Int J Public Health 52 (2007) 223–232
1661-8556/07/040223-10
DOI 10.1007/s00038-007-6087-9

Original article

Patterns and predictors of tobacco smoking cessation: A hospital-based study of pregnant women in Lebanon

Kalid Yunis[1], Hind Beydoun[2], Pascale Nakad[1], Mustafa Khogali[3], Faysal Shatila[4], Hala Tamim[5]

[1] *Department of Pediatrics, Faculty of Medicine, American University of Beirut, Beirut, Lebanon*
[2] *Department of Epidemiology, College of Public Health, University of Iowa, Iowa City, Iowa, USA*
[3] *Department of Family Medicine, Faculty of Medicine, American University of Beirut, Beirut, Lebanon*
[4] *Department of Pediatrics, Middle East Hospital, Beirut, Lebanon*
[5] *Department of Epidemiology & Biostatistics, Faculty of Health Sciences, American University of Beirut, Beirut, Lebanon*

Submitted: 5 July 2006; Revised: 16 April 2007; Accepted: 9 May 2007

Summary

Objectives: To describe patterns of cigarette and narghile (hubble-bubble or water-pipe) smoking before and during pregnancy and identify predictors of successful smoking cessation.

Methods: A survey was conducted on 4660 pregnant women who delivered single live births between September 1st, 2001 and December 31st, 2002 at five hospitals in Beirut, Lebanon. Women were classified into four groups according to patterns of tobacco use before and during pregnancy: 1) consistent non-users, 2) successful quitters, 3) unsuccessful quitters and 4) consistent users.

Results: High education (OR = 2.03, 95 % CI: 0.99–4.15), adequate prenatal care (OR = 1.72, 95 % CI: 1.02–2.91) and mild smoking at baseline (OR = 2.35, 95 % CI: 1.36–4.09) were main determinants of successful cigarette smoking cessation, whereas successful quitters of narghile use were more likely to be nulliparous (OR = 1.80, 95 % CI: 1.08–2.99) or to have a non-smoking partner (OR = 7.57, 95 % CI: 2.31–24.78).

Conclusions: Different populations should be targeted when designing smoking cessation interventions for cigarette and narghile users.

Tobacco use and smoking cessation in the context of pregnancy remain issues of major concern in public health (Higgins 2002; Walsh et al. 2001). It has been documented that pregnant women who consume tobacco products are at increased risk for perinatal mortality (Higgins 2002; Walsh et al. 2001) and morbidity (Walsh et al. 2001; Ventura et al. 2003; Secker-Walker & Vacek 2002; Lieberman et al. 1994; Mainous & Hueston 1994; Ramsey et al. 1993). A number of health conditions including placental abruption, placenta previa, fetal growth restriction, low birthweight, preterm birth, congenital anomalies and sudden infant death syndrome have been reported in relation to cigarette use among pregnant women (Higgins 2002).

In contrast, little is known about adverse health effects of smoking narghile (hubble-bubble or water pipe), a well-established method of tobacco use in the East (Maziak et al. 2004a; Maziak et al. 2004b; Maziak et al. 2004c; Maziak et al. 2004d; Maziak et al. 2004e; Shehadeh, 2003; Shafagoj & Mohammed 2002; Fakhfakh et al. 2002; Tamim et al. 2001; Kandela 1997; Macaron et al. 1997; Zahran et al. 1985). The main ingredient of the narghile is the "tumbak", a dark paste tobacco lit by charcoal embers, which is usually placed on a tray on top of a pipe connected to a glass bottle half-filled with water (Tamim et al. 2001). When the smoker inhales, the water dilutes the smoke before it enters through the lungs (Tamim et al. 2001). Whereas epidemiological evidence has associated narghile smoking with different cancers (El-Hakim & Uthman 1999; Gunaid et al. 1995; Lubin et al. 1992; Dayal & Kinman 1983; Howe et al. 1980) as well as dermatological (Onder et al. 2002), respiratory (Kiter et al. 2000) and cardiovascular (Jabbour et al. 2003) disorders, only one study looked into the adverse pregnancy outcomes of narghile (hubble-bubble) smoking (Nuwayhid et al. 1998).

Despite the existing stigma around cigarette use during pregnancy (Nuwayhid et al. 1998; Chaaya et al. 2003; Chaaya et al. 2004b), attitudes towards narghile smoking during pregnancy remains largely unknown (Chaaya et al. 2004a; Radwan et al. 2003; Maziak et al. 2004e). On the other hand, a number of population-based studies were conducted to examine patterns, trends and predictors of tobacco use among men and women in Middle Eastern countries (Thompson & Fagerstrom 2006; West 2006; Maziak et al. 2004e; Fakhfakh et al. 2002; Memon et al. 2000; Taha & Ball 1982). Yet, none

of these studies looked at tobacco smoking cessation in the context of pregnancy (Maziak et al. 2004c).

