



## **Factors Associated with Successful Smoking Cessation in Tunisian Smokers: Findings from the Smoking Cessation Clinic in the University Hospital of Sahloul, Sousse, Tunisia**

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### **Authors' contributions**

*This work was carried out in collaboration between all authors. Authors SKA, HSL and LD designed the study, wrote the protocol and coordinated the study. Authors OG and HG performed data collection. Authors MBR and LM managed the analyses of the study. Author JS managed the literature searches and wrote the first draft of the manuscript. All authors read and approved the final manuscript.*

### **Article Information**

DOI: 10.9734/JAMMR/2017/35713

#### Editor(s):

(1) Andrea S. Melani, Antismoking Centre, Azienda Ospedaliera Senese, Italy.

#### Reviewers:

(1) Neema Tiwari, Eras Luck Now Medical College And Hospital, India.

(2) Diana C. Tapia-Pancardo, National Autonomous University of México, México.

Complete Peer review History: <http://www.sciencedomain.org/review-history/20729>

**Original Research Article**

**Received 26<sup>th</sup> July 2017**  
**Accepted 21<sup>st</sup> August 2017**  
**Published 30<sup>th</sup> August 2017**

### **ABSTRACT**

**Aims:** To identify the determinants of successful smoking cessation among the attendees of the smoking cessation clinic of the University Hospital of Sahloul.

**Place and Duration of the Study:** The smoking cessation clinic of the University Hospital of Sahloul and the the Department of prevention and safety of care, University Hospital Sahloul, Sousse, Tunisia.

**Type of the Study:** Retrospective study.

**Methodology:** This study included all the attendees of the smoking cessation clinic of the University Hospital of Sahloul (n=423) from 2009 to 2014. The monitoring of the attendees was

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performed until October 2015 in order to verify their smoking cessation status at one year.

**Results:** The participants were predominantly male (n=394, 93.4%). Their mean age was  $41.5 \pm 13.6$  years. The mean number of daily smoked cigarettes is  $27.18 \pm 14.50$  cigarettes. The mean score of the Fagerström test was  $6.13 \pm 2.39$ . The smoking cessation rates were 30.70%, 23.40%, 15.10%, 12.8% and 10.4% respectively at one week, one month, three months, six months and at twelve months. In the multivariate analysis, being married, being a smoker for less than 10 years, having an exhaled CO<10 ppm, being confident in quitting and attending the clinic three visits and more were independent factors associated with smoking cessation at 12 months.

**Conclusion:** Management of smoking cessation consultation needs to take an integrative approach focusing on the identified factors in order to improve current success rates.

*Keywords: Tobacco use; smoking; tobacco use cessation; prevention; clinic activities.*

## 1. INTRODUCTION

Smoking is one of the biggest public health threats the world has ever faced [1]. It is one of the leading, but preventable, causes of premature death and chronic diseases worldwide [1]. The results from a 50 year study shows that half to two thirds of all lifelong cigarette smokers will be eventually dead because of their habit [2]. Smoking leads to serious diseases in both smokers and nonsmokers exposed to secondhand smoke [3]. These diseases include coronary artery disease, chronic obstructive lung disease, stroke, and cancer [1]. In consequence, smoking imposes an enormous economic burden on society [3], and in addition to the direct medical costs of treating tobacco-induced diseases, there are other indirect costs such as loss of productivity, fire damage and environmental harm from cigarette litter and destructive farming practices [4].

Evidence-based recommendations indicate that health risks associated with cigarette smoke can be reversed following a sufficient period of smoking cessation [5]. Smoking cessation, in addition to its beneficial effects to smokers, is an important component of tobacco-control policies and it is an efficient and cost-effective intervention because it promotes a significant reduction in morbidity and mortality rates [1]. The spectrum of available smoking cessation interventions ranges from simple advice to intensive behavioral support and pharmacological treatment [6]. But even if approximately two-thirds of smokers want to quit smoking, not many people succeed in smoking cessation [7].

Tunisia, a middle income North African country of 11 447 643 inhabitants, is not spared of the tobacco phenomenon, with more than two millions current smokers among adults and 10.000 deaths per year [8,9]. In addition to the ratification in 7 June 2010 of the Framework

Convention on Tobacco Control, the Tunisian Ministry of Health has, in recent years, set up a national control program to fight against smoking [8]. The objectives of this program include specific training of physicians on smoking cessation and the creation of clinics for smoking cessation in primary care all around the country [10].

