

5-8-2015

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Recommended Citation

Jaber, Rana; Mzayek, Fawaz; Madhivanan, Purnima; Khader, Yousuf; and Maziak, Wasim, "Predictors of Cigarette Smoking Progression Among a School-Based Sample of Adolescents in Irbid, Jordan: A Longitudinal Study (2008–2011)" (2015). *Department of Epidemiology*. 29.

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Original investigation

Predictors of Cigarette Smoking Progression Among a School-Based Sample of Adolescents in Irbid, Jordan: A Longitudinal Study (2008–2011)

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Abstract

Introduction: Little evidence regarding longitudinal predictors of cigarette smoking progression is available from developing countries. This study aimed to identify gender-specific individual and social predictors of cigarette smoking progression among a school-based sample of adolescents in Irbid, Jordan.

Methods: A total of 1781 seventh graders (participation rate 95%) were enrolled and completed an annual self-administered questionnaire from 2008 through 2011. Students who reported “ever-smoking a cigarette” at baseline or in the subsequent follow-up but not being “heavy daily smokers” (>10 cigarettes per day) were eligible for this analysis ($N = 669$). Grouped-time survival analyses were used to identify predictors of cigarette smoking progression in boys and girls.

Results: Among the study sample, 38.3% of students increased the frequency and /or amount of cigarette smoking during the 3 years of follow-up. Among individual factors, the urge to smoke in the morning predicted smoking progression for boys and girls. The independent predictors of cigarette smoking progression were friends’ smoking and attending public schools in boys, and siblings’ smoking in girls. Discussing the dangers of smoking with family members was protective for girls.

Conclusion: Boys and girls progressed similarly in cigarette smoking once they initiated the habit. Progression among girls was solely family-related, while it was peer-related for boys.

Introduction

Although, most tobacco control efforts focus on preventing initiation of cigarette smoking, there are 80 000 to 100 000 adolescents worldwide begin smoking every day, and almost half of them become regular smokers.¹ In the Eastern Mediterranean Region (EMR), the percentage of adolescents who smoke cigarettes is increasing.

Findings from the Global Youth Tobacco Survey showed that 2% of girls and 7% of boys in the EMR were current cigarette smokers.² Jordan, an EMR country, has a high prevalence of current cigarette smoking at 17.4% and 6.6% for boys and girls, respectively.³

Smoking behavior among adolescents can be characterized into several developmental stages including: precontemplation,

contemplation, trial or initiation, experimentation, regular smoking, and nicotine addiction or daily smoking.⁴ The majority of adolescents who smoke daily continue to smoke later in their life.⁵ However, not all adolescents who initiate cigarette smoking become daily smokers.^{6,7} It is important therefore to understand the factors that are associated with progression of smoking from early experimentation to regular smoking. Such knowledge will help inform interventions that aim to prevent nicotine addiction and the adverse health consequences of lifetime tobacco use. Smoking progression differs by gender. For example, girls (12–17 years old) have been shown to be at higher risk of addiction to nicotine once they start smoking, compared with boys.^{8,9} Additionally, since cigarette smoking is generally a socially unacceptable habit for girls in the EMR,^{10,11} gender roles may influence cigarette smoking progression differentially by gender.¹⁰

Evidence from developed countries showed the strength of the longitudinal study designs in gaining valuable information about determinants of cigarette smoking progression.^{12,13} Such research has resulted in identification of a number of individual (intrapersonal) and social (family and nonfamily) predictors.^{4,14} As these factors are likely to be context-dependent,^{15,16} evidence about population-specific determinants of smoking progression is needed to inform tobacco control interventions among youth. This study aims to identify the individual as well as the contextual predictors of cigarette smoking progression among adolescents in Jordan using a longitudinal study design.

