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**Tobacco Dependence among French University Students: A Cluster Analytic Approach to
Identifying Distinct Psychological Profiles of Smokers**

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Author note

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Abstract

This study investigates the combination of several psychological factors related to tobacco smoking to identify smokers' psychological profiles among French university students. A cluster analysis was performed on smoking motives, psychosocial variables, and the smoker identity ($N = 909$). Five profiles were identified and then compared regarding tobacco dependence and motivations to quit. "Normative" and "sociohedonist smokers" are characterized by two distinct social factors (normative influences and social motives) and moderate dependence. "Dependent identified smokers" have higher levels of dependence motives, smoker identity and tobacco dependence associated with low motivations to quit. "Inconsistent smokers" have weak smoker identity and weak smoking motives, a strong perceived control over resisting smoking, low dependence and motivations to quit. "Coping smokers" have strong sedative and addictive motives and exhibit moderate dependence and motivations to quit. This research encourages prevention programs to consider the diversity of student smokers with strategies adapted to their psychological profiles.

Keywords

smoking psychosocial factors, smoking motives, smoker identity, university students, tobacco dependence

Introduction

Tobacco use is a leading cause of poor health and premature death worldwide (World Health Organization, 2018). Tobacco dependence, generally defined as the experience of a strong need to smoke (West, 2017), can lead to neuropsychological impairments even among young people (Chamberlain et al., 2012). Although smoking mainly begins during adolescence (Talip et al., 2016), young adulthood and especially the university period have a critical influence on smoking habits (Schulenberg et al., 2019), because most individuals will become regular smokers in this period and then remain addicted to tobacco for decades (Kenford et al., 2005). In France, smoking is widespread among young people, with 28.3% of university students smoking (Pasquereau et al., 2017). Hence, achieving smoking cessation among students is an important public health concern (Pardavila-Belio et al., 2019). From this perspective, studies on youth and smoking students have mainly focused on the psychological factors shaping smoking cessation (Cengelli et al., 2012). However, in addition to identifying the reasons for quitting smoking, understanding psychological determinants of tobacco dependence may constitute a decisive complementary issue because they could be considered obstacles to stopping smoking (Lee et al., 2014). Unlike long-term and more dependent smokers, who may have less specificity because they smoke primarily for dependence reasons (Piasecki et al., 2007), youth smokers may differ in their psychological antecedents related to smoking (Thrul et al., 2014). If smoking students do not constitute a unitary group, as suggested by qualitative studies (Brown et al., 2011; Rosa & Aloise-Young, 2015), the identification of potential heterogeneity in their psychological profiles may be highly beneficial for prevention campaigns to more appropriately target various smokers' profiles. Researchers indeed agree that tobacco dependence is a multidetermined construct (Piper et al., 2004), but no research to date has simultaneously measured various theory-based psychological factors related to smoking among university students. Therefore, the present study aims to assess the implications of several psychological factors and foremost their potential combinations for understanding tobacco dependence among French university students. Beyond the demographic and environmental variables related to smoking and tobacco dependence in youth and university students (e.g., gender, Mao et al., 2009; age, Riou França et al., 2009; and age of onset, Levinson et al., 2007), three theory-based

categories of psychological factors have been identified, the first of which are motivational factors related to tobacco use.

Motivational Factors Related to Tobacco Use

Based on different theoretical models (e.g., Best & Hakstian, 1978; Ikard et al., 1969), the earlier interest of research was to identify different individuals' motivations related to smoking and tobacco dependence. People have different reasons for smoking and becoming addicted to tobacco, as evidenced by studies of the general population: "it's addictive," "it's fun," "it's a way to relax," it is a way to "be social," it is "stimulating," and it "keeps [them] busy" (e.g., Dupont et al., 2015). More generally, two main types of motivations have been distinguished, namely, so-called primary and secondary addictive motivations (Piper et al., 2004; S. S. Smith et al., 2010). Primary motivations include, but are not limited to, craving (i.e., smoking in response to experiencing intense or frequent urges to smoke), automaticity (i.e., smoking without awareness or intention), and tolerance (i.e., needing to smoke increasing amounts over time to experience the desired effects). These are the main motivations associated with tobacco addiction. Secondary motivations include social (i.e., smoking to facilitate and improve social relationships), stimulation (i.e., smoking to improve cognitive functioning), and coping (i.e., smoking to ameliorate negative internal states) motivations (Berlin et al., 2003). Among university students, the prevalence and effects of primary dependence motives have been less evidenced, probably because students are "light" smokers (Thompson et al., 2007). In contrast, studies have evidenced the role of different secondary dependence motives for youth and university student smokers (Pancani et al., 2015), such as smoking to improve cognitive functioning (Hayes & Plowfield, 2007), cope with internal states (Kobus, 2003), or socialize with others (Moran et al., 2004). While some studies have shown the various motivations associated with smoking, other studies have focused on identifying psychosocial factors.

Psychosocial Factors Related to Tobacco Use

Mainly based on the Theory of Planned Behavior (TPB; Ajzen, 1991, 2020), researchers have evidenced the role of three *psychosocial* factors related to smoking behavior among youth and university students. The TPB model considers the major role of three factors, namely, attitudes, subjective norms,

and perceived behavioral control, to understand and predict a behavior. *Attitudes* are defined as people's favorable or unfavorable evaluations of performing a target behavior. *Subjective norms* refer to people's "normative beliefs" about whether the people they care about (e.g., friends, parents, and coworkers) approve or disapprove of a particular behavior and their motivation to align with these significant others. *Perceived behavioral control* refers to the feeling of being able to enact a target behavior, which is associated with beliefs of controllability and self-efficacy (Fishbein & Ajzen, 2011; Montaña & Kasprzyk, 2015). Controllability is the degree to which people perceive that they have control over performing a target behavior (i.e., how easy or difficult it is to engage in an action), and self-efficacy reflects one's confidence in one's ability to act and successfully execute behaviors required to produce desired outcomes. Among a range of theoretical models (see Webb & Sheeran, 2006 for a meta-analysis), the TPB is the most widely applied and best predicts behavior. In the specific context of tobacco use, several studies have shown that *attitudes* toward smoking, or students' evaluations of smoking (e.g., Mao et al. 2009), and *subjective norms* related to smoking, students' perceptions about whether important others approve of smoking (e.g., Riou França et al., 2009), are positively associated with smoking behavior, whereas *perceived behavioral control* to smoke, or students' sense of feeling able to not smoke, is negatively related to smoking (e.g., Jalilian et al., 2016; Martinelli, 1999). Beyond these psychosocial factors, research has also shown that a third category of psychological factors, derived from identity theories, enhances our understanding of tobacco use.