Various smoking cessation strategies were found to be effective means for altering tobacco use during the period of pregnancy (Acharya et al. 2002; Jaakola et al. 2001; Gilen et al. 1997) thereby reducing its negative impact on the newborn infant (Lightwood 1999). Despite the well-known fact that tobacco is a hazardous substance in the context of pregnancy, prevalence studies have suggested that 20–50 % of women in developed countries report smoking cigarettes at the onset of pregnancy (Higgins 2002). Recent studies have reported a decline in the prevalence of smoking during pregnancy (Ventura et al. 2003; Eriksson et al. 1998). In a Norwegian study, the prevalence of cigarette users among pregnant women declined from 34 % in 1987 to 22 % in 1994 (Eriksson et al. 1998). By the same token, in the United States, the national rate of cigarette smoking during pregnancy decreased from 19.5 % in 1989 to 12.2 % in 2000 (Ventura et al. 2003). This observation has stimulated research on smoking cessation patterns in pregnant women as well as on background characteristics that determine successful quitting during pregnancy (Eriksson et al. 1998; McLeod et al. 2003; Kahn et al. 2002; Yu et al. 2003; Woodby et al. 1999; Ford et al. 1993). The most frequently cited predictors were maternal age (Ventura et al. 2003; Eriksson et al. 1998; Yu et al. 2003; Lu et al. 2001; Dejin-Karlsson et al. 1996), education (Eriksson et al. 1998; Kahn et al. 2002; Yu et al. 2003; Lu et al. 2001, Dejin-Karlsson et al. 1996), other socioeconomic factors (Lu et al. 2001), civil status (Eriksson et al. 1998; Lu et al. 2001; Dejin-Karlsson et al. 1996), nulliparity (Mainous & Hueston 1994; Eriksson et al. 1998; McLeod et al. 2003), dose and duration of smoking before pregnancy (Eriksson et al. 1998; Yu et al. 2003; Woodby et al. 1999; Lu et al. 2001), partner's smoking habits or environmental tobacco smoke (Woodby et al. 1999; McLeod et al. 2003; Lu et al. 2001) and adequacy of prenatal care (Ramsey et al. 1993). Although there is extensive literature on determinants of cigarette smoking cessation and their effects on pregnancy outcome (Walsh et al. 2001; Secker-Wlaker & Vacek 2002; Mainous & Hueston 1994; Acharya et al. 2002; Jaakola et al. 2001; Gielen et al. 1997; Israel et al. 2003), no similar studies on narghile smoking cessation have been identified.

The present study was conducted through the database project of the National Collaborative Perinatal Network (NCPNN) among women delivering at five tertiary care centers located in Greater Beirut, Lebanon. Its main objectives were to: 1) analyze patterns and characteristics of cigarette and narghile smoking before and during pregnancy and 2) identify socioeconomic, demographic and health behavioral determinants of successful (cigarette or narghile) smoking cessation among pregnant women in Lebanon.

Methods

Study overview

The study was planned and implemented by a group of pediatricians and public health professionals affiliated to the NCPNN. The database project was approved by the Institutional Review Board of the American University of Beirut. A survey of consecutive deliveries was conducted at five major healthcare institutions in Beirut, Lebanon, over a sixteen months period (September 1st, 2001-December 31st, 2002). The study population was defined as all pregnant women who delivered single live births admitted to Normal Nurseries (NN) and Neonatal Intensive Care Units (NICUs) of the five network hospitals during that study period. Sources of data included medical charts of mothers and their newborn infants as well as direct interviews with surveyed mothers. Trained nurses, midwives and research assistants collected data retrospectively shortly after delivery. The standard NCPNN survey instrument covered socioeconomic, demographic and obstetric characteristics as well as neonatal health outcomes. A new sheet was added to enquire about tobacco smoking history and other lifestyle factors. Women were asked at the time of delivery to report whether or not they consumed tobacco and the average use of cigarettes (on a daily basis) and narghile (on a weekly basis), over the following time periods: before pregnancy, during the first, second and third trimesters of pregnancy. In order to assess environmental tobacco smoke (ETS) exposure, participating women were asked whether individuals in their social network, at the household level, smoked either cigarettes or narghile.

Study sample

A total of 6747 deliveries were registered at the five NCPNN centers during the specified study period. Exclusion criteria were multiple gestation (361 (5.3 %)), unknown gestation (171 (2.5 %)) and missing data on any question related to tobacco use (1743 (25.8 %)). In addition, women who reported initiation of cigarette (n = 10) or narghile (n = 12) use during pregnancy and those who smoked both substances were excluded from the analyses. Out of a total of 4600 eligible women delivering single live births, 4218 subjects were used for the analysis of cigarette use and 3967 were used for analyzing narghile smoking behavior.

Variable definitions

Dependent variables. Patterns of tobacco use were grouped according to cigarette or narghile use at baseline and during the three trimesters of pregnancy. Tobacco non-users at baseline who continued not to use that substance until the end of pregnancy were defined as *consistent non-users* (Group I),

Int J Public Health 52 (2007) 223–232

while *consistent users* (Group II) were defined as all women who used a substance at baseline and continued using the substance until the end of pregnancy. *Successful quitters* (Group III) were users at baseline who did not use the substance for the entire pregnancy period. Finally, tobacco users at baseline who attempted to quit during pregnancy but reported smoking during any trimester of pregnancy were defined as *unsuccessful quitters* (Group IV).

Independent variables. Data on maternal age was obtained from medical charts in its continuous form and was further categorized into five-year age groups: 1) <25; 2) 25–29; 3) 30–34 and 4) 35+ years. Data on parental education and occupation as well as household crowding index were collected through direct interviews with the mothers after delivery. Social class was defined based on paternal occupation as follows: Professional, semi-professional or managerial (Class I); Technical, clerical, skilled or semi-skilled (Class II); Unskilled, unemployed or unclassified (Class III). Household crowding index was defined as the total number of co-residents per household, excluding the newborn infant, divided by the total number of rooms, excluding the kitchen and bathrooms. Obstetric characteristics included maternal parity and number of previous abortions. Lifestyle factors were identified as the number of prenatal care visits and the dose of either cigarette or narghile smoking before pregnancy, with heavy smokers defined as those who reported at least ten cigarettes per day or more than two narghile sessions per week. Partner smoking behavior during pregnancy was defined as follows: 1) Non-smoker, 2) Cigarette smoker only, 3) Narghile smoker only, 4) Cigarette and narghile smoker.