Methods

Study Participants

This study used data from the Irbid Longitudinal Study of Smoking behavior. Details about the study methods were previously reported by our group.¹⁷ Briefly, a total of 60 schools in Irbid, Jordan were stratified by gender (boys, girls, and mixed) and school type (public or private). A total of 19 schools were randomly selected with probability proportionate to size. All seventh grade students in the selected schools were invited to participate and 1781 participants were enrolled at baseline (wave 1) with a 95% participation rate. All the students were followed annually for 3 years (four waves) from 2008 through 2011. For the purpose of this study, only students who reported ever smoking cigarettes at any point of data collection were included in the analysis. Nonsmokers who reported smoking more than 10 cigarettes per day for the first time they reported ever smoking were considered progressed, and therefore were excluded from the analysis. The final sample included 669 students, of whom 90% remained in the study to the end of follow-up (see [Figure 1](#) for details about participants' selection).

Procedures

Data were collected using a validated questionnaire that was developed using international guidelines¹⁸ and instruments tested and validated in Arabic such as the Global youth Tobacco Survey.¹⁹ The questionnaire had four modules: the demographics and socioeconomic status (SES) module, cigarette smoking behavior module, waterpipe smoking behavior module, and a module that included questions about smoking-related social influences and perceptions. The questionnaires were completed during class hours and were facilitated by trained study personnel who explained the purpose of the study and answered the students' questions. To increase the data validity, no school personnel were allowed in the classroom during

data collection. Parent consent and student assent were obtained before enrollment. This study was reviewed and approved by the Institutional Review Boards of Jordan University for Science and Technology, University of Memphis, Syrian Society against Cancer, and Florida International University.

Measures

Outcome

The outcome was "progression of cigarette smoking." Progression was defined as the escalation in the frequency and/or number of cigarettes smoked between any time point of data collection and the subsequent ones. The smoking status categories were defined as: ever smoked but not currently smoking = 0, currently smoking (at least once during the last month) = 1, smoking once a week = 2, smoking more than once a week but not daily = 3, smoking one cigarette per day = 4, smoking daily but less than 10 cigarettes a day = 5, and smoking more than 10 cigarettes a day = 6. Any escalation in cigarette smoking from "0" through "6" during the subsequent follow-up was considered "progression" and given a value of "1," while "no progression" was given a value of "0."

Potential Predictors

Selection of the study variables was guided by a broad theoretical model of behavioral change "Attitude–Social influence–self-Efficacy model (ASE)." This model states that behavior results from intentions, abilities and motivational factors such as attitudes, social influences, and self-efficacy that determine intentions. Abilities and environmental barriers (eg, availability and restrictions) determine whether intentions will be realized.²⁰ This framework includes several individual and environmental factors that can be examined as potential predictors for progression of cigarette smoking among youth. SES was established using "home density" as a proxy measure.^{10,21} Details about the individual and social factors and the way they were measured are summarized in [Table 1](#).

Statistical Analysis

Life-table estimates (product-limit) were obtained to determine the hazard probabilities of cigarette smoking progression associated with each time interval. Dichotomous grouped-time survival analyses were conducted to examine the association between each potential predictor and the hazard of cigarette smoking progression using hazard ratio and its 95% confidence intervals (95% CI). In this statistical approach, survival time is represented as a set of indicators of whether or not the participant failed in each time point (until the individual experiences the event or is censored). This approach considers the timing as well as the occurrence of the first progression in cigarette smoking. It also handles censoring and allows for a discrete specification of time since our data are interval-censored. Items measured from wave 1 through wave 4 were used for time-varying predictors, linking predictors to the risk of cigarette smoking progression at the subsequent student's interview.²³ Multivariate grouped-time survival analyses were performed by including all potential predictors that were associated with the outcome in the bivariate analysis at a $P \leq .20$ simultaneously in one model in order to protect against residual confounding. Maldonado and Greenland²⁴ suggest that potential confounders be eliminated only if $P > .20$. Multi colinearity and interaction between variables were examined. All the analyses were stratified by gender and weighted by school weights to account for differences among schools. The detailed method of calculating school weights has been described elsewhere.²⁵ The significance level

