

BMJ Open Waterpipe dependence in university students and effect of normative beliefs: a cross-sectional study

P Salameh,¹ J Salamé,² M Waked,³ B Barbour,⁴ N Zeidan,⁴ I Baldi⁵

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¹Clinical & Epidemiological Research Laboratory, Faculty of Pharmacy, Lebanese University, Hadath, Lebanon

²Charité—Universitätsmedizin University Hospital, Berlin, Germany

³Pulmonology Department, Saint Georges Hospital & Faculty of Medicine, Balamand University, Beirut, Lebanon

⁴Faculty of Public Health, Lebanese University, Fanar, Lebanon

⁵Laboratoire Santé Travail Environnement, Université Bordeaux Segalen, Bordeaux, France

Correspondence to

Professor Pascale Salameh; psalameh@ul.edu.lb

ABSTRACT

Objectives: The objective of this study was to measure the correlates, including normative beliefs, associated with waterpipe (WP) and cigarette smoking prevalence and dependence.

Setting: A cross-sectional study was carried out using a proportionate cluster sample of Lebanese students in 17 public and private universities.

Participants: Of the 4900 distributed questionnaires, 3384 (69.1%) were returned to the field worker. All available students during break times were approached, with no exclusion criteria.

Primary and secondary outcome measures: sociodemographic variables, detailed active and passive smoking, in addition to items of the tobacco dependence scales were all evaluated.

Results: Correlates to WP smoking were studying in a private university (adjusted OR, aOR=1.50 (1.26 to 1.79); $p<0.001$) and ever smoking cigarettes (aOR=1.80(1.44 to 2.26); $p<0.001$); friends' and societal influence were found on smoking behaviour and dependence. Although the role of parents was not visible in decreasing the risk of smoking WP, their protective influence seemed more important on WP dependence ($\beta=-1.09(-1.79$ to $-0.28)$; $p<0.001$), a behaviour that is considered more deleterious for health. Parents' and friends' disagreement with smoking had a protective effect on cigarette smoking and dependence (aOR<1; $p<0.01$), while thinking that idols and successful people smoke increased the risk of both cigarette smoking and dependence (aOR>1; $p<0.01$).

Conclusions: In conclusion, WP smoking and dependence are influenced by parents' and friends' opinions, and idols' smoking status. Future research is necessary to further improve our understanding of motives for WP smoking and dependence.

INTRODUCTION

Waterpipe (WP) smoking is increasing in popularity, particularly among young people and university students.^{1–4} WP is thought to contain toxic substances, similar to those contained in cigarette.^{5–6} It has been shown to increase the risk of several diseases, including

Strengths and limitations of the study

- This is the epidemiological first study exploring normative beliefs effect on waterpipe (WP) smoking in university students.
- This is the first study in the region concerning WP dependence in university students.
- The study was conducted over a large number of university students in Lebanon.
- Anonymity and non-traceability of participants increases the possibility of honest answers.
- The study showed that parents' opinion did not affect WP smokers, while it had a protective effect against WP dependence.
- The sample was not random, thus a selection bias could not be excluded.
- Information bias is also possible, because results were based on self-declared answers.
- The use of self-completed questionnaires may increase the risk of non-response to certain items.
- We have not taken into account all factors that may predict nicotine dependence.
- Qualitative studies could be useful to further explain the results we obtained.

chronic bronchitis,⁷ chronic obstructive pulmonary disease,⁸ lung cancer⁹ and other ailments.⁹

WP has also been demonstrated to contain nicotine, the substance responsible, at least partially, for addictive effects.^{10 11} It has been associated with an identified dependence effect similar to what could be found with cigarette, in addition to a social factor that adds to its potential addictive effect¹²; as expected, WP dependence per se was associated with higher smoking frequency and higher risk of health effects among WP smokers, as compared to non-dependent WP smokers.^{7 8}

