Determinants of Adolescent Hookah Pipe Use: A Systematic Review

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Determinants of Adolescent Hookah Pipe Use: A Systematic Review

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ABSTRACT

Adolescent hookah pipe use is increasing at a rapid rate, thus posing a major public health concern globally. The hookah pipe is a gateway substance to other substances that may be more harmful. Yet, at present, little is known about why adolescents are so drawn to this mechanism. It is this gap that this study attempted to fill. This study, therefore, aimed to review the determinants of adolescent hookah pipe use. An electronic search of 12 databases identified studies investigating determinants of adolescent hookah pipe use. Twenty-five studies sampling a total of 88,988 adolescents who use the hookah pipe were included. This study found that adolescent hookah pipe use is determined by an interplay of family factors, peer/friends factors, individual factors, school factors, the actual hookah pipe mechanism, advertisements, and awareness of hookah pipe lounges or bars. Prevention and early intervention strategies aimed at reducing adolescent hookah pipe use is needed.

KEYWORDS

Determinants; hookah pipe; prevention and early intervention strategies; smoking; systematic review; tobacco

Introduction

Hookah pipe smoking is a global public health concern affecting people of all ages. Experimentation with hookah pipe smoking most often begins during adolescence (Roman et al., 2017; Van der Merwe et al., 2013). Adolescence is an overwhelming period in one’s life where intense development occurs in preparation for adulthood (Gilmore & Meersand, 2014; Sugar, 2014). In their endeavor to become independent and unique individuals (Gilmore & Meersand, 2014), adolescents often engage risk-taking behaviors. It is, therefore, a period of learning, experiencing, and active experimentation (Sugar, 2014). As they develop, they establish norms and lifestyles congruent with the values and culture of their peers, school, families, and communities (Case-Smith & O’Brien, 2014). During this vulnerable time, adolescents are easily influenced, seek peer approval, and are inquisitive (Louw & Louw, 2014). Hence, it is not uncommon that experimentation of hookah pipe smoking begins in adolescence (Roman et al., 2017; Van der Merwe et al., 2013).

The hookah pipe is a way of smoking any smokable substance that may be legal or illegal (Castañeda et al., 2016; Haskins, 2011). However, it is typically used to smoke flavored tobacco (Haskins, 2011), although some people mix cannabis with the tobacco (Jacobs et al., 2015) and/or replace the water used in the vase of the hookah pipe with alcohol (Fielder et al., 2012). Others may drink alcohol or smoke other substances concurrently (Sterling & Mermelstein, 2011). Therefore, hookah pipe smoking can be regarded as a gateway substance to the use of other substances, such as cigarettes, alcohol, or cannabis (Kandel & Kandel, 2015; Merianos et al., 2018; Sterling & Mermelstein, 2011).

The hookah pipe is usually smoked in specialized bars, restaurants, cafés, or even at home, particularly in groups (Hammal et al., 2008; Roskin & Aveyard, 2009). Needless to say, tobacco companies have capitalized on this growing trend and have introduced new appealing flavors to increase the demand (Sepetdjian et al., 2008). Most hookah pipe users believe that hookah pipe smoking is less harmful and a healthier alternative to cigarette smoking (Castañeda et al., 2016; Haskins, 2011).

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et al., 2016). This perception has resulted in the popularization and romanticizing of hookah pipe smoking over the last decade (World Health Organization [WHO], 2005, 2015).

However, Haroon et al. (2014) argue that even though hookah pipe smoking is perceived by users as less harmful than cigarette smoking, this is not the case, as it contains tobacco as well as toxins found in cigarettes, such as tar, nicotine, and carbon monoxide. This makes it hazardous not only for the user, but also for people in close proximity to the user as well as the environment (Koc¸ak et al., 2017). In addition to the harmful toxins entering the body when smoking the hookah pipe, Haroon et al. (2014) and Waziry et al. (2017) mention other harmful long-term effects of hookah use, such as nicotine dependence, pulmonary dysfunction, cardiovascular disease as well as the transmission of infectious diseases, since the same mouth piece is passed from person to person. Hookah pipe smoking carries more than just health concerns as Sterling and Mermelstein (2011) found that hookah use in the last 30 d affects school performance in terms of average grades. These effects are concerning, especially for adolescents whose health and school performance is cardinal for the opportunities that they may be exposed to in future (Kola, 2014). If hookah pipe smoking is associated with so many concerns, why do adolescents use it? This study aimed to review determinants of adolescent hookah pipe use in order to understand why adolescents smoke the hookah pipe. This understanding is important so that it can guide the development and implementation of interventions since the behaviors, circumstances, and beliefs of the target group is paramount to the success of any intervention.

Information sources and search strategy

The study included peer reviewed data-based papers in English that were published between 2007 and 2017. The publication dates were selected based on a broad scope of literature done by the authors and study conclusions of Combrink et al. (2010), Daniels and Roman (2013), Jacobs et al. (2015), Senkubuge and Mayosi (2012), Theron et al. (2010), and Van der Merwe et al. (2013) which stated that hookah pipe research has significantly gained momentum during this period. Therefore, the researchers thought that it would be an opportune time to review the research. The following electronic databases were searched: Cumulative Index to Nursing & Allied Health (CINAHL), Dentistry and Oral Sciences Source, Green File, Health Source—Consumer Edition, Health Source—Nursing/Academic Edition, Medline, PsycARTICLES, Sosindex, SPORTDiscus, Cochrane, Wiley, and PubMed. Keywords relating to determinants and hookah pipe use were used. The following three sets of keywords were used for each search (a) hookah pipe, (b) determinants, and (c) age group. Similar words were used within each set of keywords, for example (a) shisha and water pipe; (b) factors, predictor, reasons, perception, motivation, why, attitude, and belief; and (c) preadolescent and adolescents. The same keyword variations were used for all 12 databases. The search terms per database are included in the file labeled: “Supplementary Material A.” Additionally, the reference lists of the retrieved articles were manually searched for potentially eligible studies.

Review procedure

The review process consisted of three rounds to identify appropriate studies for this study. Round one was focused on title screening. At this point, duplicates were removed. Round two was focused on abstract screening. Round three was focused on full text screening. At each round, articles that did not meet the eligibility criteria were eliminated. Thereafter, the reference lists of the eligible full texts were manually scanned for any relevant studies that could be included in this study. To establish reliability of eligible studies at

Methods

The review was prepared according to the Preferred Reporting Items for Systematic Reviews (PRISMA) standards (Moher et al., 2009). A protocol was prepared in advance. It can be accessed at: https://www.crd.york.ac.uk/prospero/display_record.php?RecordID=76814
the full text stage, a random selection of six articles were screened by all researchers and the results pertaining to inclusion and exclusion were discussed among all three researchers. Once consensus was reached, the primary researcher reviewed each of the remaining articles to determine the nature of the study and the determinants of adolescent hookah pipe use.

