Sex and gender differences in tobacco smoking among adolescents in French secondary schools
S. Kalaboka1,2, J.P. Piau1,2, G. King3, D. Moreau1,2, M. Choquet4, I. Annesi-Maesano1,2

ABSTRACT: Sex and gender differences in tobacco smoking among adolescents in French secondary schools. S. Kalaboka, J.P. Piau, G. King, D. Moreau, M. Choquet, I. Annesi-Maesano.

Introduction

Studies have revealed that women who engage in certain risk behaviours at an early age may be more vulnerable to certain illnesses or health outcomes than men who partake in similar behaviours during early adolescence [1, 2]. With respect to tobacco consumption, it has been suggested that women may be at greater risk than men of developing respiratory health problems and susceptibility to lung cancer later in life, as a result of the fact that smoking affects airway development during childhood [3-6]. In addition, studies have found that sex-specific factors may be important etiologic factors in the development of asthma [7, 8], pulmonary diseases [9] and lung cancer [10].

In several European countries the prevalence of smoking among girls and young women is high [11, 12]. A recent publication by the WHO stressed that women smoking and its impact on health constitutes an important public health issue: “...a rise in tobacco use by young school girls is a danger signal... If the current trend continues, within 15 to 30 years there will be a major explosion in the health cost of smoking among young women...” [13].

Furthermore, in the aforementioned countries, the daily use of tobacco among adolescents augments also with the age [11]. In France, the proportion of regular smokers rises from 7 to 37% in boys and from 6 to 34% in girls between 14 and 18 years [14]; Choquet and colleagues have found that smoking among young girls (12-15 years old) has increased substantially during the last decade [15].

Sex or/and gender differences in relation to adolescent [16-20] and adults [21-23] tobacco smoking behaviour have been described mostly in industrialised countries. Recent statistics published in 2005 by the “Observatoire Français des drogues et des toxicomanies” (OFDT, the French governmental...
agency dedicated to the fight against addictions), indicated that the proportion of daily tobacco smokers was decreasing with age for both sexes but was the highest in young adults (25-34 years 40% for men and 30% for women) [24]. Accordingly, in the same report, high dependency to tobacco smoking was shown to increase with age up to 44 years (from 11% for the 18-25 to 23% for the 36-44). These statistics, prompted us to analyse unpublished data collected in '93-'94 for sex and gender differences in relation to tobacco smoking in a representative sample of 14,278 students aged 8 to 25 attending French public secondary schools. To our knowledge, this is the first study to examine these differences in a representative sample of students in French public secondary schools. The need for gender differentiated strategies and campaigns to fight against the tobacco epidemic has been recognised [13, 19, 25, 26]. Our results may have practical implications for tobacco control with respect to the use of sex and gender based factors in intervention programs. This analysis can also be valuable to helping in developing intervention strategies for the prevention and cessation of smoking among youth.

Although often employed interchangeably, in this study a distinction is made between the terms sex and gender. Sex refers to biological differences between men and women such as genetic, reproductive and hormonal factors that affect variations in development, health and illness in these two groups; whereas gender refers to the meaning that a particular culture attaches to being men or women, such as the socialisation of girls and boys, differential rewards and opportunities, habits concerning sexual activity and contraceptive use. The interaction between sex and gender differences may modulate smoking behaviour and habits among adolescents and these findings could contribute significantly to a broader understanding of adolescent health issues.

Methods

The National Adolescent Health Survey (NAHS) (Etude “Santé de l’Adolescent”) is an ongoing survey in France that investigates somatic and psychological health and associated risk factors in adolescents. The present analysis focuses specifically on sex and gender related and influential factors in adolescents. In this analysis, the need for gender differentiated strategies and campaigns to fight against the tobacco epidemic has been recognised [13, 19, 25, 26].