Identification of factors that predict success in smoking cessation is necessary as this could guide the smoking cessation consultations to identify smokers who might need more intensive treatment and improve their impact. Considering the above, we conducted this study to identify the determinants of successful smoking quitting among the attendees of the smoking cessation clinic of the University Hospital of Sahloul.

## 2. MATERIALS AND METHODS

### 2.1 Study Design, Population Study and Presentation of the Clinic Activities

This is a retrospective study conducted in the smoking cessation clinic of the University Hospital of Sahloul in Sousse, Tunisia. Our clinic activities have begun in December 2009 and all the departments of the hospital were informed of its creation. This preventive clinic is linked to the Prevention Service and Security of Care. It is open free of charge to all public including hospital staff, hospital patients and community. It is provided by a team of two tobacco graduated physicians, two nurses and a nutritionist if necessary. It takes place twice a week with prior appointment. Our general strategy to help smokers to quit is to conduct at least six sessions per smoker according to the recommendations of the National Tobacco Control Program.

The first consultation includes an identification of the stage of behavior change, an assessment of

the motivation to quit, an assessment of anxiety and depression, an assessment of the dependence to nicotine and a therapeutic decision based on cognitive behavioral therapy and pharmacological therapy [nicotine replacement therapy (NRT)].

Smoking cessation interventions is appropriately tailored at each behavior change stage to each patient to enhance success according to the Trans-theoretical Model or Stages of change Model. This model shows that, for most persons, a change in behavior occurs gradually and can be conceptualized in subsequent phases that are pre-contemplation (there is no interest, need or awareness to make a change); contemplation (acknowledging that there is a problem, considering the possibility of change but no readiness to make the change); preparation (deciding and preparing to make a change), action (modification of the behavior) and finally maintenance of the changed behavior. Relapses can occur and be a part of the process of lifelong change [11-12]. When smokers are in the pre-contemplation stage, the doctor makes them aware of the negative effects of smoking and inform them about the benefits of quitting. In the contemplation stage, the doctor uses motivational interviewing (MI), a directive patient-centred style of counselling designed to help people to explore and resolve ambivalence about behaviour change and may assist people to make a successful attempt to quit smoking. In the stage of preparation, encouragement and motivation are essential consecutively to bring these people to the stages of action and maintenance and a pharmacological prescription is started only if the patient is at the stage of preparation. In the action and maintenance stages, the doctors use cognitive behavioral therapy to offer support, reinforcement, and guidance to people for practicing coping skills and alternative non-smoking activities [11,12].

The approach adopted in the consultations is illustrated in the Fig. 1.

We included in this study all smokers who attended the clinic since the date of its creation in December 2009 until the month of October 2014. The monitoring of the attendees was done until October 2015 in order to verify their smoking cessation status at one year.

## 2.2 Data Collection and Definition of the Operational Variables

The records of the attendees in our smoking cessation clinic were used as source and data

collection tool. These data have concerned predictor measures and outcome measures.

- Socio-demographic variables of smokers: Age, sex, marital and employment status, educational level, personal history of health problems and lifestyle habits.
- The characteristics of the smoking history: The duration of smoking, number of daily smoked cigarettes, the age of smoking initiation and previous quit attempts.
- The degree of physical dependence on nicotine: Assessed by the Fagerström test for nicotine dependence (FTND) [13].
- The exhaled carbon monoxide in air (CO) at the first visit: this measure was performed using Bedfont Scientific piCO+ Smokerlyzer® breath CO monitor. Exhaled CO in air <10 parts per million (ppm) were considered low levels of CO [14].
- The perceived motivation to quit: Assessed by the Lagrue and Legeron test [15]. Smokers having a score  $\geq 12$  were considered as motivated to quit.
- The score of perceived self-confidence to quit smoking: Assessed by a likert scale ranging from 0 (not confident at all) to 10 (extremely confident). Smokers having a score  $\geq 5$  were considered confident to quit [10].
- The level of perceived social support to quit: Assessed by a likert scale ranging from 0 (not supported at all) to 10 (extremely supported). Smokers having a score  $\geq 5$  were considered having a social support to quit.
- Intention to quit according to the Trans-theoretical Model or Stages of change Model: Assessed on a 2-points scale since attendees were either on the stages of contemplation (Planning to quit within the next 6 month: coded 0) or in preparation (planning to act within the next month: coded 1).
- The presence of anxiety or/and depression: Assessed by the HAD test (Hospital Anxiety Depression scale). Scores of respectively 12 and 8 were considered the threshold for anxiety and depression [16].
- The treatment strategy: Having received or not a nicotine replacement therapy (nicotine patch).
- The number of the visits: Attending three visits and more was considered as adequate.

