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Prevalence and Socio-Behavioral Determinants of Smoking among Medical Students in Rabat, Morocco

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ABSTRACT

Introduction: Smoking remains a major public health concern, responsible for preventable morbidity and mortality worldwide. Among medical students, tobacco use represents both a personal risk of dependence and a challenge to their future role as health promoters. Assessing its prevalence and associated determinants is essential to guide prevention and management strategies.

Materials and Methods: A cross-sectional survey was conducted in 2021–2022 among 239 medical students at the Faculty of Medicine and Pharmacy of Rabat. Data were collected using an anonymous self-administered questionnaire assessing sociodemographic characteristics, smoking habits, initiation factors, and quit attempts. Statistical analysis included descriptive statistics, bivariate tests, and multivariate logistic regression using Jamovi software.

Results: The prevalence of smoking was 16.3%. Three significant predictors of smoking were identified: alcohol consumption (OR = 7.75; p = 0.023), having friends who smoke (OR = 5.97; p = 0.012), and having a smoking partner (OR = 7.15; p = 0.030). Non-significant trends suggested an increased likelihood of smoking among males (OR = 3.47; p = 0.064) and students with at least one smoking parent (OR = 4.36; p = 0.096).

Conclusion: Smoking remains relatively frequent among medical students in Rabat. The strong influence of social and behavioral determinants underscores the need for targeted prevention and cessation programs. Integrating such interventions into medical training is crucial to strengthen the role of future physicians as models and advocates in tobacco control.

Keywords: Smoking, Prevalence, Determinants, Medical students, Smoking cessation

Introduction

Tobacco use remains one of the leading preventable causes of morbidity and mortality worldwide. According to the World Health Organization, it is responsible for more than seven million deaths each year, including 1.6 million among non-smokers involuntarily exposed to second-hand smoke (WHO 2019). Of the 1.3 billion people who consume tobacco globally, nearly 80% live in low- and middle-income countries, where health systems already face significant challenges (WHO 2024).

The burden of tobacco extends beyond its well-documented health consequences. It is a key determinant of major chronic diseases such as cardiovascular disease, cancer, chronic respiratory illness, and diabetes, while also imposing a considerable economic cost through healthcare expenditures and productivity losses. At the global level, tobacco-related costs are estimated to exceed 1.4 trillion US dollars annually, representing around 1.8% of the world's GDP (Tobacco Atlas, 2022).

Smoking is a multifaceted behavior shaped by biological, psychological, and social factors. Beyond the addictive potential of nicotine, socio-behavioral influences play a decisive role. Family and peer environments are key predictors, with parental or partner smoking increasing the likelihood of use and social networks reinforcing consumption (Leonardi-Bee et al., 2011; Shrestha et al., 2020). Psychosocial factors such as academic stress, anxiety, or depressive symptoms are often linked to higher smoking rates, reflecting the use of tobacco as a maladaptive coping strategy (Sreeramareddy et al., 2007; Al-Dubai et al., 2011; Melaku et al., 2015). Concurrent consumption of other substances, particularly alcohol, further reinforces tobacco use through shared neurobiological pathways and social settings (Bakar et al., 2013; Alanazi et al., 2025). These determinants interact with cultural norms, accessibility, and perceptions of smoking, producing heterogeneous patterns across populations (Ilic et al., 2022).

Medical students represent a population of particular interest in this context. As future physicians, they are expected to act as role models and health promoters in tobacco control. However, their own smoking behaviors reflect not only personal health risks but also potential barriers to effective patient counseling and public health advocacy. Understanding the prevalence of smoking and its socio-behavioral determinants in this group is therefore essential to design targeted prevention strategies and integrate tobacco control more effectively into medical education.

Materials and Methods

Study design and setting: This was a cross-sectional descriptive and analytical study conducted among students of the Faculty of Medicine and Pharmacy of Rabat during the 2021–2022 academic year

Data collection tool: Data were collected using a self-administered online questionnaire (Google Forms), ensuring confidentiality of responses. The questionnaire included sections on: sociodemographic data, consumption habits, Psychiatric history, Socio-environmental factors.

Inclusion criteria: Students enrolled in the Faculty of Medicine and Pharmacy of Rabat who agreed to complete the questionnaire were eligible for inclusion.

Exclusion criteria: Questionnaires with missing essential data or inconsistent responses were excluded.