Inclusion and exclusion criteria

English full text and peer reviewed studies published in academic journals were included. Quantitative, qualitative, and mixed method studies focusing on the determinants, correlates, factors, motivation, predictors, reasons, perceptions, attitudes, and beliefs of hookah pipe use among adolescents within the timeframe (2007–2017) were included. Study outcomes included the determinants of adolescent hookah pipe use. Hookah pipe use included experimentation only, continued use, ever use, or recent use. Intervention studies, animal studies, studies that focused solely on any other form of tobacco (such as cigarettes or e-cigarettes) besides hookah pipe guidelines, protocols, legislation, editorials, reviews, and discussion papers, were excluded.

Quality assessment

All studies meeting the inclusion criteria underwent quality assessment. The following appraisal tools were designed for this study: (1) adapted qualitative appraisal tool (Critical Appraisal Skill Program [CASP], 2014), (2) adapted quantitative appraisal (Roman & Frantz, 2013), and (3) adapted mixed methods appraisal tool (Roman & Frantz, 2013). However, the results of the study included only quantitative studies; therefore, the adapted quantitative appraisal (Roman & Frantz, 2013) was used in this study, since the use of the tool was based on the methodology of the included study. The methodological quality was assessed on sampling methods, measurement tools, source of data, ethics, reference to hookah pipe and specific age group, research design, and appropriateness of method. The quality of the studies was rated using a percentage score. Based on the content of the manuscripts, each component was assessed and rated according to a three-grade scale: good (67–100%), satisfactory (34–66%), or bad (0–33%). Two researchers independently assessed the quality of the included studies. Disagreements between the two reviewers were discussed until consensus was reached. The opinion of a third researcher was consulted to come to agreement in case of indecisions.

Data extraction

Once consensus was reached around the inclusion and exclusion of studies, the data from the included studies were extracted and placed in a data extraction tool which was developed and piloted prior to the search. The data was extracted by one researcher and verified by the other two researchers so that accuracy of extraction was confirmed by all three researchers. In the event of any disagreements, discussions were held to gain consensus. This was done to strengthen the quality of analysis of the included studies and to not exclude studies immediately that could potentially be eligible. The data was extracted from eligible studies and tabulated into Microsoft Excel. The following data were extracted: the author, year of study, sample details, number of participants, mean age or age range of participants, gender distribution of participants, relevant variables (determinants), and the associations of these relevant variables (determinants) with hookah pipe use (e.g. odds ratio [OR]).

Data analysis

Narrative synthesis using thematic analysis was used in this study because each study reported the strength of the determinant differently, for example, some made use of OR, whilst others made use of percentage, Nagelkerke R², or crude prevalence ratio (PR). The relevance of the determinants was based on the effect size of the associations with the outcome of interest. The data was analyzed according to the study properties and the strength of the association. This meant that the greater the odds or higher the percentage, the more relevant the determinant for hookah pipe use. Once all the results were presented
and analyzed, the researcher further analyzed all the results and then identified the most relevant determinants of hookah pipe use amongst adolescents and grouped them into family factors, peers/friends factors, individual factors, school factors, and other factors.

**Results**

Hookah pipe use included experimentation only, continued use, ever use, or recent use. The search yielded 9656 hits. After removal of duplicates \((n = 116)\), 9540 title records were screened. Titles that did not meet the inclusion criteria were excluded. Forty-four abstracts were screened for eligibility, only 30 of these records were found eligible for the study. The reference list of these records was scanned to identify any potentially eligible studies. Four references were found eligible. This resulted in 34 studies being eligible for the final step (full text review) of determining appropriate studies that would be included in the review. Nine studies were excluded. The reasons for exclusion include: (a) intervention study \((k = 1)\), (b) did not report associations \((k = 6)\), and (c) only reported on tobacco and alcohol use but did not specify hookah use \((k = 2)\). During data extraction, only one study used a qualitative methodology while the remainder of the sample made use of a quantitative methodology. For this reason, the three researchers decided to exclude this study post hoc. The final sample for this review comprised 25 studies. Figure 1 shows the flow diagram of the review process.

**Study characteristics**

Seventy-two percent of the studies were from Asia, 16% were from North America, 8% were
from South America, and 4% were from Europe. The majority of the studies used a cross-sectional study research design (84%). The remainder of the studies made use of longitudinal (8%), quasi-experimental (4%), and prospective (4%) research designs. Studies referred to hookah pipe use as past, current, or ever use.

**Methodological quality**

The methodological quality of the studies was assessed using eight items that were derived from validated methodological quality rating scales (Roman & Frantz, 2013). The studies satisfied an average of 86% of the criteria, with 88% of the studies considered strong, and 12% of the studies considered moderate, indicating moderate to strong methodological quality. All studies focused on children aged 10–19 and made reference to the hookah pipe. All 25 studies made use of appropriate quantitative methods and successfully addressed the research questions with appropriate research designs. All studies reported their measures but only 56% reported on the reliability and validity of this measured in the respective studies. Majority of studies made use of primary data sources (76%). Seventy-two percent of the studies reported that ethical approval was obtained, the remainder of the studies did not report on ethical approval. Table 1 shows the methodological quality of the studies used to identify the determinants of adolescent hookah pipe use.

**Sample characteristics**

Only preadolescents and adolescents aged 10–19 years old that use the hookah pipe were considered for analysis in this study. Age is reported differently in the studies; therefore, a mean age cannot be reported across all studies, nor can an age range be conclusively reported. Forty-six percent of the study sample were female and 96% of the population was school going students; hence, the sample was drawn from the school population. Shujaat et al. (2013) studied the general population visiting hookah pipe bars, hookah pipe cafés, and tobacco shops, and that is how he drew his sample. In total, 88,988 adolescents were studied across the 25 included studies.

**Determinants of hookah pipe use amongst adolescents**

Table 2 identifies the determinants of adolescent hookah pipe use and highlights the relevance of the determinants regarding adolescent hookah pipe use. Table 3 places the relevant determinants into themes. The most dominant themes were the family factors, peer/friends factors, individual factors, and school factors, while the factors that could not be placed under these themes were referred to as “other” factors. Tables 2 and 3 are presented below followed by a discussion of each theme. All references were given an alphabetic code and are, therefore, reported with a code in the next section. The alphabetic codes are listed in Table 2.

**Family determinants**

A number of significant family factors emerged. Two subthemes were identified from the family factors: (1) parents’ or sibling tobacco use and adolescents’ perception of how parents would respond to their hookah pipe use and (2) parents’ education levels and employment status or occupation.

**Theme 1: Parents’ or sibling tobacco use and adolescents’ perception of how parents would respond to their hookah pipe use.** Adolescents’ hookah pipe use is determined by the smoking habits of one or both parents (particularly the father), siblings (particularly brothers) as well as other family members. Adolescents who lived in a home where hookah pipe is used are 10.55 times more likely to use the hookah pipe (OR = 10.55; 95% CI, 7.32–15.20). Higher odds of hookah pipe smoking among adolescents is determined by fathers who smoke (OR = 9.73, p = 0.001), parents who smoke (OR = 4.75; 95% CI, 1.38–12.35), hookah smoking siblings (OR = 4.01; 95% CI, 2.76–5.8), brothers who smoke the hookah pipe (OR = 5.18, p = 0.001), and fathers and brothers who smoke the hookah pipe (OR = 6.67, p = 0.001). Having other family members who smoke the hookah pipe increases
Table 1. Methodological quality of the studies used to identify the determinants of adolescent hookah pipe use.