The questionnaire included socio-demographic items, sex and gender variables and various adolescent risk behaviours. In this analysis, the demographic variables included age, school type, nationality, country of origin and paternal socio-economic status. Age was categorised into four different groups: ≤13 year-olds, 14-15 years, 16-17 years, and ≥18 year-olds. Educational districts represented regional differences and included Aix-Marseille, Amiens, Bordeaux, Clermont-Ferrand, Créteil, Nice, Rennes and Strasbourg. School type was divided into junior high school, high school, and vocational school. Nationality was French, foreign or dual nationality and country of origin referred to the place of birth and included France, French Overseas Departments and Territories, Southern and Eastern Europe, North Africa, Sub-Saharan Africa and other countries.

The following categories comprised the paternal occupational variable which served as a proxy of socioeconomic status (INSEE classification): 1) farmers/agricultural workers; 2) craft/trade workers; 3) professionals/managers; 4) technicians; 5) clerks; 6) manual workers; 7) retired individuals; and 8) unemployed individuals.

Sex specific factors

For girls, the presence of menarche was considered evidence of puberty, as generally consis-
defined as BMI above or below the 95th percentile, the square of height in meters, and overweight was defined as body weight in kilograms divided by taken into account. Body Mass Index (BMI) was defined as having sexual intercourse on a regular ty outside of school. Regular sexual activity was considered as: 1) the use of birth control pills; and 2) prescribed hormone intake. Girls less than 13 years of age were not asked these questions.

**Gender specific factors**

Gender specific or socially influenced factors referred to those risk behaviours that are likely to occur more frequently among boys or girls respectively due to social patterns or cultural determinants, and included exposure to environmental tobacco smoking (ETS), alcohol consumption and drug abuse as risk behaviours that are gender influenced. ETS was defined as being exposed to environmental tobacco smoke of parents or peers. Alcohol consumption was based on yes or no responses to drinking wine, beer or liquor several times per week and drug abuse consisted of having used illegal drugs (i.e., marijuana, cocaine, heroin etc.) more than 10 times in their lifetime. Family structure which can also be modulated by gender was defined as living with both parents or other living situation.

**Sex/gender influenced factors**

In addition, we assessed sex and gender differences by examining sexual activity, contraceptive use (consistent or not) (i.e., condoms, diaphragm, etc.), body mass index and regular physical activity outside of school. Regular sexual activity was defined as having sexual intercourse on a regular basis and the number of sexual partners was also taken into account. Body Mass Index (BMI) was defined as body weight in kilograms divided by the square of height in meters, and overweight was defined as BMI above or below the 95th percentile, which is consistent with other studies. Physical activity was categorised as extracurricular physical activity less than 15 hours per week vs. 15 or more hours per week for boys, and less than 10 hours a week vs. 10 or more hours per week for girls. However, the type of the exercise was difficult to specify, because in France students at this age practice a variety of sports.

**Statistical Analysis**

Classical descriptive statistics were used to present variations in the exposure variables. Chi-square analysis was used to assess significant differences between qualitative variables. Multiple logistic regression (MLR) analysis was performed to identify factors associated with ever vs. never smoking. Ordinal polychotomous logistic regression (OLR) model was applied to identify factors associated with the 3-class variable, namely with regular smoking, experimental/occasional smoking compared to never smoking. Due to the elevated number of comparisons (often for variables coded in many categories) the Bonferroni correction (p=0.004) was taken into account in the identification of the significant relationships. The BMDP computer software package (MLR and PLR programs) was used to conduct the analysis.

**Results**

**Descriptive Statistics**

Out of 14,278 adolescents recruited for the survey, 12,466 completed and returned the questionnaires [27] (response rate 87.3%) and the 11,582 subjects for whom we had complete information were included in the analysis.