Smoker Identity Related to Tobacco Use

Smoker identity appears to be another key factor related to smoking behavior. Whereas different perspectives exist (e.g., social-cognitive theory, Kendzierski & Whitaker, 1997; the self-perception theory, Bem, 1972; and the PRIME theory, West & Hardy, 2007), identity can be defined as an individual's belief that a behavior can help one define oneself as an individual (self-identity, Hertel & Mermelstein, 2016) and as a member of a social category (i.e., social identity, Tajfel, 1974). Smoker identity is thus the extent to which students view themselves as smokers (Rosa & Aloise-Young, 2015). Considerable research on adolescents, adults and university students has shown the significant role of smoker identity in smoking. Having a smoker identity is positively related to smoking behavior and

tobacco dependence among adolescents (Hertel & Mermelstein, 2012), adults (Tombor et al., 2013) and university students (Levinson et al., 2007; Moran et al., 2004). Consequently, the level of smoker identity is positively associated with smoking frequency among adults (Choi et al., 2010) and university students (Levinson et al., 2007). In addition, college students who smoke to a lesser extent do not necessarily consider themselves smokers (Brown et al., 2011; Levinson et al., 2007; Rosa & Aloise-Young, 2015).

The Present Study

Previous studies clearly show that *motivational*, *psychosocial*, and *identity*-related factors are important psychological factors involved in smoking among university students. However, quantitative (Levinson et al., 2007; Moran et al., 2004) but especially qualitative (Brown et al., 2011; Rosa & Aloise-Young, 2015) studies have shown that the psychological determinants of smoking among students could be different and, more importantly, interact with each other. As researchers often study these factors separately on the basis of different theories rather than simultaneously considering them to provide a comprehensive account of smoking, these interactions may not be sufficiently documented. Furthermore, different combinations acting on psychological determinants may play a decisive role in smoking and thus in the obstacles encountered in quitting smoking among university students. Consequently, we argue that the simultaneous assessment of these three main categories of psychological factors could lead to the identification of different psychological profiles of university student smokers, as has been done for adult smokers (Pancani et al., 2015) and other substance uses, such as alcohol (Lannoy et al., 2017) and cannabis (Pearson et al., 2017). Through a cluster analysis, we explored (1) the respective involvement and combination of these key psychological factors in different subgroups of university student smokers and then (2) examined their associations with levels of tobacco dependence and motivations to quit.

Based on the literature, we expected to identify and/or gain a deeper understanding of several smoker profiles among university students. First, it was expected that two profiles of smokers would be distinguished according to rather positive motivations (i.e., social and pleasure) and rather negative motivations (i.e., coping). For the former, previous studies have shown that light smokers smoke to a

greater extent with others (Thrul et al., 2014). Additionally, other studies have shown that these social motivations to smoke appear to be associated with a weak smoker identity and low motivation to quit (Berg et al., 2009, 2010; Brown et al., 2011; Moran et al., 2004) but have not yet been related to psychosocial factors. For the latter, some students appear to smoke mainly to cope with stress in a specific period of time (e.g., before an academic test; Rosa & Aloise-Young, 2015), which seems to be associated with weak normative pressures to smoke and motivations to quit. Nevertheless, the role of the identity-related factor in these smokers does not seem to have been explored yet. Second, we expected some university students to smoke due to normative pressure, as it has been shown that social norms have a strong influence on tobacco use (Riou França et al., 2009). Despite showing an association with a positive attitude toward smoking (Moran et al., 2004), no studies have further investigated the role of identity- and motivational-related factors among these smokers. Third, we expected some smokers to be distinguished primarily by their confidence in their ability to quit smoking and the strength of their smoker identity. Indeed, associations between a strong smoker identity, less confidence in quitting and strong tobacco dependence have been evidenced (Dupont et al., 2015), but they have not yet been related to motivational factors. In contrast, another study showed a somewhat different psychological pattern among students associating lower smoking levels, perceptions of not being addicted, a lack of normative pressure to smoke and smoker identity (Levinson et al., 2007). On the whole, evidence from both qualitative and quantitative studies shows differences in and interplays between psychological antecedents of smoking among students. Therefore, this study aimed to identify and clarify psychological subgroups of smokers to deepen our understanding of smoking among university students. Moreover, this typology could help elaborate more appropriate prevention campaigns by targeting specific barriers to quitting adapted to specific smokers' profiles.

Methods

Procedure and Participants

This study was carried out on a convenience sample of 909 students (see Figure 1 for a flow diagram) of the University of Caen Normandy (France). The participants were recruited by mail at their

institutional addresses and were asked if they wished to participate in an online survey on tobacco smoking (via the Limesurvey® application, March 2019). No compensation was provided to the participants. Based on the approximately 28.3% proportion of university students who smoke in France (Pasquereau et al., 2017), the response rate (17.1%) is similar to that of other studies carried out on college students (Lannoy et al., 2017).

Figure 1 about here

Ethics

All participants took part in the study voluntarily and gave their consent before starting the survey. The protocol was approved by the Data Protection Officer (DPO) of the university, and the participants' anonymity was guaranteed by the University Information System Direction (DSI). The survey was conducted in full agreement with the Declaration of Helsinki (2008) and the ethical standards set by the university's psychology department, which follows the American Psychological Association Ethical Principles of Psychologists and the Code of Conduct (APA, 2017) for the ethical treatment of human participants.

