Addictive Behaviors 90 (2019) 258–264

Contents lists available at ScienceDirect

Addictive Behaviors

journal homepage: www.elsevier.com/locate/addictbeh

Hookah Use among Russian adolescents: Prevalence and correlates

Artur Galimov[a,*], Omar El Shahawy[b,c,d,e], Jennifer B. Unger[a], Radik Masagutov[f], Steve Sussman[a,g,h]

[a] Department of Preventive Medicine, Keck School of Medicine, Institute for Health Promotion and Disease Prevention, University of Southern California, 2001 N Soto St., 3rd Floor, Los Angeles, CA 90089-9239, USA
[b] Department of Population Health, New York University School of Medicine, 227 East 30th Street, New York, NY, 10016, USA
[c] Public Health Research Center, New York University Abu Dhabi, Abu Dhabi, USA
[d] College of Global Public Health, New York University, NY, USA)
[e] Community Health Department, Faculty of Medicine, Ain Shams University, Cairo, Egypt
[f] Department of Psychiatry and Narcology, Bashkir State Medical University, 3 Lenina str, Ufa 450000, Russia
[g] Department of Psychology, University of Southern California, 3620 South McClintock Ave, Los Angeles, CA 90089-1061, USA
[h] School of Social Work, University of Southern California, 669 W 34th St, Los Angeles, CA 90089-0411, USA

HIGHLIGHTS

- We evaluated the prevalence and correlates of hookah use among Russian adolescents.
- The estimated lifetime and past-30-day prevalence were 34.9% and 9.4% respectively.
- Lifetime and past 30-day hookah users were older among our sample.
- Hookah co-occurred with ever use of other substances.
- There were no gender differences with regards to past 30-day hookah use.

ARTICLE INFO

Keywords:
Hookah
Youth
Russia
Nicotine
Waterpipe
Tobacco

ABSTRACT

Hookah use among adolescents is increasing globally. No prior studies in the published literature have examined hookah use among youth in the Russian Federation. We assessed demographic, psychological and behavioral factors associated with lifetime and past 30-day hookah use among Russian youth. This cross-sectional study was conducted in three areas of Bashkortostan, Russia. In 2015, we surveyed Russian high school students (n = 716) on socio-demographic characteristics, tobacco (cigarettes, e-cigarettes, hookah) and drug use (alcohol, marijuana, and other illicit drugs), coping strategies, and getting in trouble (self and/or family). We estimated hookah use prevalence and performed bivariate analyses prior to fitting two multilevel models evaluating lifetime and past 30-day hookah use. Within this sample, 34.92% and 9.36% were lifetime and last 30-day hookah users, respectively. Lifetime hookah use was associated with older age (OR = 1.29), higher anger coping (OR = 1.41), school troubles (OR = 2.30), lifetime cigarette (OR = 1.59), e-cigarette (OR = 4.62), alcohol (OR = 5.61), and marijuana use (OR = 8.05). Additionally, past 30-day hookah use was associated with older age (OR = 1.71), lifetime use of alcohol (OR = 5.39), school troubles (OR = 5.82), and anger coping strategies (OR = 1.40). Hookah use is currently high among Russian youth in Bashkortostan and is associated with other risky behaviors. Effective interventions targeting multiple substances and coping strategies are needed. Social media campaigns encouraging cessation and advocating against its use at home may be beneficial in curbing hookah use among youth.

1. Introduction

Hookah (also called waterpipe, narghile, argileh, shisha, hubble-bubble, or goza) smoking is the practice of inhaling tobacco smoke generated by a single - or multi-stemmed device. Typically, charcoal pieces are placed on top of a perforated aluminum foil separating it from specially made tobacco that is usually flavored (e.g., fruit flavors), so when the smoker inhales air through a mouthpiece the tobacco

* Corresponding author.
E-mail address: galimov@usc.edu (A. Galimov).

https://doi.org/10.1016/j.addbeh.2018.11.018
Received 31 May 2018; Received in revised form 9 November 2018; Accepted 15 November 2018
Available online 16 November 2018
0306-4603/ © 2018 Elsevier Ltd. All rights reserved.

mixture heated by charcoal generates smoke and passes through the water basin (usually made from glass), where it cools before being inhaled and then puffed into an aromatic cloud of smoke by the smoker (Akl et al., 2011; Maziak, 2011; Maziak, 2014; Maziak, Ward, Afifi Soweid, & Eissenberg, 2004).

The prevalence of hookah experimentation among adolescents seems to be increasing across the globe with relatively higher rates in Middle Eastern countries, where it has traditionally been used. (Amrock, Gordon, Zelikoff, & Weitzman, 2014; Fakhari, Mohammadpoorasl, Nedjat, Hosseini, & Fotouhi, 2015; Fielder, Carey, & Carey, 2013; Jordan & Delnevo, 2010; Mzayek et al., 2012; Smith et al., 2011; Smith et al., 2011). For instance, studies conducted in Lebanon among intermediate and secondary students (average age 15 years) showed that 25% were past 30-day users and 65–66% were ever hookah users (Akl et al., 2011; Shihadeh, Azar, Antonios, & Haddad, 2004). Prevalence rates from Europe are lower than in Middle Eastern countries; for instance, 24% ever and 7.6% current hookah smoking (regular and occasional smokers) was reported in a study conducted in London and 10% past 30-day use was reported in a study conducted in Germany (Jawad et al., 2013; Kuntz, Lampert, & Ki, 2015). Data from a large sample of Canadian youth showed comparable prevalence rates: 14.3% for ever use and 5.4% for past 30-day use (Minaker, Shuh, Burkhalter, & Manske, 2015). Approximately 7.3–25.9% ever and 2.6–13.3% current use prevalence (past 30-day use) has been reported in National U.S. studies among 13–17-year-old adolescents (Amrock et al., 2014; Mzayek et al., 2012).