The outcomes measures collected at follow up

The number of smoking cessation days: Were calculated according to the self reported smoking status.

All patients were contacted and interviewed by telephone by the nurse in charge of the clinic, this allowed us to retrieve information from patients who discontinued monitoring. Non-responders, on the date of the point, were

considered to be persistent smokers in the analysis of results.

In our study, successful smoking cessation, defined as a complete and continuous abstinence, was assessed at one week, one month, at three months, at six months and at 12 months. An exploratory analysis to predictive factors of successful smoking cessation at 12 months was conducted.

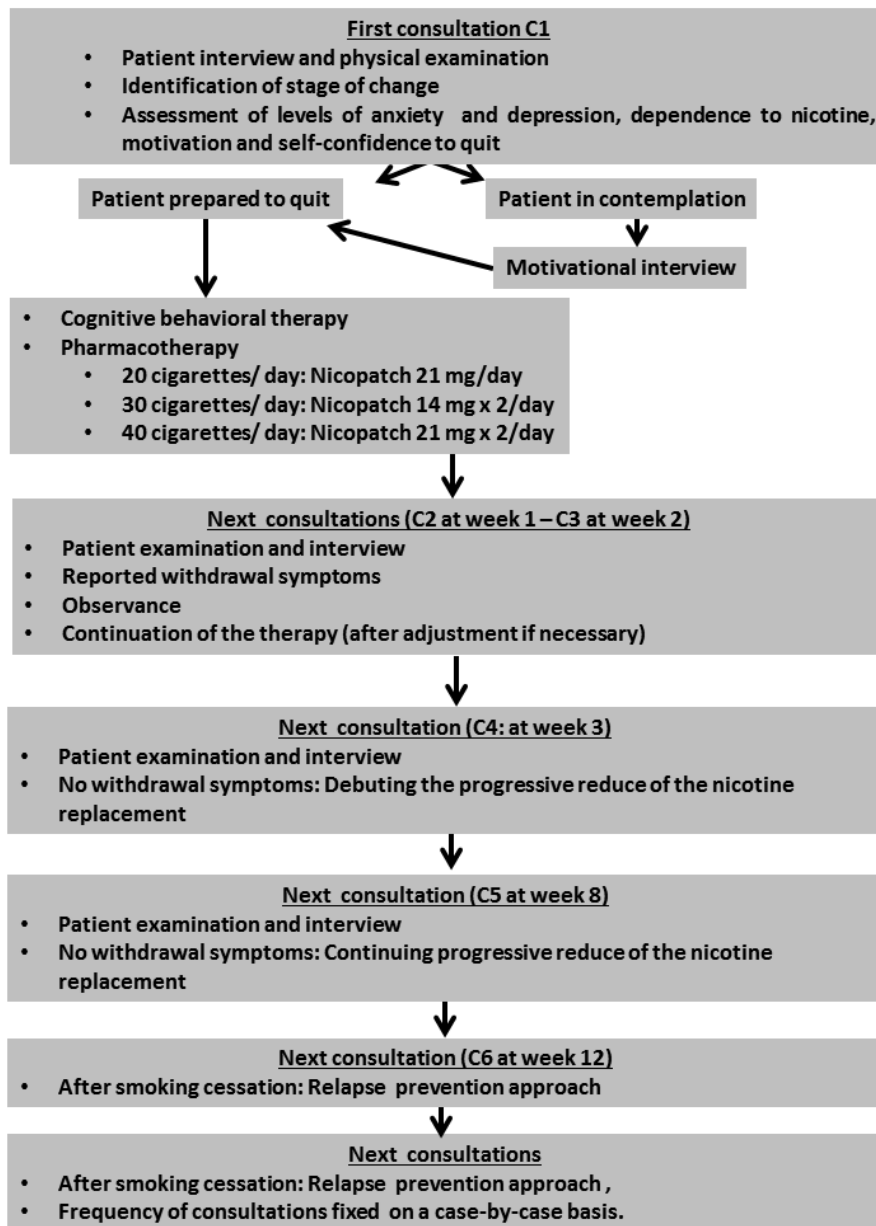


Fig. 1. The approach adopted in the smoking cessation clinic of the University Hospital of Sahloul, Sousse, Tunisia

### 2.3 Statistical Analysis

Statistical analysis was performed using the SPSS 18.0 software. Data were presented with frequencies, means and standard deviations. Chi square test was used to compare categorical variables. To identify the determinants of a successful smoking cessation in the study, binary logistic regression model was used. The significant variables at a p value  $\leq$  to 20% in the univariate analysis were the variables used in the model. The fit of the final model was evaluated with the Hosmer and Lemeshow test.