Statistical analysis

All statistical analyses were achieved using SPSS Statistical Package version 11.0 (George & Mallery 1999). Separate analyses were conducted for "cigarette only" and "narghile only" groups. The "cigarette only" group included all consistent non-smokers and those who smoked cigarettes exclusively before or during pregnancy. Similarly, the "narghile only" group comprised all those who reported not smoking cigarettes before or during pregnancy. Socioeconomic, demographic, obstetric and lifestyle characteristics at baseline were defined in relation to the four-group outcome variable (consistent users (CU), consistent non-users (CNU), successful quitters (SQ), unsuccessful quitters (UQ)) among "cigarette only" and "narghile only" subjects. Statistical significance for categorical associations was assessed using the Chi-square test of independence, at an alpha level of 0.05. Two stepwise logistic regression models among cigarette and narghile smokers, respectively, were generated for the main predictors of successful smoking cessation, with the binary outcome defined as: 1) successful quitters versus 2) unsuccessful quitters and consistent users. Thus, consistent non-users were excluded from the logistic regression analyses. All independent variables that showed at least marginal association with the outcome of interest ($p < 0.1$) were considered for inclusion in the stepwise regression models. Statistical significance levels for variable entry and removal were set at 5 % and 10 %, respectively.

Results

Tobacco smoking patterns before and during pregnancy

Tab. 1 presents smoking patterns of study subjects before and during pregnancy. Out of 4 660 pregnant women, 3 600 (77.3 %) were classified as CNU. During pregnancy, a total of 3 969 (85.2 %) were reported as non-smokers, 651 (13.9 %) smoked either cigarettes or narghile on a regular basis, and another 40 (0.9 %) used both cigarettes and narghile. Women who smoked both cigarettes and narghile were excluded from the current analysis. Women who were either CNU or used cigarettes exclusively were labeled as the "cigarette only" group (n = 4 218). Similarly, CNU and those who smoked only narghile were categorized as "narghile only" (n = 3 967).

"Cigarette only" group. A total of 618 (14.7 %) women smoked cigarettes before pregnancy while 470 (11.1 %) used cigarettes at anytime during pregnancy. The majority of women who smoked cigarettes during pregnancy reported doing so over the entire period (431 (10.2 %)), while few women smoked during one or two trimesters of pregnancy (39 (0.9 %)). A total of 187 (30.3 %) cigarette users at baseline attempted to quit during pregnancy, 148 (23.9 %) were SQ and another 39 (6.3 %) were UQ. The majority of women (171 (91.4 %)) who quit smoking reported doing so during the first trimester of pregnancy, while the remaining quit after the first trimester (16 (8.6 %)). Finally, a total of 431 (10.2 %) were CU of cigarettes.

"Narghile only" group. A total of 367 (9.3 %) and 161 (4.1 %) women smoked narghile before and during pregnancy, respectively. The majority of women who smoked narghile during pregnancy reported doing so over the entire period [121 (3.1 %)], while few women smoked during one or two trimesters of pregnancy [40 (1.0 %)]. Also, 246 (67.0 %) attempted narghile smoking cessation with a total of 206 (56.1 %) and 40 (10.9 %) were SQ and UQ, respectively. The majority of women who quit smoking reported doing so during the first trimester of pregnancy [229 (93.1 %)], while the rest quit after the first trimester [17 (6.9 %)]. Finally, a total of 121 (3.1 %) were CU of narghile.

Table 1 Smoking patterns before and during pregnancy among "cigarette only" and "narghile only" groups

	Cigarette only (N = 4218)	Narghile only (N = 3967)
Smoking history	**N (%)**	**N (%)**
Before pregnancy	618 (14.7)	367 (9.3)
During pregnancy	470 (11.1)	161 (4.1)
1st trimester	447 (10.6)	138 (3.5)
2nd trimester	453 (10.7)	138 (3.5)
3rd trimester	454 (10.8)	143 (3.6)
Smoking groups	**N (%)**	**N (%)**
CNU[a]	3600 (85.3)	3600 (90.7)
Attempting to quit	187 (4.4)	246 (6.2)
SQ[b]	148 (3.5)	206 (5.2)
UQ[c]	39 (0.9)	40 (1.0)
CU[d]	431 (10.2)	121 (3.1)
Number of trimesters smoked	**N (%)**	**N (%)**
0 trimesters	3748 (88.9)	3806 (95.9)
1–2 trimesters	39 (0.9)	40 (1.0)
3 trimesters	431 (10.2)	121 (3.1)
Trimester of smoking cessation	**N (%)**	**N (%)**
1st trimester	171 (91.4)	229 (93.1)
2nd or 3rd trimester	16 (8.6)	17 (6.9)
TOTAL	4218 (100)	3967 (100)

[a] CNU = Consistent non-users; [b] SQ = Successful quitters; [c] UQ = Unsuccessful quitters; [d] CU = Consistent users

Tobacco smoking patterns: associations with baseline characteristics

In Tab. 2, baseline socioeconomic, demographic and health-related characteristics were compared across the four tobacco smoking groups.

"Cigarette only" group. All hypothesized associations between baseline characteristics and patterns of cigarette use were highly statistically significant ($p < 0.001$). The greatest proportion of nulliparous women (43.1 %) was found among CNU. Also, the percentage of women less than 25 years of age (18.5 %) was greatest among CNU, whereas SQ had the highest rates of mothers aged 35 years and above (31.1 %) and those who received at least nine prenatal care visits (83.1 %). UQ had the lowest rates of nulliparity (17.9 %), previous abortions (30.8 %) and the highest rates of smoking partners (33.1 %) and high crowding index (15.8 %). CU had the lowest rates of University education for themselves (2.1 %) and their partners (30.2 %). In addition, CU reported the highest rate of moderate to heavy smokers at baseline (77.2 %).