Sharing hookah smoking in groups, in which the same mouthpiece is passed from person to person, is a common practice (Akl et al., 2011; Maziak, 2011; Maziak, 2014; Maziak et al., 2004).This practice makes hookah smoking a collective experience that usually takes place in hookah cafes, which may be especially attractive to adolescents (Aslam, Saleem, German, & Qureshi, 2014; Heinz et al., 2013). Several studies have shown that hookah smokers actively use social media (i.e., Instagram, Facebook, and YouTube) and the Internet to obtain and share information about hookah products and discuss hookah-related activities (Brockman, Pumper, Christakis, & Moreno, 2012; Link, Cawkwell, Shelley, & Sherman, 2015). Yet, social media posts rarely address the harmful consequences associated with hookah use (Allem, Chu, Cruz, & Unger, 2017; Brockman et al., 2012; Carroll, Shensa, & Primack, 2013) and its common misperceptions (e.g., the false belief that smoke is purified from toxins when it passes through water making it safer than cigarette smoking) promote social learning experiences (Aljarrah, Ababneh, & Al-Delaimy, 2009; Bandura & Walters, 1977; Cobb, Ward, Maziak, Shihadeh, & Eissenberg, 2010; Maziak, 2011; Maziak, 2014). There also is a growing market offering many different smooth and sweet tasting hookah tobacco flavors. Young people may view hookah as an affordable, accessible, and socially acceptable way to socialize with friends (Cobb et al., 2010; Jordan & Delnevo, 2010; Martinasek, McDermott, & Martini, 2011; Maziak et al., 2004; Sutfin, Song, Reboussin, & Wolfson, 2014).

Hookah smokers tend to view this activity as less addictive and harmful compared to cigarettes (Eissenberg, Ward, Smith-Simone, & Maziak, 2008; Jordan & Delnevo, 2010; Minaker et al., 2015; Noonan & Patrick, 2013; Smith, Edland, et al., 2011; Smith, Novotny, et al., 2011). However, prior studies have shown that hookah use is neither less harmful nor less addictive than cigarette smoking (Cobb et al., 2010; Eissenberg & Shihadeh, 2009; Knishkowy & Amitai, 2005; Maziak et al., 2004). Recent systematic reviews and individual studies have suggested that hookah smoking is associated with respiratory diseases, lung cancer, esophageal cancer, chromosomal aberrations, chronic obstructive lung disease, periodontal diseases, low birth weight, and negatively affects the cardiovascular system (Akl et al., 2010; Gunaid et al., 1995; Maziak et al., 2004; Nasrollahzadeh et al., 2008; Shaikh, Vijayaraghavan, Sulaiman, Kazi, & Shafi, 2008; Yadav & Thakur, 2000).

Demographic and psychosocial correlates of hookah use have been identified among US adolescents. Accumulating evidence reveals that hookah use among youth increases with age and is more prevalent among males (Amrock et al., 2014; Berg, Schauer, Asfour, Thomas, & Ahluwalia, 2011; Chan, Leatherdale, Burkhalter, & Ahmed, 2011; Minaker et al., 2015; Palamar, Zhou, Sherman, & Weitzman, 2014; Sterling & Mermelstein, 2011). The few studies that have examined the relationship between socioeconomic status (SES) and hookah use have shown that youth with higher weekly spending money and higher parents' education are more prone to use hookah (Amrock et al., 2014; Minaker et al., 2015; Palamar et al., 2014). Hookah use is more prevalent among youth who use cigarettes, e-cigarettes, alcohol, marijuana, or other illegal drugs (Amrock et al., 2014; Barnett, Soule, Forrest, Porter, & Tomar, 2015; Chan et al., 2011; Eissenberg et al., 2008; Fielder et al., 2013; Heinz et al., 2013; Jordan & Delnevo, 2010; Minaker et al., 2015; Mzayek et al., 2012; Palamar et al., 2014; Shepardson & Hustad, 2016; Sterling & Mermelstein, 2011; Villanti, Cobb, Cohn, Williams, & Rath, 2015). Among psychological factors, sensation seeking, impulsivity, openness to new experience, low level of conscientiousness, and greater perceived stress are associated with hookah use (Berg et al., 2011; Fakhari et al., 2015; Hampson, Tildesley, Andrews, Barckley, & Peterson, 2013). The association between coping strategies and hookah use has not been addressed yet; however, previous studies have demonstrated that negative coping strategies (i.e. “avoidance coping” and “anger coping”) are associated with substance use (i.e. cigarette and e-cigarette smoking, alcohol and marijuana use), whereas positive coping strategies (i.e. “social-support” and “decision-making coping”) are negatively associated with youth substance use (Kong, Idrisov, Galimov, Masagutov, & Sussman, 2017; McConnell, Memetovic, & Richardson, 2014; Sussman et al., 1993; Wills, Sandy, Yaeger, Cleary, & Shinar, 2001).

Despite the fact that Russia is the largest country geographically with high tobacco use rates, to our knowledge, no prior studies in the published literature have examined hookah use among youth in the Russian Federation (Bobak et al., 1996; Gunning, Sussman, Rohrbach, Kniazev, & Masagutov, 2009). Current conventional cigarette smoking among Russian adolescents aged 13–15 years is 26.9% among boys and 23.9% among girls, while lifetime and past 30-day e-cigarette use among 15–18 years old adolescents is 28.6% and 2.2% respectively (Baška, Warren, Bašková, & Nrjijoph, 2009; Kong et al., 2017). Against a changing background of tobacco use norms among adolescents it is crucial to obtain knowledge of hookah use patterns and to assess demographic, psychological and behavioral correlates of hookah use among Russian youth. This study sought to fill an important research gap by examining hookah use among Russian adolescents. We considered gender, age, ethnicity, living situation, level of parents' education, getting into legal trouble or trouble at school, ever use of substances (i.e. cigarettes, e-cigarettes, alcohol, marijuana and other illicit drugs), and coping strategies as correlates of hookah use. We hypothesized that the prevalence of hookah use among the Russian adolescent sample would be higher among older participants and among those with higher parents' education, consistent with the available literature. Given that the cigarette smoking prevalence among Russian adolescents is higher among boys than among girls, (Warren et al., 2008), we expected that hookah use also would be more prevalent among boys. In accordance with problem behavior theory (Jessor, 1991), we hypothesized that hookah use would be more prevalent among lifetime substance users and those who reported legal or school troubles. Finally, we hypothesized that hookah use would be higher among those adolescents with negative coping strategies and lower among those with positive coping strategies.