## 3. RESULTS

### 3.1 Characteristics of the Population Study

The number of smokers who attended the smoking cessation clinic of the University hospital of Sahloul during five years was 423 attendees. The participants were predominantly male (n=394, 93.4%). Their mean age was  $41.5 \pm 13.6$  years old with extremes ranging from 14 to 82 years old. The mean number of daily smoked cigarettes is  $27.18 \pm 14.50$  cigarettes with extremes ranging from 1 to 100 cigarettes. The mean score of the Fagerström test was

$6.13 \pm 2.39$  with extremes ranging from 0 to 10 (Table 1).

### 3.2 Smoking Cessation Prevalence and Determinants Factors

Among the 423 attendees during 6 years, the smoking cessation rates were 30.70%, 23.40%, 15.10%, 12.8% and 10.4% respectively at one week, one month, three months, six months and at twelve months. All smoking cessation rates were significantly higher among individuals who attended the clinic three visits and more (Fig. 2).

In the univariate analysis, attending the clinic three visits and more, having an exhaled CO in air less than 10 ppm and having received a nicotine replacement therapy were significantly associated with successful cessation at 12 months at least. In the multivariate analysis, being married, being a smoker for less than 10 years, having an exhaled CO<10 ppm, being confident in quitting and attending the clinic three visits and more were independent factors associated with smoking cessation at 12 months (Table 3). The fit of the final model was evaluated with the Hosmer and Lemeshow (chi 2= 4.73, degree of freedom =7, p=0.69) which indicated a good fit of the model to the data.