The overall prevalence of regular smoking was 15.6% and there was no statistically significant gender difference in smoking (table 1). Similarly, about the same proportion of girls and boys indicated that they were never (53.8 vs. 54.3%) or former smokers (4.8 vs. 4.9%). As expected, smoking status varied significantly (p < .001) by age, educational district, type of school, nationality, country of origin and parental socio-economic status (table 1). The lowest proportion of never smokers was found in vocational schools which also had the highest rate of occasional and regular smokers. Students whose parents migrated to France from Southern and Eastern European countries had the highest proportion of regular smokers compared to those whose parents were born in French overseas territories. The majority of students whose fathers were farmers or agricultural workers were never smokers compared to other responders.

**Sex Specific Factors**

Although the percentage of never smokers was the same among boys and girls who were in puberty (table 2), girls in early puberty had a much lower proportion (43.9%) of never smokers than boys who were similarly classified (67.2%). In addition, a higher proportion of girls compared to boys were regular (26.2 vs. 5.9%) or occasional smokers (10.3 vs. 4.6%) during early puberty. The results also revealed that among girls a high percentage of those who had been pregnant previously or were pregnant at the time of the survey and of those who were using birth control pills or other hormones as medications, were regular smokers (42.9%, 45.7% and 36.8% respectively).

**Gender Specific Factors**

A higher percentage of regular smokers was found among girls exposed to environmental tobacco smoke than among boys. Gender influenced variables such as alcohol and drug consumption were significantly higher for girls who were regular smokers compared to boys. Girls exposed to gender
Sex and Gender Differences in Tobacco Smoking Among Adolescents in French Secondary Schools

Influenced variables, such as alcohol and drug consumption, were significantly more likely to be current smokers than boys who used alcohol and drugs.

Sex/Gender Influenced Factors

Boys and girls differed considerably regarding smoking behaviour and factors that were socially influenced or mediated. A greater proportion of boys who smoked cigarettes regularly were more likely, compared to girls, to be virgins. Boys who smoked cigarettes regularly were also less likely to have “at least 1 sexual partner” or to engage in regular sexual activity. The pattern however was reversed among never smokers, as boys were less likely to be virgin, more likely to have sex regularly, more likely to use

---

Table 1. - Percent prevalence of tobacco smoking in relation to individual socio-economic characteristics among 11,582 students in France