2. Methods

2.1. Study population

This cross-sectional study was conducted in three areas of Bashkortostan, Russia. Bashkortostan is a republic (federal subject)

within the Russian Federation, located between the Volga River and the Ural Mountains. It has a population of 4.1 million, is comprised of numerous ethnicities, and spans over 143,600 km^2. Ufa is the capital of Bashkortostan and has a population of over 1 million. Sterlitamak is the second largest city of Bashkortostan with a population of 274,000. Finally, Karagaevo is a village in Bashkortostan, which is 143 km from Ufa and has a population of 330 (Minahan, 2000; Saunders & Strukov, 2010).

In 2015, we anonymously surveyed Russian high school students, where we assessed demographics, tobacco and other drug use, coping strategies, and trouble-related behaviors. A total of 778 students were invited to participate in our study. Data was collected from 716 participants (response rate 92.1%) sampled from nine selected high schools located in these three locations in the Bashkortostan Republic, Russian Federation (Ufa, Sterlitamak, and Karagaevo).

The schools were selected as a convenience sample by researchers and city officials (Education Department officials), representing a cross-section of their cities: six schools in Sterlitamak, two schools in Ufa, and one school in Karagaevo. The classes that participated in the survey were randomly selected from each school. The questionnaire was developed in English, translated into Russian and back-translated into English by two bilingual speakers. A similar method has been used in prior studies conducted in the Russian Federation (Gunning et al., 2009). The Bashkir State Medical University Institutional Review Board approved all study procedures. Participation in the study was voluntary, and all participants had the option of withdrawing from the study at any time without a penalty. Adolescents' verbal agreement and parents' informed consent was obtained for students under age 18; students who were 18 years or older provided informed consent prior to participating in the study.

2.2. Measures

2.2.1. Demographics and drug use behavior

2.2.1.1. Demographics. We assessed gender, age, ethnicity, socioeconomic status (SES), and living situation. We originally had seven ethnic group categories in our sample: Russian, Tatar, Bashkir, Tatar/Bashkir, Russian/Tatar; Russian/ Bashkir, and Other. To represent the ethnicity categories in terms of similar cultural and religious backgrounds, we collapsed these categories into three groups: Russian, Tatar and/or Bashkir, and other. We asked students "who do you live with?" to examine the family structure. Response options included "both parents (or step parents)", "only with my mother (or stepmother)", "only with father (or stepfather)", "sometimes with my mother (or stepmother) and sometimes with my father (or stepfather)", and "other." Since the majority of the participants indicated that they live with both parents (75.8%) and with my mother/ stepmother (22.2%) response options for this question were collapsed into two categories: "both parents (or step parents)" and "other." Finally, we assessed participants' SES by asking about their parents' level of education separately for mothers and fathers (i.e., "*What is the highest degree completed by your mother/father?*"). The response categories included: "secondary school," "vocational training," "university degree," and "other." Since none of the participants selected "other" category for father's education and only 3 participants (0.4%) selected this category for mother's education, we decided to exclude this response option from the analysis. Those who chose "other" for mother's education were treated as missing for this question.

2.2.1.2. Drug use behavior. To examine lifetime use of substances (i.e., cigarettes, e-cigarettes, hookah, alcohol, marijuana, and other drugs) we asked the following item: "*In your lifetime, how many times have you tried each of the drugs below?*" The 11 response categories ranged from 0 times to over 100 times. We coded a response other than "0 times" as ever use of each corresponding product. We assessed last 30-day use of hookah e-cigarettes, cigarettes, alcohol, marijuana, and other drugs by asking a question: *"How many times have you used each of these drugs in the last month (last 30 days)?"* The response categories also ranged from 0 times to over 100 times and any answers other than "0 times" were coded as past 30-day use of each corresponding product.

2.2.2. Coping and trouble-related behaviors

To assess coping strategies, we asked subjects what they would do when they have a problem at school or at home. We provided 12 coping statements, each with a five-point answer scale ranging from "never" to "always". This measure was designed to assess four coping strategies: social-support coping (e.g., "I talk to my mother/father"), avoidance coping (e.g., "I tell people to just leave me alone"), anger coping (e.g., "I yell and scream at someone") and decision-making coping (e.g., "I think hard about what steps to take"). These subscales are adapted from Wills (Wills, 1986) and assessed positive (decision-making and social-support coping) and negative (avoidance and anger coping) coping strategies. The reliability of three subscales were high: Cronbach's alphas for social-support coping, decision-making coping, and anger coping items were 0.88, 0.82 and 0.70 respectively. However, avoidance coping subscale showed poor reliability (Cronbach's alpha = 0.51), so we decided to remove this subscale from the analysis. Multilevel models with and without the avoidance subscale sensitivity analyses showed comparable results.

To assess participants' and family members' history of getting into trouble, we asked two items: *"During the past 2 years, I got disciplined or suspended from school or work"*. *"During the past 2 years, someone in my family or I was arrested"*. Response categories for these last two questions were "yes" or "no".

2.3. Data analysis

Univariate distributions of all variables and descriptive statistics were calculated before bivariate and multivariate analyses were performed. We used Pearson's Chi-square test to examine the associations between categorical study variables and ever / past 30-day use of hookah. Differences between groups defined by ever / past 30-day use of hookah were evaluated using *t*-tests for continuous study variables. For the final model, based on the intraclass correlation of 0.09 and 0.46 (respectively for lifetime and past 30-day hookah use) and the average cluster size, we used a multilevel modeling approach to control for the nesting of students (Level 1) within schools (Level 2). We fitted two separate multilevel models to evaluate associations between lifetime and past 30-day hookah use (outcome variables) and the following predictor variables: family structure, gender, age, father's and mother's highest education, coping strategies, trouble-related behaviors, lifetime use of cigarettes, e-cigarettes, alcohol, marijuana and other drugs. All statistical analyses were conducted using SAS software (version 9.4; SAS Institute, Cary, NC).

3. Results

The age ranged between 15 and 18 years (mean 16.27), with a nearly even gender split (48.5% male; 51.5% female). A total of 34.9% of the total sample ($n = 716$) tried hookah smoking at least once in their lifetime, and 9.4% were past 30-day users. The majority of lifetime and past 30-day hookah users used hookah between 1 and 10 times in their lifetime or past 30 days, respectively (see Table 1). Adolescents represented 3 ethnic groups, of the total sample 29.0% were Russian, 50.6% were Tatar/Bashkir, and 20.4% represented other ethnic groups. Demographic characteristics for the total sample size and stratified by hookah use status are shown in Table 1.