"Narghile only" group. Although in many instances no clear trend was observed, potential predictors of narghile smoking patterns were maternal and paternal education ($P < 0.001$), social class ($P = 0.001$), initial dose of narghile smoking ($P < 0.001$), partner's smoking habits ($P < 0.001$), number of prenatal care visits ($P = 0.011$) and age at delivery ($P = 0.019$). SQ had the highest percentage of nulliparous women (44.7 %), whereas CNU had the lowest rates of partners who smoked (38.1 %).

Predictors of successful tobacco smoking cessation

Tab. 3 displays two stepwise multiple logistic regression models for the determinants of SQ among cigarette users only (Model I) or narghile users only (Model II). In both models, the control group combines UQ with CU of either cigarettes or narghile.

The main predictors of SQ of cigarettes were maternal education, number of prenatal visits and pre-pregnancy dose of cigarette smoking. University-educated mothers were nearly twice as likely as illiterate mothers to succeed in cigarette smoking cessation (OR = 2.03, 95 % CI: 0.99–4.15). Having had at least nine prenatal care visits significantly increased the chance of SQ (OR = 1.72, 95 % CI: 1.02–2.91). Taking heavy smoking as the reference category, an initial dose of less than five cigarettes per day was associated with 2.35 times the odds of being a successful quitter (95 % CI: 1.36–4.09).

Among narghile smokers, the odds of being a SQ were 1.80 times higher in nulliparous women (95 % CI: 1.08–2.99) and 7.57 times higher among women whose husbands were non-smokers (95 % CI: 2.31–24.78) versus those whose husbands consumed both cigarettes and narghile on a regular basis. Similarly, women whose husbands were non-smokers were 70 % more likely to be SQ than those whose husbands smoked cigarettes only and 60 % more likely to be SQ than those whose husbands smoked narghile only.

Int J Public Health 52 (2007) 223–232

Table 2 Associations between smoking status and socio-demographic or health-related characteristics: "Cigarette smokers only" and "Narghile only" groups

	Cigarette only (N = 4218)			Narghile only (N = 3967)		
	CNU[a]	SQ[b]	UQ[c]/ CU[d]	CNU[a]	SQ[b]	UQ[c]/ CU[d]
Maternal age	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
<25	669 (18.6)	9 (6.1)	38 (8.1)	669 (18.6)	55 (26.7)	44 (27.3)
25–29	1174 (32.6)	31 (20.9)	143 (30.4)	1174 (32.6)	60 (29.1)	45 (28.0)
30–34	1110 (30.8)	62 (41.9)	172 (36.6)	1110 (30.8)	62 (30.1)	40 (24.8)
35+	647 (17.9)	46 (31.1)	117 (24.9)	647 (17.9)	29 (14.1)	32 (19.9)
Total	3600	148	470	3600	206	161
P-value		$\chi2 = 72.6$, $p < 0.001$			$\chi2 = 16.1$, $p = 0.007$	
Parity	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Nulliparous	1552 (43.1)	47 (31.9)	97 (20.6)	1552 (43.1)	92 (44.7)	54 (33.5)
Parous	2047 (56.9)	100 (68.0)	373 (79.4)	2047 (56.9)	114 (55.3)	107 (66.5)
Total	3599	147	470	3599	206	161
P-value		$\chi2 = 89.3$, < 0.001			$\chi2 = 5.7$, $p = 0.048$	
Previous abortions	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
No	2777 (77.3)	103 (70.1)	333 (71.2)	2777 (77.3)	165 (80.1)	123 (76.4)
Yes	817 (22.7)	44 (29.9)	135 (28.8)	817 (22.7)	41 (19.9)	38 (23.6)
Total	3594	147	468	3594	206	161
P-value		$\chi2 = 11.9$, $p = 0.003$			$\chi2 = 0.3$, $p = 0.61$	
Maternal education	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Illiterate to primary	136 (3.8)	14 (9.7)	56 (12.0)	136 (3.8)	9 (5.2)	8 (5.1)
Intermediate	640 (18.1)	27 (18.8)	149 (32.0)	640 (18.1)	38 (21.9)	31 (19.6)
Secondary	757 (21.4)	30 (20.8)	127 (27.3)	757 (21.4)	45 (26.0)	45 (28.5)
Technical	255 (7.2)	9 (6.3)	21 (4.5)	255 (7.2)	31 (17.9)	16 (10.1)
University	1755 (49.5)	64 (44.4)	112 (24.1)	1755 (49.5)	50 (28.9)	58 (36.7)
Total	3543	144	465	3543	202	158
P-value		$\chi2 = 166.0$, $p < 0.001$			$\chi2 = 31.2$, $p< 0.001$	
Paternal education	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Illiterate to primary	197 (5.6)	17 (11.8)	76 (16.3)	197 (5.6)	11 (5.8)	11 (7.0)
Intermediate	553 (15.7)	21 (14.9)	127 (27.3)	553 (15.7)	34 (17.8)	28 (17.8)
Secondary	459 (13.0)	21 (14.6)	72 (15.5)	459 (13.0)	26 (13.6)	40 (25.5)
Technical	403 (11.4)	16 (11.1)	51 (11.0)	403 (11.4)	23 (12.0)	15 (9.6)
University	1917 (54.3)	69 (47.9)	139 (29.9)	1917 (54.3)	97 (50.8)	63 (40.1)
Total	3529	144	465	3529	191	168
P-value		$\chi2 = 148.7$, $p < 0.001$			$\chi2 = 27.8$, $p < 0.001$	