|            | Never (%) | Experimental (%) | Ex (%) | Occasional (%) | Regular (%) | P1 | Total |
|------------|-----------|------------------|-------|----------------|-------------|----|-------|
| Female     | 54.0      | 17.9             | 4.8   | 7.7            | 15.6        |    | N=11,582 |
| Male       | 53.8      | 17.4             | 4.8   | 8.3            | 15.8        |    | 5,886 |
| Age (years) |          |                  |       |                |             |    |       |
| ≤13        | 77.5      | 12.8             | 3.4   | 3.6            | 2.7         |    | 3,540 |
| 14-15      | 52.8      | 20.6             | 5.5   | 9.0            | 12.2        |    | 3,226 |
| 16-17      | 40.7      | 20.9             | 5.7   | 10.2           | 22.5        |    | 2,631 |
| ≥18        | 33.8      | 18.4             | 5.1   | 9.6            | 33.1        |    | 2,185 |
| Educational District |      |                  |       |                |             |    |       |
| Aix-Marseille | 56.0     | 16.9             | 4.1   | 8.6            | 14.4        |    | 1,532 |
| Amiens      | 53.8      | 16.0             | 5.4   | 6.5            | 18.4        |    | 1,286 |
| Bordeaux    | 53.0      | 17.9             | 4.5   | 7.3            | 17.4        |    | 1,694 |
| Clermont    | 46.4      | 17.8             | 5.0   | 10.3           | 20.5        |    | 838   |
| Créteil     | 54.7      | 20.8             | 5.5   | 6.3            | 12.8        |    | 2,695 |
| Nice        | 55.2      | 18.4             | 4.0   | 6.8            | 15.6        |    | 1,120 |
| Rennes      | 49.4      | 16.1             | 4.7   | 10.9           | 19.0        |    | 1,094 |
| Strasbourg  | 59.7      | 15.8             | 4.7   | 8.1            | 11.8        |    | 1,324 |
| Type of School |        |                  |       |                |             |    |       |
| Junior high school | 64.8    | 16.8             | 4.6   | 6.0            | 7.9         |    | 6,924 |
| High school  | 41.2      | 20.4             | 4.9   | 9.9            | 23.7        |    | 3,390 |
| Vocational school | 29.6  | 17.1             | 5.8   | 11.6           | 35.9        |    | 1,267 |
| Nationality |          |                  |       |                |             |    |       |
| French      | 53.1      | 17.8             | 4.8   | 8.1            | 16.3        |    | 10,208 |
| Foreign     | 63.1      | 18.0             | 5.2   | 5.9            | 7.9         |    | 796   |
| Dual Nationality | 58.9 | 19.3             | 4.7   | 3.9            | 13.2        |    | 508   |
| Country of Origin |      |                  |       |                |             |    |       |
| France      | 53.4      | 17.5             | 4.8   | 8.1            | 16.2        |    | 8,807 |
| French overseas areas² | 53.3 | 24.7             | 6.6   | 7.0            | 8.5         |    | 259   |
| South and East Europe | 49.1 | 21.3             | 5.8   | 6.7            | 17.1        |    | 970   |
| North Africa | 63.4     | 16.6             | 4.2   | 5.7            | 10.1        |    | 855   |
| Sub-Saharan Africa | 60.8  | 17.8             | 2.8   | 6.5            | 12.2        |    | 107   |
| Other       | 62.0      | 18.1             | 4.0   | 8.0            | 8.0         |    | 226   |
| Paternal Socio-Economic Status |      |                  |       |                |             |    |       |
| Farmers, agricultural |      |                  |       |                |             |    |       |
| Workers     | 60.6      | 15.5             | 4.2   | 8.3            | 11.4        |    | 264   |
| Craft and trade workers | 51.1 | 17.5             | 5.3   | 8.1            | 18.0        |    | 1,129 |
| Professionals and managers | 52.8 | 19.1             | 4.0   | 8.6            | 15.5        |    | 1,552 |
| Technicians | 52.0      | 20.1             | 3.7   | 8.0            | 16.2        |    | 1,819 |
| Clerks      | 55.8      | 17.4             | 5.1   | 8.1            | 13.6        |    | 1,580 |
| Manual workers | 55.5  | 17.4             | 5.5   | 6.7            | 15.0        |    | 3,175 |
| Retired     | 55.6      | 19.4             | 3.9   | 7.8            | 13.3        |    | 180   |
| Unemployed  | 53.4      | 19.1             | 5.3   | 6.0            | 16.3        | <10⁻⁴| 283   |

1 Global comparison among smoking behaviours.
2 French overseas departments and territories.
contraceptives. Boys who were experimenters were also slightly more likely than girls to follow this pattern. Differences among former or occasional smokers were less pronounced with respect to sexual activity and contraceptive use.

Proportional differences regarding BMI were evident among boys and girls according to smoker status. Boys who were never smokers had a lower percentage than girls in the same category (51.8% vs. 56.4%) who were within the upper 95th per-

Table 2. - Percent prevalence of smoking habits according to sex and gender influenced factors among adolescents in France

| Sex-Specific                  | Never (%) | Experimental (%) | Ex (%) | Occasional (%) | Regular (%) | Total (%) |
|-------------------------------|-----------|------------------|-------|---------------|-------------|-----------|
| Puberty                       |           |                  |       |               |             |           |
| Boys                          | 46.8      | 20.1             | 5.3   | 8.4           | 19.3        | 4,195     |
| Girls                         | 45.3      | 19.6             | 5.7   | 9.9           | 19.5        | 4,692     |
| Early Puberty                 |           |                  |       |               |             |           |
| Boys                          | 67.2      | 19.3             | 3.1   | 4.6           | 5.9         | 591       |
| Girls                         | 43.9      | 15.0             | 4.7   | 10.3          | 26.2        | <10<sup>-3</sup> |
| Regular menstrual cycle (girls)| 42.1      | 20.0             | 5.6   | 10.8          | 21.6        | 3,391     |
| Pregnancy (girls)             | 19.1      | 17.5             | 12.7  | 7.9           | 42.9        | 63        |
| Dysmenorrhea (girls)          | 60.0      | 14.3             | 8.6   | 5.7           | 11.4        | 35        |
| Hormone intake (girls)        | 34.2      | 17.5             | 5.3   | 6.1           | 36.8        | 114       |
| Birth control pill intake (girls)| 22.2 | 13.4             | 8.4   | 10.3          | 45.7        | 775       |