<table>
<thead>
<tr>
<th>No</th>
<th>Author, Year</th>
<th>Age group/target population identified in methodology</th>
<th>Sampling method</th>
<th>Measurement tool valid and reliable</th>
<th>Source of the data</th>
<th>Hookah pipe use by participants included in sample details</th>
<th>Ethical approval obtained</th>
<th>Quantitative methodology</th>
<th>Research design addresses the research question</th>
<th>Score</th>
<th>Percentage (%)</th>
<th>Interpretation</th>
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<td>1 1 1 1 1 1 1 1</td>
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Table 2. Relevance of determinants regarding adolescent hookah pipe use.

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<th>n</th>
<th>Age</th>
<th>% (F) Relevant variables (determinants)</th>
<th>Odds Ratio of determinant of hookah pipe use</th>
<th>95% Confidence Interval (CI)</th>
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<td>Jeddah, Saudi Arabia 7–9 grade students</td>
<td>1019</td>
<td>R: 11 – M: 14.3</td>
<td>[67x60] Involved in religious activities 0.39 0.2 0.76</td>
<td>[67x60] Involved in study 0.43 0.27 0.70</td>
<td>2.07 1.37 3.12</td>
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<td>Engage in recreation activities or hobbies</td>
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<td>2.07 0.48</td>
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<td>Male students 1.99 1.23 3.11</td>
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<td>Skip class often 9.13 3.96 21.04</td>
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<td>Live in middle-income community 2.18 1.01 4.69</td>
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<td>Live in upper middle-income community 2.69 1.10 6.55</td>
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<td>Live in high-income community 2.18 1.01 4.69</td>
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<td></td>
<td>Receive 5–6 riyals pocket money 1.73 0.27 3.12</td>
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<td>Receive 7–8 riyals pocket money 3.18 1.42 7.09</td>
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<td>2</td>
<td>b Alavijeh et al. (2016)</td>
<td>Ahvaz, Iran school students</td>
<td>120</td>
<td>M: 14.93</td>
<td>Smoked for leisure 30.8% 30.8% 30.8%</td>
<td>Smoked to test taste 30.8% 30.8% 30.8%</td>
<td>2.07 1.37 3.12</td>
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<td>Close family and relatives smoked usually</td>
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<td>Relatives experience substance use 96.2%</td>
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<td>Smoking in most/all friends 5.65 2.87 11.13</td>
<td>Believed smoking was harmful 0.31 0.29 0.92</td>
<td>2.07 1.37 3.12</td>
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<td>More pocket money (&gt;US $1.3) 3.3 2.3 4.6</td>
<td>One or both parents smoke 1.25 0.75 2.09</td>
<td>2.07 1.37 3.12</td>
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<td>4</td>
<td>d Amin et al. (2012)</td>
<td>Al-Hassa, Saudi Arabia school students</td>
<td>1652</td>
<td>R: 15-19 M: 17.5</td>
<td>Male gender 18.3</td>
<td>Adolescent age 3.02 1.01 9.12</td>
<td>Lower paternal education status (secondary) 1.59 1.01 2.40</td>
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<td>Fathers who smoke hookah 9.73 p = 0.001</td>
<td>Fathers and brothers who smoke hookah 6.67 p = 0.001</td>
<td>2.07 1.37 3.12</td>
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<td>Brothers who smoke hookah 5.18 p = 0.001</td>
<td>Smoking among all close friends 7.42 p = 0.001</td>
<td>2.07 1.37 3.12</td>
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<td>Smoking among most close friends 9.25 p = 0.001</td>
<td>Smoking among some close friends 1.99 p = 0.005</td>
<td>2.07 1.37 3.12</td>
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<td>Smoking among close friends 2.35 1.01 5.37</td>
<td>Higher proportions of the following conditions compared to non-smokers</td>
<td>2.07 1.37 3.12</td>
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<td>&quot;Other depression&quot; 1.51 p = 0.044</td>
<td>Major depression 2.94 p = 0.001</td>
<td>Any depression 1.72 p = 0.003</td>
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<td>Panic disorder 4.7 p = 0.001</td>
<td>Anxiety 2.2 p = 0.001</td>
<td>Any anxiety or depression 6.7 p = 0.001</td>
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</table>

* Among current regular hookah users, 43 (32.1%) were former cigarette smokers. Adolescents mentioned primary motives for current hookah use was outings with friends, boredom, and meeting friends and family members. Negligence by the family and imitating friends, fathers, and big brothers were stated in >50% of the responses. The presence of emotional and family problems and hookah smoking as a method to relieve stress was stated by about 20% of the students. Pleasure as a motive was stated in less than 10% of the responses.