[a] CNU = Consistent non-users; [b] SQ = Successful quitters; [c] UQ = Unsuccessful quitters; [d] CU = Consistent users

Table 2 (Cont'd) Associations between smoking status and socio-demographic or health-related characteristics: "Cigarette smokers only" and "Narghile only" groups

	Cigarette only (N=4218)			Narghile only (N=3967)		
	CNU[a]	SQ[b]	UQ[c]/ CU[d]	CNU[a]	SQ[b]	UQ[c]/ CU[d]
Paternal occupation	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Class I [e]	1556 (43.2)	49 (33.1)	113 (24.0)	1556 (43.2)	73 (35.4)	44 (27.3)
Class II [f]	580 (16.1)	26 (17.6)	125 (26.6)	580 (16.1)	35 (16.9)	27 (16.8)
Class III [g]	1462 (40.6)	73 (49.3)	232 (49.4)	1462 (40.6)	98 (47.6)	90 (55.9)
Total	3598	148	470	3598	206	161
P-value		$\chi2 = 75.8$, $p < 0.001$			$\chi2 = 20.4$, $p = 0.001$	
Crowding Index	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
< 2	3395 (97.2)	126 (91.3)	406 (89.2)	3395 (97.2)	195 (97.5)	147 (97.4)
> = 2	98 (2.8)	12 (8.7)	49 (10.8)	98 (2.8)	5 (2.5)	4 (2.6)
Total	3493	138	455	3493	200	151
P-value		$\chi2 = 75.8$, $p < 0.001$			$\chi2 = 0.7$, $p = 0.96$	
Paternal smoking habits	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Non-smoker	2222 (63.7)	49 (34.8)	113 (25.0)	2222 (63.7)	85 (49.1)	40 (31.7)
Cigarette smoker only	1177 (33.7)	89 (63.1)	326 (72.1)	1177 (33.7)	57 (32.9)	51 (40.5)
Narghile smoker only	71 (2.0)	2 (1.4)	6 (1.3)	71 (2.0)	27 (15.6)	19 (15.1)
Cigarette and narghile smoker	19 (0.5)	1 (0.7)	7 (1.5)	19 (0.5)	4 (2.3)	16 (12.7)
Total	3489	141	452	3489	173	161
P-value		$\chi2 = 301.7$, $p < 0.001$			$\chi2 = 375.8$, $p < 0.001$	
Number of prenatal care visits	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
0–8	690 (19.2)	25 (16.9)	139 (29.6)	690 (19.2)	38 (18.4)	40 (24.8)
> = 9	2910 (80.8)	123 (83.1)	331 (70.4)	2910 (80.8)	168 (81.6)	121 (75.2)
Total	3600	148	470	3600	206	161
P-value		$\chi2 = 24.2$, $p< 0.001$			$\chi2 = 1.2$, 0.19	
Initial dose of cigarette smoking	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Non-smokers or light smokers (<10 cigs/day)	3600 (100)	56 (38.4)	106 (22.8)	–	–	–
Moderate to heavy smokers (> = 10 cigs/day)	0 (0.0)	90 (61.6)	358 (77.2)	–	–	–
Total	3600	146	464	–	–	–
P-value	2 = 4300.2, $p < 0.001$			–	–	–
Initial dose of narghile smoking	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
< = 2 narghile/week	–	–	–	3600 (100)	150 (73.2)	103 (65.2)
> 2 narghile/week	–	–	–	0 (0.0)	55 (26.8)	55 (34.8)
Total	–	–	–	3600	205	158
P-value	–	–	–		$\chi2 = 1161.8$, $p < 0.001$	

[a] CNU = Consistent non-users; [b] SQ = Successful quitters; [c] UQ = Unsuccessful quitters; [d] CU = Consistent users; [e] Class I: Professional, semi-professional or managerial; [f] Class II: Technical, clerical, skilled or semi-skilled; [g] Class III: Unskilled, unemployed or unclassified.

Int J Public Health 52 (2007) 223–232

Table 3 Stepwise logistic regression for the baseline socio-demographic and health-related determinants of successful smoking cessation

	Successful smoking cessation		OR	95 % Confidence Interval
	SQa	UQb/CUc		
Model I: Cigarette use only				
Maternal education				
Illiterate to primary	14 (9.7)	56 (12.0)	1.00	
Intermediate	27 (18.8)	149 (32.0)	0.75	0.35–1.61
Secondary	30 (20.8)	127 (27.3)	0.87	0.41–1.86
Technical	9 (6.3)	21 (4.5)	1.57	0.57–4.33
University	64 (44.4)	112 (24.1)	2.03	0.99–4.15
Prenatal visits				
0–8	25 (16.9)	139 (29.6)	1.00	–
> = 9	123 (83.1)	331 (70.4)	1.72	1.02–2.91
Initial dose of cigarette smoking				
< 5 cigs/day	–	–	2.35	1.36–4.09
5–9 cigs/day	–	–	1.56	0.89–2.74
> = 10 cigs/day	90 (61.6)	358 (77.2)	1.00	
Model II: Narghile use only				
Parity				
Nulliparous	92 (44.7)	54 (33.5)	1.80	1.08–2.99
Parous	114 (55.3)	107 (66.5)	1.00	–
Paternal smoking habits				
Non-smoker	85 (49.1)	40 (31.7)	7.57	2.31–24.78
Cigarette smoker only	57 (32.9)	51 (40.5)	4.29	1.31–14.07
Narghile smoker only	27 (15.6)	19 (15.1)	4.86	1.37–17.27
Cigarette and narghile smoker	4 (2.3)	16 (12.7)	1.00	–

[a] SQ = Successful quitters; [b] UQ = Unsuccessful quitters; [c] CU = Consistent users.