| Gender-Influenced             |          |                  |       |               |             |           |
| Exposed to ETS               |           |                  |       |               |             |           |
| Boys                          | 17.7      | 14.2             | 6.0   | 14.0          | 48.1        | 401       |
| Girls                         | 14.0      | 9.7              | 8.7   | 12.7          | 55.0        | <0.10     |
| Alcohol consumption           |           |                  |       |               |             |           |
| Boys                          | 17.9      | 14.9             | 6.2   | 15.4          | 45.6        | 630       |
| Girls                         | 11.5      | 13.7             | 9.8   | 10.4          | 54.6        | <0.05     |
| Drug Abuse                    |           |                  |       |               |             |           |
| Boys                          | 10.5      | 18.9             | 6.0   | 15.1          | 49.5        | 1,032     |
| Girls                         | 8.8       | 11.4             | 7.6   | 13.6          | 58.8        | <10<sup>-3</sup> |
| Lives with both parents       |           |                  |       |               |             |           |
| Boys                          | 56.4      | 18.2             | 4.8   | 6.7           | 13.9        | 1,126     |
| Girls                         | 56.9      | 17.4             | 4.3   | 7.9           | 13.5        | NS        |
| Other living situation        |           |                  |       |               |             |           |
| Boys                          | 45.6      | 19.3             | 5.1   | 8.9           | 21.2        | 4,560     |
| Girls                         | 42.9      | 17.6             | 6.2   | 9.6           | 23.7        | <0.10     |

| Sex/Gender-Influenced         |          |                  |       |               |             |           |
| Sexual intercourse            |           |                  |       |               |             |           |
| At least 1 partner            |           |                  |       |               |             |           |
| Boys                          | 31.2      | 20.4             | 7.0   | 10.5          | 30.9        | 2,162     |
| Girls                         | 20.4      | 14.9             | 7.9   | 12.2          | 44.5        | <10<sup>-3</sup> |
| Regular sexual activity       |           |                  |       |               |             |           |
| Boys                          | 27.1      | 16.1             | 6.1   | 9.8           | 40.9        | 726       |
| Girls                         | 20.0      | 11.9             | 7.7   | 11.5          | 48.9        | <10<sup>-3</sup> |
| Consistent contraceptive use  |           |                  |       |               |             |           |
| Boys                          | 27.4      | 20.2             | 5.1   | 11.5          | 35.8        | 1,227     |
| Girls                         | 19.2      | 14.2             | 8.0   | 12.1          | 46.5        | <10<sup>-3</sup> |
| Any contraceptive use         |           |                  |       |               |             |           |
| Boys                          | 27.2      | 19.3             | 5.9   | 11.1          | 36.5        | 1,548     |
| Girls                         | 18.6      | 14.5             | 7.9   | 12.3          | 46.7        | <10<sup>-3</sup> |
| Overweight                    |           |                  |       |               |             |           |
| Boys                          | 51.8      | 19.9             | 5.0   | 6.4           | 17.0        | 282       |
| Girls                         | 56.4      | 15.9             | 6.6   | 7.6           | 13.5        | NS        |
| ≥15 hours physical activity/week|   |                  |       |               |             |           |
| Boys                          | 49.1      | 18.2             | 5.5   | 9.1           | 18.2        | 55        |
| Girls                         | 60.5      | 13.2             | 5.3   | 13.2          | 7.9         | NS        |

NS: not statistically significant.
1 Comparison between boys and girls.
centile of BMI. However, among regular smokers the reverse pattern was found (17.0% in boys vs., 13.5% in girls). Physical activity was more intense among girls who never smoked but, among regular smokers, boys engaged more in extracurricular physical activity.