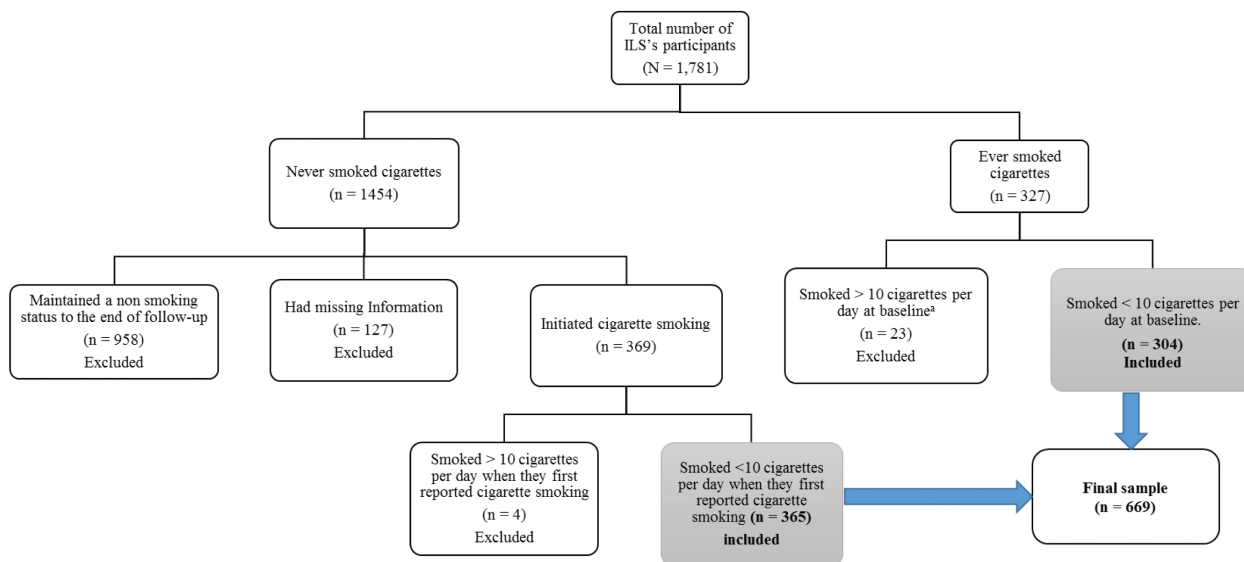


Figure 1. Participants' selection from Irbid Longitudinal Study of smoking behavior to examine the predictors of cigarette smoking progression among school adolescents in Jordan (2008–2011).

Table 1. Potential Individual and Social Predictors of Cigarette Smoking Progression and How They Were Measured in a School-Based Sample of Adolescents in Irbid, Jordan, (2008–2011)

Potential predictors	Questions and responses
Individual factors	
Ever smoking waterpipe (WP)	Did you ever smoke WP, a buff or two? (0 = No, 1= Yes)
Physical activity	Do you participate in sports such as jogging, soccer, basketball, swimming, etc? (0 = No, 1 = Sometimes, 2 = Often, 3 = Regular).
The urge to smoke	Do you smoke cigarette, or feel the urge to smoke, when you wake up in the morning? (0 = No, 1 = Eventually, 3 = Daily)
More friend belief	Do you think that students who smoke cigarettes have more friends? (0= No, 1 = Yes)
Attractiveness belief	Do you think that students who smoke cigarettes are more attractive? (0 = No, 1 = Yes)
Body weight belief	Do you think smoking cigarettes decrease body weight? (0 = No, 1 = Yes)
Harm belief	Do you think smoking cigarettes is harmful for health?
Easy to quit belief	Do you think it is easy to stop smoking cigarettes after smoking for a year or two? (0 = No, 1 = Yes)
Refusal self-efficacy	If a friend offers you a cigarette, would you smoke it? (0 = Absolutely no, 1 = Maybe, 2 = Absolutely yes). The responses1 and 2 were collapsed into one category as both indicate a susceptibility to smoke. ²²
Social factors	
Dangers discussion	Did any of your family members talk to you about the dangers of cigarette smoking? (0 = No, 1= Yes)
Parents knowledge	Do your parents know that you smoke cigarettes? (0 = Parents don't know, 1 = Any of the parents knows, 2 = Both parents know). Responses were re-coded as binary due to inadequate responses in some categories. (0 = No, 1 = At least one knows)
Parents smoking	Do your parents smoke cigarettes? (0 = None of them smoke WP, 1= Both smoke WP, 2 = Father only smoke WP, 3= Mother only smoke WP)
Friends smoking	Do you have close friends who smoke cigarettes? (0 = No, 1= Yes)
Sibling smoking	Do your brothers or sisters smoke cigarettes? (0 = No / I don't know, 1= Yes)
Social bonds	In general, how would you describe your relations with your parents/siblings/classmates/teachers (0 = Not good, 1 = Good). Separate question to assess each.
Promoting smoking	In the past month, did you see ads promoting smoking in the media (eg, TV, radio, newspapers, or movies)? (0 = No, 1 = Sometimes)
Warning from smoking	In the past month, did you see ads warning of the dangers of smoking on health in the media (eg, TV, radio, newspapers, or movies)? (0 = No, 1 = Yes)
Teachers smoking	Do your teachers smoke in front of the students? (0 = No, 1 = Yes)
Cigarettes' price	How much do you usually pay for a pack of cigarettes?
Warning labels	In the past month, did you notice the health warnings on the cigarettes packs? (0 = No, 1 = Sometimes)."
Actor smoking	Have you seen actors/actresses smoking in the movies or on TV? (0 = No, 1= Sometimes).
Intention to quit	Do you want to quit smoking? (0 = No, 1 = Yes)
Attempts to quit	Did you try to quit smoking during the last year? (0 = No, 1 = Yes)