47 Current Hookah use is identified in 13.3% by male gender and increasing age of adolescent (Nagelkerk $R^2 = 0.133$, $\chi^2 = 26.44$, $p = 0.001$). In model 2, hookah smoking could be attributed in 19.5% to the current hookah smoking status among close family members and friends as these variables imposed a positive association (Nagelkerk $R^2 = 0.195$, $\chi^2 = 28.17$, $p = 0.003$); the effect of smoking among family members was attenuated in the final model. Cigarette smoking was a significant positive predictor for hookah smoking in model 3 (Nagelkerk $R^2 = 0.216$, $\chi^2 = 31.32$, $p = 0.005$), while higher knowledge level lacks in its influence as a negative predictor in the final model. Primary motives in the form of outing, meeting friends, and passing time were other positive predictors for hookah smoking while the presence of anxiety and/or depressive disorders was not strongly associated with the current hookah smoking behavior in the final regression model (Nagelkerk $R^2 = 0.238$, $\chi^2 = 38.44$, $p = 0.013$)
<table>
<thead>
<tr>
<th>Study (Year)</th>
<th>Country</th>
<th>Sample Size</th>
<th>Age</th>
<th>Gender</th>
<th>Type of Users</th>
<th>Employment</th>
<th>Father Education</th>
<th>Father Employment</th>
<th>School Attending</th>
<th>Cigarette Consumption</th>
<th>Friends Smoking</th>
<th>Self-efficacy</th>
<th>Odds Ratio</th>
<th>Effect Size</th>
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<td>Charandabi et al. (2015)</td>
<td>Iran</td>
<td>Student</td>
<td>1324</td>
<td>R: 14–18 M: 15.1</td>
<td>50</td>
<td>Adolescent users not currently working</td>
<td>0.3</td>
<td>0.5</td>
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<td>0.1</td>
<td>12.6</td>
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<td>High school educated fathers</td>
<td>2.8</td>
<td>1.2</td>
<td>6.4</td>
<td>Employed fathers vs. self-employed fathers</td>
<td>0.9</td>
<td>Adolescents smoke cigarettes</td>
<td>8.1</td>
<td>5.3</td>
<td>0.5</td>
<td>0.4</td>
<td>0.7</td>
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<td>Middle Eastern</td>
<td>2.34</td>
<td>1.16</td>
<td>4.74</td>
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<td>1.0</td>
<td>3.3</td>
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<td>Indonesia</td>
<td>2016</td>
<td>Student</td>
<td>32,921</td>
<td>No age; only Gr 9–12</td>
<td>48.7</td>
<td>Students diagnosed with asthma</td>
<td>1.54</td>
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<tr>
<td>Pakistan</td>
<td>2015</td>
<td>Student</td>
<td>1350</td>
<td>R: 13–18</td>
<td>44</td>
<td>16 years or older vs. younger than 16</td>
<td>4.41</td>
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<tr>
<td>Parents or siblings who smoke</td>
<td>1.97</td>
<td>1.04</td>
<td>2.77</td>
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<td>Have some friends who smoke</td>
<td>2.67</td>
<td>1.83</td>
<td>3.89</td>
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<tr>
<td>Most/all friends smoke</td>
<td>8.18</td>
<td>4.65</td>
<td>18.39</td>
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<tr>
<td>Students diagnosed with asthma believe smoking hookah makes people look cool or fit in vs. students without asthma</td>
<td>27.6</td>
<td>25.4</td>
<td>29.8</td>
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<tr>
<td>Helps people feel more comfortable in social situations</td>
<td>61.2%</td>
<td>58.8</td>
<td>63.7</td>
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<td>Black</td>
<td>0.77</td>
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<td>South Asian</td>
<td>1.49</td>
<td>0.87</td>
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<td>Middle Eastern</td>
<td>2.34</td>
<td>1.16</td>
<td>4.74</td>
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<tr>
<td>Other substance use</td>
<td>3.25</td>
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<tr>
<td>Friends who smoke</td>
<td>30.36</td>
<td>5.58</td>
<td>30.23</td>
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<tr>
<td>Most/all friends smoke</td>
<td>3.65</td>
<td>2.10</td>
<td>6.34</td>
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<td>Moderate or not committed religious beliefs</td>
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<td>2.23</td>
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<tr>
<td>Peers who use hookah only</td>
<td>3.40</td>
<td>2.09</td>
<td>5.60</td>
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<tr>
<td>Peers who use cigarettes only</td>
<td>2.34</td>
<td>1.22</td>
<td>4.49</td>
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<td>Peers who use hookah and cigarettes</td>
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<td>1.26</td>
<td>4.75</td>
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<tr>
<td>Parents who use cigarettes only</td>
<td>3.07</td>
<td>1.64</td>
<td>5.76</td>
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<td>1.53</td>
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<td>Karimy et al. (2013)</td>
<td>Iran Male High School students</td>
<td>365</td>
<td>M: 16.49</td>
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<td>Parents who smoke</td>
<td>4.75</td>
<td>1.38</td>
<td>12.35</td>
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<td>Smoking siblings</td>
<td>4.21</td>
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<td>Smoking friends</td>
<td>3.76</td>
<td>1.20</td>
<td>11.76</td>
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<td>Kelishadi et al. (2016)</td>
<td>Iran school student with high-risk behaviors</td>
<td>13,486</td>
<td>R: 6–18 M: 12.47</td>
<td>49.2</td>
<td>Age</td>
<td>1.37</td>
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<td>Time spent with friends (1–3 d)</td>
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<td>Time spent with friends (more than 3 d)</td>
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<th>Sample details</th>
<th>n</th>
<th>Age</th>
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<th>Relevant variables (determinants)</th>
<th>Odds Ratio of determinant of hookah pipe use</th>
<th>99% Confidence interval (CI)</th>
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<td>14 N</td>
<td>Moamary et al. (2012)</td>
<td>Riyadh, Saudi Arabia High School students</td>
<td>1272</td>
<td>R: 16–18</td>
<td>34.1</td>
<td>Hookah smoking by the father: 3.02</td>
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<td>Hookah smoking by siblings: 4.01</td>
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<td>Hookah smoking by other members of family: 4.00</td>
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<td>Cigarette smoking by the father: 1.63</td>
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<td>More than 2 h/day screen time: 1.64</td>
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<td>Female gender: 0.51</td>
<td>0.38</td>
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<td>Living in rural area: 0.62</td>
<td>0.40</td>
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<td>Boys vs. girls: 2.49</td>
<td>2.02</td>
<td>3.08</td>
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<td>Living in urban area: 2.14</td>
<td>1.79</td>
<td>2.56</td>
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<tr>
<td>15 O</td>
<td>Nohair (2011)</td>
<td>Riyadh, Saudi Arabia Secondary school students</td>
<td>255</td>
<td>R: 16–22</td>
<td>n/a</td>
<td>Accepting hookah from friends: 10.6</td>
<td>7.7</td>
<td>14.4</td>
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<td>Percentage of population: 34.1</td>
<td>13</td>
<td>43.6</td>
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<td>16 P</td>
<td>Palamar et al. (2014)</td>
<td>United States of America high school senior students</td>
<td>5400</td>
<td>51.4</td>
<td>45.6% is less than 18 years old</td>
<td>Population density: Small metropolitan statistical area (MSA): 2.67</td>
<td>2.04</td>
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<td>Population density: Large MSA: 2.64</td>
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<td>3.56</td>
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<td>Residing in a non MSA: 1.00</td>
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<td>High parent education: 1.58</td>
<td>1.24</td>
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<td>Smoked cigarette once or twice: 2.22</td>
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<td>2.76</td>
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<td></td>
<td>Smoked cigarette regularly in the past: 2.45</td>
<td>1.66</td>
<td>3.61</td>
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<td></td>
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<td></td>
<td>Smoked cigarette occasionally: 4.19</td>
<td>3.03</td>
<td>5.78</td>
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<td></td>
<td>Smoked cigarette regularly: 5.12</td>
<td>3.61</td>
<td>7.26</td>
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<td></td>
<td></td>
<td>Lifetime alcohol use: 3.34</td>
<td>2.12</td>
<td>5.25</td>
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<td></td>
<td></td>
<td>Lifetime marijuana use: 4.48</td>
<td>3.38</td>
<td>5.94</td>
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<td></td>
<td></td>
<td>Lifetime illicit substance use: 1.53</td>
<td>1.22</td>
<td>1.92</td>
</tr>
<tr>
<td>17 Q</td>
<td>Reveles et al. (2013)</td>
<td>Brazil school students</td>
<td>495</td>
<td>R: 10–19</td>
<td>53.8</td>
<td>Presence of work activities: 2.23</td>
<td>1.73</td>
<td>2.88</td>
</tr>
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<td></td>
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<td></td>
<td></td>
<td>Enrolment in private school: 1.80</td>
<td>1.37</td>
<td>2.78</td>
</tr>
<tr>
<td>18 R</td>
<td>Roohafza, Hedayati et al. (2015)</td>
<td>Iran Middle and high school students (grades 6–12) from September to October 2010</td>
<td>5408</td>
<td>M: 15.37</td>
<td>50</td>
<td>After a bad event: 6.06</td>
<td>4.87</td>
<td>7.46</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td>Feeling angry: 6.06</td>
<td>4.87</td>
<td>7.46</td>
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<td></td>
<td></td>
<td></td>
<td>Feeling distressed (It relases me): 6.06</td>
<td>4.87</td>
<td>7.46</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Having fun with friends: 6.06</td>
<td>4.87</td>
<td>7.46</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Everyone smokes (good entertainment): 6.06</td>
<td>4.87</td>
<td>7.46</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>After a meal: 6.06</td>
<td>4.87</td>
<td>7.46</td>
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<td></td>
<td>After waking up (helps to start good day): 6.06</td>
<td>4.87</td>
<td>7.46</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Decreases appetite: 6.06</td>
<td>4.87</td>
<td>7.46</td>
</tr>
<tr>
<td>19 S</td>
<td>Roohafza, Kasei et al. (2015)</td>
<td>Iran Students in middle and high schools (grades 6–12)</td>
<td>5500</td>
<td>M: 14.37</td>
<td>50</td>
<td>Boys (gender): 6.06</td>
<td>4.87</td>
<td>7.46</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Residing in urban areas: 1.87</td>
<td>1.35</td>
<td>2.58</td>
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<td></td>
<td></td>
<td></td>
<td>Siblings who smoke hookah pipe: 5.06</td>
<td>4.00</td>
<td>6.25</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Parent smoking hookah pipe: 2.41</td>
<td>2.02</td>
<td>2.87</td>
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<td></td>
<td></td>
<td></td>
<td>Students who thought parents would show no reaction to hookah pipe use: 3.89</td>
<td>3.22</td>
<td>4.71</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Appealing because of taste: 18.07</td>
<td>14.80</td>
<td>22.07</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Appealing because of smell: 13.40</td>
<td>11.00</td>
<td>16.69</td>
</tr>
</tbody>
</table>
appealing because of preparation
appealing because of sound
provides stress relief