The structure of the WP-associated dependence concept was shaped by the development and validation of a specific score, the Lebanese Waterpipe Dependence Scale-11 (LWDS-11).¹³ The score included items of 'smoking to please others' and 'smoking for pleasure'; two items shown to have high importance in late adolescence and young

adulthood.¹⁴ The main motives for WP smoking are declared to be socialising, relaxation, pleasure and entertainment; this was suggested in a systematic review with qualitative data synthesis of numerous studies. Peer pressure, fashion and curiosity were additional motives declared by university students, while expression of cultural identity seemed an additional motive for people in the Middle East.^{14 15}

Among young cigarette smokers, students' perceptions of smoking among the successful/elite and disapproval by parents/peers were independently associated with susceptibility to smoking.¹⁶ In parallel, some epidemiological studies were conducted to evaluate these effects in case of WP smoking, and showed that parents' tolerance of WP smoking, peer WP smoking and the idea of popularity were main motives for this behaviour.^{17–19}

For cigarette dependence, earlier onset of at least once a month cigarette smoking, heavier overall consumption and peers' smoking were associated with higher nicotine dependence in young Saudi students.²⁰ Moreover, parental smoking restrictions may have the potential to impede adolescent progression to adult smoking behaviour by reducing smoking rates and nicotine dependence.²¹

To our knowledge, very few studies have been conducted regarding WP dependence, particularly in the Middle Eastern region, while normative beliefs have hardly been addressed.

Thus, although we may know what drives WP smoking in youngsters, no studies have ever quantitatively assessed the magnitude of normative beliefs' influences among university smokers on WP dependence, a more deleterious behaviour for health. The objective of this study was to measure the correlates, including normative beliefs, associated with WP and cigarette prevalence and dependence.

METHODS

Population and sampling

A cross-sectional study was carried out using a proportionate cluster sample of Lebanese students in the public and private universities. A list of universities in Lebanon, provided by the Center for Pedagogic Researches, was used to adjust the sample size.²² A sample size of at least 3000 individuals was targeted to allow for adequate power for bivariate and multivariate analysis to be carried out on several factors; this sample size is powerful enough for any factor prevalence and association OR above 2.

The administrative offices of most universities in Lebanon that were approached did not allow drawing a random sample of their enrolled students to participate in the study; they did not provide us with the lists of students and permission was not granted to enter classrooms and search for students nominatively. Thus, our research group had to work with a non-random sample of students outside their classes. Students were

approached on campus during break times between courses by a field worker.

The latter explained the study objectives to the student; and after obtaining oral consent, the student was handed the anonymous and self-administered questionnaire. On average, the questionnaire was completed by participants within approximately 20 min. At the end of the process, the completed questionnaires were placed in closed boxes and sent for data entry. During the data collection process, the anonymity of the students was guaranteed, to allow for lower information bias. Of the 4900 distributed questionnaires, 3384 (69.1%) were returned to the field worker; the sample included students from 17 universities (the public university of Lebanon that accounts for half the university students in Lebanon and 16 private ones which account together for the other half). Further methodological details are presented in more details elsewhere.³

Questionnaires

The questionnaire used in this study had several parts, including the sociodemographic part, and a detailed active and passive smoking history, in addition to items of the tobacco dependence questions. Socioeconomic status of students was defined using their mean monthly income per family divided by the number of family members; afterwards, quartiles were calculated and used to classify individuals into four levels.

Current WP smoking was defined as smoking at least one WP per month, while current cigarette smoking was defined as smoking at least one cigarette per day. For cigarette dependence, we used the Young Adults Cigarette Dependence (YACD) scale,²³ and for WP dependence, the LWDS-11,¹³ both of which were developed by our team for the Lebanese population. The YACD has been developed for university students; it comprises 16 items, loading over six factors: nicotine dependence, craving intensity; positive reinforcement and negative reinforcement.²³ The LWDS-11 comprises 11 items, loading on a four-factors structure in adults: nicotine physiological dependence, positive reinforcement, negative reinforcement and psychological craving¹³; its validity and reliability had to be confirmed in this young adults' sample before use.