Bivariate analysis showed that those who tried hookah in their lifetime, compared to those who did not, were significantly older (mean age 16.4 years vs. 16.2 years, $p < .01$) and scored higher on the anger coping scale (7.4 vs. 6.6, $p < .01$). Lifetime hookah users compared to

Table 1
Participant characteristics for the total sample and separated by lifetime and past-30-day hookah use.

Study variables	Total sample (n = 716)	Lifetime hookah		p[a]	Past-30 day hookah		p[b]
		users (n = 250)	Non-users		users (n = 67)	Non-users	
Hookah use frequency (%)							
- 1–10 times		82.00	–	N/A	83.58	–	N/A
- 11–20 times		6.40	–		10.44	–	
- 20–30 times		3.60	–		2.99	–	
- > 30 times		8.00	–		2.99	–	
Gender (%)							
- Male	48.46	43.60	51.07	0.06	55.22	47.77	0.25
- Female	51.54	56.40	48.93		44.78	55.22	
Age (M, SD)	16.27 ± 1.02	16.41 ± 1.01	16.20 ± 1.01	< 0.01	16.34 ± 1.02	16.26 ± 1.02	0.53
Ethnicity (%)							
- Russian	29.05	30.40	28.33	0.77	49.25	26.96	< 0.01
- Bashkir/Tatar	50.56	50.40	50.64		29.85	52.70	
- Other	20.39	19.20	21.03		20.90	20.34	
Family structure (%)							
- Both parents	75.84	76.80	75.32	0.66	65.67	76.89	0.04
- Other	24.16	23.20	24.68		34.33	23.11	
Mother's highest degree (%)							
- Secondary school	5.34	4.84	5.60	0.76	9.09	4.95	0.10
- Vocational training	55.48	57.26	54.53		62.12	54.80	
- University degree	39.19	37.90	39.87		28.79	40.25	
Father's highest degree (%)							
- Secondary school	8.18	7.66	8.46	0.93	10.61	7.93	< 0.01
- Vocational training	50.92	51.21	50.76		65.15	49.46	
- University degree	40.90	41.13	40.78		24.24	42.61	
Lifetime use (%)							
- Cigarettes	38.69	68.40	22.75	< 0.01	58.21	36.67	< 0.01
- E – cigarettes	28.63	57.20	13.30	< 0.01	43.28	27.12	< 0.01
- Alcohol	40.92	73.60	23.39	< 0.01	83.58	36.52	< 0.01
- Marijuana	4.61	12.00	0.64	< 0.01	17.91	3.24	< 0.01
- Other drugs	4.75	4.80	4.72	0.96	7.46	4.47	0.24
Trouble-related behaviors (%)							
- School trouble	6.84	10.40	4.94	< 0.01	19.40	5.55	< 0.01
- Trouble with the law	4.75	7.20	3.43	0.02	4.48	4.78	0.91
Stress-coping scale (M, SD)							
- Decision-making coping	10.32 ± 2.30	10.15 ± 2.19	10.41 ± 2.36	0.16	10.82 ± 2.48	10.27 ± 2.28	0.16
- Anger coping	6.84 ± 2.21	7.37 ± 2.01	6.56 ± 2.26	< 0.01	7.03 ± 2.18	6.83 ± 2.21	< 0.01
- Social-support coping	10.55 ± 2.86	10.35 ± 2.77	10.65 ± 2.90	0.18	10.57 ± 3.28	10.54 ± 2.82	0.18

[a] for the difference between lifetime hookah users and non-users.
[b] for the difference between past 30-day hookah users and non-users.

non-users were more likely to be females (43.6% vs. 56.4%, p = .05), and were more likely to report using cigarettes (68.4% vs. 22.8%, p < .01), e-cigarettes (57.2% vs. 13.3%, p < .01), alcohol (73.6% vs. 23.4%, p < .01), and marijuana (12.0% vs. 0.6%, p < .01). Lifetime hookah users were more likely to report being disciplined/ suspended from school (10.4% vs. 4.9%, p < .01); and being arrested or having a family member arrested (7.2% vs. 3.4%, p < .05).

Past 30-day hookah users, compared to those who did not smoke hookah in the past 30 days, more likely to report getting disciplined/ suspended from school (19.4% vs. 5.6%, p < .01), report using cigarettes (58.2% vs. 36.7%, p < .01), e-cigarettes (43.3% vs. 27.1%, p < .01), consuming alcohol (83.6% vs. 36.5%, p < .01), and trying marijuana (17.9% vs. 3.2%, p < .01), in their lifetime. In addition, past 30-day hookah users were less likely to live with both parents (65.7% vs. 76.9%, p < .05) and reported lower father's education (p < .01) compared to past-30 day non-users. There were no gender differences among past 30-day hookah users.

3.1. Correlates of lifetime hookah use

The multilevel analysis (Table 2) revealed that after adjusting for other variables, lifetime use of e-cigarettes (OR = 4.62; 95% CI, 2.65, 8.05), alcohol (OR = 5.61; 95% CI, 3.56, 8.86), marijuana (OR = 8.05; 95% CI, 1.91, 33.81), and experiencing troubles at school (OR = 2.30; 95% CI, 1.04, 5.07) were associated with greater odds of lifetime use of hookah. In addition, a 1-SD increase in age was associated with 29% greater odds (OR = 1.29; 95% CI, 1.03, 1.62), while a 1-SD increase on anger coping scale was associated with 41% greater odds (OR = 1.41; 95% CI, 1.10, 1.80) of being a lifetime user. Finally, males had marginally lower odds (OR = 0.66; 95% CI, 0.43, 1.03) of being lifetime hookah user, compared to females.

3.2. Correlates of past 30-day hookah use

Lifetime use of alcohol (OR = 5.39; 95% CI, 2.36, 12.35), and having school troubles (OR = 5.82; 95% CI, 2.13, 15.87), were associated with greater odds of past 30-day use of hookah. A 1-SD increase in age (OR = 1.71; 95% CI, 1.20, 2.46) as well as a 1-SD increase in the anger coping scale (OR = 1.40; 95% CI, 1.02, 1.93) were associated with 71% and 40% greater odds of being past 30-day hookah user, respectively. Meanwhile, belonging to other ethnicity groups relative to Russian ethnicity (OR = 0.44; 95% CI, 0.19, 0.99) was associated with lower odds of past 30-day use of hookah.