20 T Shujat et al. (2013) Lahore City, Pakistan General population visiting shisha bars, tobacco shops, and shisha cafés.

1.79 1.32 2.42
1.87 1.38 2.64
1.69 1.23 2.33

21 U Smith et al. (2011) San Diego High School students 689 R: 16-19 M: 17.1

3.06 1.54 6.11
2.07 1.09 3.91
4.59 1.27 16.57

22 V Sterling and Mermelstein (2011) Chicago High School students 951 M: 17.6

3.67
1.36
1.26
1.53
1.78
2.77
2.77
1.69
2.10
9.23

23 W Tamim et al. (2007) Beirut, Lebanon Intermediate and secondary school students 2443 M: 15

Male
Age 13–15
Age 15–17
Age 17
Mothers education (Intermediate)
Fathers education (Primary)
Fathers occupation
Mothers occupation

1.9
2.3
4.0
6.9
2.0
1.9
1.8
4.1
1.4
0.8
1.4
2.4
1.2
1.1
1.5
1.8

2.7
6.6
11.2
19.7
3.2
3.3
3.7
9.2

24 X Urrutia-Pereira et al. (2017) Brazil school students 798 R: 12–19

Smoking amongst close friends
Experimentation with cigarettes
Final level of high school
Accept hookah pipe from best friends

5.67
1.57
1.54
4.36
2.06
1.32
0.79
2.69
7.09
2.20
3.04
7.07

25 Y Ziaei et al. (2016) Iran High school students 1517 R: 15 – 17 M: 16.1

1.54 0.79 3.04
1.46 0.73 3.23
3.46 2.69 7.07

percentage (prevalence); **p value; °% of motives and mental health characteristics in relation to current smoking status; °°Nagelkerke R^2; °°% of population; °°°Crude prevalence ratio (PR);
°Correlations bold text: significant codes are used because it becomes more practical when reporting on the studies in the results section.
the likelihood of adolescents smoking the hookah pipe by four times (OR = 4.00; 95% CI, 2.82–5.67). Eighty-one percent of adolescent respondents reported having close family or relatives that regularly smoked and 96.2% reported relatives who had experience of substance abuse. Sixty-two percent of adolescents reported smoking the hookah pipe because they were imitating their fathers and brothers. Seventy-three percent of adolescents felt that their families were negligent, and this served as a motive to smoke. Adolescents who thought that their parents would show no reaction to their hookah pipe use were 3.89 times more likely to smoke the hookah pipe (OR = 3.89; 95% CI, 3.22–4.71).

Theme 2: Parents’ education levels and employment status or occupation. Adolescent hookah pipe use is determined by fathers’ and mothers’ education levels and occupations. Three of the five studies focused on fathers only; one study did not specify which parent and made reference to parent education; and one study focused on fathers’ and mothers’ education levels and type of employment. Parents who did not attend university and only had a high school education were considered to have lower education levels.

Adolescents who have fathers with lower education levels were 1.59–2.8 times more likely to smoke the hookah pipe (OR = 1.59, p = 0.001) (OR = 2.8; 95% CI, 1.2–6.4), whereas
adolescents who have mothers with lower education levels were twice as likely to smoke the hookah pipe (OR = 2.0; 95% CI, 1.2–3.2). Unspecified parents’ education increased the odds of adolescent hookah pipe use by 1.58 times (OR = 1.58; 95% CI, 1.24–2.02). Employed fathers increased the likelihood of adolescents smoking hookah by 2.1 times compared to self-employed fathers (OR = 2.1; 95% CI, 1.2–3.8). Fathers with an administrative job increased the likelihood of adolescent hookah smoking by 1.8 times (OR = 1.8; 95% CI, 1.5–3.7). The odds of adolescent smoking was 4.1 times more likely if mothers were employed, irrespective of whether the occupation required her to be skilled or unskilled (OR = 4.1; 95% CI, 1.8–9.2).

Peers/friends determinants
Factors pertaining to adolescents’ peers and friends are significant determinants of hookah pipe use. Three subthemes emerged from the peer/friends factors: (1) peers and friends who smoke, (2) socializing with friends, and (3) encouragement and status symbol amongst peers.

Theme 1: Peers and friends who smoke. Smoking amongst close friends is a strong determinant of adolescent hookah pipe use. More specifically, smoking among all close friends increased the likelihood by 7.42 times (OR = 7.42, p = 0.001) and smoking among most close friends increased the likelihood by 9.25 times (OR = 9.25, p = 0.001). However, having any friends that smoke increases the odds of adolescents using the hookah pipe by 2.67–10.36 times (OR = 2.67; 95% CI, 1.83–3.89) (OR = 10.36; 95% CI, 5.58–19.23). These results indicate that the peer group has a significant influence on determining adolescent hookah pipe use. These findings are corroborated by 61% of respondents who confirmed their friends’ influence on their hookah pipe smoking behavior.