Moreover, questions on normative beliefs were taken from a study performed on cigarette smokers by Primack *et al*¹⁶ measures of students' perceptions of smoking among successful people, cool people and idols and disapproval by parents and peers were evaluated by Likert scale questions: 0 indicated strongly disagree; 1, disagree; 2, maybe; 3, agree; 4, strongly agree. These were further collapsed in bivariate analysis into yes (3 and 4), maybe (2) and no (0 and 1).

Statistical analysis

Data entry was performed by independent lay persons who were unaware of the objectives of the study; these were postgraduate students who were not involved in

data collection process. Data cleaning was performed by researchers, and a sample of 50 questionnaires was completely checked for errors. The error rate was lower than 1%; thus, data entry was considered adequate.

Statistical analysis was performed using SPSS software, V.13.0. A *p* value of 0.05 was considered significant. Cluster sampling effect was taken into account according to Rumeau-Rouquette *et al.*²⁴. Data weighting was performed according to the total number of students per university, as described by the Center for Educational Research and Development—Lebanese Ministry of Education.²²

To confirm the LWDS-11 validity and reliability in the study sample, an exploratory factor analysis was first performed with its items, after ensuring sample adequacy with the Kaiser-Meyer-Olkin (KMO) index, and Bartlett's χ^2 test of sphericity. Factors were extracted using the principal component analysis. Items were retained if they loaded 0.4 or more on factors. Since factors were found to be correlated, we chose to perform a promax rotation with Kaiser normalisation. Afterwards, reliability analysis was performed by Cronbach's α values for factors and the total scale.

Comparison of means was performed using analysis of variance in bivariate analysis, with Bonferoni correction on post hoc tests. Non-parametric tests were used in case of small subgroups (Kruskal-Wallis and Wilcoxon tests, respectively).

To decrease confounding bias, we performed multivariate analyses: multiple regressions were carried out using a stepwise backward method, after ensuring sample adequacy, linearity of the model, residual normality and non-collinearity of retained items (variance inflation factor <2). We took WP dependence and cigarette dependence as dependent variables in respective models, using sociodemographic characteristics normative beliefs and other forms of smoking (ie, WP smoking among cigarette smokers and cigarette smoking among WP smokers) as independent variables. Both dependent variables were normally distributed. A *p* value <0.05 was considered significant; missing data were not replaced for this analysis due to their low percentage (<10%).

For indicative purposes, we also conducted multiple logistic regressions, using current WP and cigarette smoking as dichotomous dependent variables, respectively and sociodemographic characteristics, other forms of smoking and normative beliefs as independent variables. After ensuring non-collinearity and sampling adequacy by Hosmer-Lemeshow test, we reported adjusted ORs (aORs).

RESULTS

Among 3384 university students, 779 (23%) reported that they were current WP smokers, and 649 (19.2%) that they were current cigarette smokers. Among WP smokers, 760 (97.6%) answered to all questions of the LWDS-11 scale, while among cigarette smokers, 595

(91.7%) answered to the complete YACD scale questions.

Description of the current WP and cigarettes smokers' subsamples

Among WP smokers (*n*=779), the mean number of WP smoked per week was 4.12 (SD=4.76), while the mean duration of smoking was 6.96 years (SD=2.33). The mean age of the first WP intake was 16.46 years (SD=2.43). Among WP smokers, 35% declared having the intention to stop smoking later, and 20% declared wanting to stop smoking immediately. Moreover, 28.7% ever tried to stop smoking but did not succeed. LWDS mean was 10.23, its median was 9, and SD 6.03. The minimum was zero and maximum 30. Its distribution was almost normal, with a skewness of 0.1.