4. Discussion

In this study, 34.9% of the participants reported lifetime hookah use and 9.36% reported past 30-day use. These prevalence estimates were slightly higher than observed in prior studies among European and U.S adolescents (Amrock et al., 2014; Jawad, Cheeseman, & Brose, 2017; Kuntz et al., 2015; Mzayek et al., 2012). This may be due to the widespread availability of alternative tobacco products in Russia, as

Table 2
Multilevel model examining the association between study variables and lifetime and past-30-day hookah use with school as cluster.

Predictors	Lifetime hookah use (n = 250)		Past-30 day hookah use (n = 67)	
	OR	95% CI	OR	95% CI
Gender (female = ref)	0.66‡	0.43-1.03	1.22	0.61–2.43
Age (1-SD increase)	1.29*	1.03–1.62	1.71**	1.20–2.46
Ethnicity				
- Russian (ref)				
- Bashkir/Tatar	1.36	0.80–2.31	0.53‡	0.25-1.12
- Other	0.79	0.44–1.44	0.44*	0.19–0.99
Family structure				
- Other person(s) (ref)				
- Both parents	1.13	0.69–1.87	0.95	0.47–1.90
Mother's highest degree				
- Secondary school (ref)				
- Vocational training	0.70	0.27–1.86	0.45	0.14–1.49
- University degree	0.62	0.23–1.69	0.37	0.10–1.31
Father's highest degree				
- Secondary school (ref)				
- Vocational training	1.43	0.60–3.41	1.89	0.64–5.61
- University degree	1.46	0.58–3.68	1.21	0.36–4.07
Lifetime use (never use = ref)				
- Cigarettes	1.59‡	0.93-2.71	0.76	0.34–1.70
- E – cigarettes	4.62**	2.65–8.05	2.05‡	0.90-4.64
- Alcohol	5.61**	3.56–8.86	5.39**	2.36–12.35
- Marijuana	8.05**	1.91–33.81	1.52	0.51–4.50
- Other drugs	0.41	0.14–1.20	0.66	0.16–2.79
Trouble-related behaviors (no = ref)				
- School trouble	2.30*	1.04–5.07	5.82**	2.13–15.87
- Trouble with the law	0.92	0.36–2.34	0.46	0.10–2.04
Decision-making coping (1-SD increase)	1.12	0.88–1.42	1.14	0.84–1.56
Anger coping (1-SD increase)	1.41**	1.10–1.80	1.40*	1.02–1.93
Social-support coping (1-SD increase)	1.21	0.96–1.54	1.04	0.78–1.39

‡ $p < 0.1$ * $p < 0.05$. ** $p < 0.01$. p-values derived from testing logistic regression coefficients.

they remain under-regulated (Galimov et al., 2018).

To our knowledge, this is the first study to assess the prevalence and correlates of hookah use among Russian youth living in the Bashkortostan Republic. As tobacco use norms among adolescents change, it is crucial to obtain knowledge of hookah use patterns, and assess demographic, psychological and behavioral correlates of hookah use among Russian youth. As was hypothesized, hookah co-occurred with ever use of other substances (i.e. cigarettes, e-cigarettes, alcohol, marijuana and other illicit drugs) and was associated with trouble-related behaviors (i.e., troubles at school). These findings are consistent with prior studies (Amrock et al., 2014; Barnett et al., 2015; Chan et al., 2011; Eissenberg et al., 2008; Fielder et al., 2013; Heinz et al., 2013; Jordan & Delnevo, 2010; Minaker et al., 2015; Mzayek et al., 2012; Palamar et al., 2014; Shepardson & Hustad, 2016; Sterling & Mermelstein, 2011; Villanti et al., 2015) and consistent with Problem Behavior Theory (Jessor, 1991), which suggests that problem behaviors tend to cluster. Nonetheless, more longitudinal studies investigating temporal associations and the complex interplay among these substances are warranted.

Hookah use appears to be a behavior that is more common among high-risk youth than among low-risk youth. Anger coping strategies were associated with lifetime and past 30-day hookah use, but other coping strategies (social-support, decision-making) were not associated with hookah use. Even though this is the first study examining hookah use and coping strategies among adolescents, our results are consistent with the prior findings showing that negative coping strategies (i.e. “avoidance coping” and “anger coping”) are associated with substance use (McConnell et al., 2014; Sussman et al., 1993; Wills et al., 2001). One may speculate that future hookah prevention efforts involving anger control may be beneficial.

As hypothesized, the prevalence of hookah use increased with age. However, contrary to our hypotheses and contrary to previous studies (Barnett et al., 2013; Berg et al., 2011; Chan et al., 2011; Minaker et al., 2015; Palamar et al., 2014; Sterling & Mermelstein, 2011), there were no gender differences in past 30-day hookah use. Several recent studies have found that hookah use is increasing in popularity among adolescent girls, and that girls view it as more attractive, more affordable, and more socially acceptable than other tobacco products (Fakhfakh, Hsairi, Maalej, Achour, & Nacef, 2002; Maziak et al., 2004; Nakkash, Khalil, & Afifi, 2011; Smith, Novotny, et al., 2011; Sterling & Mermelstein, 2011). These findings may explain the higher lifetime experimentation rates among females in our sample compared to males; nevertheless future longitudinal studies are needed to examine such potential gender differences.

Contrary to our hypothesis on demographics and hookah use, but consistent with an at-risk youth perspective, past 30-day users had less educated parents (proxy of SES) and were less likely to live with both of them. Little is known about how Russian youth are obtaining hookah products. One Russian survey suggested that more than half of hookah users smoke it at home (Baboshkina, Yurkova, & Pichugina, 2018). Therefore, adolescents might own their own hookah devices, however future studies are warranted to better understand where they obtain these devices. Social campaigns, encouraging parents to prohibit their children from smoking hookah at home, may also be needed.

Finally, we found that those participants, who represented Bashkir/Tatar and Other (mostly comprised of mixed Bashkirs and Tatars) ethnicities, were less likely to use hookah in the past 30-days. Similar results were reported in a prior study examining substance use among Russian adolescents from Bashkortostan Republic (Kong et al., 2017). These findings may reflect the fact that Russians and Bashkirs/Tatars have different languages, religious histories, and traditions. For instance, Bashkirs and Tatars are historically Muslims, while Russians are Orthodox Christians. Bashkirs and Tatars may perceive stronger social and religious norms against substance use. Future studies identifying ethnic specific attitudes and perceptions regarding use of substances and hookah specifically are needed.