Statistical analysis: Data entry, cleaning, and management were performed using Microsoft Excel (version 16.78, 2023, macOS). Statistical analysis was conducted with JAMOVI (version 2.6.45, 2024, macOS). Descriptive statistics summarized prevalence and participant characteristics. Associations between smoking status and independent variables were examined with chi-square or Fisher's exact tests for categorical variables, and Mann–Whitney U test for continuous variables, as appropriate. Variables showing significant associations in bivariate analysis were entered into a multivariate logistic regression model to identify independent predictors of smoking. Results are reported as odds ratios (OR) with 95% confidence intervals (CI). A two-sided p-value < 0.05 was considered statistically significant.

Results

The study included 239 medical students with a median age of 21 years [IQR: 20–22], with no significant difference between smokers and non-smokers (p = 0.114). The overall prevalence of smoking was 16.3% (39/239). Smoking was significantly more common among males (32.2%) compared to females (7.2%, p < 0.001). By year of study, prevalence ranged from 10% in first-year students to 27.8% in seventh-year students. Although prevalence appeared slightly higher in advanced years, the differences were not statistically significant (p = 0.424) **(Table 1).**

A history of psychiatric disorders was reported by 18% of students, with a higher prevalence among smokers (23.3%) compared to non-smokers (14.8%), although the difference did not reach statistical significance (p = 0.177). Depression and anxiety were the most frequent conditions reported, affecting approximately one-quarter of smokers, while schizophrenia and bipolar disorder were rare and evenly distributed between groups **(Table 2).**

Psychoactive substance use was strongly associated with smoking. All smokers reported concurrent use of at least one psychoactive substance, compared to 13.5% of non-smokers (p < 0.001). The most commonly reported substances among smokers were alcohol (63.5%), cannabis (69.0%), Hookah (74.3%), and benzodiazepines and maâjoun (both 91.7%). Less frequently reported substances included ecstasy/MDMA and LSD, which were significantly more frequent among smokers despite their low absolute numbers. Other substances were very rarely reported. Overall, nearly all psychoactive substances showed higher prevalence among smokers compared to non-smokers **(Table 2)**.

Exposure to smoking in the social and family environment was strongly associated with students' smoking status. Having at least one smoking parent was reported by 39.3% of smokers compared to 14.4% of non-smokers (p < 0.001), while the prevalence rose to 60% when both parents smoked (p = 0.008). Peer influence was particularly marked: 84.6% of smokers had friends who smoked, compared to 36.7% of non-smokers (p < 0.001). Having a smoking partner was also significantly associated with smoking (61.1% vs 7.7%, p < 0.001). In contrast, sibling smoking (9.1% vs 10.0%) and extended family smoking did not differ significantly between groups (p = 1.000 and p = 0.135, respectively) **(Table 3).**

We used a multivariable logistic regression to examine factors associated with cigarette smoking. The initial model included seven independent variables, all of which were significant in the bivariate analysis **(Table 4).** After stepwise reduction, the final multivariable model retained four independent predictors **(Table 5).** Alcohol use emerged as the strongest determinant, with drinkers being more than fourteen times more likely to smoke compared to non-drinkers (OR = 14.34; 95% CI: 4.48–45.88; p < 0.001). Hookah use was also significant, increasing the odds more than fivefold (OR = 5.58; 95% CI: 1.71–18.28; p = 0.004). Peer smoking continued to exert a strong influence, raising the risk nearly fivefold (OR = 4.65; 95% CI: 1.39–15.53; p = 0.012). Finally, having a smoking partner or spouse increased the likelihood of smoking more than fivefold (OR = 5.31; 95% CI: 1.12–25.17; p = 0.035). Male sex, cannabis use, and parental smoking also showed positive but non-significant trends. Together, these results highlight the central role of both substance co-use and social environment in shaping smoking behaviors among medical students.

Table 1. Sociodemographic and academic characteristics of medical students by smoking status (Faculty of Medicine and Pharmacy of Rabat, 2021–2022).