**Multivariate Analysis**

Among boys, MLR analysis adjusted for paternal SES, educational district and nationality, revealed that age, puberty, exposure to environmental tobacco smoke, alcohol, drug use and regular sexual activity, although in a lesser extent, were positively associated with an increased likelihood of being a life smoker (table 3). Overweight and physical exercise were not found to be significantly related to the increasing likelihood of being a life smoker. Individuals who lived with both parents as opposed to those who did not live with both parents were less likely to be life smokers. Similar results were found among girls (table 3). Once again, living with both parents decreased the likelihood of being a smoker compared to students who did not live with both parents. Father’s employment status, overweight, and physical activity were not statistically significant predictors.

In the polychotomous logistic model, puberty had a much greater effect on the likelihood of being a regular smoker (OR=18.0, CI=9.6-32) than of being an experimental/occasional smoker (OR=3.7, CI=2.9-4.6) among girls. This was also the case for exposure to ETS, regular alcohol consumption, drug use and living with parents. For boys, however, the effect of puberty was not as large (OR= 2.1 for experimenters and OR=4.7 for regular smokers). Illicit drug use had a larger effect on the likelihood of boys being a regular smoker vs. a non-smoker (OR=15.0, CI=12.0-20.0) than an experimental/occasional smoker vs. a non-smoker (OR=4.8, CI=3.7-6.1), than in girls. Other significant co-variants included exposure to environmental tobacco smoking, regular alcohol consumption, and living with parents.

**Discussion**

The important strength of this work is the idea that age, puberty, exposure to environmental tobacco smoke, alcohol, drug use and regular sexual activity, although in a lesser extent, were positively associated with an increased likelihood of being a life smoker. Physical activity was more intensely engaged among girls who never smoked but, among regular smokers, boys engaged more in extracurricular physical activity.

**Multivariate Analysis**

Among boys, MLR analysis adjusted for paternal SES, educational district and nationality, revealed that age, puberty, exposure to environmental tobacco smoke, alcohol, drug use and regular sexual activity, although in a lesser extent, were positively associated with an increased likelihood of being a life smoker (table 3). Overweight and physical exercise were not found to be significantly related to the increasing likelihood of being a life smoker. Individuals who lived with both parents as opposed to those who did not live with both parents were less likely to be life smokers. Similar results were found among girls (table 3). Once again, living with both parents decreased the likelihood of being a smoker compared to students who did not live with both parents. Father’s employment status, overweight, and physical activity were not statistically significant predictors.

In the polychotomous logistic model, puberty had a much greater effect on the likelihood of being a regular smoker (OR=18.0, CI=9.6-32) than of being an experimental/occasional smoker (OR=3.7, CI=2.9-4.6) among girls. This was also the case for exposure to ETS, regular alcohol consumption, drug use and living with parents. For boys, however, the effect of puberty was not as large (OR= 2.1 for experimenters and OR=4.7 for regular smokers). Illicit drug use had a larger effect on the likelihood of boys being a regular smoker vs. a non-smoker (OR=15.0, CI=12.0-20.0) than an experimental/occasional smoker vs. a non-smoker (OR=4.8, CI=3.7-6.1), than in girls. Other significant co-variants included exposure to environmental tobacco smoking, regular alcohol consumption, and living with parents.

**Discussion**

The important strength of this work is the idea that age, puberty, exposure to environmental tobacco smoke, alcohol, drug use and regular sexual activity, although in a lesser extent, were positively associated with an increased likelihood of being a life smoker. Physical activity was more intensely engaged among girls who never smoked but, among regular smokers, boys engaged more in extracurricular physical activity.

