Original article

Stress, attention deficit hyperactivity disorder (ADHD) symptoms and tobacco smoking: The i-Share study

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Abstract

Background: The contribution of mental health to the risk of smoking is increasingly acknowledged but still insufficiently studied during the key period of student life. In particular, the simultaneous action of stress and Attention Deficit Hyperactivity Disorder (ADHD) symptoms on the risk of smoking remains poorly understood.

Aims: To assess the effects of stress and ADHD symptoms on tobacco smoking.

Method: Multivariate modeling was conducted on the French i-Share study (n = 8110, median age 20.3 years, 74.8% females, 32.9% regular/occasional smokers) to evaluate the associations between stress, ADHD symptoms and tobacco smoking, adjusting for potential family/socio-demographic confounders.

Results: Students with high levels of stress were more likely to smoke > 10 cigarettes/day (adjusted odds ratio [aOR]: 1.48, 95% CI: 1.12–1.96) than those with low levels of stress. Students with high levels of ADHD symptoms were more likely to smoke > 10 cigarettes/day (aOR: 2.08, 95% CI: 1.58–2.75) than those with low levels of ADHD symptoms.

Conclusions: Stress and ADHD contribute independently to the risk of smoking. Interventions targeting each condition are likely to reduce the burden of tobacco use in students.

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1. Introduction

With more than 1 billion smokers worldwide and 6 million deaths per year, the tobacco epidemic is a major factor threatening human health and economic development [1]. Despite massive public health policies targeting its use, tobacco still remains unduly consumed, notably in western countries. France does not escape this pattern since 34.3% of adults are daily smokers [2]. While tobacco smoking is intrinsically a modifiable behavior, the highly addictive power of nicotine makes smoking cessation a daunting task. Tobacco initiation and addiction, like numerous health risk behaviors, settle down mostly during adolescence and young adulthood [3]. Student life is consequently a critical period when interventions may efficiently modify the onset of problematic behaviors and subsequently improve future outcomes. In this line, the Center for Disease Control has recently expended the age range for initiation prevention to college/university young adults [4]. Beyond the classical social risk factors for tobacco use (e.g. poverty, low education, cigarette availability, peer influences), individual mental health factors may play a crucial role [5]. In particular, stress and Attention Deficit Hyperactivity Disorder (ADHD) symptoms are two potentially important contributors that represent identifiable targets for interventions.

Stress has been shown to be associated with tobacco use (e.g. initiation, continuation and difficulties to quit) in both human and animal studies [6–8]. Epidemiological studies have shown that individuals exposed to high levels of stress report rates of cigarette smoking between two and three times higher than their non-stressed counterparts [8–10]. Engagement in smoking is often attributed to stress by individuals themselves. Indeed smoking is reported to be a means to alleviate stress and anxiety symptoms [11]. This is biologically plausible since acute nicotine modifies cerebrocortical neuroactive steroids and plasma corticosterone concentrations [12]. Stress and smoking may also have common genetic and environmental vulnerabilities. Interestingly, females...
may be more prone to smoking than men when exposed to stress
[13,14]. Some authors even suggest that stress plays a key role in
the emergence of tobacco use in women [14].

ADHD symptoms also represent significant independent risk
factors for smoking. Epidemiological and clinical studies have
repeatedly shown a consistent association between childhood/
adult ADHD and tobacco use with a twofold risk of onset and
dependence in ADHD individuals [15–17]. Although still to be
elucidated, the underlying etiology of this association may be
subsumed by several hypothesized mechanisms. In particular,
shared genetic/environmental vulnerability and clinical/neurocogni-
tive characteristics could make people with ADHD more likely
to consume tobacco [18]. Of note, the gender effect in the
relationship between ADHD and tobacco use remains unclear
owing to scarce data and contradictory results [19,20].

Limitations in the literature regarding the links between tobacco
smoking, stress and ADHD are manifold. First, stress and ADHD have
hardly been studied simultaneously. Although these two psycho-
pathological dimensions are likely related, there is scant data
regarding their association, especially in university students
[21,22]. Consequently, whether they confound each other, interact
or represent different pathways leading to smoking is still unknown.

Second, there may be gender differences with regard to the effect of
both stress and ADHD symptoms on tobacco smoking. Although
postulated, this potentially gender-specific vulnerability remains
insufficiently studied in the available data. Third, the concurrent
effects of stress and ADHD symptoms on tobacco smoking have
hardly been investigated during late adolescence and young
adulthood, yet this period is crucial in the crystallization of long-
lasting risky behaviors. Clarifying the respective contributions
of stress and ADHD symptoms to smoking in students is essential since
it may yield levers for innovative interventions.