Discussion

Hubble bubble smoking is on the rise worldwide. In the Middle East, its use is already very common, and is becoming attractive to the younger generation. The pattern of smoking narghile has not been well studied, particularly during pregnancy. The study found that women more successfully stop using narghile during pregnancy if their partners do not smoke. Cigarette smoking is also important. For those who smoke cigarettes, results showed that lower initial consumption rates and full use of prenatal care visits were factors in successful cessation, and that pregnant women of higher educational level were more likely not to smoke and to be successful if they quit. This can be important information for planning cessation campaigns.

In accordance with previous studies, the majority of women who actually quit cigarette smoking did so during the first trimester of pregnancy (McLeod et al. 2003; Ford et al. 1993). Based on a study by Hutchison et al. (1996), women are likely to be most receptive to quitting during their first trimester of pregnancy.

On the other hand, a wide range of demographic and socioeconomic determinants of cigarette smoking cessation were previously identified in the literature. Unlike previous reports, age had no independent effect on tobacco smoking status among pregnant women in our population. The crude association between maternal age and the use of cigarettes or narghile may have been confounded by other baseline characteristics. In a study of Swedish nulliparous women interviewed during their first prenatal visit, Dejin-Karlsson et al. (1996) identified young age as a risk factor for persistent smoking during pregnancy. In another study that assessed cigarette smoking in 5 288 U.S. pregnant women, factors associated with successful quitting were reported as the combined effect of age and smoking duration (Yu et al. 2003).

Our study showed that the characteristics of women who are likely to succeed in smoking cessation are different for cigarette versus narghile smokers. The addictive qualities of cigarettes might explain why baseline dose is a salient factor for quitting cigarette use throughout pregnancy (Yu et al. 2003), but has no effect on narghile (hubble-bubble) cessation. The higher prevalence of successful quitters in hubble-bubble us-

ers, as compared to cigarette users, may also be attributed to the stronger addictive power of cigarettes versus narghile (Yu et al. 2003; Lu et al. 2001).

There were no significant socioeconomic disparities in successful narghile quitting, whereas highly educated women were twice as likely to succeed in their attempt at cigarette smoking cessation, versus their illiterate counterparts. This is in line with previous research where narghile smoking was considered as a social activity that cuts across all socioeconomic strata in the Lebanese society (Tamim et al. 2001; Kandela 2000).

Nulliparity was formerly identified as an important determinant of successful cigarette smoking cessation (McLeod et al. 2003; Dejin-Karlsson 1996). Our results show higher odds of success in narghile smoking cessation among nulliparous women. One might speculate that nulliparous women are more health conscious as compared to those who have already experienced pregnancy and birth, and are thereby more motivated to quit smoking at the outset of pregnancy.

Many studies have highlighted the influence exerted by the women's partners and other people in their social network (Lu et al. 2001; Dejin-Karlsson et al. 1996). In a study of pregnant women in New Zealand, a smoking partner was negatively associated with quitting cigarette smoking during the first trimester (McLeod et al. 2003). We found that women whose partners did not smoke were more successful quitters of narghile smoking. In our study population, the social nature of narghile use might explain why partner's smoking habits had such a considerable impact on women's decision to stop using narghile, whereas it had no direct effect on cigarette smoking cessation.

To our knowledge, the present study is the first of its kind in Lebanon and the East Mediterranean region to have addressed issues concerning narghile-smoking cessation among pregnant women. However, study findings should be carefully assessed in light of potential limitations. For instance, the use of a hospital-based urban population may have limited our ability to generalize to the entire Lebanese population, especially in the rural areas where the socio-demographic profile is likely to be different and where a sizeable percentage of deliveries occur outside the hospital setting (LRMPH & UNICEF, 1999–2000). Therefore, our study findings can be generalized to other urban populations in Lebanon with similar socioeconomic profiles and access to medical care. Similarly, the moderate response rate (approximately 74%) may have introduced response bias, a form of selection bias whereby respondents are likely to differ systematically from non-respondents. The retrospective reporting of tobacco use and of most socio-demographic characteristics could have introduced problems with recall. This may also be aggravated by the stigma attached by post-partum women to tobacco use during pregnancy resulting in an underestimate of the true prevalence of cigarette and narghile smoking. However, there is no reason to believe that these factors that affect accuracy of reporting cigarette and narghile use around pregnancy would be different based on the various predictors examined. Therefore, non-differential misclassification may have lead to underestimated measures of association. Furthermore, we did not have information on a factor that reflects perceived susceptibility for smoking-related illnesses, namely a history of morbidity or mortality related to smoking in the family. Given the retrospective nature of data collection, it was not possible to obtain biomarkers for validating self-reported smoking patterns. Precautions, however, were taken in order to insure that both interviewers and participants were blinded regarding the specific hypotheses being tested.

In conclusion, study results suggest that the prevalence and background determinants of cigarette and narghile use are somewhat different. Therefore, distinct populations should be targeted when designing smoking cessation interventions for cigarette and narghile users. Narghile smoking cessation efforts should target both pregnant women and their partners. Tailoring of health communications to patient's level of education is of great importance. In addition, health professionals should emphasize the importance of follow-up visits to their patients. Further research is needed to assess determinants of successful smoking cessation in a representative sample of Lebanese pregnant women.

