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Determinants of waterpipe smoking initiation among school children in Irbid, Jordan: A 4-year longitudinal analysis☆

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ABSTRACT

Objective: Guided by the Attitude-Social influence-self Efficacy (ASE) theory, this study identified predictors of waterpipe (WP) smoking initiation in a WP naïve cohort of Jordanian school children.
Methods: A school-based cohort of all 7th grade students ($N = 1781$) in 19 of 60 schools in Irbid, Jordan, was followed from 2008 to 2011. Generalized linear mixed modeling was used to examine predictors of WP initiation among WP-naïve students ($N = 1243$).
Results: During the 3-year study, WP initiation was documented in 39% of boys and 28% of girls. Prior cigarette smoking (boys: odds ratio 7.41; 95% confidence interval 4.05–12.92 and girls: 8.48; 4.34–16.56) and low WP refusal self-efficacy (boys: 26.67; 13.80–51.53 and girls: 11.49; 6.42–20.55) were strongly predictive of initiating WP. Boys were also more likely to initiate WP smoking if they had siblings (2.30; 1.14–4.64) or teachers (2.07; 1.12–3.84) who smoked and girls if they had friends (2.96; 1.59–5.54) who smoked.
Conclusion: There is a sizeable incidence of WP initiation among students of both sexes. These findings will help in designing culturally responsive prevention interventions against WP smoking. Gender-specific factors, refusal skills, and cigarette smoking need to be important components of such initiatives.

1. Introduction

The global spread of waterpipe (WP) smoking among adolescents is widely documented (Centers for Disease Control and Prevention, 2013; Maziak, 2011; Mzayek et al., 2011; Primack et al., 2009; Parna et al., 2008; Maziak et al., 2004b; Maziak, 2014; Warren et al., 2009; Amrock et al., 2014). While the evidence is still preliminary, it suggests that WP smoking is as addictive and detrimental to health as cigarette smoking (Maziak et al., 2011; Rastam et al., 2011; Eissenberg and Shihadeh, 2009; Fromme et al., 2009; Al Rashidi et al., 2008). Prevalence of WP smoking is high among school children in other parts of the world and is increasing among adolescents in the US (Martinasek et al., 2011; Maziak and Mzayek, 2000; Mzayek et al., 2012; Weglicki et al., 2008; Barnett et al., 2013; Warren et al., 2009). A recent review by Akl et al. (2011) reported prevalence for current WP smoking among school students in Estonia and Lebanon to be 21% and 25% respectively; with estimates ranging from 12% to 15% for Arab-Americans. In the US, a recent national survey of WP use among adolescents revealed ever-WP smoking prevalence of 7.3% and of large survey involving more than 100,000 students in 152 colleges found the prevalence of waterpipe smoking was 8.4%, second only to cigarettes (16.8%) (Primack et al., 2013). Waterpipe popularity is partly fueled by the widespread misperception that it is safer alternative to cigarettes (Akl et al., 2013; Roskin and Aveyard, 2009; Eissenberg et al., 2008; Maziak et al., 2004a,b,d). Evidence, however, shows that WP smoking is likely to be associated with many of the health risks of cigarette smoking such as lung cancer, respiratory disease, periodontal disease, and low birth-weight (Akl et al., 2010). Additionally, there are reports of associations between communal

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WP smoking and increased rates of Helicobacter pylori, hepatitis A, hepatitis C, herpes simplex, and Epstein–Barr virus (Meleigy, 2007). Finally, Torrey et al. (2014) found indoor airborne concentrations of particulate matter and carbon monoxide were higher in WP cafes than in cigarette smoking bars (in Baltimore, MD) and exceeded occupational exposure guidelines; suggesting that both patrons and employees of WP venues are at increased risk from exposure to second hand smoke.

Despite the adverse public health implications of this resurging smoking method, there are no effective prevention or intervention strategies to curb its spread (Maziak et al., 2007, 2005). One of the reasons that such efforts are delayed lies in the lack of knowledge about early stages of WP adoption and important factors influencing initiation. Most of the work about WP initiation has been based on cross-sectional studies and/or lacked guidance of an appropriate theoretical model of behavioral change (Asfar et al., 2005; Fielder et al., 2012, 2013; Islam and Johnson, 2003; Kassim et al., 2013; Knishkowy and Amitai, 2005; Kulwicki and Hill Rice, 2003; Martinasek et al., 2011; Primack et al., 2009; Ribisl, 2012; Rice et al., 2003, 2006; Weglicki et al., 2008). Recently, two longitudinal studies assessing predictors of WP initiation were conducted among college students in the US (Fielder et al., 2012; Sidani et al., 2013). While both studies reported high rates of initiation; they also reported high prevalence of ever-WP smoking at baseline, which emphasizes the need to study WP initiation dynamics at an earlier age. This evidence is in line with studies worldwide that suggest much of WP initiation occurs at younger ages (Barnett et al., 2013; Akl et al., 2011; Martinasek et al., 2011; Nasim et al., 2012; Prokhorov et al., 2006; Warren, 2002; Amrock et al., 2014).