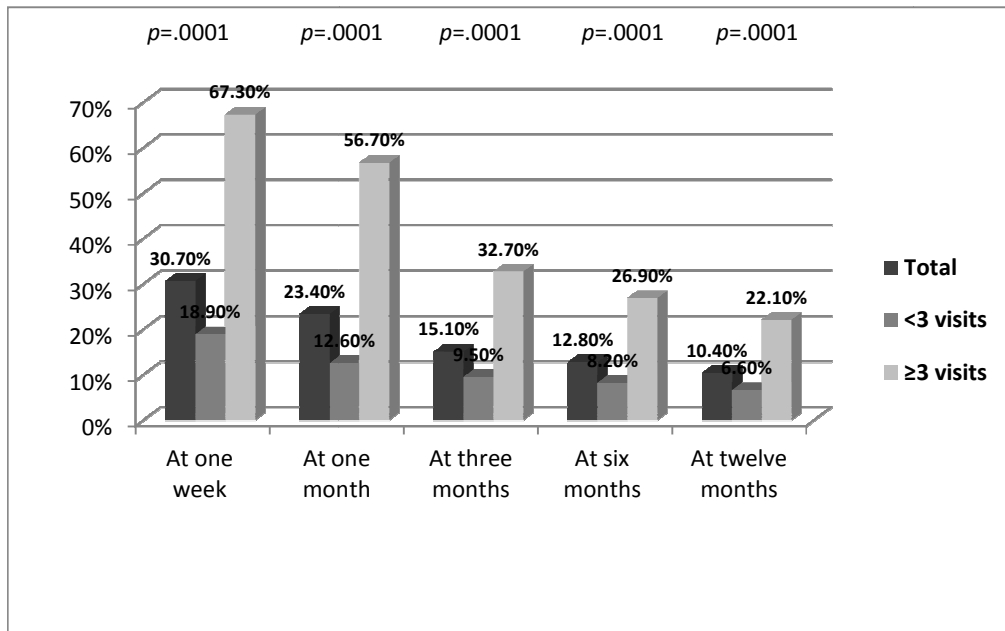


Fig. 2. Smoking cessation rates among the 423 attendees of the clinic of the University Hospital of Sahloul (Sousse, Tunisia), 2009-2014

**Table 1. Characteristics of smokers seen in the smoking cessation clinic of the University Hospital Sahloul, Sousse, 2009-2014**

		Number (n)	Percentage (%)
Gender (n=423)	Male	394	93.1
	Female	29	6.9
Age (n=423)	<45 years	231	54.6
	≥ 45 years	192	44.4
Marital status (n=418)	Married	283	67.7
	Not married	135	32.3
Education level (n=409)	Primary	105	25.7
	Secondary	183	44.7
	University	121	29.6
Employment status (n=423)	Student	34	8.0
	Employee	315	74.5
	Unemployed	74	17.5
Alcohol intake (n=355)		71	20
Practice of 30 minutes of physical activity 5 days per week (n=417)		183	75.3
Medical history of systolic and/or diastolic hypertension (n=422)		35	8.3
Medical history of Mellitus diabetes (n=423)		51	12.1
Medical history of coronary heart diseases (n=423)		27	6.4
Medical history of gastric pathologies (n=423)		28	6.6
Age of smoking onset (n=419)	<15 years	136	32.5
	≥15 years	283	67.5
Number of daily smoked cigarettes (n=422)	<20	218	51.6
	≥20	204	48.4
Duration of smoking (n=402)	<10 years	170	42.3
	≥10 years	232	57.7
Fagerström score (n=417)	< 7	224	53.7
	≥ 7	193	46.3
Exhaled CO in air (n=339)	<10ppm	100	29.5
	≥10ppm	239	70.5
Previous attempt to quit (n=423)		222	52.5
Stage of change (n=420)	Contemplation	29	6.9
	Preparation	391	93.1
Score of motivation (n=422)	< 12	161	38.1
	≥ 12	261	61.9
Score of perceived self-confidence to quit (n=397)	< 5	117	29.5
	≥ 5	280	70.5
Score of perceived psychological support to quit (n=423)	< 5	408	96.5
	≥ 5	15	3.5
Score HAD-anxiety (n=419)	< 12	262	62.5
	≥ 12	157	37.5
Score HAD-depression (n=419)	< 8	283	67.5
	≥ 8	136	32.5
Number of visits (n=421)	<3	317	75.3
	≥ 3	104	24.7
Nicotine replacement therapy (Nicotine patch) (n=423)		142	33.6

#### 4. DISCUSSION

Worldwide, the majority of smokers are interested in quitting; but despite the

development of numerous cessation strategies, the overall success rate of long-term smoking abstinence is modest. For example, in the United States more than 70% of adult cigarette smokers

had made at least one attempt to quit during their smoking careers. Nonetheless, only about 7% had maintained their smoking abstinence for one year [17]. This known poor response of smokers to smoking cessation efforts can lead to negative beliefs and attitudes towards the effectiveness of smoking cessation. To address these negative beliefs and attitudes, predictive factors of smoking cessation should be identified and this identification should be translated into an efficient use of physicians' consultation time [17].