Characteristics	**Smokers (n=39, 16.3%)**	**Non-smokers (n = 200, 83.7%)**	**Prevalence (%) [95% CI]**	***p-value***
Median age [IQR]	**21 [21 – 22]**	**21 [19 – 22]**	**-**	*0,114**
Sex				
Female	11 (7.2)	141 (92.8)	7.2 [4.1 – 12.5]	

Characteristics	**Smokers (n=39, 16.3%)**	**Non-smokers (n = 200, 83.7%)**	**Prevalence (%) [95% CI]**	***p-value***
Male	28 (32.2)	59 (67.8)	32.2 [23.3 – 42.6]	***<0.001*****
Total	39 (16.3)	200 (83.7)	16.3 [12.2 – 21.5]	
Academic year				
1st year	3 (10)	27 (90)	10 [3.5 – 25.6]	
2nd year	3 (12.5)	21 (87.5)	12.5 [4.3 – 31.0]	
3rd year	4 (16.7)	20 (83.3)	16.7 [6.7 – 35.9]	
4th year	15 (21.7)	54 (78.3)	21.7 [13.6 – 32.8]	
5th year	9 (13.2)	59 (86.8)	13.2 [7.1 – 23.3]	*0.424***
6th year	0	6 (100)	0 [0.0 – 39.0]	
7th year	5 (27.8)	13 (72.2)	27.8 [12.5 – 50.9]	

Values are presented as n (%) unless otherwise specified. IQR = interquartile range. CI = confidence interval. *p-value from Mann–Whitney U test. **p-value from Fisher's exact test or chi-square test, depending on sample size

Table 2. Psychiatric history and psychoactive substance use among medical students according to smoking status (Faculty of Medicine and Pharmacy of Rabat, 2021–2022)

Characteristics	**Smokers (n=39, 16.3%)**	**Non-Smokers (n = 200, 83.7%)**	**Prevalence (%) [95% CI]**	***p-value****
Psychiatric history				
No	29 (14.8)	167 (85.2)	14.8 [10.5 – 20.4]	*0.177*
Yes	10 (23.3)	33 (76.7)	23.3 [13.2 – 37.7]	
Psychiatric disorders				
Depression	7 (25)	21 (75)	25 [12.7 – 43.4]	*0.186*
Anxiety	7 (25)	19 (73)	26.9 [13.7 – 46.1]	*0.121*
Schizophrenia	2 (50)	2 (50)	50 [15 – 85]	*0.126*
Bipolar disorder	0	1 (100)	0 [0 – 79.3]	*1.00*
Psychoactive substance use				
No	0	173 (100)	0 [0 – 2.2]	
Yes	39 (59.1)	27 (40.9)	59.1 [47 – 70.1]	***<0.001***
Substances types				
Alcohol	33 (63.5)	19 (36.5)	63.5 [49.9 – 75.2]	***<0.001***
Cannabis	29 (69)	13 (31)	69 [54 – 80.9]	***<0.001***
Hookah "Shisha"	26 (74.3)	9 (25.7)	74.3 [57.9 – 85.8]	***<0.001***
Benzodiazepines	11 (91.7)	1 (8.3)	91.7 [64.6 – 98.5]	***<0.001***
Maâjoun	11 (91.7)	1 (8.3)	91.7 [64.6 – 98.5]	***<0.001***
Ecstasy/MDMA	6 (100)	0	100 [61 – 100]	***<0.001***
LSD	3 (75)	1 (25)	75 [30.1 – 95.4]	***0.014***
Others	5 (83.3)	1 (16.7)	*various*	*various*

Values are presented as n (%) unless otherwise specified. CI = confidence interval. *p-values from Fisher's exact test or chi-square test, depending on sample size.

"Other" includes substances rarely reported (codeine, snus, khat, synthetic cannabinoids, DMT and magic mushrooms).

Table 3. Smoking environment among medical students according to smoking status (Faculty of Medicine and Pharmacy of Rabat, 2021–2022)

Smoking environment	**Smokers (n=39, 16.3%)**	**Non-Smokers (n = 200, 83.7%)**	**Prevalence (%) [95% CI]**	***P value****
No exposure	0	101 (100)	0 [0 – 3.7]	***<0.001***
≥ 1 parent smoking	11 (39.3)	17 (60.7)	39.3 [23.6 – 57.6]	***<0.001***
Both parents smoking	3 (60)	2 (40)	60 [23.1 – 88.2]	***0.008***
Peer smoking	33 (36.7)	57 (63.3)	36.7 [27.4 – 47.0]	***<0.001***
Sibling smoking	1 (9.1)	10 (90.9)	9.1 [1.6 – 37.7]	*1*
Partner/spouse smoking	11 (61.1)	7 (38.9)	61.1 [38.6 – 79.7]	***<0.001***
Other family member smoking	0	13 (100)	0 [0 – 22.8]	*0.135*

Values are presented as n (%) unless otherwise specified. CI = confidence interval. *p-value from Fisher's exact test or chi-square test, depending on sample size.