Measures

The online survey assessed (a) sociodemographic variables; (b) smoker identity; (c) psychosocial factors related to smoking; (d) smoking motives; and (e) smoking-related variables (details of all measures and items described below are available in the supplemental online material at https://osf.io/fsjy4/?view_only=f2b4c59d42824c06add672cb9972bc17).

Sociodemographic Variables

The sociodemographic variables measured include gender, age, academic level, the age of smoking onset, and parents' smoking habits.

Smoker Identity

Smoker identity was assessed using the Smoker Self-Concept Scale (SSCS; 5-item Likert-type scale ranging from 1 = *do not agree* to 5 = *agree very much*; Cronbach $\alpha=.85$, Shadel & Mermelstein, 1996). A sample item is “Smoking is part of my self-image.” The SSCS assesses the importance of being a smoker to one’s self-concept and has shown considerable predictive and discriminant validity as well as good internal consistency (Shadel & Mermelstein, 1996).

Psychosocial Factors of Smoking

The items used to measure the three psychosocial factors were derived from the TPB (Ajzen, 1991; Jalilian et al., 2016). They assessed *attitudes* toward smoking (4 items; e.g., “Smoking is for me [totally unpleasant – totally pleasant]”), perceived subjective norms related to smoking (3 items; e.g., “Most people whose opinions I value approve of me smoking”), and perceived behavioral control to resist smoking (3 items; e.g., “Not smoking if people smoke is for me”) rated on a Likert-type scale scored from 1 = *do not agree* to 5 = *agree very much*.

Smoking Smoking Motives

Smoking motives were assessed using the seven-factor Modified Reasons for Smoking Scale (MRSS, Berlin et al., 2003), which measures addiction (e.g., When I have run out of cigarettes, I find it almost unbearable until I can get more), pleasure from smoking (e.g., I want to smoke most when I am comfortable and relaxed), sedation (e.g., I smoke more when I am worried about something), social motivation (e.g., It is easier to talk and get on with other people when smoking), stimulation (e.g., I like smoking while I am busy and working hard), automatism (e.g., I have found a cigarette in my mouth without recalling putting it there), and handling (e.g., I smoke for the pleasure of having something to put in my mouth) subscales (21 items rated from 1 = *not at all* to 5 = *absolutely*). The MRSS assesses the influence of these seven reasons to smoke and has shown good predictive and discriminant validity as well as an acceptable level of reliability (Berlin et al., 2003).

Smoking-related Variables

Smoking-related variables measured include the assessment of tobacco dependence, the

motivation to quit and recent attempts to quit. Tobacco dependence was assessed using the Cigarette Dependence Scale (CDS-12, Etter et al., 2003). This 12-item (e.g., “Usually, how soon after waking up do you smoke your first cigarette?”) self-report questionnaire provides a continuous score for cigarette addiction. The scale overcomes the psychometric limitations of the Fagerström Test for Nicotine Dependence (FTND), seems to be more adapted to moderate smokers than the FTND (Etter, 2005), and covers important elements of dependence that cannot be assessed with the FTND (Etter et al., 2003). The CDS-12 has shown considerable internal consistency, predictive validity, and test-retest reliability (Etter et al., 2003). The motivation to quit smoking was assessed by the single item of the Motivation to Stop Scale (MTSS, Kotz et al., 2013). Participants were asked to choose which of the following statements best fit them: 1- I don't want to stop smoking; 2- I think I should stop smoking but don't really want to; 3- I want to stop smoking but haven't thought about when; 4- I REALLY want to stop smoking but I don't know when I will; 5- I want to stop smoking and hope to soon; 6- I REALLY want to stop smoking and intend to do so in the next 3 months; and 7- I REALLY want to stop smoking and intend to do so in the next month. Previous studies have shown that this single-item measure has at least as strong a correlation with future attempts to quit as other measures of the motivation to quit (Hummel et al., 2018). Finally, recent attempts to quit were measured with a single item asking participants to indicate how many serious attempts to quit smoking they had made over the last 12 months (coded as 0 for no recent attempts made to quit and as 1 for one or more attempts made to quit, Perski et al., 2018).

Statistical Analyses

First, we examined the factorial structures of the identity-related and psychosocial variables and the MRSS by performing CFAs with the full information maximum likelihood method (Hu & Bentler, 1999). Second, a cluster analysis was performed to identify subgroups of students among the 909 smokers by including in the model the smoker identity variable, the three psychosocial variables, and the seven smoking motives. As recommended by current theoretical trends (Hair et al., 2010), a hierarchical method was first realized to determine the optimal number of clusters (using Ward's method with a squared Euclidean distance measure), and then a nonhierarchical K-means analysis was performed to identify the cluster membership of smokers. All variables included in the analysis were z

scored to make a reliable comparison. Finally, using analyses of variance (ANOVA) and Chi², comparisons were drawn between the obtained clusters on the external correlates, namely, sociodemographic and smoking-related variables.

Results

Characteristics of the Sample

Table 1 presents the participants' characteristics. Among the 909 smokers ($M_{age} = 20.60$, $SD = 2.24$), 68.6% were female and 80.6% were undergraduates. The participants had been smoking for an average of 4.50 years ($SD = 2.66$). According to the CDS-12 criteria (Etter et al., 2003), 30.6% of smokers exhibited light tobacco dependence (i.e., score < 25), 54.5% exhibited moderate dependence (i.e., $25 \leq \text{score} \leq 44$) and 15% exhibited heavy dependence (i.e., score ≥ 45). Whereas almost half of the smokers included (45.55%) had tried to quit smoking in the past year, a majority (59.4%) had not considered quitting smoking.

Table 1 about here

Factorial Structures of the Measures

The CFA performed on the 5 items of smoker identity indicates acceptable fit statistics ($\chi^2(5) = 48.5$, $p < 001$, CFI = .98, TLI = .96, RMSEA range 0.074–0.124). The factor loadings are available in the supplemental materials (see Supplemental Table 1). The internal consistency of the 5 items is good (Cronbach's $\alpha = .85$).