for multivariate analyses was set to $P < .05$. All analyses were conducted using statistical analysis software SAS V. 9.3 (SAS Institute Inc, Cary, NC).

Results

Descriptive Analysis

This study included 669 participants who reported ever smoking cigarettes at baseline or for the first time at any subsequent data collection point. About 67% of the sample were boys with mean (standard deviation) ages at baseline being 12.9 (0.59) and 12.7 (0.59) for boys and girls, respectively. Among all participants, 32% had progressed in cigarette smoking and 9% censored (lost to follow-up at any time point) during the whole course of the follow-up. However, reporting this progression rate is a bit conservative because it did not take into consideration the progression probability among those who lost to follow-up. Findings from the survival analysis that took into consideration the censored data showed that 38% of experimenters may progress in cigarette smoking within the 3 years of follow-up. Analysis by gender showed faster progression among girls compared to boys during the first year, where the incidence rate of cigarette smoking progression among girls was almost double that for boys (Table 2). Although cigarette smoking progression was higher for boys (43%) compared to girls (32%), including gender as a predictor in the final model showed no significant difference in the overall risk of progression (hazard ratio: 1.17; CI: 0.89–1.52).

Bivariate Analysis

The 12-month risk of cigarette smoking progression among boys in public schools was twice that for private schools. Additionally, a one-unit increase in home density (indicating lower income) was associated with an 87% increase in risk of cigarette smoking progression among girls. Among individual factors, “refusal self-efficacy,” “feeling the urge to smoke in the morning,” and “ever smoking waterpipe” were the main predictors of cigarette smoking progression for both boys and girls. Belief that “cigarette smoking is harmful to health” was associated with a lower risk of progression among girls. Among social factors, the highest risk of cigarette smoking progression was associated with “friends smoking” among boys, and “siblings smoking” among girls.

Multivariate Analysis

The independent predictors among boys were “older age,” “attending public schools,” “the urge to smoke in the morning,” “belief that cigarette smoking decreases body weight,” “belief it is easy to quit cigarettes after smoking for a year,” and “friends smoking.” Among girls, the independent predictors were: “high home density,” “the urge to smoke in the morning,” and “siblings smoking.” On the other hand, “belief that cigarette smoking was harmful to health” and “discussing the dangers of smoking with any family member” in girls were associated with 90% and 75% reduction in risk of cigarette smoking progression respectively. “Higher father education” was protective for boys (Figure 2).