Among cigarette smokers (*n*=649), the mean number of cigarettes smoked per day was 17.23 (SD=9.3), while the mean duration of smoking was 4.32 years (SD=2.25). The mean age of the first cigarette intake was 15.89 years (SD=2.35). Among cigarette smokers, 43.2% declared having the intention to stop smoking later, and 27.2% declared wanting to stop smoking immediately. Moreover, 48.7% ever tried to stop smoking but did not succeed. YACD mean was 13.92, its median was 14.04 and SD 5.95. The minimum was 2.5 and maximum 29. Its distribution was almost normal, with a skewness of 0.6.

We note that 234 (6.9% of the total students sample) were currently dual smokers of both cigarettes and WP. They constituted 36.4% of cigarette smokers and 30% of current WP smokers.

Validity and reliability of the LWDS-11 in Lebanese university students

The KMO measure of sampling adequacy was 0.79 (*p*<0.001). All communalities were higher than 0.35, and the extracted principal component sums of squared loadings explained 66.58% of the total variance.

The Promax rotation with Kaiser normalisation gave a four-factors solution with the following pattern (table 1): factor 1 (physiological dependence; 33.14% of the variance explained), factor 2 (psychological craving; 13.08% of the variance explained), factor 3 (negative reinforcement; 11.59% of the variance explained) and factor 4 (positive reinforcement; 8.78% of the variance explained). Reliability measured by Cronbach's α for the total score was 0.77. We note that the structure is highly similar to the one found in adults, with one difference: the income item which originally loaded on physiological dependence, now loaded on psychological craving. For the rest of psychometric properties, the scale gave almost identical results.

Factors were correlated with each other: factor 1 correlated with factors 2 (r_{12} =0.42), 3 (r_{13} =0.39) and 4 (r_{14} =0.09), factor 2 correlated with factors 3 (r_{23} =0.40) and 4 (r_{24} =0.02) and factor 3 correlated with factor 4 (r_{34} =0.14).

WP and cigarette dependence variation with sociodemographic characteristics.

Table 1 Validity and reliability of the LWDS-11 among university students of Lebanon

Items	Factor 1 Physiological dependence	Factor 2 Psychological craving	Factor 3 Negative reinforcement	Factor 4 Positive reinforcement
How many times were you able to stay 7 days without smoking waterpipe?	0.877			
How many days could you stay without smoking waterpipe?	0.871			
Number of smoked waterpipes per week?	0.798			
Would you smoke waterpipe even if you are ill/bedridden?		0.836		
Are you ready not to eat in exchange for a waterpipe?		0.827		
Would you smoke waterpipe alone?		0.547		
How much of your income are you ready to pay for waterpipe smoking?		0.426		
Smokes waterpipe to relax his nerves			0.868	
Smokes waterpipe to improve his morale			0.862	
Smokes waterpipe to please others (conviviality)				0.910
Smokes waterpipe for pleasure				0.573
Cronbach's α reliability measure	0.806	0.659	0.671	0.527

LWDS-11, Lebanese Waterpipe Dependence Scale-11.

In [table 2](#), we first present the characteristics of the whole sample of university students, for descriptive purposes. WP dependence was significantly higher among widows or divorced individuals, and among individuals who have higher numbers of smokers at home ([table 2](#)). However, cigarette dependence was higher in males, lower socioeconomic status individuals, the 20–21 years age class, the public university and among individuals who have higher numbers of smokers at home; it was also lower in South Lebanon versus other regions ([table 2](#)).

Normative beliefs influence on WP and cigarette dependence

WP dependence was higher in case individuals believed that successful people smoke, rich people smoke, their idols smoke; it was lower in case individuals knew it was important for their parents, their friends and people of their age that they do not smoke ([table 3](#)). Nearly similar results were found for cigarette dependence, except for an additional significantly higher dependence in case individuals believed that cool people smoked, and a lower trend for significance for the peers' opinion about smoking ([table 3](#)).