**Table 2. Factors associated with a successful smoking cessation at one year at least among the attendees of the smoking cessation clinic of the University Hospital Sahloul, Sousse, 2009-2014 (univariate analysis)**

		Smoking cessation at one year		OR <sub>c</sub> [95% CI]	p
		No n (%)	Yes n (%)		
Gender	Female	26 (89.7)	3 (10.3)	1.00 [0.29-3.47]	.99
	Male	353 (89.6)	41 (10.4)		
Age	< 45 years	212 (91.8)	19 (8.2)	1.67 [0.89-3.13]	.10
	≥ 45 years	167 (87.0)	25 (13.0)		
Marital status	Not married	127 (94.1)	8 (5.9)	2.16 [0.97-4.82]	.053
	Married	249 (88.0)	34 (12.0)		
Education level	Primary	97 (92.4)	8 (7.6)	NA	.48
	Secondary	161 (88.0)	22 (12.0)		
	University	107 (88.4)	14 (11.6)		
Employment status	Student	32 (94.1)	2 (5.9)	NA	NA
	Employee	280 (88.9)	35 (11.1)		
	Unemployed	67 (90.5)	7 (9.5)		
Alcohol intake	No	250 (88.0)	34 (12.0)	0.55 [0.21-1.48]	.23
	Yes	66 (93.0)	5 (7.0)		
Practice of 30 minutes of physical activity 5 days per week	No	212 (90.6)	22 (9.4)	1.31 [0.70-2.46]	.38
	Yes	161 (88.0)	22 (12.0)		
Medical history of systolic and/or diastolic hypertension	No	346 (89.4)	41 (10.6)	0.79 [0.23-2.69]	.93
	Yes	32 (91.4)	3 (8.6)		
Medical history of Mellitus diabetes	No	332 (89.2)	40 (10.8)	0.70 [0.24-2.06]	.52
	Yes	47 (92.2)	4 (7.8)		
Medical history of coronary heart diseases	No	353 (89.1)	43 (10.9)	0.31 [0.04-2.38]	.34
	Yes	26 (96.3)	1 (3.7)		
Medical history of gastric pathologies	No	357 (90.4)	38 (9.6)	2.56 [0.97-6.70]	.058
	Yes	22 (78.6)	6 (21.4)		
Age of cigarette onset	<15 years	122 (89.7)	14 (10.3)	0.99 [0.50-1.95]	.98
	≥15 years	254 (89.8)	29 (10.2)		
Number of daily smoked cigarettes	<20	237 (91.2)	23 (8.8)	1.17 [0.53-2.55]	.69
	≥20	88 (89.8)	10 (10.2)		
Duration of smoking	<10 years	147 (86.5)	23 (13.5)	0.57 [0.30-1.08]	.08
	≥10 years	213 (91.8)	19 (8.2)		
Fagerström score	< 7	195 (87.1)	29 (12.9)	0.56 [0.29-1.09]	.086
	≥ 7	177 (92.2)	15 (7.8)		
Exhaled CO in air	<10ppm	81 (81.0)	19 (19.0)	0.24 [0.11-0.51]	.000
	≥10ppm	226 (94.6)	13 (5.4)		
Previous attempt to quit	No	182 (90.5)	19 (9.5)	1.21 [0.64-2.28]	.54
	Yes	197 (88.7)	25 (11.3)		
Stage of change	Contemplation	349 (89.3)	42 (10.7)	0.29 [0.03-2.23]	.34
	Preparation	28 (96.6)	1 (3.4)		

		Smoking cessation at one year		OR <sub>c</sub> [95% CI]	p
		No n (%)	Yes n (%)		
Score of perceived motivation to quit	< 12	147 (91.3)	14 (8.7)	1.36 [0.70-2.65]	.36
	≥ 12	231 (88.5)	30 (11.5)		
Score of perceived self-confidence to quit	<5	109 (93.2)	8 (6.8)	1.88 [0.84-4.20]	.11
	≥ 5	246 (87.9)	34 (12.1)		
Score of perceived social support to quit	<5	366 (89.7)	42 (10.3)	2.90 [0.29-28.55]	.35
	≥ 5	3 (75.0)	1 (12.5)		
Score HAD-anxiety	<12	229 (87.4)	33 (12.6)	[0.25-1.06]	.07
	≥ 12	146 (93.0)	11 (7.0)		
Score HAD-depression	<8	251 (88.7)	32 (11.3)	0.75 [0.37-1.52]	.43
	≥8	124 (91.2)	12 (8.8)		
Number of visits	<3	296 (93.4)	21 (6.6)	4.00 [2.10-7.59]	.0001
	≥ 3	81 (77.9)	23 (22.1)		
Nicotine replacement therapy	No	266 (93.2)	19 (6.8)	2.94 [1.56-5.56]	.001
	Yes	117 (82.4)	25 (17.6)		