Discussion

To the best of our knowledge, this is the first longitudinal study guided by a theoretical model of behavioral change to identify the risk and gender-specific predictors of cigarette smoking progression among adolescents in the Middle East. Among adolescents who initiate cigarettes, 38% are expected to progress in cigarette smoking within a period of 3 years. This estimate lies within the range of 30%–50% progression rate that was reported from national studies among youth in the United States.^{26,27} Cigarette smoking progression was merely influenced by familial factors among girls and extra-familial factors such as schools and peers for boys. These findings increase our understanding of the social context that delineate a specific pattern of predictors of cigarette smoking progression by gender, and identify some modifiable risk factors that may be useful in tobacco cessation programs that are targeting youth in Jordan and possibly in other EMR countries.

One of the interesting findings of this study is the inverse association between cigarette smoking progression and the SES measures such as father’s education and attending private school for boys and low income as indicated by high home density for girls suggesting more progression among adolescents from a lower SES home. These findings are consistent with those reported for cigarette smoking onset by Conrad, Flay and Hill.²⁸

Rather than being causal, low SES may reflect a constellation of factors that are more directly related to smoking. Consistent with previous research findings in the EMR,^{29,30} we found that attending public schools predicts cigarette smoking progression only in boys. This variation by school type and gender may have several

Table 2. Progression of Cigarette Smoking by Time Interval and Gender Among School-Based Sample of Adolescents in Irbid, Jordan, 2008–2011 (N = 669)

Time interval	Entered N	Progressed N (%) ^a	Censored N (%) ^a	Remained (not progress) N (%) ^a	Hazard probability	Cumulative hazard probability
Male (N = 448)						
Baseline—Year 1	237	28 (8.1)	18 (12.0)	191 (79.8)	.08	.08
Year 1—Year 2	283 ^b	61 (20.1)	4 (1.2)	218 (78.7)	.2	.26
Year 2—Year 3	337 ^b	75 (22.7)	20 (5.4)	242 (71.9)	.23	.43
Female (N = 221)						
Baseline—Year 1	81	12 (15.7)	5 (6.6)	64 (77.8)	.16	.16
Year 1—Year 2	133 ^b	12 (9.0)	4 (3.7)	117 (87.3)	.09	.24
Year 2—Year 3	188 ^b	23 (10.7)	7 (3.7)	158 (85.6)	.11	.32

^aAll percentages are weighted.

^bThe difference between the total number of students who didn’t progress in the previous interval and the total number entered the subsequent interval is due to the initiation of cigarette smoking by participants who were never smokers. Participants entered: Year 1–Year 2 = (Male = 92, Female = 69); Year 2–Year 3 (Male = 119, Female = 71).