To address this knowledge gap, we employed the Attitude–Social influence–self-Efficacy (ASE) model as a framework for variable selection and interpretation (de Vries et al., 1988, 2003). The ASE model incorporates insights from other tested and validated social cognitive theories, and suggests that behavior is the result of intentions and abilities, whereby motivational factors, such as various attitudes, social influences, and self-efficacy determine intention, while abilities and environmental barriers (e.g., availability, restrictions) determine whether intentions will be realized (Ajzen, 1991; Bandura, 2001). Within this framework, gender is not a central focus; however, gender differences in determinants of adolescent smoking initiation are widely documented and evidence also points to differential effects of smoking prevention and cessation interventions by gender (Amos et al., 2012; Austin and Gortmaker, 2001; Babar et al., 2010; Greaves, 2007; Nichter, 2003; Okoli et al., 2013; Trudeau et al., 2007; Zhu et al., 1996). Moreover, the defined gender roles found in Jordan are likely to influence smoking uptake differently for boys compared to girls (Maziak et al., 2004a,b,c,d,e; Nichter, 2003). This longitudinal study, guided by the ASE model, examined gender specific predictors of WP initiation among WP naïve school children in Jordan.

2. Methods

Detailed description of the methodology from this study is published elsewhere (Mzayek et al., 2012, 2011). Briefly, from 2008 to 2011, a school-based cohort of 7th graders (at baseline) was surveyed annually through 10th grade in the city of Irbid, Jordan. The 60 schools in the city of Irbid (Jordan) were stratified by gender (boys, girls, mixed) and type of school attended (public and private). A cluster random sample of 19 schools (8 male, 9 female, 2 mixed and 6 private) was selected with probability proportional to size (PPS). All 7th grade students (age ≈13 at baseline) in the selected schools were invited to participate. All selected schools and 95% of the students approached (N = 1781) agreed to participate in the study.

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.

2.1. Survey instrument

Development of the study questionnaire was guided by the international guidelines of the World Health Organization (WHO; World Health Organization, 1998), other previously used and validated instruments in Arabic and it was subsequently pilot-tested (Maziak et al., 2005; Warren, 2002). The questionnaire included four modules: socio-demographics; cigarette smoking; waterpipe smoking; and media and tobacco control.

2.2. Measures

Initiation of WP was the main outcome. Initiation was defined as the change from never smoker (of WP) at baseline to ever smoker or current smoker (of WP) at any subsequent follow-up survey(s). A student was considered an ever smoker if he/she reported ever experimenting with smoking and a current smoker if he/she reported having smoked in the last 30 days. Assessed theoretical domains and corresponding survey questions are shown in Table 1. Variables were selected by choosing questions on our questionnaire that corresponded to domains in the ASE model as described in previous studies (Kremers et al., 2004; de Vries et al., 1988; Bidstrup et al., 2009; Ma et al., 2008). Density index (DI) is the number of persons living in a dwelling divided by the number rooms in a home (minus kitchen and bathrooms), which is a proxy for economic status that was used and tested previously in the Middle East (Maziak et al., 2004a; Maziak and Asfar, 2003).

2.3. Statistical analysis

All statistical analyses were performed using SAS version 9.3 (SAS Institute Inc., Cary, NC, 2011). The cohort for this analysis was derived from WP-naïve participants at baseline (N = 1243). Baseline characteristics were compared between WP initiators and non-WP initiators using chi-square test for categorical variables and t-test for continuous variables. The cohort was then stratified by gender for regression analysis. SAS Proc GLIMMIX was used, which accounted for clustering of schools and the repeated measures during the follow-up in students. Questions with more than two possible response categories were analyzed in two ways: once as they were originally obtained, and the second time as binary. The variables were dichotomized by combining responses such as may be and sometimes with yes. I do not know answers were excluded from the analysis. We also combined mother and father into parents and brother and sister into siblings. The results were robust, whether we used multiple categories or binary categories; binary categories were used for clarity of reporting (DeCoster et al., 2009).

Bivariate correlations for all predictor variables revealed no multicollinearity problems. This was also inspected by checking for extraordinary estimated coefficients and standard errors, which would have suggested the existence of colinearity. A full(er) model as described by Flom and colleagues (2007), that included all potential predictor variables, was then fitted using SAS proc GLIMMIX to find adjusted effects of each variable on initiation.

Odds ratios (OR) and 95% confidence intervals (CI) were reported. P-values of <0.05 were considered significant. Weighted proportions to adjust for complex sampling design were reported throughout.

3. Results

3.1. Characteristics of sample

Baseline characteristics of 1243 WP initiating and non-WP initiating participants are shown in Table 1. The participants who initiated WP were less likely to have fathers with more than a high school education; to have attended a public school; and to have reported they would accept WP from a friend.

3.2. Smoking initiation incidence

Over the study period of 4 years, 36.8% of participants initiated WP (39.2% of boys and 28.3% of girls). The largest proportion of participants initiated WP smoking at age ≈14, in the 8th grade (Fig. 1).

3.3. Association of ASE variables and WP smoking initiation by tenth grade

The results of the longitudinal analyses assessing the relationship between WP initiation by 10th grade and potential predictor variables, stratified by gender, are summarized in Table 2. Socio-economic status was not associated with WP smoking initiation