Multivariate analysis of WP and cigarette current smoking

Studying in a private university and ever smoking cigarettes were correlated to current WP smoking; moreover, thinking that successful and cool people smoke increased the odds of being a current WP smoker, while having friends who disagree with smoking was correlated with lower WP smoking ([table 4](#)). However, being male sex, not

single, higher age, residing in Mount or North Lebanon, studying in a private university and ever smoking WPs increase the odds of being a current cigarette smoker; thinking that successful people or idols smoke was correlated to increased cigarette smoking probability, while having parents who disagree with smoking was correlated with lower cigarette smoking ([table 4](#)).

Multivariate analysis of WP and cigarette dependence

In multiple regression of WP dependence, parents and friends' opinion against smoking were inversely associated while belief that idols smoke were positively associated with WP dependence; moreover, higher age class was also associated with higher WP dependence ([table 4](#)). For cigarette dependence, parents' opinion against smoking was strongly and inversely associated, while the perception that idols, rich and successful people smoked were positively associated with cigarette dependence ([table 4](#)).

We note that performing the analysis among dual smokers gave similar results of dependence correlates for both WP and cigarettes with normative beliefs, except for a visible association of dual dependence with male gender versus females (OR=5.10 (2.83; 9.19); $p < 0.001$; other results not shown).

DISCUSSION

In this study, we found that correlates of current WP smoking were studying in a private university (representing access to money), ever smoking cigarettes and clear friends' and societal influence, as found in other studies.^{17–19 25} Moreover, friends' disagreement with

Table 2 LWDS-11 and YACD means in different sociodemographic categories of smokers

Characteristic**	Total n=3384	LWDS-11 Mean (SD)	p Value	YACD (SD)	p Value
Sex			0.082		0.006
Male	1980 (58.5%)	10.62 (6.21)		14.22 (5.95)	
Female	1399 (41.3%)	9.86 (5.84)		12.70 (5.98)	
Marital status			0.006*		0.664
Married	115 (3.4%)	10.00 (4.85)		14.76 (7.65)	
Single	3243 (95.8%)	10.19 (6.02)		13.84 (5.99)	
Widow or divorced	9 (0.3%)	17.50 (6.17)		11.5 (0.00)	
Socioeconomic status quartiles††			0.35		0.051
Quartile 1	736 (21.7%)	9.69 (5.51)		15.61 (6.09)	
Quartile 2	746 (22.0%)	10.67 (5.78)		14.11 (6.11)	
Quartile 3	632 (18.7%)	9.68 (6.04)		13.51 (5.65)	
Quartile 4	746 (22.1%)	10.47 (6.90)		13.70 (5.95)	
Age classes (years)			0.053†		<0.001*
17–19	958 (28.3%)	9.42 (5.86)		11.69 (5.37)	
20–21	1424 (42.1%)	10.75 (5.88)		14.93 (5.90)	
22 and more	982 (29.0%)	10.14 (6.36)		13.27 (6.07)	
Private university	1754 (51.8%)	10.21 (6.03)	0.422	13.33 (5.88)	0.005
Public university	1630 (48.2%)	9.86 (6.07)		14.77 (6.09)	
Region			0.135		<0.001¶
Beyrouth	526 (15.5%)	10.72 (6.62)		13.21 (5.99)	
Mount Lebanon	1606 (47.5%)	9.55 (6.03)		14.05 (5.89)	
North Lebanon	505 (14.9%)	10.91 (4.87)		15.47 (6.43)	
South Lebanon	474 (14.0%)	10.55 (6.21)		9.99 (3.47)	
Bekaa plain	221 (6.5%)	9.95 (6.07)		12.28 (6.31)	
Number of smokers at home			<0.001*		<0.001§
No smokers	896 (26.5%)	9.00 (5.51)		11.98 (5.19)	
One smoker	1022 (30.2%)	8.87 (5.65)		11.68 (5.44)	
Two smokers	722 (21.3%)	10.21 (5.75)		12.46 (5.45)	
Three and more	604 (17.8%)	12.28 (6.42)		16.21 (5.92)	

*All two by two differences were significant.