The CFA performed on the 10 items of psychosocial variables indicates acceptable fit statistics ($\chi^2(32) = 245$, $p < 001$, CFI = .92, TLI = .89, RMSEA range 0.076–0.096). The factor loadings are available in the supplemental materials (see Supplemental Table 2). The results indicate that attitudes (Cronbach's $\alpha = .68$), subjective norms (Cronbach's $\alpha = .73$), and perceived behavioral control

(Cronbach's $\alpha = .78$) are statistically reliable.

For the 21-item MRSS, the CFA indicates acceptable fit statistics ($\chi^2(168) = 691, p < .001, CFI = .92, TLI = .90, RMSEA \text{ range } 0.054\text{--}0.063$). The factor loadings are available in the supplemental materials (see Supplemental Table 3). The internal consistencies of automatism (Cronbach's $\alpha = .63$), sedation (Cronbach's $\alpha = .88$), social motivation (Cronbach's $\alpha = .65$), pleasure (Cronbach's $\alpha = .53$), addiction (Cronbach's $\alpha = .80$), handling (Cronbach's $\alpha = .66$), and stimulation (Cronbach's $\alpha = .72$) are acceptable.

Profiles of Smoking University Students

The cluster analysis reveals an optimal five-cluster solution (see Figure 2). The five clusters encompass 19.2%, 20.7%, 24.0%, 14.4%, and 21.7% of the sample (see Table 2). As recommended by some researchers (Hair et al., 2010), each cluster encompasses more than 10% of the sample.

Figure 2 about here

Table 2 about here

We analyzed the differences between clusters on the main/clustering variables, namely, smoker identity, psychosocial variables, and smoking motives, as well as differences between clusters on external correlates. The results support the reliability of the five subgroups (see also Table 3 for statistical details). Cluster 1, including “normative smokers”, is mainly characterized by strong attitudes and subjective norms regarding smoking and is associated with moderate tobacco dependence and a low level of motivation to quit. Cluster 2, including “sociohedonist smokers”, is characterized by strong social, pleasure-related and stimulation motives accompanied by moderate tobacco dependence and a low level of motivation to quit. Cluster 3, including “dependent identified smokers”, is characterized by a strong adherence to the seven smoking motives and especially automatism, handling and addictive

motives; a strong smoker identity; a positive attitude toward smoking; and less perceived behavioral control to resist smoking. In addition, this subgroup of smokers is the most dependent on tobacco, reports few past attempts to quit, and appears to have a low motivation to quit. Cluster 4, including “inconsistent smokers”, is characterized by weaker smoking motives, smoker identity, attitudes and subjective norms but a high level of perceived behavioral control to resist smoking. In addition, these smokers exhibit low tobacco dependence and indicate an intention to quit smoking. Cluster 5, including “coping smokers”, is characterized by strong sedative, addictive, and handling motives and weak attitudes and subjective norms regarding smoking. This subgroup of smokers exhibits moderate tobacco dependence and reports a more past attempts to quit smoking as well as a stronger motivation to quit.

Regarding sociodemographic variables, Cluster 5 students are older than those of the other clusters, whereas the age of smoking onset is lower for Clusters 1, 3 and 5. Clusters 1 and 5 students most often have parents who smoke. This pattern is not as widespread in Cluster 1. Last, academic level and gender characteristics do not differ between the five clusters.

Table 3 about here

Discussion

The present study is the first to investigate the combined role of psychosocial, identity and motivational factors in tobacco use. It thus allows us to identify smoker psychological profiles among university students to further understand tobacco dependence and motivations to quit. The cluster analysis reports five smoker profiles that vary in terms of motivational, psychosocial and identity characteristics as well as in terms of tobacco dependence and the motivation to quit. Thus, two important elements must be discussed. First, we review each of the profiles identified, from the most tobacco dependent to the least dependent, and show how these profiles shed light on the relation between tobacco dependence and the motivation to quit. Second, we highlight the practical implications of our findings in terms of prevention and propose that smoking reduction strategies be adapted to students' psychological profiles.

Five Psychological Smoker Profiles related to Tobacco Dependence and the Motivation to Quit

By considering potential interactions between three key psychological variables related to smoking, our results offer a clearer and more comprehensive account of university student smokers. These profiles support the few qualitative studies conducted on student smokers and appear to offer some insight into the "nonlinear" relationship between tobacco dependence and the motivation to quit.

The "dependent identified smokers" (Cluster 3) appear to be the more problematic group, as they are the most addicted to tobacco. They adhere to all smoking motives, and even more so for dependence motives, a pattern is traditionally be found among heavy adult tobacco users (Pancani et al., 2015). They are also characterized by a strong smoker identity, which has recently been identified as an extreme barrier to quitting smoking in adults (Falomir-Pichastor et al., 2020), and they did not report past attempts to quit or intentions to quit. Research has shown that this type of smoker is likely to develop a positive smoker identity (Jarvis, 2003). Moreover, these individuals indicated a moderate level of normative beliefs regarding smoking, meaning that they know that smoking is disapproved of by others but are not influenced by these beliefs. This could be consistent with studies showing that the more dependent people are, the more dependence motives become the priority over surrounding norms (Piasecki et al., 2007). Research has also shown that some smoker students react negatively to smoking bans (Blondé & Falomir-Pichastor, 2021). To deepen our understanding of these "dependent identified smokers", it would be interesting to further investigate whether they have developed not only a strong smoker identity but also a positive smoker identity (Tombor et al., 2013).

