

Predictors of High Program Exposure Among Adolescents Participating in a Smoking Prevention Intervention in Romania

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ABSTRACT

INTRODUCTION: Web-based smoking prevention programs can be delivered to large groups of adolescents under relatively private conditions at a convenient cost, but their effectiveness is highly dependent on the level of exposure to the educational content. The objective of the study was to identify the predictors of high program exposure among a group of adolescents participating in a web-based smoking prevention cluster randomized trial in Romania.

METHODS: The study sample included 675 adolescents from Târgu Mureș, Romania. The level of exposure to the ASPIRE web-based smoking prevention program was monitored using data automatically saved on the system server. High program exposure was defined as watching 75% to 100% of the educational content. Associations between adolescents' sociodemographic, psychological, and behavioral variables collected online at the beginning of the intervention and high program exposure were tested using chi-square test and logistic regression.

RESULTS: In all, 68.3% of students were highly exposed to the program. There were 4 significant predictors of high program exposure in the multivariable logistic regression model: participant's father's lower level of education (odds ratio [OR]: 1.75; 95% confidence interval [CI]: 1.19-2.44), participant's brother's nonsmoking status (OR: 1.76; 95% CI: 1.13-2.72), never trying e-cigarettes (OR: 1.73; 95% CI: 1.22-2.45), and considering the health of others an important reason not to smoke (OR: 2.46; 95% CI: 1.54-3.93).

CONCLUSIONS: The analysis identified sociodemographic, psychological, and behavioral factors that may be useful in project management of such intervention to improve program effectiveness.

KEYWORDS: intervention dose, program exposure, web-based smoking prevention, ASPIRE, adolescents

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Introduction

Despite the extensive tobacco control measures implemented during the last decades, cigarette smoking among children and adolescents remains a major public health issue, especially in low- and middle-income countries.¹ The most recent Global Youth Tobacco Survey (GYTS) investigating students aged 13 to 15 years from Central and Eastern European countries revealed a lifetime smoking prevalence that spanned from 39.2% in the Republic of Moldova to 58.8% in Bulgaria and a past 30 days smoking that ranged from 9.3% in Serbia to 28.2% in Bulgaria.² Lifetime prevalence of smoking among Romanian students of similar age was 41.2%, whereas past 30 days smoking was 13.5% in 2009.³

A wide range of approaches including school, family, community, computer, and policy-based programs have been devised and carried out to reduce the prevalence of smoking and exposure to secondhand smoke among children and youth.⁴ School-based smoking prevention curricula are the most widely used intervention in youth tobacco control, but the evidence regarding their efficacy is mixed and depends on

intervention type, time of the assessment, and implementation fidelity.^{5,6} The educational curricula can reflect different theoretical approaches such as the rational model, the affective-emotional and social skills development model, the social influence theory, or they can combine several theoretical models. Thomas et al in a Cochrane Review published in 2013 analyzed 49 randomized controlled trials that included a total of 140 000 school children. They observed an overall significant 12% reduction of smoking initiation in the intervention groups compared with the control groups at the longest follow-up, but not at 1 year or less after delivering the smoking prevention curricula. Interventions that blended elements of the social competence and social influence models have shown significant effects both at 1 year and longer periods of time after the intervention. However, school curricula employing only the social influence model or the rational approach (conveying knowledge), and all the other programs using a combination of several models, had no significant effect at any time point.⁵ Danish researchers assessing the impact of program implementation on the outcomes of a multicomponent school-based



smoking prevention intervention designed for grade 7 pupils by measuring 4 dimensions of implementation (adherence, dose or level of exposure, quality of delivery, and participant responsiveness) have found that higher degrees of implementation improved the effect of the intervention.^{6,7}

Studies investigating the results of computer- and web-based smoking prevention programs are promising.^{8–12} However, some authors found that program exposure was low and may prevent digital interventions from producing benefits of practical significance.^{7,8} Data about defining cut-off values for program completion/exposure are scarce. Buller et al⁸ who measured the level of completion of the “Consider this” smoking prevention program, refer to 90% of activities as indicating program completion but no objective criteria are given for setting this particular cut-off. Implementation dose was measured also by Sy and Glanz in the SPLASH tobacco prevention curriculum. Low dosage was considered from 0% to 66.6%, whereas high dosage was considered from 66.7% to 100%, but the reasons for choosing the cut-off value are not provided.¹³

In a previously published study, Nădășan et al¹⁴ have shown that students exposed to 75% or more of a web-based smoking prevention curriculum were significantly less likely to initiate smoking than those in the control group, suggesting that increasing the level of participants’ exposure may maximize the impact of the intervention. In this study, high program exposure was defined as being exposed to 75% to 100% of the educational content based on the judgment of the experts involved in the research, considering the actual content of the educational curriculum.¹⁴

The aim of the study was to identify the predictors of high program exposure among a group of adolescents participating in the ASPIRE smoking prevention intervention in Târgu Mureș, Romania.