†Difference significant between the first two categories.

‡Difference between first and third categories was significant. §Difference significant between third category and others is significant.

¶Difference between the third category and others is significant.

¶¶South Lebanon significantly different from other regions.

**ANOVA was used in all comparisons, with Bonferoni adjustment; Kruskal-Wallis non parametric test was used for marital status due to small subgroup size, with further Wilcoxon two-by-two comparison.

††Socioeconomic status of students was defined using their mean monthly income per family divided by the number of family members; afterwards, quartiles were calculated and used to classify individuals into four levels; we note that 524(15.5%) gave no valid answer for socioeconomic status.

ANOVA, analysis of variance; LWDS-11, Lebanese Waterpipe Dependence Scale-11; YACD, Young Adults Cigarette Dependence.

smoking decreased WP dependence: in the latter case, smoking for conviviality during social gatherings is absent, and this component of positive reinforcement and cue for smoking in many individuals would be expected to affect individuals' dependence to WP.¹³ Idols' smoking of university students increased the risk of WP dependence, which may also be considered the reverse side of the medal of the societal influence.

Age increased the risk of WP dependence; this may be explained by the establishment of this habit with time during life in university and more frequent exposure, or due to its possible insidious nature of dependence that may only appear after repeated exposures. The nature of WP dependence installation may differ from cigarette dependence that seems to install in young people after only a few cigarettes.^{26–28} Indeed, Asfar *et al*²⁹ have shown the existence of beginners and established WP

smokers, the latter being less willing to quit WP smoking and more hooked on the habit.

Although the role of parents was not visible in decreasing the risk of smoking WP, their protective influence seemed more important on WP dependence; the latter behaviour has been shown to be more deleterious for health.^{7 8} A social tolerance of WP smoking by parents may explain this finding,¹⁷ who may intervene with their offspring in case of dependence only; additional studies are necessary to evaluate whether parents are able to differentiate between occasional WP smokers and dependent WP smokers among their children.

As for cigarette smoking, numerous sociodemographic factors were found to correlate with the behaviour: male sex, high age, married/widow/divorced marital status, residing in Mount and North Lebanon, studying in a private university and ever smoking WP. Parents'

Table 3 LWDS-11 and YACD means bivariate analysis with societal influence

Characteristic*	LWDS-11 mean (SD)	p Value	YACD mean (SD)	p Value
Successful people smoke		<0.001†		<0.001‡
Yes	9.93 (5.80)		12.81 (5.91)	
Maybe	9.61 (5.61)		12.50 (5.39)	
No	11.92 (6.90)		16.43 (5.66)	
Cool people smoke		0.163		0.002§
No	9.93 (6.30)		12.79 (5.91)	
Maybe	9.91 (5.99)		13.88 (5.95)	
Yes	10.79 (5.91)		14.76 (5.94)	
Rich people smoke		0.002†		<0.001‡
No	10.04 (6.21)		12.71 (5.89)	
Maybe	9.55 (5.60)		13.72 (5.89)	
Yes	11.79 (5.86)		16.69 (5.35)	
My idols smoke		0.030§		<0.001‡
No	10.03 (6.09)		12.49 (5.78)	
Maybe	9.90 (5.69)		12.86 (5.96)	
Yes	11.43 (6.58)		16.77 (5.65)	
For my parents, it is important not to smoke		<0.001†		<0.001‡
No	13.25 (6.88)		16.99 (5.24)	
Maybe	10.28 (6.17)		16.18 (5.51)	
Yes	9.78 (5.78)		12.57 (5.77)	
For my friends, it is important not to smoke		<0.001¶		<0.001**
No	12.22 (6.50)		15.49 (5.79)	
Maybe	10.00 (5.65)		13.26 (5.52)	
Yes	9.34 (5.81)		13.05 (6.19)	
For people of my age, it is important not to smoke		0.009†		0.088
No	11.33 (6.31)		14.53 (6.04)	
Maybe	9.37 (5.69)		13.45 (5.70)	
Yes	9.79 (6.03)		13.39 (6.06)	

*ANOVA was used in all comparisons, with Bonferroni adjustment.