"Coping smokers" (Cluster 5) displayed moderate tobacco dependence explained by strong sedative, addictive, and handling motives. This smoking pattern could be viewed as a maladaptive emotion regulation strategy, since both qualitative and quantitative research of adolescents and adults has shown that cigarettes may perform this emotion regulation function for smokers (Kobus, 2003; Piasecki et al., 2007). Furthermore, other studies have shown that this function is more present in smokers with some psychological distress (e.g., high levels of anxiety and impulsivity, Comeau et al., 2001). Thus, further research could more precisely explore the reason why these smokers need to regulate their emotions. Reasons could be related to some studies showing that stress and negative mood

are related to smoking behavior among university students (e.g., Brown et al., 2011), and some students smoke to cope with stress during the academic period (Hayes & Plowfield, 2007).

Whereas the tobacco dependence of “normative smokers” (Cluster 1) and “sociohedonist smokers” (Cluster 2) seems to be explained by social factors (subjective norms for the former and social and pleasure motives for the latter), these are two distinct profiles of smokers underpinned by two distinct motivations to smoke. On the one hand, “sociohedonist smokers” seem to match what researchers have previously referred to as “social smokers” (Moran et al., 2004). “Social smokers” smoke mainly in the presence of others, in bars and at parties (Gilpin et al., 2005), and have a low level of dependence (Shiffman et al., 1994). Our study goes further in the understanding these “social smokers” by showing that they also smoke for the enjoyment they derive from it (i.e., pleasure from smoking), which is precisely why we call them “sociohedonist smokers.” On the other hand, the tobacco dependence of Cluster 1 students can mainly be explained by strong perceived norms regarding smoking. This is in line with previous studies showing the important role of normative influence among youth in beginning and maintaining smoking (Riou França et al., 2009). Additionally, according to research on the influence of social norms, we know that people behave in accordance with norms to seek acceptance from others and to avoid social rejection (Cialdini & Goldstein, 2004). In summary, sociohedonist students seem to smoke for positive outcomes (for fun and to socialize) while normative smokers smoke to prevent negative outcomes (such as social rejection from peer groups). Thus, our study makes it possible to psychologically distinguish these two groups apparently similar of smokers. This should invite future research considering these groups individually, particularly for prevention purposes.

Last, the subgroup of “inconsistent smokers” (Cluster 4) is particularly interesting due to its inconsistencies. While these are smokers, they indicate not identifying as smokers, have weak smoking motives and a negative attitude toward smoking, perceive antitobacco norms, and exhibit strong behavioral control to resist smoking. Taken together, these results lead us to question whether these students are aware that they are tobacco smokers. This echoes some qualitative findings showing that many smoker students self-categorize as nonsmokers (Rosa & Aloise-Young, 2015), have a nonsmoker identity that is related to a lower likelihood of having tried to quit, exhibit a negative attitude toward

smokers, name fewer reasons for smoking, and exhibit a lesser perception of being addicted to tobacco (e.g., Levinson et al. 2007). The fact that some students deny being smokers (Levinson et al., 2007) could explain such inconsistencies among this subgroup of smokers. In addition, it may be interesting to study whether such inconsistencies between what these individuals should do (not smoke) and what they actually do (smoke) may generate cognitive dissonance (Fointiat et al., 2013) because in such cases, one way to regain a state of cognitive balance would be to stop smoking. Exploring cognitive dissonance and its related emotions could be an interesting future means to further understand this profile of smokers.

Beyond underlining the heterogeneity among smokers by identifying five subgroups, our assessment of the three key psychological variables related to smoking improves our understanding of tobacco dependence in relation to the motivation to quit. Indeed, research of adult smokers indicates a nonlinear relationship between dependence and smoking cessation. At times, higher dependence reduces the likelihood of success in quitting smoking (Etter, 2005; Oksuz et al., 2007) or leads to a motivation to quit (Perski et al., 2018) and success in quitting (Etter, 2005). From these smoker profiles, it seems that we observe a nonlinear relationship between dependence and the motivation to quit. However, we go further by showing that this relationship could be due to psychological factors underlying smoking. On the one hand, some students with a higher level of dependence are motivated to quit smoking (“coping smokers”), while others are not (“dependent smokers”). Consistent with previous findings (Falomir-Pichastor et al., 2020; Lee et al., 2014), smoker identity and positive beliefs about tobacco seem to constitute major barriers to quitting. On the other hand, some students with a low level of tobacco dependence have the intention to quit (“inconsistent smokers”) or do not (“normative and “sociohedonist smokers”). Barriers to quitting seem to relate to the immediate social benefits of smoking (e.g., enjoyment and seeking others’ acceptance) and lesser perceived control to resist smoking for smokers with a low level of dependence. Overall, these findings are consistent with recent data (Mauduy et al., 2022) showing that psychosocial factors may play a more important role in explaining the motivation to quit smoking, while identity- and motivation-related factors may play a more important role in explaining tobacco dependence.

Developing Interventions Adapted to Each Smoker Profile's Barriers to Quitting Smoking to Reduce Tobacco

Beyond providing a more comprehensive typology of university student smokers, this study identifies which psychological barriers need to be addressed for each student profile to support them in quitting smoking.

First, normative beliefs related to smoking seem to be a major barrier to reducing smoking for “normative smokers”. As research shows that students overestimate substance use (e.g., Perkins et al., 2019), changing their normative beliefs would thus be a solution. A strategy developed for this purpose could involve providing personalized normative feedback (Steinberg et al., 2004; Vallentin-Holbech et al., 2018). Concretely, university student smokers could be asked to answer questions about their attitudes toward smoking and the numbers of students they estimate to be smokers and nonsmokers. Then, personalized feedback could be returned to each normative smoker reflecting three elements with charts: their own attitudes toward smoking, the perceived numbers of students who are smokers and nonsmokers, and the actual numbers of students at their university who are smokers and nonsmokers.

Second, the positive outcomes of smoking (i.e., social, pleasure and stimulation) that “sociohedonist smokers” perceived reduced their intention to quit smoking and their smoking cessation. Emphasizing both the potential gains (positive outcomes) of quitting and losses (negative outcomes) from continuing smoking could enhance their motivation to quit smoking. Providing information objectively through a framing technique (Gallagher & Updegraff, 2012) is an efficient means to improve attitudes and intentions surrounding behavior (see Steinmetz et al., 2016 for a meta-analysis).