OR<sub>c</sub>: Crude Odds ratio, 95%CI: 95% Confidence interval, NA: not applicable

**Table 3. Factors associated with a successful smoking cessation at one year at least among the attendees of the smoking cessation clinic of the University Hospital Sahloul, Sousse, 2009-2014 (multivariate analysis)**

	OR <sub>a</sub>	[95% CI]	p
Being married	4.92	[1.63-14.83]	.005
Duration of smoking ≥ 10 years	0.08	[0.02-0.27]	.000
Score of perceived self-confidence to quit ≥ 5	5.57	[1.54-20.18]	.009
Exhaled CO ≥ 10ppm	0.16	[0.06-0.43]	.0001
Number of visits ≥ 3	3.99	[1.50-10.59]	.005

OR<sub>a</sub>: Adjusted odds ratio, 95%CI: 95% Confidence interval

In our study, 10.4% of the participants succeeded in smoking cessation at 12 months at least. Success rates can be defined in many different ways leading to very different estimates. In the study of Ferguson et al. [18], assessing the impact of English treatment services on quit rates at 52-week follow-up (considered as the optimal estimate of continuous abstinence rate), 17.7% of users reported prolonged abstinence and 14.6% were CO-validated successful quitters.

The scientific research has identified many factors that can influence the success or failure of quit attempts, including physiological (e.g.

level of nicotine dependence), behavioral (e.g. pattern of smoking), environmental (e.g. living or working with smokers), psychological or emotional (e.g. depression, anxiety) and cognitive (e.g. motivation, self-efficacy) [17,19].

In our study, older smokers (≥ 45 years old) were more successful in sustained smoking cessation at one year than younger respondents but without a significant difference. It is suggested that older smokers may have a high cessation rate because they are more likely to experience health problems, visit more healthcare professionals and in consequence receive repeated advice to quit smoking, which encourage them to make quit attempts or quit successfully [17,19-21].

In respect with gender, in our study, there was no significant difference in the smoking cessation rate by gender. It appears that, compared to men, smoking cessation among women is associated with more negative outcomes such as weight gain, increases in negative mood, reduced ability to concentrate, and loss of enjoyment] among women compared to men. Furthermore, women seem to be less motivated to quit smoking than men [17,19].

In our study, being married appeared to be a predictive factor of successful smoking cessation. Our findings are consistent with other studies. Kim et al. [22] suggested that support from spouse may play an important role in quitting smoking.



Among the socio-demographic factor, high education level or socioeconomic status appear to be associated with smoking cessation outcome [17,20,23]. In our study, employment status and education level were not significantly associated with successful smoking cessation.

Health determinants can play a role in the success of smoking cessation since health problems were often reported as a reason for stopping smoking [20]. In our study, the smoking cessation rate did not vary significantly with any of the health variables. Similarly, Osler et al. [20] did not find a significant association between successful smoking cessation and health status suggesting that these results could be due to the long follow-up period in their study since the sickest smokers (who may be the most successful quitters) were less likely to attend the follow up because they had died or become too ill to participate.

Among health behaviors, alcohol use is a negative prognostic factor for successful smoking cessation [17,21]. Yang JJ et al. [21] found that alcohol use is one of the major determinants in the success of smoking cessation. This concurrence can be associated with complications such as reduced likelihood of trying to quit smoking, a lower success rate for those who make an attempt and an increased rate of relapse in the presence of heavy drinking [24]. It is suggested that a referral to a specialist center may be recommended if a history of current alcoholism is present [17]. In our study, smokers who reported alcohol consumption were less successful in quitting but without a significant difference.

Physical activity was not associated with successful smoking cessation among our population study, but the rate of those who reported practicing a recommended physical activity was higher than those who did not. It has been shown that moderate to high physical activity levels are associated with successful quitting, with health consciousness probably an explanation for this association [25].

Concerning the patterns of smoking, several international studies indicate that later age of cigarette onset, low prior consumption of cigarettes appears to be more likely associated with successful quitting [17,19]. In our study, having duration of smoking less than 10 years was a predictive factor of successful smoking cessation among our attendees.