Acknowledgments

We would like to acknowledge the following National Collaborative Perinatal Neonatal Network (NCPNN) Investigators who were involved in data collection at the network institutions: Dr. Alia Aaraj (Rassoul Aazam Hospital), Dr. Mona Alameh (Sahel General Hospital), Dr. Philip Chedid (Lebanese University), Dr. Imad Chokr (Middle East Hospital), Dr. Mohammad Itani (Najjar Hospital), Dr. Imad Melki (Hotel Dieu de France Hospital), Dr. Fadlallah Nassif (St. Charles Hospital), Dr. Yolla Nassif (St. Georges Hospital), Dr. Mariam Rajab (Makassed General Hospital), Dr. Gerard Wakim (Rizk Hospital)

This work was partially supported by funds from the World Health Organization (WHO), Abbott Laboratories, the Lebanese National Council for Scientific Research (LNCSR), the Medical Practice Plan (MPP), the University Research Board (URB) and the Chairman's fund at the Pediatrics Department of the American University of Beirut.

References

Acharya G, Jauniaux E, Sathia L, Griffin M, Morgan H (2002). Evaluation of the impact of current antismoking advice in the UK on women with planned pregnancies. J Obstet Gynecol *22*: 498–500.

Chaaya M, Awwad J, Campbell OM, Sibai A, Kaddour A (2003). Demographic and psychosocial profile of smoking among pregnant women in Lebanon: public health implications. Matern Child Health J *7 (3)*: 179–86.

Chaaya M, E Roueihedb Z, Chemaitelly H, Azar G, Nasr J, Al-Sahab B (2004). Argileh smoking among university students: a new tobacco epidemic. Nicotine Tob Res *6*: 457–63.

Chaaya M, Jabbour S, El-Roueiheb Z, Chemaitelly H (2004). Knowledge, attitudes, and practices of argileh (waterpipe or hubble-bubble) and cigarette smoking among pregnant women in Lebanon.

Dayal H, Kinman J (1983). Epidemiology of kidney cancer. Sem Oncol *10*: 366–77.

Dejin-Karlsson E, Hanson BS, Ostergren PO, Ranstam J, Isacsson SO, Sjoberg NO (1996). Psychosocial resources and persistent smoking in early pregnancy – a population study of women in their first pregnancy in Sweden. JECH *50*: 33–9.

Dolan-Mullen P, Ramirez G, Groff JY (1994). A meta-analysis of randomized trials of prenatal smoking cessation interventions. Am J Obstet Gynecol *171*: 1328–34.

El-Hakim IE, Uthman MAE (1999). Squamous cell carcinoma and keratoacanthoma of the lower lip associated with "Goza" and "Shisha" smoking. Int J Dermatol *38*: 108–10.

Eriksson KM, Haug K, Salvesen KA, Nesheim BI, Nylander G, Rasmussen, et al. (1998). Smoking habits among pregnant women in Norway 1994–95. Acta Obstet Gynecol Scand *77*: 159–64.

Fakhfakh R, Hsairi M, Maalej M, Achour N, Nacef T (2002). Tobacco use in Tunisia: behaviour and awareness. Bull World Health Organ *80*: 350–6.

George D, Mallery P (1999). *SPSS for Windows Step by Step. A Simple Guide and Reference, 11.0 update – 4th edition*. Ontario, CA: Allyn and Bacon.

Gielen AC, Windsor R, Faden RR, O'Campo P, Repke J, Davis M (1997). Evaluation of a smoking cessation intervention for pregnant women in an urban prenatal clinic. Hlth Educ Res *12*: 247–54.

Gunaid AA, Sumairi AA, Shidreawi RG, et al. (1995). Oesophageal and gastric carcinoma in the Republic of Yemen. Br J Cancer; *71*: 409–10.

El-Hakim IE, Uthman MA (1999). Squamous cell carcinoma and keratoacamthoma of the lower lip associated with "Goza" and "Shisha" smoking. Int J Dermatol *38 (2)*: 108–10.

Ford RP, Wild CJ, Glen M, Price G, Wilson C (1993). Patterns of smoking during pregnancy in Canterbury. NZ Med J *106*: 426–9.

Higgins S (2002). Smoking in pregnancy. Curr Opin Obstet Gynecol *14*: 145–51.

Howe GR, Burch JD, Miller AB, et al. (1980). Tobacco use, occupation, coffee, various nutrients, and bladder cancer. J Nat Cancer Inst *64*: 701–13.

Hutchison KE, Stevens VM, Collins FL Jr (1996). Cigarette smoking and the intention to quit among pregnant smokers. J BehavMed *19*: 307–16.

Israel E, El-Setouhy, Mohamed MK (2003). Smoking prevention and treatment in Egypt. J Egypt Soc Parasitol *33*: 1111–20.

Jaakkola N, Zahlsen K, Jaakkola JJ (2001). Effects of a population-based smoking cessation programme on smoking in pregnancy. Eur J Public Health *11*: 446–9.

Jabbour S, El-Roueiheb Z, Sibai AM (2003). Narghile (water-pipe) smoking and incident coronary heart disease: a case-control study. Ann Epidemiol *13*: 570.

Kahn RS, Certain L, Whitaker RC (2002). A reexamination of smoking before, during, and after pregnancy. AJPH *92*: 1801–8.

Kandela P (1997). Signs of trouble for hubble-bubble. Lancet *349*: 9063.

Kandela P (2000). Narghile smoking keeps Arabs in the wonderland. Lancet; *356*: 1175.

Kiter G, Ucan ES, Ceylan E, Kilinc O (2000). Water-pipe smoking and pulmonary functions. Resp Med *94*: 891–4.

Lebanese Republic Ministry of Public Health & United Nations Children's Fund (2000). National Perinatal Survey Lebanon *1999–2000*, p. 1–22.

Lieberman E, Gremy I, Lang JM, Cohen AP (1994). Low birthweight at term and the timing of fetal exposure to maternal smoking. AJPH *84*: 1127–31.