†All two by two differences were significant.

‡Difference was not significant between categories 1 and 2

§Difference between first and third categories was significant.

¶Difference significant between the first two categories.

**Difference was not significant between categories 2 and 3.

ANOVA, analysis of variance; LWDS-11, Lebanese Waterpipe Dependence Scale-11; YACD, Young Adults Cigarette Dependence.

disagreement with smoking had a protective effect on cigarette smoking and dependence, while thinking that idols and successful people smoke increased the risk of both cigarette smoking and dependence, similar to other researchers' findings.^{16 30} Friends influence was also visible, as with other studies.^{16 30–31}

The idea of dual smoking deserves to be noted: smoking one kind of tobacco is associated with higher odds of smoking the other, and being dependent on one kind of tobacco increases the risk of dependence on other kinds. Similar results were found among British university students, where cigarette smoking was a major motive for WP smoking³² and among US students, where the majority of WP smokers were also cigarette smokers.³³ The fact that dependence to cigarettes and to WP includes nicotine dependence components clearly explains this finding.^{11 34 35} This may also biologically be confirmed with results found by Rastam *et al*,³⁶ where cigarette and WP both decrease nicotine craving symptoms in dual smokers, and WP may interact with cigarette smoking cessation.

One more conceptual issue deserves our attention: the LWDS-11 was of adequate validity and reliability in university students of Lebanon; the structure was highly similar to the one found in adults,¹³ with one difference: the income item which originally loaded on physiological dependence in adults, now loaded more adequately on psychological craving among students. One explanation could be that many adults adapt their smoking frequency and agree to pay portions of their incomes according to usual physiological nicotine needs, while younger university students would be ready to pay higher portions of their incomes only in case of extreme psychological craving (which is considered a more compelling urge than usual physiological dependence). Access to money being more limited for university students than for working adults may clarify this issue; in parallel, it is worth noting that in the YACD, the money item had also loaded on the psychological craving factor, not on the nicotine dependence factor.²³ Additional qualitative studies would be necessary to confirm this finding; nevertheless, the LWDS-11

Table 4 Multivariate analysis tobacco use and dependence

Binomial-dependent variable	Logistic regression				
	Independent variables	Adjusted OR	(95% of CI)	p Value	
Current waterpipe smoking*, †	Studying in a private university	1.50	(1.26 to 1.79)	<0.001	
	Successful people smoke	1.46	(1.29 to 1.65)	<0.001	
	Cool people smoke	1.25	(1.12 to 1.39)	<0.001	
	Friends think it is important not to smoke	0.86	(0.78 to 0.96)	0.006	
	Ever smoking cigarettes	1.80	(1.44 to 2.26)	<0.001	
	Female sex vs. male	1.00	(0.83 to 1.21)	0.969	
	Higher age class	1.01	(0.90 to 1.13)	0.871	
Current cigarette smoking*, †	Female sex vs. male	0.24	(0.19 to 0.29)	<0.001	
	Other than single marital status	2.63	(1.20 to 5.76)	0.016	
	Higher age class	1.37	(1.19 to 1.57)	<0.001	
	Mount Lebanon vs. Beirut	1.37	(1.03 to 1.82)	0.029	
	North Lebanon vs. Beirut	1.46	(1.00 to 2.13)	0.053	
	South Lebanon vs. Beirut	0.48	(0.30 to 0.78)	0.003	
	Bekaa plain vs. Beirut	0.61	(0.36 to 1.02)	0.057	
	Studying in a private university	1.96	(1.58 to 2.43)	<0.001	
	Successful people smoke	1.75	(1.52 to 2.01)	<0.001	
	My idols smoke	1.13	(0.99 to 1.30)	0.074	
	Parents think it is important not to smoke	0.81	(0.70 to 0.93)	0.002	
	Ever smoking waterpipes	1.56	(1.22 to 1.99)	<0.001	
Continuous-dependent variable	Multiple regression		Adjusted standardised β (95% CI)	Adjusted β values	p Value
	Independent variables				
LWDS-11 among WP smokers†, ‡	Parents think it is important not to smoke		-0.124	-1.09 (-1.79 to -0.28)	0.002
	Friends think it is important not to smoke		-0.117	-0.87 (-1.46 to -0.28)	0.004
	My idols smoke		0.079	0.63 (0.06 to 1.21)	0.031
	Higher age class		0.069	0.58 (-0.01 to 1.17)	0.053
	Female sex vs. Male		-0.019	-0.23 (-1.09 to 0.64)	0.609
YACD among cigarette smokers§, †	Parents think it is important not to smoke		-0.24	-1.87 (-2.45 to -1.29)	<0.001
	My idols smoke		0.16	1.18 (0.56 to 1.80)	<0.001
	Rich people smoke		0.13	0.97 (0.37 to 1.57)	0.002
	Successful people smoke		0.08	0.56 (-0.02 to 1.14)	0.059
	Higher age class		0.07	0.58 (-0.06 to 1.21)	0.075
	Female sex vs. male		-0.06	-0.77 (-1.77 to 0.24)	0.136