Methods

We conducted a secondary exploratory analysis of data originating from a cluster randomized trial that investigated the efficacy of ASPIRE-Romania, a translated and adapted school-based computer-assisted multimedia smoking prevention program designed for high-school students.¹⁴ The original ASPIRE curriculum was developed by Prokhorov et al^{9,10} at MD Anderson Cancer Center and The University of Texas Health Science Center in Houston.

This study sample included 675 adolescents from Târgu Mureș, Romania, who were part of the intervention group of the smoking prevention trial. These students represented 65% of the 1038 students allocated to the intervention group and had completed the smoking prevention program, as well as the initial and the 6-month follow-up evaluations. Students who did not complete the smoking prevention program ($n=187$), those who did not attend both evaluation sessions ($n=121$), or provided invalid or incomplete data were excluded from the final analytical sample ($n=55$).

The baseline questionnaire included sociodemographic data (sex and ethnicity), school-related information (average grades and school disciplinary actions), psychological variables (Brief Sensation Seeking Scale [BSSS], Center for Epidemiological Studies Depression Scale [CES-D Ro Scale], and Decisional Balance Scale), social environment variables (parents’ level of education, and family members’ and friends’ smoking status), and information about the participants’ smoking behavior (ever tried conventional cigarettes/e-cigarettes and smoked during the last 30 days). The detailed description of the variables is available in previously published work.¹⁴ The baseline assessment was performed in November to December 2014 and the follow-up assessment in May 2015. Participation in the study was voluntary and the enrollment started following the approval by the Institutional Review Board of The University of Medicine, Pharmacy, Sciences, and Technology of Târgu Mureș, and the participants’ parental written consent.

The level of exposure to the ASPIRE web-based smoking prevention program was monitored using data automatically saved on the system server. High program exposure was defined as watching 75% to 100% of the educational content.

Associations between adolescents’ sociodemographic, psychological, and behavioral variables collected online at the beginning of the intervention and high program exposure were tested using chi-square test and logistic regression. *P* values were considered significant at less than 0.05 for the logistic regression, whereas the Bonferroni correction was applied for the exploratory chi-square analyses resulting in a significance level of less than 0.001. The IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp. was used for statistical analyses.

Results

The mean age of the participants was 14.9 years (SD of ± 0.5 years) and 48.6% were women. More than half (55.0%) of the students self-identified as Romanian, 41.6% as Hungarian, and 3.4% were of other ethnic groups. Most of the students (71.0%) had high grades. Of the 675 students in the analytical sample, 44.1% have tried smoking at least once before the initial assessment and 20.0% had smoked during the last 30 days.

On average, the students completed 79.5% of the educational activities. The level of exposure was more than 90% for 53.2% of the students, between 81% and 90% for 11.3% of the students, between 71% and 80% for 10.8% of the students, between 61% and 70% for 2.4% of the students, between 51% and 60% for 3.3% of the students, between 41% and 50% for 4% of the students, between 31% and 40% for 7% of the students, between 21% and 30% for 6.2% of the students, between 11% and 20% for 1.8 of the students, and 10% or less for 0.1% of the students.

The results of the bivariate analysis testing the sociodemographic, psychological, and behavioral predictors of high program exposure are presented in Table 1 (only significant associations are included; full data about the 44 variables are

Table 1. Bivariate analysis of the sociodemographic characteristics, social environmental factors, and program exposure among participants in the ASPIRE-Romania smoking prevention program.

| VARIABLES | | LOW PROGRAM EXPOSURE (%) | HIGH PROGRAM EXPOSURE (%) | P VALUE |
|---|----------------------------------|--------------------------|---------------------------|----------|
| Punishment for bad behavior in school | No punishment | 30.4 | 69.6 | 0.048* |
| | At least 1 warning or suspension | 41.6 | 58.4 | |
| Father's level of education | Low | 29.1 | 70.9 | 0.031* |
| | High | 37.4 | 62.6 | |
| Brother's smoking status | Nonsmoker | 29.3 | 70.7 | 0.002* |
| | Smoker | 44.4 | 55.6 | |
| Friends' smoking status | Less than half smoke | 29.8 | 70.2 | 0.028* |
| | More than half smoke | 39.8 | 60.2 | |
| Ever tried conventional cigarettes | No | 27.3 | 72.7 | 0.006* |
| | Yes | 37.2 | 62.8 | |
| Ever tried e-cigarettes | No | 27.1 | 72.9 | <0.001** |
| | Yes | 40.6 | 59.4 | |
| Depression symptoms score | High | 37.5 | 62.5 | 0.011* |
| | Low | 28.1 | 71.9 | |
| Smoking can affect the health of others | Not important | 50.6 | 49.4 | <0.001** |
| | Important | 28.9 | 71.1 | |
| Smoking is hazardous to people's health | Not important | 46.2 | 53.8 | 0.008* |
| | Important | 30.2 | 69.8 | |
| Tobacco smoke bothers other people | Not important | 45.6 | 54.4 | 0.002* |
| | Important | 29.6 | 70.4 | |
| Smoking is too expensive | Not important | 39.6 | 60.4 | 0.025* |
| | Important | 29.7 | 70.3 | |
| Smoking is addictive | Not important | 45.1 | 54.9 | 0.003* |
| | Important | 29.6 | 70.4 | |
| Smoking makes you bad at sports | Not important | 40.5 | 59.5 | 0.022* |
| | Important | 29.8 | 70.2 | |

*P values significant at 0.05.