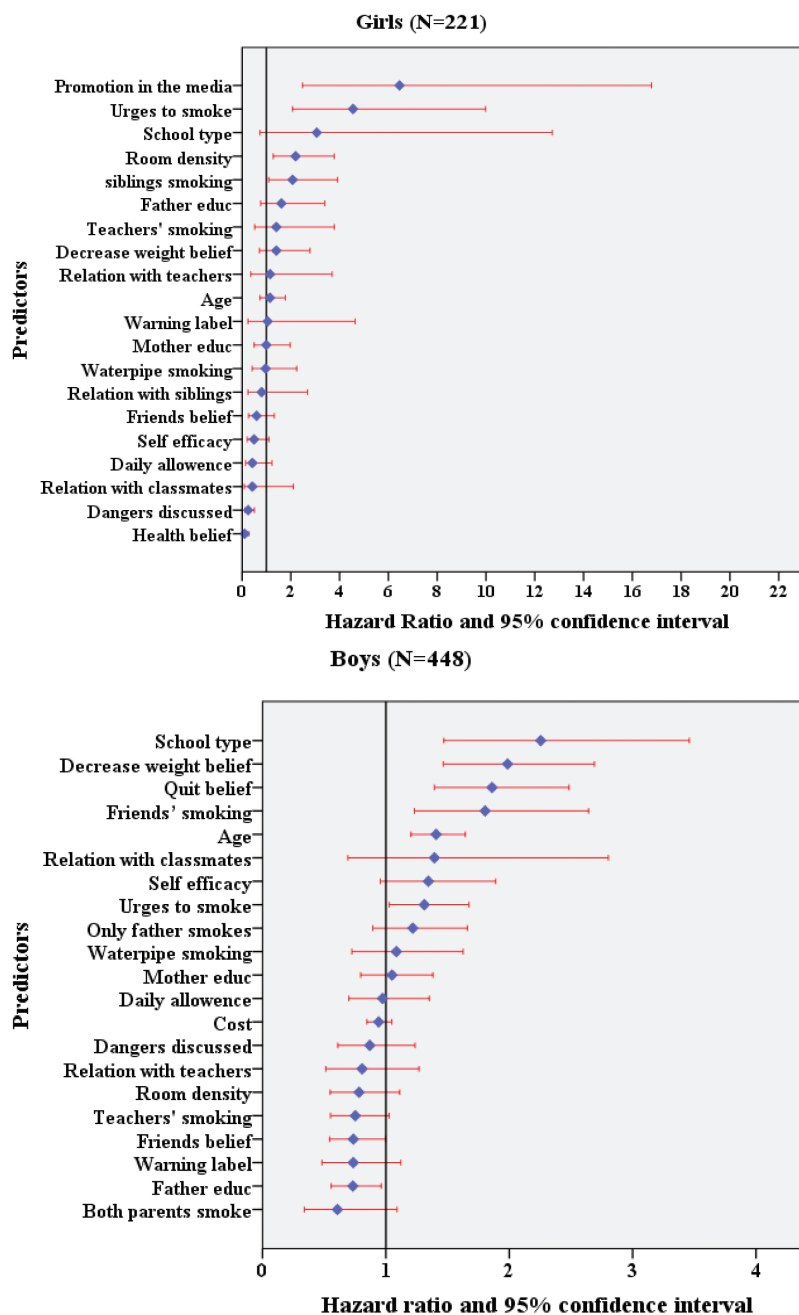


Figure 2. Adjusted gender-specific predictors of cigarette smoking progression among school based sample of adolescents in Irbid, Jordan (2008–2011).

contextual explanations and implications. First, public schools may not be strictly enforcing tobacco control policies that prevent smoking among their students and staff which make them more tolerant to smoking compared with private ones in Jordan. On the other hand, private schools are for-profit institutions. They attract customers (parents) by maintaining their reputation in both educational and behavioral aspects. Thus, they apply stricter rules to prevent smoking among their students and staff, which makes them less tolerant to smoking. Similarly, being a smoking-tolerant school was shown to be associated with a cigarette smoking onset.¹³ Our findings suggest a persistent relationship between schools' policy for tolerance to smoking and cigarette smoking even beyond the onset stage.

Secondly, teachers' smoking has been shown to influence adolescent smoking through modeling of behavior.³¹ Due to the social undesirability of cigarette smoking among girls in the EMR,^{10,11} female teachers may avoid smoking at schools and thus they provide positive role models for their students against smoking. On the other hand, male teachers do not face the same social taboos, and smoke in front of their students, thereby affecting the student's smoking behavior. Finally, compared to parents whose children attend public schools, parents whose children attend private schools may be more concerned about the future of their children's behavior.³²

Among individual factors, "feeling the urge to smoke in the morning" was predictive of the progression in both genders. However this

factor predicted a higher risk of smoking progression among girls. These findings are not surprising. Previous evidence among adolescents showed that girls are at a higher risk of becoming nicotine dependent once they start smoking than boys.^{8,9} These findings are also consistent with our results showing cigarette smoking among girls progressed considerably faster than boys (double incidence rate) in the first year of follow-up. Tobacco control strategies could be more efficient if they are tailored to address these disparities.