Table 4. Multivariable logistic regression of factors associated with smoking among medical students

	Estimate	**SE**	**z-value**	**p-value**	**OR [IC95%]**
Intercept	-5.38	0.840	-6.41	<.001	0.004 [$8.84e^{-4}$ – 0.02]
Male sex	1.07	0.612	1.75	0,080	2.92 [0,88 – 9.67]
Alcohol use	1.54	**0.760**	2.03	**0,043**	**4.66 [1,05 – 20.65]**
Hookah use	1.48	**0.677**	2.18	**0,029**	**4.37 [1,16 – 16.49]**
Cannabis use	1.42	0.750	1.90	0,058	4.14 [0,95 – 18.01]
At least one smoking parent	1.62	0.861	1.88	0,060	5.06 [0,93 – 27.36]
Peer smoking	1.76	**0.689**	2.56	**0,011**	**5,82 [1,51 – 22.44]**
Partner/spouse smoking	2.08	**0.830**	2.50	**0,012**	**7,98 [1,57 – 40.58]**

SE = standard error; OR = odds ratio; CI = confidence interval.

Table 5. Final multivariable logistic regression model of factors associated with smoking among medical students

	Estimate	**SE**	**z value**	**p-value**	**OR [IC95%]**
Intercept	-4.42	0.604	-7.31	<0.001	0.01 [0.00 – 0.04]
Alcohol use	2.66	0.54	4.49	<0.001	14.34 [4.48 – 45.88]
Hookah use	1.72	0.605	2.85	0.004	5.58 [1.71 – 18.28]
Peer smoking	1.54	0.614	2.50	0.012	4.65 [1.39 – 15.53]
Partner/spouse smoking	1.67	0.793	2.11	0.035	5.31 [1.12 – 25.17]

SE = standard error; OR = odds ratio; CI = confidence interval.

Discussion

This study highlights several key determinants of smoking, particularly alcohol and hookah use, as well as the social influence exerted by peers and smoking partners. By contrast, some factors commonly reported in the literature—such as male sex or having a smoking parent—did not show significant

associations in the multivariable analysis of our sample. These findings underscore the central role of social and behavioral influences, while also pointing to the need to consider the specific characteristics of our population and to compare them with published data, in order to derive meaningful implications for prevention and management strategies.

The prevalence of smoking among medical students in Rabat was 16.3%, a level that places them in an intermediate range compared to national and international data. In Morocco, Zaghba et al. (2013) reported a lower prevalence of 7.9% among medical students in Casablanca, while Khalis et al. (2023) found a higher rate of 31.2% among dental students, suggesting field-specific vulnerabilities. Internationally, the Global Health Professions Student Survey (GHPSS, 2005–2011), including over 51,000 medical students, estimated smoking prevalence at 29.2% in Europe, 20.3% in the Americas, 12.8% in South-East Asia and the Western Pacific, 9.9% in the Eastern Mediterranean, and 8.2% in Africa (La Torre et al. 2012). Similarly, a multicenter study in the Balkans (n = 2452) found prevalence rates ranging from 13.9% to 32.3%, with a pooled estimate of 22% (Ilic et al., 2022). Shrestha et al. (2020) reported that 30.1% of Nepalese medical students were current smokers, while a recent Saudi meta-analysis (2014–2023) estimated a pooled prevalence of 24.5% among health sciences students, with 10.6–34.3% among medical students (Alanazi et al., 2025). Finally, a study in Sudan found an alarmingly high prevalence of 48.8% among medical students at Al Neelain University (Jarelnape et al. 2023). Taken together, our findings place Moroccan medical students in an intermediate range, with lower prevalence compared to several international contexts but still raising concern given their future role in tobacco prevention and control.