The i-Share cohort, which is one of the largest epidemiological
studies conducted in European students, offers a unique possibility
to test whether stress and ADHD symptoms contribute independ-
ently to the risk of smoking and if the association varies according
to the sex. Addressing the key research question of the interplay
between stress, ADHD and tobacco use could open new avenues for
designing preventive and smoking cessation interventions early
on. The aim of the present study was to assess the effects of stress
and ADHD symptoms on tobacco smoking in the at-risk population
of students.

2. Material and methods

2.1. Study population

Study subjects were participants in the Internet-based Students
Health Research Enterprise (i-Share, www.i-share.fr) project, a
prospective population-based cohort study of students in higher
education institutions in France. The objectives of i-Share are to
evaluate important health aspects among university students over
the course of 10 years, including mental health, risk behaviors,
adictions, accidents, infections and migraine. Eligible participants
had to be officially registered at a university or higher education
institute (within the Universities of Bordeaux, Versailles and Nice),
be at least 18 years of age, able to read and understand French and
provide informed consent for participation. Participants were
invited to participate thanks to a recruitment campaign started in
February 2013. Students were informed about the objectives of the
study through promotion campaigns (via information stands at
registration, lectures, flyers, social media and newsletters).
Specifically, a group of trained students informed their peers
about the study and collected information to initiate the online
recruitment process. Registration was conducted in two steps:

firstly, an online portal pre-registration was required; secondly,
each student completed a self-administered online questionnaire.
The baseline inquiry collected information on students’ health,
personal and family medical histories, socio-demographic charac-
teristics, and lifestyle habits. The i-Share cohort is still ongoing.
For this specific study, we used data available as of April 29th,
2016. Only students aged between 18 and 30 years old were
included. The i-Share project on which this study was based was
approved by the Commission nationale de l’Informatique et des
libertés (CNIL) [DR-2013-019].

2.2. Measures

2.2.1. Main variables of interest: stress and ADHD symptoms

Stress: perceived stress was assessed by using the short version
of the Perceived Stress Scale (PSS-4) [23]. This self-reported
questionnaire measures the degree to which situations in one’s life
over the past month are appraised as stressful (i.e. how overloaded,
uncontrollable and unpredictable respondents find their lives).
The PSS-4 consists of four items with possible responses rated on a 0
(never) to 4 (very often) scale. The global score was obtained by
summing the items with reverse coding to score items 2 and
3. Higher scores corresponded to higher perceived stress. As the
PSS-4 is not a diagnostic instrument, no cutoff was available to
determine stressed individuals. Consequently, scores were divided
into tertiles within each gender, the lowest tertile of the score
distribution being the reference. The PSS has demonstrated good
reliability and validity in university student samples [23].

2.2.2. ADHD symptoms

Students were asked to complete questions about their behavior
during the past 6 months based on the 6-item version
of the Adult ADHD Self-Report Scale (ASRS-v1.1, available in
various languages at http://www.hcp.med.harvard.edu/ncs/asrs.
php) [24]. The ASRS-v1.1 is a screening tool and not a diagnostic
instrument. This scale lists the 6 questions found to be the most
predictive of symptoms consistent with ADHD. Each of the six
items was coded using a 5-point Likert scale ranging from never (0)
to very often (4). We calculated three different scores by summing
the items: 1: a global score (6 items); 2: an inattention symptoms
score (4 items); 3: a hyperactivity symptoms score (2 items).
Scores were then dichotomized according to the 90th centile of
the score distribution within each gender. This cutoff was chosen
in order to identify a subgroup with a high level of ADHD symptoms
in the absence of a validated cutoff in French university students.

2.2.3. Covariates

Using the self-administered online questionnaire we built the
following variables: age (continuous), sex (male/female), student
variables (including current place of living [at parents’ home/other
place], job activity [yes/no], alcohol consumption [no/rare/occasional/regular/very regular]), and family variables (including
family financial help [yes/no], parents’ marital status [separated/
not separated], parents’ educational level [no postgraduate
studies/postgraduate studies], family economic condition in
childhood [comfortable/satisfactory/difficult], family support during
childhood [high/moderate/low], parents’ alcohol or depression
problem [at least one parent has/had alcohol and/or depression
problem: yes/no]).

2.2.4. Outcomes tobacco smoking variable

If students were smokers (i.e. answered yes to the question “do
you smoke tobacco regularly or occasionally?”), the number of
cigarettes smoked per day was quantified (i.e. students answered
the question “how many cigarettes on average do you smoke
per day/week/month?”). A count number of cigarettes smoked
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