
3. Smoking friends	.12***	.07*	-							
4. Smoking Mother	−.02	.11***	.14***	-						
5. Smoking Father	−.02	.07*	.07*	.25***	-					
6. Smoking Siblings	.02	.11***	.12***	.14***	.07*	-				
7. Smoking behavior (CPD)	.22***	−.06	.33***	.17***	.05	.11***	-			
8. HONC score	.10**	.05	.31***	.09**	.09**	.11***	.55***	-		
9. Previous quit attempt	−.03	.04	−.00	−.08*	.01	.00	−.05	.19***	-	
10. Quit motivation	−.10**	−.00	−.13***	−.08*	−.02	.01	−.29***	−.20***	.28***	-
11. Participation	.00	.01	.10***	.01	.01	.08*	.12***	.22***	.16***	.08**

Note: CPD = cigarettes per day; HONC = Hooked on nicotine checklist;

*
 p<.05;

**
 p<.01;

***
 p<.001