4.1. Study limitations and future research directions

First, only a convenience sample of teens within one Republic of the Russian Federation was assessed. Although the results of the study can be generalized to 15–18 years Bashkortostan adolescents, our findings may not be representative of all Russian adolescents. Additionally, since only one rural school was recruited, we were not able to compare rural and urban differences. To enhance generalizability, future research should sample subjects with a wider age range from multiple regions of the country. Second given the nature of the data (self-reported), recall and social desirability biases may have affected the results. However, since the study was anonymous with a response rate of 92.1%, these biases are less plausible. Third, given the cross-sectional study design, it was not possible to assess the causality of relationships or to perform long-term trend analyses. Longitudinal work would be better able to catch temporal associations. Finally, owing to the limitations of the questionnaire, we could not account for other important variables, such as peers'\parents' substance\hookah use, attitudes and perceptions regarding hookah use, ease of access to tobacco products, age of hookah \substance use initiation, which have been found to be associated with hookah use in other studies (Amrock et al., 2014; Heinz et al., 2013; Sidani, Shensa, Barnett, Cook, & Primack, 2014; Smith, Novotny, et al., 2011; Villanti et al., 2015). Future studies (both quantitative and qualitative) that include a wider range of predictors are needed to

better understand hookah use initiation and its development process in Russian adolescents.

4.2. Conclusions

Our results indicate that hookah use is an emerging public health concern in Bashkortostan, Russia and is another set of relatively risky behaviors. Accordingly, hookah may introduce more harm by creating new attractive methods for youth to become addicted to nicotine, potentially leading to use of alcohol, marijuana and other illicit drugs. Effective intervention measures targeting multiple substances and anger control prevention measures may help prevent youth from using hookah and perhaps other tobacco products. Social media campaigns encouraging youth to quit and advocating against its use at home may also be beneficial. Finally, polices banning hookah smoking in bars and cafes and setting the minimum purchase age to at least 18 years are warranted.

References

Akl, E. A., Gaddam, S., Gunukula, S. K., Honeine, R., Jaoude, P. A., & Irani, J. (2010). The effects of waterpipe tobacco smoking on health outcomes: A systematic review. *International Journal of Epidemiology. 39*(3), 834–857. https://doi.org/10.1093/ije/dyq002.

Akl, E. A., Gunukula, S. K., Aleem, S., Obeid, R., Jaoude, P. A., Honeine, R., et al. (2011). The prevalence of waterpipe tobacco smoking among the general and specific populations: A systematic review. *BMC Public Health, 11*(1), 244. https://doi.org/10.1186/1471-2458-11-244.

Aljarrah, K., Ababneh, Z. Q., & Al-Delaimy, W. K. (2009). Perceptions of hookah smoking harmfulness: Predictors and characteristics among current hookah users. *Tobacco Induced Diseases. 5*(1), 16. https://doi.org/10.1186/1617-9625-5-16.

Allem, J.-P., Chu, K.-H., Cruz, T. B., & Unger, J. B. (2017). Waterpipe Promotion and Use on Instagram: #Hookah. *Nicotine & Tobacco Research. 19*(10), 1248–1252. https://doi.org/10.1093/ntr/ntw329.

Amrock, S. M., Gordon, T., Zelikoff, J. T., & Weitzman, M. (2014). Hookah Use among Adolescents in the United States: Results of a National Survey. *Nicotine & Tobacco Research. 16*(2), 231–237. https://doi.org/10.1093/ntr/ntt160.

Aslam, H. M., Saleem, S., German, S., & Qureshi, W. A. (2014). Harmful effects of shisha: Literature review. *International Archives of Medicine. 7*(1), 16. https://doi.org/10.1186/1755-7682-7-16.

Baboshkina, L., Yurkova, I., & Pichugina, N. (Eds.). (2018). *Smoking patterns among students. (in Russian) Modern features of the Advancement of natural and technical sciences*.

Bandura, A., & Walters, R. H. (1977). *Social learning theory.* Englewood Cliffs, NJ: Prentice-hall.

Barnett, T. E., Smith, T., He, Y., Soule, E. K., Curbow, B. A., Tomar, S. L., et al. (2013). Evidence of emerging hookah use among university students: A cross-sectional comparison between hookah and cigarette use. *BMC Public Health, 13*(1), 302. https://doi.org/10.1186/1471-2458-13-302.

Barnett, T. E., Soule, E. K., Forrest, J. R., Porter, L., & Tomar, S. L. (2015). Adolescent Electronic Cigarette Use. *American Journal of Preventive Medicine. 49*(2), 199–206. https://doi.org/10.1016/j.amepre.2015.02.013.

Baška, T., Warren, C. W., Bašková, M., & Nrjijoph, J. (2009). *Prevalence of youth cigarette smoking and selected social factors in 25 European countries: findings from the Global Youth Tobacco Survey. 54*, 439. https://doi.org/10.1007/s00038-009-0051-9.

Berg, C. J., Schauer, G. L., Asfour, O. A., Thomas, A. N., & Ahluwalia, J. S. (2011). Psychosocial Factors and Health-Risk Behaviors Associated with Hookah use among College students. *Journal of addiction research & therapy.*. https://doi.org/10.4172/2155-6105.S2-001 Suppl 2.

Bobak, M., Gilmore, A., McKee, M., Rose, R., & Marmot, M. (2006). Changes in smoking prevalence in Russia. *%J Tobacco Control, 15*(2), 131–135.

Brockman, L. N., Pumper, M. A., Christakis, D. A., & Moreno, M. A. (2012). Hookah's new popularity among US college students: A pilot study of the characteristics of hookah smokers and their Facebook displays. *BMJ Open, 2*(6), https://doi.org/10.1136/bmjopen-2012-001709.

Carroll, M. V., Shensa, A., & Primack, B. A. (2013). A comparison of cigarette- and hookah-related videos on YouTube. *Tobacco Control. 22*(5), 319–323. https://doi.org/10.1136/tobaccocontrol-2011-050253.

Chan, W. C., Leatherdale, S. T., Burkhalter, R., & Ahmed, R. (2011). Bidi and Hookah Use among Canadian Youth: An Examination of Data from the 2006 Canadian Youth smoking survey. *Journal of Adolescent Health. 49*(1), 102–104. https://doi.org/10.1016/j.jadohealth.2010.11.250.