**Multivariate Analysis**

Among boys, MLR analysis adjusted for paternal SES, educational district and nationality, revealed that age, puberty, exposure to environmental tobacco smoke, alcohol, drug use and regular sexual activity, although in a lesser extent, were positively associated with an increased likelihood of being a life smoker (table 3). Overweight and physical exercise were not found to be significantly related to the increasing likelihood of being a life smoker. Individuals who lived with both parents as opposed to those who did not live with both parents were less likely to be life smokers. Similar results were found among girls (table 3). Once again, living with both parents decreased the likelihood of being a smoker compared to students who did not live with both parents. Father’s employment status, overweight, and physical activity were not statistically significant predictors.

In the polychotomous logistic model, puberty had a much greater effect on the likelihood of being a regular smoker (OR=18.0, CI=9.6-32) than of being an experimental/occasional smoker (OR=3.7, CI=2.9-4.6) among girls. This was also the case for exposure to ETS, regular alcohol consumption, drug use and living with parents. For boys, however, the effect of puberty was not as large (OR= 2.1 for experimenters and OR=4.7 for regular smokers). Illicit drug use had a larger effect on the likelihood of boys being a regular smoker vs. a non-smoker (OR=15.0, CI=12.0-20.0) than an experimental/occasional smoker vs. a non-smoker (OR=4.8, CI=3.7-6.1), than in girls. Other significant co-variants included exposure to environmental tobacco smoking, regular alcohol consumption, and living with parents.
Table 3. - Relationship between life smoking* and sex and gender influenced factors among adolescents in France