Lightwood JM, Phibbs CS, Glantz SA (1999). Short-term health and economic benefits of smoking cessation: low birth weight. Pediatrics *104*: 1312–20.

Lu Y, Tong S, Oldenburg B (2001). Determinants of smoking and cessation during and after pregnancy. Hlth Prom Int *16*: 355–65.

Lubin JH, Li JY, Xuan XZ, et al. (1992). Risk of lung cancer among cigarette and pipe smokers in Southern China. Int J Cancer *51*: 390–5.

Macaron C, Macaron Z, Maalouf MT, Macaron N, Moore A (1997). Urinary cotinine in narghileh or chichi smokers. J Med Lib *45 (1)*: 19–20.

Mainous AG 3rd, Hueston WJ (1994). The effect of smoking cessation during pregnancy on preterm delivery and low birthweight. J Fam Pract *38*: 262–6.

Maziak W, Eissenberg T, Rastam S, et al. (2004). Beliefs and attitudes related to narghileh (waterpipe) smoking among university students in Syria. Ann Epidemiol *14 (9)*: 646–54.

Maziak W, Eissenberg TE, Ward KD (2004). Factors related to level of narghile use: the first insights on tobacco dependence in narghile users. Drug Alcohol Depend *76*: 101–6.

Maziak W, Eissenberg T, Klesges RC, Keil U, Ward KD (2004). Adapting smoking cessation interventions for developing countries: a model for the Middle East. Int J Tuberc Lung Dis *8*: 403–13.

Maziak W, Fouad MF, Hammal F, et al. (2004). Prevalence and characteristics of narghile smoking among University students in Syria. Int J Tub & Lung Dis *8*: 882–9.

Maziak W, Rastam S, Eissenberg T, et al. (2004). Gender and smoking status-based analysis of views regarding waterpipe and cigarette smoking in Aleppo, Syria Prev Med *38*: 479–84.

Maziak W, Ward KD, Afifi Soweid RA, Eissenberg T (2004). Tobacco smoking using a waterpipe: a re-emerging strain in a global epidemic. Tobacco Control *13*: 327–33.

McLeod D, Pullon S, Cookson T (2003). Factors that influence changes in smoking behavior during pregnancy. NZ Med J *116 (1173)*: U418.

Memon A, Moody PM, Sugathan TN, et al. (2000). Epidemiology of smoking among Kuwaiti adults: prevalence, characteristics and attitudes. Bull World Health Org *78*: 1306–15.

Nuwayhid I, Yamout B, Azar G, Kambris MA (1998). Narghile (Hubble-bubble) smoking, low birth weight, and other pregnancy outcomes. Am J Epidemiol *148*: 375–83.

Onder M, Oztas M, Arnavut O (2002). Narghile (Hubble-Bubble) smoking-induced hand eczema. Int J Dermatol *41*: 771–2.

Radwan GN, Mohamed MK, El-Setouhy M, Israel E (2003). Review on water pipe smoking. J Egypt Soc Parasitol *33*: 2051–71.

Radwan GN, Israel E, El-Setouhy M, Abdel-Aziz F, Mikhail N, Mohamed MK (2003) Impact of religious rulings (Fatwa) on smoking. J Egypt Soc Parasitol *33*: 1087–101.

Ramsey AM, Blose D, Lorenz D, Thomas W, De-Perso SR, Bruce FC (1993). Cigarette smoking among women in Oklahoma: before, during and after pregnancy. J Okla St Med Assoc *86*: 231–6.

Secker-Walker RH, Vacek PM (2002). Infant birth weight as a measure of harm reduction during smoking cessation trials in pregnancy. Hlth Educ Behav *29*: 557–69.

Shafagoj YA, Mohammed FI (2002). Levels of maximum end-expiratory carbon monoxide and certain cardiovascular parameters following hubble-bubble smoking. Saudi Med J *23*: 953–8.

Shehadeh A (2003). Investigation of mainstream aerosol of the argileh water pipe. Food Chem Toxicol; *41*: 143–52.

Taha A, Ball K (1982). Smoking in Africa: the coming epidemic. World Smoking Health *7*: 25–30.

Tamim H, Terro A, Kassem H, et al. (2001). Tobacco use by university students, Lebanon. Addiction *98*: 933–9.

Thompson F, Fagerstrom K (2006). Current trends in international tobacco control. Clin Occup Environ Med *5 (1)*: 101–16.

Ventura SJ, Hamilton BE, Mathews TJ, Chandra A (2003). Trends and variations in smoking during pregnancy and low birthweight: evidence from the birth certificate, 1990–2000. Pediatrics *111 (5 Part 2):* 1176–80.

Walsh, RA, Lowe JB, Hopkins PJ (2001). Quitting smoking in pregnancy. Med J Aust *175*: 320–3.

Woodby LL, Windsor RA, Snyder SW, Kohler CL, Diclemente CC (1999). Predictors of smoking cessation during pregnancy. Addiction *94*: 283–92.

West R (2006). Tobacco control: present and future. Br Med Bull *77–78*: 123–36.

Yu SM, Part CH, Schwalberg RH (2003). Factors associated with smoking cessation among U.S. pregnant women. MCH J *6*: 89–97.

Zahran FM, Ardawi MSM, Al-Fayez SF (1985). Carboxyhaemoglobin concentrations in smokers of sheesha and cigarettes in Saudi Arabia. BMJ *291*: 1768–70.

Address for Correspondence
Khalid Yunis, MD
Department of Pediatrics
American University of Beirut
Bliss Street, Beirut, Lebanon
Tel.: +961 1 350000
Fax: +961 1 744464
e-mail: kayunis@aub.edu.lb