Third, “coping smokers” seem to use tobacco to cope with and regulate their negative emotions. Helping these individuals develop appropriate emotional regulation strategies would be a means to encourage smoking cessation. To this end, mindfulness-based and cognitive-behavioral stress reduction interventions (Smith et al., 2008) are effective for many health-related problems (see Butler et al., 2006 for a review) and thus could be provided to students during individual interviews.

Fourth, the primary barrier for “dependent identified smokers” lies in their strong smoker identity. While the reduction of this smoker identity would be necessary to reduce smoking behavior

and tobacco dependence (see, for example, Falomir-Pichastor et al., 2020), a first step could involve encouraging smokers to define themselves not only as smokers but also as members of other social groups. For this purpose, a multicategorization process (Kang & Bodenhausen, 2015) could involve making prominent in the individual a series of ingroup categorical affiliations other than the target one, reducing the salience of the problematic identity to reduce its potential role in driving behaviors (see Crisp & Hewstone, 2007 for a review). In practical terms, smokers could write a few sentences about four other categories to which they belong (e.g., music groups or television show fan groups) to reduce the influence of the problematic “smoker” category.

Fifth, one action lever for helping “inconsistent smokers” bring their smoking behavior in line with their strong personal and normative beliefs against smoking could involve targeting this belief-behavior inconsistency. This could be achieved via the cognitive dissonance process (Festinger, 1957) and more specifically the induced-hypocrisy paradigm (Priolo et al., 2019), which aims to lead people to adopt behavior in accordance with their personal and normative beliefs. The efficacy of the hypocrisy paradigm has been demonstrated in many fields and in relation to problematic behavior (see Mauduy, 2022 for a review). Concretely, a two-step procedure could involve first asking smokers to publicly advocate for the importance of not smoking and then asking them to complete a questionnaire about their current tobacco use. Making salient the inconsistency between what they think about smoking and what they do (smoke) would increase their likelihood of changing their behavior in the future, namely, quitting smoking.

Thus, in general, it would be better for any smoking prevention program to start with an initial diagnostic stage that would make it possible to identify the different psychological reasons why university students smoke tobacco and then to adapt the proposed interventions to the different profiles. Given the heterogeneity of smoker profiles in universities, this profiling seems essential to effectively support students in smoking cessation.

Limitations

The limitations of this study mainly concern the lack of other measures used to verify our results. First, a biochemical measure of tobacco dependence (Bize et al., 2009) or a combination of measures

(Hughes et al., 2004) would have provided an interesting complement to self-reported measures. Nevertheless, we used the self-reported dependence measure that appears to be the most reliable, effective and comprehensive measure of tobacco dependence to date (Etter, 2005). Second, this study would benefit from a more comprehensive measure of smoker identity. In addition to the self-concept of identity that measures both the personal and social identity of smokers (Shadel & Mermelstein, 1996), people can have other smoker-related identities, such as a positive smoker identity (Tombor et al., 2013), social smoker identity (Hertel & Mermelstein, 2016), and nonsmoker identity (Levinson et al., 2007). Such assessments would further enhance our understanding of the psychological profiles of smokers, especially for highly dependent smokers. Third, other external correlates could have been measured, such as emotional and personality factors (e.g., anxiety and positive and negative affect; Comeau et al., 2001) and other substance use habits (e.g., alcohol and cannabis use; Riou França et al., 2009), because they can be associated with smoking, smoking motives and “social smoking” (Ma et al., 2000). Finally, further studies need to confirm these smoker profiles because the cluster analytic approach is sample dependent. Hence, the generalizability of the findings, both throughout France and internationally, could be impacted, as this study was conducted at a single site.

Conclusion

The present simultaneous consideration of several factors related to smoking among university students shows that smoking students are not to be considered a single group. They belong to different subgroups related to distinct psychological factors and levels of tobacco dependence and motivation to quit. While university students are often considered “light” smokers (Thompson et al., 2007), this research seems somewhat alarming, as it highlights that most students have moderate tobacco dependence and that a nonnegligible proportion is highly dependent. In addition to providing a deeper understanding of smoking consumption among university students, this research has major implications in terms of prevention. Scientific literature consistently shows that a great majority of students report a failure to quit smoking, and current interventions struggle to support youth in quitting (Villanti et al., 2020). Our study therefore suggests that interventions should not be identical for all students but rather need to be adapted to specific subgroups of smokers to enhance prevention actions. New interventions

should both target different smokers' stages of change (DiClemente & Prochaska, 1982), i.e., making them willing to quit or preparing them to take action, and focus on specific psychological barriers to quitting for each smoker profile.

Declaration of Interest Statement

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Tables and Figures

Table 1

Sample Characteristics

Sociodemographics	Mean (SD)
Females (%)	68.60
Males (%)	31.4
Age (in years)	20.60 (2.24)
Academic level	
Undergraduate (%)	80.6
Graduate (%)	19.4
Age of on-set smoking (in years)	16.10 (1.75)
Parents smokers (%)	53.7
Smoking-related variables	
CDS-12 – Tobacco dependence	31.80 (11.20)
MTSS – Motivation to quit smoking	2.89 (1.71)
Recent attempts to quit smoking (%)	45.55
Identity variable	
Smoker identity	2.25 (0.98)
Psychosocial variables related to smoking	
Attitude	2.78 (0.65)
Subjective norms	2.62 (0.94)
Perceived behavioral control	2.77 (1.12)
Motivational variables related to smoking	
Addictive	2.52 (1.13)
Automatism	1.37 (0.58)
Handling	2.71 (0.98)
Pleasure	3.14 (0.86)
Sedative	3.67 (1.11)
Social	3.28 (0.92)
Stimulation	2.14 (1.00)

Note. Except for gender, educational level, and recent attempts to quit, data show means (standard deviations); CDS: Cigarette Dependence Scale; MTSS: Modified Reasons for Smoking Scale.