Theme 2: Socializing with friends. Socializing with friends was reported by adolescents as the main predictor of hookah pipe use. Outings with friends (87.3%), meeting friends (76.1%), and escaping boredom/passing time (78.4%) were their most cited reasons for hookah smoking. Forty percent of respondents reported that they smoke the hookah pipe to sit with friends (40%), have fun with friends (54%), or because everyone smokes so it’s considered good entertainment (55%). Adolescents who spent more than three consecutive days with friends were 1.96 times more likely to smoke the hookah pipe (OR = 1.96; 95% CI, 1.38–2.79). It was also found that adolescents who engage in recreational activities or hobbies are 3.77 times more likely to smoke the hookah pipe (OR = 3.77; 95% CI, 1.37–3.12).

Theme 3: Encouragement and status symbol amongst peers. Accepting hookah from a friend was more likely (OR = 10.6; 95% CI, 1.4–83.4) to motivate one to smoke compared to accepting hookah from a best friend (OR = 4.36; 95% CI, 2.69–7.07). Sixty-one percent of respondents felt their friends encouraged them to smoke. While 69% perceived smoking the hookah pipe as a status symbol, making them feel more admired by their peers.

Individual determinants
Individual factors also play an important role in hookah pipe use. Four subthemes emerged from the individual factors: (1) demographics, religion, pocket money, and screen time; (2) living conditions; (3) substance experimentation or use, and (4) physical or mental health. These are described below in more detail.

Theme 1: Demographics, religion, pocket money, and screen time. All studies that considered gender reported that being male is a determinant for hookah pipe use. One study found that being male increased the odds of hookah pipe smoking by 18.3 times (OR = 18.3, p = 0.001). In terms of age, clear distinctions cannot be made whether younger adolescents are more likely to smoke hookah pipe compared to older adolescents, or vice versa, because adolescents in the final year of adolescence are 6.54 times more likely (OR = 6.54; 95% CI, 2.79–15.32) to smoke hookah, but adolescents eleven years old and older are 7.7 times more likely to smoke (OR = 7.7; 95% CI, 1.3–43.6). It is unclear what the
mean age is for the respondents that are older than eleven years old; therefore, clear conclusions cannot be made, but it is evident that adolescents are very likely to smoke the hookah pipe based on these results. Respondents who identified themselves as Asian (OR = 1.55; 95% CI, 0.65–3.67) or Middle Eastern (OR = 2.34; 95% CI, 1.16–4.74) proved to be more likely to use the hookah pipe compared to adolescents from other backgrounds. Furthermore, adolescents who had moderate or non-committed religious beliefs were 1.58 times more likely to smoke the hookah pipe (OR = 1.58; 95% CI, 1.12–2.23) compared to adolescents who reported having committed religious beliefs. Participants who had more than 2 h screen time were 1.64 times more likely to smoke the hookah pipe (OR = 1.64; 95% CI, 1.26–2.14) compared to less than 2 h/d screen time. The amount of pocket money received also increased the likelihood of smoking the hookah pipe. In one study, adolescents who received 5–6 Saudi riyals were 1.73 times more likely (OR = 1.73; 95% CI, 0.86–3.49) to smoke the hookah pipe compared to adolescents who received seven or more riyals. In the case of the latter, adolescents were 3.18 (OR = 3.18; 95% CI, 1.42–7.09) times more likely to smoke the hookah pipe. Similarly, adolescents who received more than 1.3 USD were 3.3 times more likely to smoke the hookah pipe (OR = 3.3; 95% CI, 2.3–4.6).

Theme 2: Living conditions. Living conditions appear to be a significant factor for determining hookah pipe use. Adolescents living in small metropolitan statistical areas that are densely populated are 2.67 times more likely to smoke the hookah pipe (OR = 2.67; 95% CI, 2.04–3.49). Similarly, adolescents living in large metropolitan statistical areas that are also densely populated are 2.64 times more likely to smoke the hookah pipe (OR = 2.64; 95% CI, 1.95–3.56). Conversely, living in an urban area makes one 1.87 times more likely to smoke the hookah pipe (OR = 1.87; 95% CI, 1.35–2.58).

Likewise, living in a middle-income community makes adolescents 2.18 times more likely (OR = 2.18; 95% CI, 1.01–4.69) to smoke the hookah pipe, whereas living in an upper middle-income community makes one 2.69 times more likely to smoke the hookah pipe (OR = 2.69; 95% CI, 1.10–6.55). However, living in a high-income community makes one 1.66 times more likely to smoke (OR = 1.66; 95% CI, 0.58–4.77). These results show that living in higher income communities makes adolescents less likely to smoke the hookah pipe compared to middle-income and upper middle-income communities, or areas that are densely populated.

Theme 3: Substance experimentation or use. Past, present, or ever-use of cigarette smoking is a strong determinant of hookah pipe use, followed by marijuana use, alcohol use, and other substance use. When adolescents experiment with tobacco, they are 9.37 times more likely to smoke the hookah pipe (OR = 9.37; p = 0.001). This is especially true if the form of tobacco smoked is cigarettes because this makes adolescents 8.1 times more likely (OR = 8.1; 95% CI, 5.3–12.6) to smoke the hookah pipe. Adolescents who have ever used marijuana are 4.48 times more likely to smoke the hookah pipe compared to those that have not used marijuana (OR = 4.48; 95% CI, 3.38–5.94). Adolescents who have ever used alcohol are 3.34 times more likely to smoke the hookah pipe compared to those who have not used alcohol (OR = 3.34; 95% CI, 2.12–5.25).

Theme 4: Physical or mental health. Hookah pipe is commonly used among people who have physical or mental health concerns. In the views of students diagnosed with asthma, 28% are convinced that smoking the hookah pipe makes them look cool and fit in with their peer groups, while 61% reported that it makes them feel more comfortable in social situations. Adolescents with any anxiety or depression are 6.7 times more likely to smoke the hookah pipe compared to adolescents who do not experience anxiety or depressive symptoms or disorders (OR = 6, p = 0.001). Adolescents reported smoking the hookah pipe after a bad event (65%), when they feel angry (63%), and when they feel distressed because it relaxes them (67%).