*Performed on whole university students sample; conditions for sample adequacy satisfied; stepwise backward model; all other variables were not retained in the model. Gender and age class were forced in the models.

†Variables included in all models: marital status, socioeconomic classes, region of residence, private university (versus public), successful people smoke, cool people smoke, rich people smoke, my idols smoke, parents think it is important not to smoke, friends think it is important not to smoke, people of the same age think it is important not to smoke, smoking other type of tobacco. Gender and age class were forced in the models.

‡R=0.255; adjusted R²=0.065; stepwise model; Variance Inflation Factor (VIF)<2; residuals are normal; all other variables were not retained in the model. Gender and age class were forced in the models.

§R=0.426; adjusted R²=0.175; stepwise model; VIF<2; residual are normal; all other variables were not retained in the model. Gender and age class were forced in the models.

LWDS-11, Lebanese Waterpipe Dependence Scale-11; WP, waterpipe; YACD, Young Adults Cigarette Dependence.

demonstrated adequate validity and reliability, and could thus be used for the current study.

Limitations of the study

Our study, as with any, has its limitations: a selection bias could have been possible since the sample is not a random sample and may not be representative of the young adults and students' population in Lebanon. This non-random sampling could lead to an over-representation of students who skip classes and may have higher risky behaviours, such as smoking. There

could also be a possibility of respondent and information bias, since the results of our study are based on a self-administered questionnaire. Despite the fact that we ensured anonymity and confidentiality of all data that has been collected, respondents may have under-reported some of their behaviours that lead to missing values. Furthermore, we have not taken into account all factors that may predict nicotine dependence, since it has been shown that background factors, psychological characteristics and genetic variation in nicotinic cholinergic receptors contribute independently or interactively

to smoking initiation and to severity of nicotine dependence in young people.³⁷ We suggest that further research be conducted taking into account these limitations; we also suggest prospective studies to thoroughly evaluate the effect of parents and friends on future smoking behaviours, in addition to qualitative research that can explore the knowledge, attitudes and values behind these behaviours.

CONCLUSION

In conclusion, WP smoking and dependence are influenced by parents' and friends' opinions, and idols' smoking status; these results suggest the potential possibility of establishing peer education and help parents advising their young offspring about the importance of non-smoking WP. Future research is necessary to further improve our understanding of motives for WP smoking and dependence.

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Competing interests None.

Ethics approval The IRB of the Lebanese University waived the need for approval because this was an observational study with no traceability of participants.

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