Table 2*Statistical indices for the five smokers' clusters*

	Clusters	1	2	3	4	5
<i>N</i>	909					
<i>R</i>²	0.42					
AIC	5941.07					
BIC	6205.75					
Size		175	188	218	131	197
Explained proportion within-cluster heterogeneity		0.150	0.216	0.297	0.222	0.115
Within sum of squares		872.05	1259.82	1733.21	1294.56	671.43

Table 3*Comparisons between the five smokers' clusters*

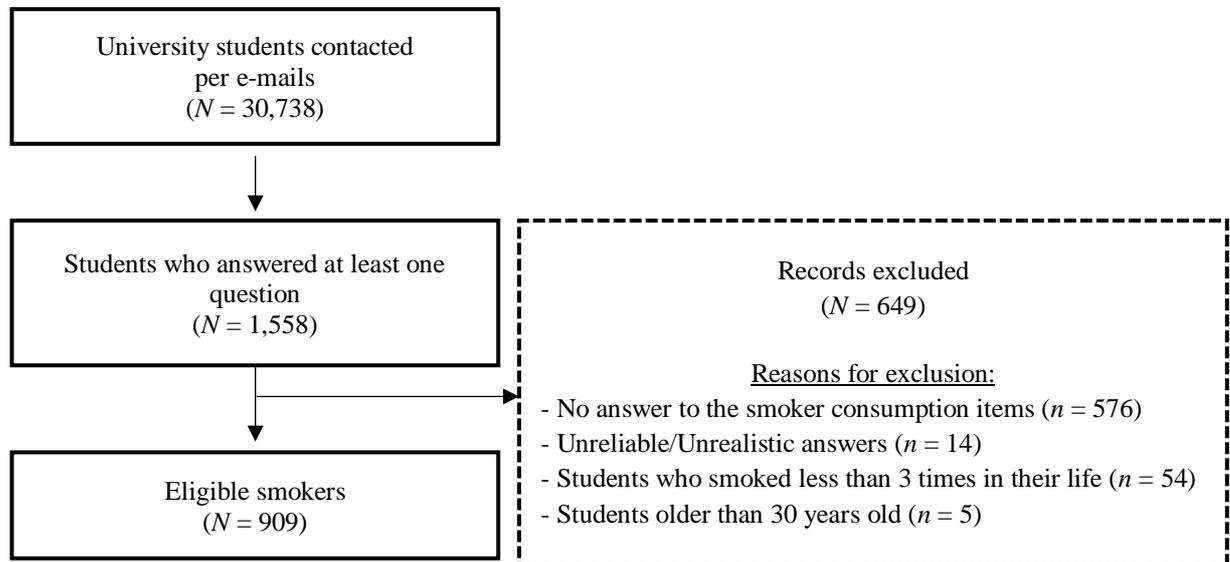
Variables	Min-Max	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	<i>F</i>	η^2	Comparisons
		(n=175; 19.2%)	(n=188; 20.7%)	(n=218; 24.0%)	(n=131; 14.4%)	(n=197; 21.7%)			
		Normative smokers	Socio-hedonist smokers	Dependent identified smokers	Inconsistent smokers	Coping smokers			
		Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)			
Cluster profiles									
<i>Psychosocial variables</i>									
Attitude towards smoking	1.0-5.0	3.08 (0.531)	2.66 (0.464)	3.24 (0.532)	2.11 (0.578)	2.58 (0.546)	119***	.35	C4<C5=C2<C1<C3
Subjective norms for smoking	1.0-5.0	3.59 (0.658)	2.34 (0.879)	2.81 (0.816)	2.08 (0.816)	2.15 (0.718)	115***	.34	C4=C5<C2<C3<C1
PBC to resist smoking	1.0-5.0	2.94 (0.844)	2.99 (0.667)	1.89 (0.667)	4.42 (0.702)	2.27 (0.749)	240***	.52	C3<C5<C1=C2<C4
<i>Identity variable</i>									
Smoker identity	1.0-5.0	2.22 (0.814)	1.76 (0.570)	3.23 (0.828)	1.18 (0.324)	2.34 (0.778)	202***	.47	C4<C2<C1=C5<C3
<i>Motivational variables</i>									
Addictive	1.0-5.0	2.27 (0.821)	1.80 (0.681)	3.63 (0.804)	1.15 (0.351)	3.11 (0.754)	332***	.60	C4<C2<C1<C5<C3
Automatism	1.0-4.33	1.18 (0.338)	1.10 (0.246)	1.96 (0.757)	1.04 (0.176)	1.33 (0.412)	130***	.37	C4=C2=C1<C5<C3
Handling	1.0-5.0	2.25 (0.796)	3.21 (0.851)	3.24 (0.888)	1.93 (0.787)	2.58 (0.858)	80***	.26	C4<C1<C5<C2=C3
Sedative	1.0-5.0	3.73 (0.838)	3.23 (0.927)	4.45 (0.561)	2.03 (0.998)	4.24 (0.565)	243***	.52	C4<C2<C1<C5<C3
Pleasure	1.0-5.0	3.26 (0.735)	3.54 (0.716)	3.51 (0.584)	2.15 (0.922)	2.88 (0.670)	99.2***	.31	C4<C5=C1<C3=C2
Social	1.0-5.0	3.23 (0.798)	3.51 (0.743)	3.83 (0.759)	2.39 (0.897)	3.08 (0.819)	73.7***	.25	C4<C5=C1<C2<C3
Stimulation	1.0-5.0	1.91 (0.695)	1.52 (0.614)	3.14 (0.832)	1.20 (0.456)	2.44 (0.848)	207***	.48	C4<C2<C1<C5<C3
External correlates									
Age	18-30	20.6 (2.17)	20.4 (2.07)	20.3 (2.16)	20.4 (2.11)	21.1 (2.51)	4.61**	.02	C1=C2=C4=C3<C5
Age of smoking onset	10-25	15.9 (1.50)	16.5 (1.62)	15.6 (1.62)	16.3 (1.95)	16.1 (1.93)	8.15***	.04	C3(=C1)<C5=C4=C2
CDS12 -Tobacco dependence	12-57	29.5 (7.79)	25.1 (6.85)	42.7 (7.13)	17.5 (5.30)	37.5 (7.08)	356***	.61	C4<C2<C1<C5<C3
MTSS - Motivation to quit	1-7	2.46 (1.48)	2.85 (1.75)	2.56 (1.41)	3.19 (2.23)	3.53 (1.62)	12.9***	.06	C1=C2=C3<C4=C5
	Mean	Percentage	Percentage	Percentage	Percentage	Percentage	χ^2		
Gender (% females)	68.60	69	70.2	73.6	58.9	69.5	8.44		
Academic level (% graduate)	19.4	17.4	21.3	15.6	19.8	22.8	4.27		
Parents smokers (%)	53.7	63.4	39.9	55	43.5	63.5	34.2***		C2=C4<C3<C1=C5
Recent attempts to quit (%)	45.55	34.5	48.1	43.2	37.2	60.6	30.4***		C1=C4=C2=C3<C5