**P values significant after applying Bonferroni correction.

available in Supplementary material). The results of the multiple logistic regression analysis are represented in Figure 1.

Discussion and Conclusions

The goal of this exploratory study was to evaluate the demographic, psychological, and behavioral correlates of high program exposure to ASPIRE-Romania to prevent or remediate low exposure among students. However, we observed very few correlates of high program exposure to ASPIRE-Romania,

and among the significant correlates, they are largely unobservable or unmodifiable in the context of a school-based smoking prevention program. For example, father's level of education and smoking status of one's brother are likely unobservable for students, and it seems infeasible (practically and ethically) to ask these questions for the purposes of identifying students at risk of low program exposure. Asking students about the importance of health of others as a reason not to smoke and about trying e-cigarettes may be the most viable questions to

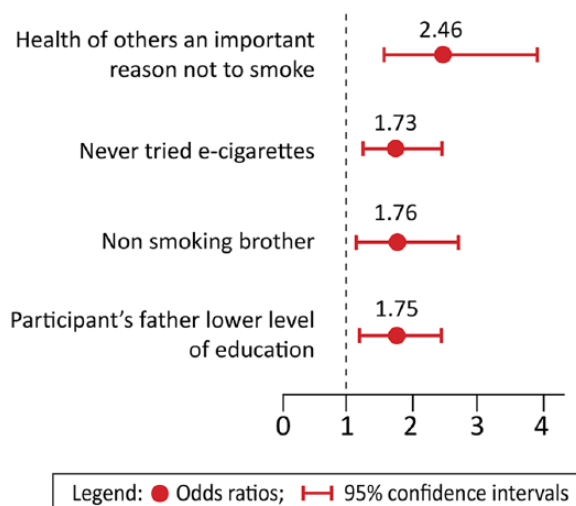


Figure 1. Logistic regression analysis of predictors of high program exposure among participants in the ASPIRE-Romania smoking prevention program.

ask students to identify those students who may not watch the full ASPIRE program and therefore not benefit from its content.

Overall, 68.3% of students had high program exposure, suggesting that most students were exposed to the majority of ASPIRE-Romania content. We observed in our study a higher level of overall exposure (79.5% vs 59%) as well as a higher percentage of students completing more than 90% of the activities (53.3% vs 26.0%) compared with the level reported by Buller et al.⁸ The percentage of pupils exposed to full implementation of intervention reported by Bast et al⁷ was also lower (38.8%), but methodological differences may prevent a rigorous comparison. Approximately 70% overall program exposure found in our study likely reflects robust implementation of ASPIRE-Romania by local teachers, the research team's engagement in the implementation of ASPIRE, and/or a student body that respects the teachers' requests to participate in ASPIRE. Thus, scaling up ASPIRE-Romania to the real world outside the research context seems promising, at least in student receptivity to watching ASPIRE.

To the best of our knowledge, this is the first study exploring the correlates of high program exposure to computer-assisted smoking prevention programs. In a systematic review, Robinson et al¹⁵ investigated participant characteristics associated with recruitment and retention of participants to randomized controlled trials involving children. The review identifies a wide range of factors such as ethnicity, socioeconomic status, parental income, and education level that significantly predict recruitment and retention for children, but none of 28 included studies investigated program retention or exposure to program content in the setting of tobacco use prevention among adolescents.¹⁵

In the main effects paper of ASPIRA participants lost to follow-up were more likely to be ever smokers (65.2% vs

44.1%), more likely to be current smokers (32.1% vs 20.0%), and more likely to report having more friends who smoke cigarettes (39.1% vs 29.5%).¹⁴ A similar pattern may likely compare participant students reporting low vs high exposure to the smoking prevention curriculum, but a direct proof to confirm this assumption cannot be provided.

Although Bonferroni correction was applied to reduce the likelihood of incorrectly rejecting the null hypothesis (type I error), the value of the study may be limited because of some factors that could predict high program exposure (eg, inclination toward online gaming), but were not measured, whereby missing correlates that could be used to predict ASPIRE uptake. The validity of the program exposure measurement could be improved in future research by devising tools (eg, eye tracking technology) that enable measuring actual time spent on reading and watching the educational materials.

The analysis identified psychological and behavioral factors that may be useful in increasing participants' compliance in the ASPIRE smoking prevention curriculum. Further research on program exposure predictors and how recruitment and retention strategies can be applied to children and adolescent would be beneficial.

Author Contributions

VN contributed substantially to study design, data acquisition, statistical analyses and interpretation of data, drafting of the article, editing table and figure, and approving the final version of the article. LF contributed to acquisition of data, drafting the article, and approving the final version of the article. ZA contributed to study design, supervision, drafting and critically revising the article, and approving the final version of the article. KLF contributed substantially to study design, supervision, data interpretation, drafting and critically revising the article, and approving the final version of the article.

Supplemental Material

Supplemental material for this article is available online.

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