Alcohol consumption emerged as the strongest predictor of smoking, aligning with the concept of cross-dependence between the two substances. This association is well documented among medical students. In India, Singh et al. (2003) reported that 88% of smoking students also consumed alcohol, compared to only 30% of non-smokers (OR = 17.49; 95% CI: 7.8–40.1). In Romania, Năsui et al. (2021) found that alcohol was the most widely used psychoactive substance among medical students, with nearly one-third presenting risky consumption patterns, particularly binge drinking. Similarly, a multicenter study in the Balkans (Ilić et al., 2022) confirmed a positive association between tobacco and alcohol use. The tight link between the two behaviors is partly explained by shared neurobiological mechanisms: both alcohol and nicotine stimulate mesolimbic dopaminergic pathways, enhancing dopamine release in the nucleus accumbens and reinforcing consumption (Adams, 2017; Tolu et al., 2017). Cross-reinforcement has been demonstrated in animal models, while clinically, nicotine attenuates the sedative effects of alcohol, favoring prolonged intake (Adams, 2017; Tolu et al., 2017). From a psychosocial perspective, co-use is strongly embedded in student socialization. Festive contexts, peer norms, and group belonging act as powerful reinforcers, normalizing the pairing of smoking and drinking (Mostardinha et al.2019). These findings converge with ours, highlighting the reinforcing nature of tobacco–alcohol co-use in student populations, where alcohol significantly increases the likelihood of smoking.

Hookah use also emerged as an important correlate of smoking in our study, consistent with evidence from the Middle East and North Africa (MENA) region. A meta-analysis covering 17 countries estimated an overall tobacco prevalence of 24.3%, with 17.4% of adults smoking cigarettes and 6.9% using hookah (Kargar et al., 2023). Beyond its addictive potential, hookah smoking is deeply embedded in cultural and social practices, strongly associated with conviviality and group interactions, which enhances its attractiveness among young adults (Akl et al., 2011; Maziak et al., 2004). In Morocco, Essadi et al. (2024) found that although most medical students were aware of the health risks of tobacco, hookah use remained common. This paradox reflects enduring social perceptions that portray hookah as a safer and more convivial alternative to cigarettes, despite strong evidence of its addictive and harmful effects.

Peers and partners exerted a particularly strong influence on smoking behaviors, confirming the central role of the social environment in shaping medical students' habits. In India, Singh et al. (2003) showed that 94.6% of smoking medical students reported peer influence, compared to only 4.6% of non-smokers, while parental smoking also significantly increased risk (OR = 4.26; 95% CI: 2.19–8.35). In Turkey, Senol et al. (2006) similarly found peer influence to be a significant factor in smoking initiation. In Romania, Năsui et al. (2021) observed that cohabitation with peers was associated with higher substance use, including tobacco, underscoring the importance of the immediate relational environment. More recently, Ilić et al. (2022), in a multicenter study of Balkan medical students, reported that parental smoking significantly increased tobacco use (OR = 1.84; 95% CI: 1.35–2.52). Beyond peers and parents, partner influence appears particularly powerful. Kennedy et al. (2011), using longitudinal data from the U.S., showed that having a smoking partner not only increased the risk of initiation but also reduced the likelihood of cessation, even after accounting for parental and peer smoking. Etcheverry and Agnew (2008) similarly demonstrated that partner smoking exerted a stronger influence than friends in predicting both initiation and maintenance. Resen et al. (2018) added that this effect may differ by gender, with a stronger partner influence reported among men. These findings suggest that smoking behaviors are shaped not only by group dynamics but also by intimate relational contexts, where daily exposure and emotional ties amplify risk. Taken together, these results support our findings that the social environment—especially peers and partners—plays a central role in shaping smoking behaviors among medical students, with parental influence acting mainly as an early exposure factor.

Limitations:

The study is limited by the relatively small number of smokers, which reduced statistical power, and by its cross-sectional design, which does not allow causal inference. Data were self-reported, which may have introduced minor recall or desirability biases, and some predictors could not be fully explored due to small subgroup sizes. As the study was conducted in a single faculty, the findings may not be generalizable to all Moroccan medical students. Nevertheless, the study provides valuable insights into the social and behavioral determinants of smoking in a population that will play a critical role in public health promotion.

Conclusion

Smoking remains relatively common among medical students in Rabat. Its determinants are strongly shaped by alcohol and hookah co-use, and by the influence of peers and partners. Targeted, socially oriented prevention strategies should be integrated into medical training to reduce smoking among future health professionals and enhance their credibility in tobacco control.

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