The main social predictors of cigarette smoking progression in the present study were “peer smoking” among boys, and “sibling smoking” among girls. Peer smoking has been consistently reported as the most robust predictor of cigarette smoking progression among youth.^{12,13,32} It has been found to be associated with all smoking trajectory groups,⁶ suggesting a persistent influence of peer smoking through modeling of behavior even beyond the initiation stage.^{33,34} However, our findings do not support the contribution of peer smoking to progression among girls. This may in part be due to the gender roles and the conservative nature of the Jordanian families, where outing with friends is allowed for boys, while girls mostly stay at home.³⁵ Furthermore, the social undesirability of cigarette smoking for women may provide fewer opportunities for girls to meet with their smoking peers and more opportunities to progress in cigarette smoking through the influences of family members smoking.³⁶ We examined this relationship by testing the interaction between “sibling relation” and “sibling smoking” on cigarette smoking progression among girls. We found that girls who had strong social bonds with their smoking siblings were three times as likely to progress in cigarette smoking as those who did not (boys: girls Adjusted Hazard Ratio (AHR): 3.01; [CI: 1.82–4.99]; $P < .001$). These findings suggest that sibling’s behavior may lead to a progression of cigarette smoking among girls in a manner similar to friend’s smoking among boys. Given these findings, tobacco use prevention among adolescent girls should involve their smoking siblings in order to help them to quit and strengthen negative norms around cigarette smoking. Among boys, tobacco prevention efforts should target peers within their networks in order to support development of negative smoking norms. Furthermore, peers could also be a source of change that is, positive peer pressure could contribute to encouraging the adolescents to quit their smoking habits.³⁷

One of our findings that may have direct implications among girls is the inverse relationship between “discussing the dangers of cigarette smoking with family members” and the risk of cigarette smoking progression. Since this relationship was not seen among boys, we hypothesize that progression in cigarette smoking among youth is a function of the balance between negative (eg, sibling smoking for girls and peer smoking among boys) and positive influences (eg, parental monitoring and negative beliefs about cigarette smoking) within the context of gender and roles of specific culture. For example, more social freedom, lack of parental monitoring, and modeling peer behavior among boys may outweigh the influence of family through the discussion of the dangers of cigarette smoking.

Finally, unlike developed countries, where tobacco control policies have been shown to be effective in curbing youth smoking,³⁸ none of the policy-related factors were shown to be influential in our study except “cigarette promotion in the media” among girls. Although this factor was not shown to be associated with cigarette smoking progression in bivariate analysis, it exhibited a strong association when other factors were added. It appears that all those factors played together to reflect a social construct that distinguished girls within their well-defined gender roles. Furthermore, girls in

Jordan may use media as an alternate recreational activity because of the restriction in going out of the home, thus likely being influenced by media advertisements. Moreover, girls in Jordan are considered a vulnerable group that can be targeted by the tobacco industry. However tobacco control efforts can use media as well to reverse the influences of tobacco industry forces and change girls behavior, attitudes, and norms toward smoking.³⁹ Additionally, banning advertisements that promote cigarettes is a challenging issue that should be resolved using strong tobacco control policies.

This study has some limitations. First, all measures were assessed using self-reports. Therefore, underreporting of smoking behavior may have been likely, especially among girls because of gender norms in the region. However, our previous work among adolescents in the EMR suggests that girls may share honest smoking information, if confidentiality is assured.⁴⁰ Secondly, we were unable to examine the association with other potential predictors because of missing responses for more than 50% of the sample (eg, inability to buy cigarettes due to the student’s age, intention to quit, and attempts to quit). Finally, our findings may not generalize to populations in other countries with different social and economic structures. Despite these limitations, this study provides strong evidence regarding the relative importance of individual and social predictors of cigarette smoking progression among adolescents in Jordan, and possibly in the EMR. Future research in the EMR should examine the social determinants of gender disparity in smoking. Qualitative studies are especially needed to enrich evidence regarding the context in which smoking progression occurs.

Conclusions

This study showed that among adolescents who initiate cigarettes, 38% may progress in their habit within 3 years. There was no significant difference in the rate of progression by gender. However, different socially-related predictors were observed for both genders. The progression of cigarette smoking was predicted by extra-family factors such as peer smoking among boys, and by intra-family factors such as sibling smoking and media advertisements among girls.

Funding

This study was supported by the National Institute on Drug Abuse (NIDA), (grants R01 DA024876 and R01 DA035160). The study sponsor had no role in the design, analyses, interpretation, or reporting of the study. The views expressed in this article are those of the authors and do not reflect the official policy or position of the US Government.

Declaration of Interests

None declared.

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