Cobb, C., Ward, K. D., Maziak, W., Shihadeh, A. L., & Eissenberg, T. (2010). Waterpipe Tobacco smoking: An emerging Health Crisis in the United States. *American Journal of Health Behavior. 34*(3), 275–285. https://doi.org/10.5993/AJHB.34.3.3.

Eissenberg, T., & Shihadeh, A. (2009). Waterpipe tobacco and cigarette smoking: Direct comparison of toxicant exposure. *American journal of preventive medicine. 37*(6), 518–523.

Eissenberg, T., Ward, K. D., Smith-Simone, S., & Maziak, W. (2008). Waterpipe Tobacco smoking on a U.S. College Campus: Prevalence and Correlates. *Journal of Adolescent Health. 42*(5), 526–529. https://doi.org/10.1016/j.jadohealth.2007.10.004.

Fakhari, A., Mohammadpoorasl, A., Nedjat, S., Hosseini, M. S., & Fotouhi, A. (2015). Hookah smoking in High School students and its Determinants in Iran:A Longitudinal Study. *American Journal of Men's Health. 9*(3), 186–192. https://doi.org/10.1177/1557988314535236.

Fakhfakh, R., Hsairi, M., Maalej, M., Achour, N., & Nacef, T. (2002). Tobacco use in Tunisia: Behaviour and awareness. *Bulletin of the World Health Organization. 80*(5), 350–356.

Fielder, R. L., Carey, K. B., & Carey, M. P. (2013). Hookah, cigarette, and marijuana use: A prospective study of smoking behaviors among first-year college women. *Addictive Behaviors. 38*(11), 2729–2735.

Galimov, A., Steinberg, J., Unger, J. B., Cruz, T. B., Idrisov, B., Baezconde-Garbanati, L., et al. (2018). No-smoking Policy in Russia: Awareness and Perceptions among Bashkortostan Adolescents. *Current Addiction Reports. 5*(1), 1–9. https://doi.org/10.1007/s40429-018-0181-3.

Gunaid, A. A., Sumairi, A. A., Shidrawi, R. G., Al-Hanaki, A., Al-Haimi, M., Al-Absi, S., et al. (1995). Oesophageal and gastric carcinoma in the Republic of Yemen. *British Journal Of Cancer. 71*, 409. https://doi.org/10.1038/bjc.1995.83.

Gunning, M., Sussman, S., Rohrbach, L. A., Kniazev, V., & Masagutov, R. (2009). Concurrent Predictors of Cigarette and Alcohol Use among U.S. and Russian Adolescents. *Journal of Drug Education. 39*(4), 385–400. https://doi.org/10.2190/DE.39.4.c.

Hampson, S. E., Tildesley, E., Andrews, J. A., Barckley, M., & Peterson, M. (2013). Smoking Trajectories across High School: Sensation seeking and Hookah Use. *Nicotine & Tobacco Research. 15*(8), 1400–1408. https://doi.org/10.1093/ntr/nts338.

Heinz, A. J., Giedgowd, G. E., Crane, N. A., Veilleux, J. C., Conrad, M., Braun, A. R., et al. (2013). A comprehensive examination of hookah smoking in college students: Use patterns and contexts, social norms and attitudes, harm perception, psychological correlates and co-occurring substance use. *Addictive Behaviors. 38*(11), 2751–2760.

Jawad, M., Cheeseman, H., & Brose, L. S. (2017). Waterpipe tobacco smoking prevalence among young people in Great Britain, 2013-2016. *European Journal of Public Health.* https://doi.org/10.1093/eurpub/ckx223.

Jawad, M., Wilson, A., Lee, J. T., Jawad, S., Hamilton, F. L., & Millett, C. (2013). Prevalence and Predictors of Water Pipe and Cigarette smoking among secondary School students in London. *Nicotine & Tobacco Research. 15*(12), 2069–2075. https://doi.org/10.1093/ntr/ntt103.

Jessor, R. (1991). Risk behavior in adolescence: A psychosocial framework for understanding and action. *Journal of Adolescent Health. 12*(8), 597–605. https://doi.org/10.1016/1054-139X(91)90007-K.

Jordan, H. M., & Delnevo, C. D. (2010). Emerging tobacco products: Hookah use among New Jersey youth. *Preventive Medicine, 51*(5), 394–396.

Knishkowy, B., & Amitai, Y. (2005). Water-Pipe (Narghile) smoking: An emerging Health Risk Behavior. *Pediatrics, 116*(1), e113–e119. https://doi.org/10.1542/peds.2004-2173.

Kong, G., Idrisov, B., Galimov, A., Masagutov, R., & Sussman, S. (2017). Electronic Cigarette Use among Adolescents in the Russian Federation. *Substance Use & Misuse. 52*(3), 332–339. https://doi.org/10.1080/10826084.2016.1225766.

Kuntz, B., Lampert, T., & Ki, G. G. S. S. G. (2015). Waterpipe (shisha) smoking among adolescents in Germany: Results of the KiGGS study: First follow-up KiGGS Wave 1. *Bundesgesundheitsblatt, Gesundheitsforschung, Gesundheitsschutz, 58*(4–5), 467–473. https://doi.org/10.1007/s00103-015-2128-3.

Link, A. R., Cawkwell, P. B., Shelley, D. R., & Sherman, S. E. (2015). An exploration of online behaviors and social media use among hookah and electronic-cigarette users. *Addictive Behaviors Reports. 2*, 37–40. https://doi.org/10.1016/j.abrep.2015.05.006.

Martinasek, M. P., McDermott, R. J., & Martini, L. (2011). Waterpipe (hookah) tobacco smoking among youth. *Current Problems in Pediatric and Adolescent Health Care. 41*(2), 34–57.

Maziak, W. (2011). The global epidemic of waterpipe smoking. *Addictive Behaviors. 36*, 1):1–5.

Maziak, W. (2014). The Waterpipe: A New way of Hooking Youth on Tobacco. *The American Journal on Addictions. 23*(2), 103–107. https://doi.org/10.1111/j.1521-0391.2013.12073.x.