Exhaled CO, a non-specific biological marker of smoking reflecting the intensity of tobacco smoke inhalation, can play an important role in smoking cessation outcome since the value of CO monitoring is as a motivational tool for smokers [26]. In our study, successful smoking cessation at one year was significantly higher among those with carbon monoxide level in the first visit <10 ppm. Similarly, Monsó et al. [27] have found a significant correlation between successful smoking cessation and lower level of carbon monoxide.

Nicotine dependence level are among the predictive factors for smoking cessation [17,19]. This may reflect more severe withdrawal symptoms and a greater constitutional need for nicotine [17]. In our study, respondents with higher dependence (Fagerström score $\geq$ 7) were less likely to quit but without a significant difference.

In relation with cognitive factors, findings from previous studies has shown that self-efficacy, which is the extent or strength of one's belief in one's own ability to complete a task or perform a behavior, is a predictor of successful smoking cessation. However, motivation to quit is related to quit attempts but not to cessation maintenance [19,28]. In concordance with literature, our study revealed a significant association between score of perceived self-confidence to quit and successful cessation.

Data on the relationship of previous quit attempts and smoking cessation indicate that previous attempts at quitting predict other quit attempt, suggesting that smokers who have made recent attempts to quit are more likely to try again and those whose previous attempts have lasted longer are more likely to successfully stop [17,19]. In our study, smokers who had tried to quit at least once had a higher successful cessation rate than those without previous quit attempts but without a significant difference.

Social environment including positive social support appears to be strongly associated with successful quitting [17]. In our study, individuals who reported having higher levels of perceived social support succeeded more in quitting than the low perceived social support group.

The progression towards the smoking cessation process shows that the stage of change is one of the predictive factors of successful smoking

abstinence. Farkas et al. [29] found that the stage of change was a predictor of smoking cessation. Controversy, this association disappeared when addiction variables were included in the multivariate analysis. In our study, there was no significant difference between the successful cessation rate among attendees in contemplation and those in preparation.

In respect with psychological factors, smoking and depression often co-occur [19]. In our study, compared to people without depression, people with depression were less likely to succeed in quit attempts. A 2013 Cochrane review evaluating the effectiveness of smoking cessation interventions in smokers with depression, indicated that adding a psychosocial mood management component to a standard smoking cessation intervention increases long-term cessation rates in smokers with depression when compared with the standard intervention alone [30]. Studies have consistently shown that anxiety plays an important role in cessation failure. Smokers with higher anxiety sensitivity are more likely to perceive quitting as difficult compared with those low in anxiety sensitivity. In our study, smokers with anxious symptoms, were more successful in quitting compared to those without anxious but without a significant decrease.

In relation with treatment of smoking quit, participants who received a pharmaceutical assistance by nicotine replacement therapy (Nicotine patch) had a significant higher successful cessation rate than those who did not. The benefit of NRT has been supported by several studies [31,32]. A Cochrane review published in 2012 concluded that NRTs increase the rate of quitting by 50 to 70% [32].

In our study, level of attendance was associated with successful smoking cessation. In concordance with our findings, Iliceto et al. [33] have found that level of attendance of the counseling program was predictor of smoking cessation. Similarly, Dorner et al. [34] found that the participating in a higher number of sessions in the provided smoking cessation program increased significantly the chance of smoking cessation from 12.1% to 61.2%. These results indicate that a continuous attendance of the counseling sessions must be recommended as a best practice in smoking cessation programs [33,34].

Our study presents limitations and the major one is the retrospective character of data

collection and in consequence the presence of missing data. Furthermore, the findings of this study may have limited generalizability to other subgroups of smokers since our sample consisted of smokers who were actively seeking to quit. In addition, our study did not explore environmental factors such as exposure to tobacco marketing and second hand smoking which play an important role in smoking cessation according to literature. Despite these limitations, our study has strength which consists in studying the whole participants consulting during 6 years.

## 5. CONCLUSION

Smoking cessation clinics are now integrated into many health-care systems and a major research effort is needed to improve current success rates. This is beyond the scope of our study which identified numerous determinants of successful quitting. Management of smoking cessation consultation needs to take an integrative approach focusing on the identified factors in order to increase success rates.

## CONSENT

This study was based on participants' freely volunteered informed consent.

## ETHICAL APPROVAL

It is not applicable.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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