School determinants

School determinants can all be grouped in one theme, namely, attending school. Adolescents
who engage in class truancy are 9.13 times more likely to smoke the hookah pipe compared to those who do not skip class often \( \text{OR} = 9.13; 95\% \text{ CI}, 3.96-21.04 \)\(^a\). Adolescents who have skipped class a few times are 4.46 times more likely to smoke the hookah pipe compared to those who do not skip class (\( \text{OR} = 4.46; 95\% \text{ CI}, 2.55-7.81 \))\(^b\), while those who have skipped class once are 2.09 times more likely to smoke the hookah pipe compared to those who have never been truant (\( \text{OR} = 2.09; 95\% \text{ CI}, 1.02-4.29 \))\(^a\). Furthermore, adolescents who are enrolled at private schools are 2.23 times more likely to use the hookah pipe \( \text{OR} = 2.23; 95\% \text{ CI}, 1.73-2.88 \)\(^c\). Adolescents in their final level of high school are 1.54 times more likely to smoke the hookah pipe compared to those at other levels (\( \text{OR} = 1.54; 95\% \text{ CI}, 0.79-3.04 \))\(^y\). However, another study found a higher odds of learners of this age group (16–18) smoking the hookah pipe (\( \text{OR} = 3.64; 95\% \text{ CI}, 1.91-6.95 \))\(^l\). Although the difference cannot be definitively concluded, the one noticeable difference between the two studies is that the first one is located in Iran and the second one in London. Therefore, context may play a role in schooling and hookah pipe use. Additionally, 62% of adolescents reported that their teacher smokes cigarettes at school.

**Other determinants**

Factors that could not be placed under family, peers/friends, individual, or school factors were placed under “other” factors. Two themes emerged from this set of factors: (1) the hookah pipe mechanism or process and (2) awareness of hookah pipe smoking.

**Theme 1: The hookah pipe mechanism or process.**

Adolescents found hookah pipe smoking appealing because it made them feel relaxed (50%), they smoked for leisure (30.8%), they had an interest in smoking (46%), they attracted attention when they smoked (41%), and they enjoyed the taste (17.5%)\(^b\,s\,o\). These perceptions were corroborated by the findings of another study which found that hookah pipe smoking was 18.07 times more appealing to adolescent users because of the taste (\( \text{OR} = 18.07; 95\% \text{ CI}, 14.80-22.07 \))\(^a\). Furthermore, adolescents were 13.40 times more likely to smoke the hookah pipe because of the sweet smell (\( \text{OR} = 13.40; 95\% \text{ CI}, 11.00-16.69 \))\(^y\) and sound (\( \text{OR} = 1.87; 95\% \text{ CI}, 11.38-2.54 \))\(^s\). Enjoying preparing and setting up the hookah, adolescents were 1.79 times more likely to smoke the hookah pipe because of the preparation methods (\( \text{OR} = 1.87; 95\% \text{ CI}, 11.38-2.54 \))\(^a\).

**Theme 2: Awareness of hookah pipe smoking.**

Thirty-two percent of adolescents reported being motivated to smoke after seeing a hookah pipe smoking advertisement in the last six months\(^o\). Adolescents were 2.07 times more likely to smoke the hookah pipe when they knew of a hookah lounge in the community where they reside (\( \text{OR} = 2.07; 95\% \text{ CI}, 1.09-3.91 \))\(^u\). Attending a hookah bar, lounge, or restaurant increased the odds of usage by 6.25 times (\( \text{OR} = 6.25; 95\% \text{ CI}, 4.24-9.23 \))\(^v\). Furthermore, owing to the perception that smoking the hookah pipe is more socially acceptable than smoking cigarettes, adolescents were 4.59 times more likely to smoke the hookah pipe (\( \text{OR} = 4.59; 95\% \text{ CI}, 1.27-16.57 \))\(^u\).

**Discussion**

This review was conducted to discover the determinants of adolescent hookah pipe use in order to answer the research question: “why do adolescents use the hookah pipe?” This study found that hookah pipe use is determined by family, peer, individual, school, and other factors, such as use of the hookah pipe mechanism and hookah pipe awareness. These findings differ from the determinants of other nicotine products, such as e-cigarettes and cigarettes. In terms of the latter, Soneji et al. (2017) found that these may activate cognitive or behavioral processes that increase the risk of smoking and that users of these products may show increases in positive expectancies about cigarette smoking and increases in affiliation with peers who smoke these products. However, it has not been conclusively reported that affiliation with peers is a determinant for use. The findings of this study clearly identifies that the social milieu as a defining determinant of hookah pipe use, making hookah pipe use more of a social phenomenon compared to e-cigarettes or cigarette smoking.
which appears to be the result of activating a cognitive or behavioral response (Soneji et al., 2017). This could be attributed to the fact that the hookah pipe is often smoked with friends and family, and therefore, its experienced effects are more than just physical.

Oyewole et al. (2018) conducted a systematic review which focused on identifying tobacco use among Nigerian youth. In their research, they found similar results to this study. Being male increased the likelihood of using tobacco products, such as the hookah pipe. This could be related to the fact that male tobacco use is influenced by different cultural, psychosocial, and socioeconomic factors, which views male tobacco use as more favorable compared to female tobacco use (Oyewole et al., 2018; World Health Organization [WHO], 2018). The role of other substances cannot be minimized as substances, such as cigarettes and alcohol act as gateway substances for hookah pipe use, or vice versa. Also, adolescents tend to experiment with substances at a young age, and then as they get older, their usage may become more frequent to gain the same effects or they may experiment with more or different substances, such as the hookah pipe (Bracken et al., 2013).

Individuals and groups exist within a social context. It is not uncommon that environmental factors, such as residential settings, peer and media influences, and access to establishments where the hookah pipe is sold plays an integral role in whether one smokes or not (Hawkins et al., 1992; Oyewole et al., 2018). Moreover, the role of the family, whether it be family modeling or family structure, influences members’ hookah pipe use, since positive or negative attitudes toward smoking the hookah pipe is experienced within the family as is also influenced by how parents respond to adolescent hookah pipe use. When substance use is considered acceptable by parents, siblings, and friends, it increases the risk of use because it may be perceived that using the hookah pipe is allowable, and in some cases desirable (Hawkins et al., 1992). Interestingly, Brook et al. (1990) examined the role of older brothers in younger brothers’ substance use and found that an older brother’s substance use can influence a younger brother’s substance use. This finding is supported in this study as well as in the study by Oyewole et al. (2018) which showed that older brothers play a central role in the lives of their younger siblings, especially regarding substance use, particularly hookah pipe use (Hawkins et al., 1992).

Furthermore, the role of mental health also needs to be considered. Once again, this study as well as that of Oyewole et al. (2018) found conclusive evidence that mental health conditions, such as anxiety and depression, plays a major role in adolescent hookah pipe use. Adolescence is a period marked by significant developmental changes. Thus, the use of substances may have a negative effect on their development. This is especially true for adolescents with symptoms of anxiety, depression, or other psychosocial problems because smoking the hookah pipe may be used as a coping mechanism to ameliorate their condition, but could instead be exacerbating their already difficult situation (Schulte & Hser, 2013). Despite having mental health conditions, curiosity and experimentation remains a common feature of adolescents. Therefore, specific interventions need to be aimed at meeting the emotional needs of adolescents who use the hookah pipe in an attempt to minimize hookah pipe use and create awareness about the harmful effects of using substances and having a mental health condition or psychosocial stressor.