Maziak, W., Ward, K. D., Afifi Soweid, R. A., & Eissenberg, T. (2004). Tobacco smoking using a waterpipe: A re-emerging strain in a global epidemic. *Tobacco Control. 13*(4), 327–333. https://doi.org/10.1136/tc.2004.008169.

McConnell, M. M., Memetovic, J., & Richardson, C. G. (2014). Coping style and substance use intention and behavior patterns in a cohort of BC adolescents. *Addictive Behaviors. 39*(10), 1394–1397.

Minahan, J. (2000). *One Europe, many nations: A historical dictionary of European national groups.* Greenwood Publishing Group.

Minaker, L. M., Shuh, A., Burkhalter, R. J., & Manske, S. R. (2015). Hookah use prevalence, predictors, and perceptions among Canadian youth: Findings from the 2012/2013 Youth smoking survey. *Cancer Causes & Control. 26*(6), 831–838. https://doi.org/10.1007/s10552-015-0556-x.

Mzayek, F., Khader, Y., Eissenberg, T., Al Ali, R., Ward, K. D., & Maziak, W. (2012). Patterns of Water-Pipe and Cigarette smoking Initiation in Schoolchildren: Irbid Longitudinal smoking Study. *Nicotine & Tobacco Research. 14*(4), 448–454. https://doi.org/10.1093/ntr/ntr234.

Nakkash, R. T., Khalil, J., & Afifi, R. A. (2011). The rise in narghile (shisha, hookah) waterpipe tobacco smoking: A qualitative study of perceptions of smokers and non smokers. *BMC Public Health, 11*(1), 315. https://doi.org/10.1186/1471-2458-11-315.

Nasrollahzadeh, D., Kamangar, F., Aghcheli, K., Sotoudeh, M., Islami, F., Abnet, C. C., et al. (2008). Opium, tobacco, and alcohol use in relation to oesophageal squamous cell carcinoma in a high-risk area of Iran. *British Journal Of Cancer. 98*, 1857. https://doi.org/10.1038/sj.bjc.6604369.

Noonan, D., & Patrick, M. E. (2013). Factors Associated with Perceptions of Hookah Addictiveness and Harmfulness among Young adults. *Substance Abuse. 34*(1), 83–85.

https://doi.org/10.1080/08897077.2012.718251.
Palamar, J. J., Zhou, S., Sherman, S., & Weitzman, M. (2014). Hookah Use among US High School Seniors. *Pediatrics, 134*(2), 227–234. https://doi.org/10.1542/peds.2014-0538.
Saunders, R. A., & Strukov, V. (2010). *Historical dictionary of the Russian Federation.* Scarecrow Press.
Shaikh, R., Vijayaraghavan, N., Sulaiman, A., Kazi, S., & Shafi, M. (2008). The acute effects of waterpipe smoking on the cardiovascular and respiratory systems. *Journal of Preventive Medicine and Hygiene. 49*(3).
Shepardson, R. L., & Hustad, J. T. P. (2016). Hookah Tobacco smoking during the transition to College: Prevalence of Other Substance Use and Predictors of Initiation. *Nicotine & Tobacco Research. 18*(5), 763–769. https://doi.org/10.1093/ntr/ntv170.
Shihadeh, A., Azar, S., Antonios, C., & Haddad, A. (2004). Towards a topographical model of narghile water-pipe café smoking: A pilot study in a high socioeconomic status neighborhood of Beirut. *Lebanon. Pharmacology Biochemistry and Behavior. 79*(1), 75–82.
Sidani, J. E., Shensa, A., Barnett, T. E., Cook, R. L., & Primack, B. A. (2014). Knowledge, attitudes, and Normative Beliefs as Predictors of Hookah smoking Initiation: A Longitudinal Study of University students. *Nicotine & Tobacco Research. 16*(6), 647–654. https://doi.org/10.1093/ntr/ntt201.
Smith, J. R., Edland, S. D., Novotny, T. E., Hofstetter, C. R., White, M. M., Lindsay, S. P., et al. (2011). Increasing Hookah Use in California. *American Journal of Public Health. 101*(10), 1876–1879. https://doi.org/10.2105/AJPH.2011.300196.
Smith, J. R., Novotny, T. E., Edland, S. D., Hofstetter, C. R., Lindsay, S. P., & Al-Delaimy, W. K. (2011). Determinants of Hookah Use among High School students. *Nicotine & Tobacco Research. 13*(7), 565–572. https://doi.org/10.1093/ntr/ntr041.
Sterling, K. L., & Mermelstein, R. (2011). Examining Hookah smoking among a Cohort of Adolescent ever smokers. *Nicotine & Tobacco Research. 13*(12), 1202–1209. https://doi.org/10.1093/ntr/ntr146.
Sussman, S., Brannon, B. R., Dent, C. W., Hansen, W. B., Johnson, C. A., & Flay, B. R. (1993). Relations of Coping Effort, Coping strategies, Perceived stress, and Cigarette smoking among Adolescents. *International Journal of the Addictions. 28*(7), 599–612. https://doi.org/10.3109/10826089309039651.
Sutfin, E. L., Song, E. Y., Reboussin, B. A., & Wolfson, M. (2014). What are young adults smoking in their hookahs? A latent class analysis of substances smoked. *Addictive Behaviors. 39*(7), 1191–1196.
Villanti, A. C., Cobb, C. O., Cohn, A. M., Williams, V. F., & Rath, J. M. (2015). Correlates of Hookah Use and Predictors of Hookah Trial in U.S. Young adults. *American Journal of Preventive Medicine. 48*(6), 742–746. https://doi.org/10.1016/j.amepre.2015.01.010.
Warren, C. W., Jones, N. R., Peruga, A., Chauvin, J., Baptiste, J.-P., Costa De Silva, V., et al. (2002). *Global youth tobacco surveillance, 2000-2007.* (57). Washington, DC: Morbidity and mortality weekly report Surveillance summaries1–28.
Wills, T. A. (1986). Stress and coping in early adolescence: Relationships to substance use in urban school samples. *Health Psychology. 5*(6), 503.
Wills, T. A., Sandy, J. M., Yaeger, A. M., Cleary, S. D., & Shinar, O. (2001). Coping dimensions, life stress, and adolescent substance use: A latent growth analysis. *Journal of Abnormal Psychology. 110*(2), 309.
Yadav, J. S., & Thakur, S. (2000). Genetic risk assessment in hookah smokers. *Cytobios, 101*(397), 101–113.