Note. Comparisons between Clusters are computed by post-hoc t-tests (Tukey) for continuous variables. Significant at * $p < .05$; ** $p < .01$; *** $p < .001$. PBC: Perceived Behavioral Control.

PSYCHOLOGICAL PROFILES OF UNIVERSITY STUDENT SMOKERS

Figure 1

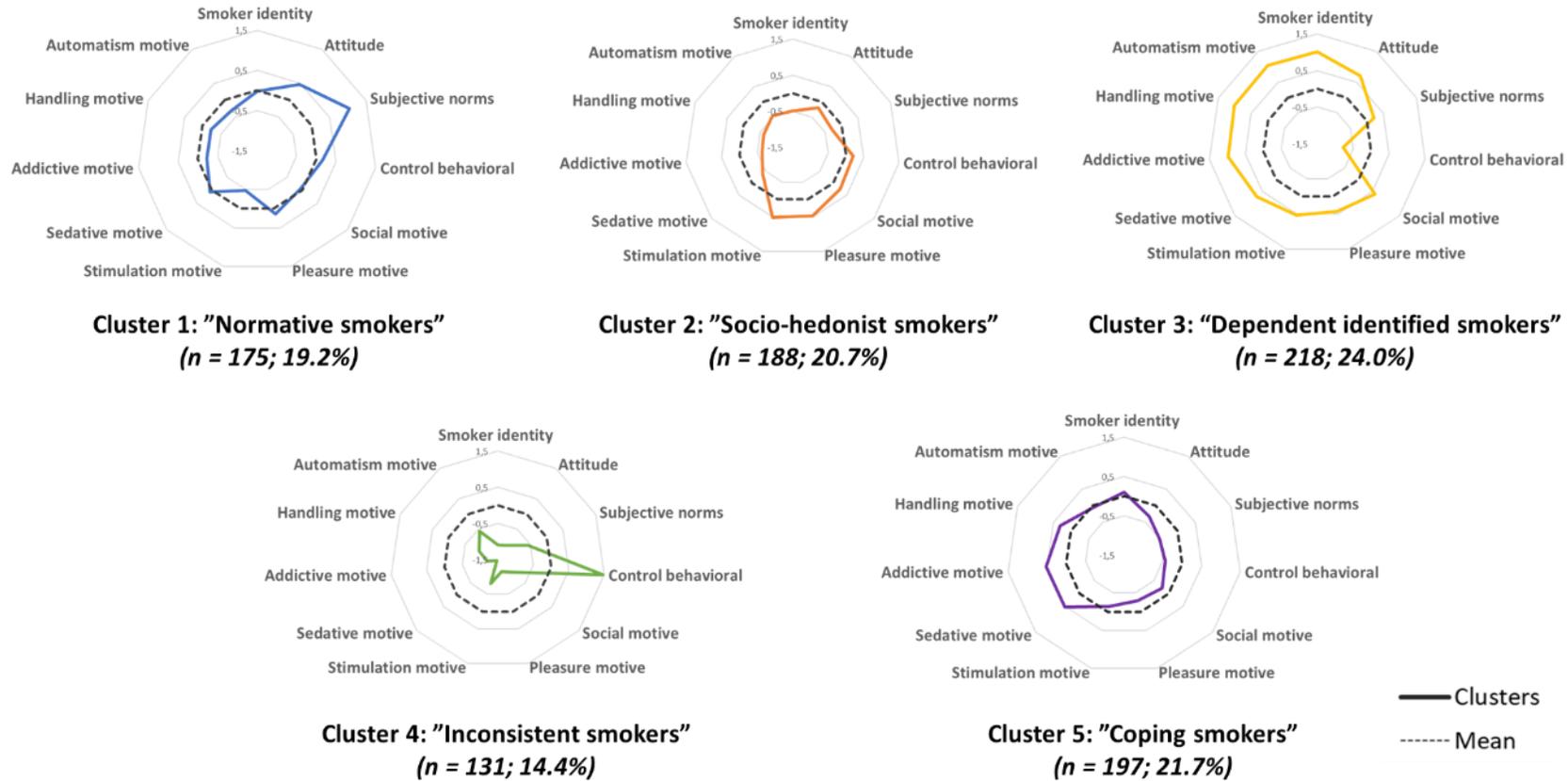
Flow Diagram of Data Processing and Inclusion



PSYCHOLOGICAL PROFILES OF UNIVERSITY STUDENT SMOKERS

Figure 2

The Five Smokers' Clusters



Note. Subgroups of smokers determined by cluster analysis according to measures of psychosocial variables related to smoking (Attitude, Subjective norms and Perceived behavioral control), smoker identity variable, and smoking motives variables (Automatism, Handling, Addictive, Sedative, Stimulation, Pleasure, and Social). The presented scores are based on z-scores calculation.