A study by Perikleous et al. (2018) focusing on e-cigarettes found similar results to this study. The study found that curiosity, male gender, lower school performance, studying at a disadvantaged school, increasing age and gender, using other substances, family or peer smoking, or being in employment and being affluent increases the odds of using e-cigarettes (Perikleous et al., 2018). Akl et al. (2015) conducted a narrative review assessing the determinants of hookah pipe use in young people aged 10–29 years. The study revealed that hookah pipe use is on the rise because of the positive attitude toward hookah pipe smoking, perceptions of addictive properties and health hazards (less harmful than cigarette smoking), and ability to quit. Furthermore, youth provided the following reasons for smoking the hookah pipe: entertainment; relaxation; to escape boredom; curiosity and experimentation; to
socialize; and the resultant positive somatic experience that engages almost all the senses—
taste, smell, sight, sound, and touch. Hookah pipe users expressed that they associate use with
culture and heritage.

The findings of all these studies indicate that
the determinants of hookah pipe use and other
tobacco products are similar. However, Siddiqi
(2018) identified that the interventions that are
effective in tobacco cessation cannot simply be
applied to hookah pipe users because it has been
found that tobacco cessation interventions do not
yield the same results for hookah pipe cessation.
This means that an alternative intervention spe-
cifically aimed at reducing hookah pipe use is
needed. Conventional tobacco interventions use
methods, such as the drug varenicline, behavioral
counseling and support to address some of the
psychological aspects of addiction. This is
achieved by short-term prevention and early
intervention support by means of supportive,
educational, or counseling sessions (Dogar et al.,
that conventional tobacco cessation interventions
lack the social element that is prominent in hoo-
kah pipe smoking, since hookah pipe users
mainly smoke with friends and family.
Additionally, when planning an intervention, the
developmental phase and context of the target
population is very important in order to captivate
their attention and implement the intervention
tools, skills, or practices effectively (Bailey
et al., 2015).

Limitations
In this study, a number of limitations were iden-
tified. Although 12 databases were used with
broad search categories, only articles published in
journals within the included databases were
accessed for this study. This means that there
may be other relevant studies describing the
determinants of hookah pipe use that have not
been included in this study. Due to the hetero-
geneity of the methodology, data, and analysis
of the trends within the identified studies, it was
challenging to compare the studies in terms of
the strengths and weaknesses of factors related to
determinants of hookah pipe use. Not all studies

provided sufficient information about the
strength of the determinants, as some only pro-
vided descriptive data making it difficult to ascer-
tain whether this was a determinant for
adolescent hookah pipe use or not. Some studies
allowed the age group to extend beyond the years
of adolescence making it difficult to clearly say
that the determinants are specific to adolescents.
The majority of the studies drew their samples
from the school setting, which means that adoles-
cents that do not attend school are not accounted
for—this may or may not have yielded additional
determinants of hookah pipe use. Lastly, we did
not include studies prior to 2007 and studies in
languages other than English, inclusion of these
articles may have yielded more results.

Recommendations
Based on the findings of this study, assessment,
prevention, and treatment recommendations are
provided for practitioners and researchers.
Assessment could include an understanding of the
adolescent’s current home, school, and family cir-
cumstances; physical and mental health chal-
lenges; substance use and patterns of use;
knowledge, beliefs, and attitudes toward smoking;
eexisting coping strategies; and adolescents’ per-
ception of their authority figures’ ideas of hookah
pipe smoking. The results of these assessments
allow clinicians to plan treatment strategies and
researchers to identify and fill gaps in hookah
pipe research in order to form a basis to propose
interventions. The target population for preven-
tion strategies should not only include adoles-
cents, but also people who have a direct impact
on the lives of adolescents. In addition, we argue
that prevention activities should occur where
they are accessible to the target audience, and
can be incorporated into school curriculums,
doctor visits, and life-skills sessions offered by
organizations offering psychosocial support. This
study found that advertisements encouraged hoo-
kah pipe smoking. This finding highlights the
influential role of advertisements on viewers’
lives. Therefore, advertisements advocating
healthier alternatives to hookah pipe smoking,
preventing hookah pipe use, and communicating
the risks of hookah pipe smoking should be
prioritized. Other age appropriate social events happening in the community should be marketed through various mediums, thereby capturing and redirecting the interests of adolescents away from attending a hookah bars or lounges. Awareness campaigns are needed in the school and community setting to educate teachers, learners, and families about the implications of hookah pipe use as well as the impact of allowing younger children to witness or smoke with parents, older siblings, or other family members. Since hookah pipe use increases with age, it is necessary to intervene as early as possible with prevention and early intervention activities to prevent adolescent hookah pipe use. In terms of research, there is a need to gain an understanding of the role of the family in hookah pipe use. Also, comparative studies can be done between users and non-users to determine the significant differences between these two groups of adolescents. In terms of treatment, interventions should be holistic in nature, taking the individual, family, school, peers, and other factors into account. As noted in the study, all these factors have an integral role in hookah pipe use. Treatment encompasses an array of activities including parent education and support sessions emphasizing the need to monitor and supervise adolescents and their activities, toolkits to understand adolescent development, understanding how the hookah pipe can be a gateway to other substances, group therapy, life skills, peer mentoring, leadership activities, and ideas on how to use pocket money wisely. Interventions must be tailored for the specific population and context. It is very important that beneficiaries of the treatment feel respected and valued—this will encourage attendance and cooperation. Treatment must occur in a space and setting where the adolescent will feel comfortable attending, for example, a park may be a more conducive environment than a clinic. Since hookah pipe smoking is a social phenomenon, the intervention needs to incorporate social elements so that attending the treatment is appealing. From a research perspective, it would be interesting to note the determinants of hookah pipe use for other age groups. Determining what drives males and females to use the hookah pipe will be helpful to decide whether an alternative intervention is needed for males and females, which in turn will guide the development of relevant and appropriate interventions. This is a noteworthy point as this study found that being male increases the odds of hookah pipe smoking. However, the other determinants can be true for males and females. Thus, the question is raised, “what makes males more likely to smoke the hookah pipe than females?” Determining adolescents’ motivations and identifying what needs are being met by hookah smoking would also produce an invaluable study on the subject. A review can be done of existing interventions to retrieve previous guideline recommendations aimed at reducing hookah pipe use. Lastly, studies should be conducted to propose a potential intervention that could reduce hookah pipe use amongst adolescents.

Conclusion

The findings highlight that numerous factors contribute to adolescent hookah pipe use. These findings also suggest that there is an interplay of family, school, friends, and individual factors that determine hookah pipe use. While friends, family use, and existing substance use appear to be the strongest determinants of hookah pipe use, individual factors, such as race, context, religion, and screen time were found not to be strong determinants of adolescent hookah pipe use. Hookah pipe use should be included in clinically and empirically validated assessments as well as using evidence-based practices when addressing adolescent hookah pipe use. The use of evidenced-based assessments and practice will aid future investigators in examining adolescents’ hookah pipe use and effectively reduce such behaviors. This review is a good starting point for further discussion and work on developing impactful interventions to reduce hookah pipe use.

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