|                          | MALES | FEMALES |
|--------------------------|-------|---------|
|                          | N     | Crude OR† | 95% CI | Adjusted OR | 95% CI |
| **MALES**                |       |          |        |            |        |
| **Age**                  |       |          |        |            |        |
| ≤13 yrs                  | 1,697 | 1        | 1      | 1          | 1      |
| 14-15 yrs                | 1,615 | 1.73     | 1.43-2.10 | 1.76  | 1.43-2.15 |
| 16-17 yrs                | 1,322 | 2.10     | 1.71-2.58 | 2.19  | 1.76-2.72 |
| ≥18 yrs                  | 1,139 | 2.36     | 1.88-2.96 | 2.53  | 1.99-3.20 |
| **Puberty**              |       |          |        |            |        |
| No                       | 1,547 | 1        | 1      | 1          | 1      |
| Yes                      | 4,246 | 1.69     | 1.41-2.03 | 1.65  | 1.36-2.01 |
| **Exposure to ETS**      |       |          |        |            |        |
| No                       | 5,203 | 1        | 1      | 1          | 1      |
| Yes                      | 404   | 2.35     | 1.75-3.15 | 2.20  | 1.62-2.99 |
| **Alcohol consumption**  |       |          |        |            |        |
| No                       | 5,002 | 1        | 1      | 1          | 1      |
| Yes                      | 634   | 2.29     | 1.82-2.88 | 2.12  | 1.67-2.70 |
| **Drug use**             |       |          |        |            |        |
| No                       | 4,605 | 1        | 1      | 1          | 1      |
| Yes                      | 1,042 | 6.21     | 5.09-7.58 | 6.17  | 5.00-7.60 |
| **Living with parents**  |       |          |        |            |        |
| No                       | 1,142 | 0.63     | 0.53-0.75 | 0.64  | 0.53-0.78 |
| Yes                      | 4,621 | 0.97     | 0.72-1.30 | 1.02  | 0.75-1.40 |
| **Overweight**           |       |          |        |            |        |
| No                       | 5,488 | 1        | 1      | 1          | 1      |
| Yes                      | 285   | 1.06     | 0.78-1.43 | 1.01  | 0.73-1.39 |
| **Regular sexual activity** |   |          |        |            |        |
| No                       | 2,957 | 1        | 1      | 1          | 1      |
| Yes                      | 732   | 1.42     | 1.14-1.77 | 1.52  | 1.20-1.93 |
| ≥15 hrs of physical activity/wk |     |          |        |            |        |
| No                       | 5,483 | 1        | 1      | 1          | 1      |
| Yes                      | 290   | 0.97     | 0.72-1.30 | 1.02  | 0.75-1.40 |
| **FEMALES**              |       |          |        |            |        |
| **Age**                  |       |          |        |            |        |
| ≤13 yrs                  | 1,892 | 1        | 1      | 1          | 1      |
| 14-15 yrs                | 1,651 | 2.16     | 1.79-2.61 | 2.00  | 1.64-2.44 |
| 16-17 yrs                | 1,333 | 2.55     | 2.08-3.13 | 2.50  | 2.02-3.11 |
| ≥18 yrs                  | 1,059 | 2.38     | 1.88-3.00 | 2.34  | 1.82-3.00 |
| **Puberty**              |       |          |        |            |        |
| No                       | 1,210 | 1        | 1      | 1          | 1      |
| Yes                      | 4,725 | 2.98     | 2.36-3.77 | 3.19  | 2.48-4.10 |
| **Birth control pill use** |   |          |        |            |        |
| No                       | 5,158 | 1        | 1      | 1          | 1      |
| Yes                      | 777   | 1.41     | 1.10-1.80 | 1.30  | 1.00-1.68 |
| **Exposure to ETS**      |       |          |        |            |        |
| No                       | 5,542 | 1        | 1      | 1          | 1      |
| Yes                      | 303   | 2.76     | 1.98-3.86 | 2.83  | 1.98-4.04 |
| **Alcohol consumption**  |       |          |        |            |        |
| No                       | 5,641 | 1        | 1      | 1          | 1      |
| Yes                      | 183   | 2.71     | 1.78-4.12 | 2.84  | 1.80-4.47 |
| **Drug Use**             |       |          |        |            |        |
| No                       | 5,122 | 1        | 1      | 1          | 1      |
| Yes                      | 688   | 4.97     | 3.92-6.30 | 5.38  | 4.17-6.95 |
| **Living with parents**  |       |          |        |            |        |
| No                       | 1,345 | 1        | 1      | 1          | 1      |
| Yes                      | 4,583 | 0.70     | 0.59-0.82 | 0.68  | 0.57-0.81 |
| **Overweight**           |       |          |        |            |        |
| No                       | 5,643 | 1        | 1      | 1          | 1      |
| Yes                      | 292   | 0.76     | 0.57-1.02 | 0.86  | 0.63-1.17 |
| **Regular sexual activity** |   |          |        |            |        |
| No                       | 5,189 | 1        | 1      | 1          | 1      |
| Yes                      | 691   | 1.45     | 1.12-1.89 | 1.39  | 1.06-1.83 |
| ≥10 hrs of physical activity/wk | |          |        |            |        |
| No                       | 5,704 | 1        | 1      | 1          | 1      |
| Yes                      | 231   | 0.95     | 0.68-1.31 | 1.02  | 0.72-1.46 |

* life smoking defined as former, experimental, occasional or regular smoking at the period of the survey.
† Odds-ratio of ever smoking vs. never smoking adjusted for age, paternal socioeconomic status (SES), educational district and nationality.
as a socially acceptable behaviour to relieve anxiety in social situations [40]. It is possible that our findings reflect the influence of social stereotypes. Whether the negative cultural stereotype that existed in the past, still operates in contemporary society, portraying smoking as a male behaviour, an “unfeminine” action [32, 41], cannot be assessed in our study. In order to understand better the role that smoking plays as a “marker” of gender identity among youth populations, social constructions of adolescence as well as feminity/masculinity have to be more specifically examined [39].

From a more general point of view, as underlined by K. Slama, smoking is not simply a bad choice that information will turn around, nor is it a simple biological addiction than can be cured; the social environment and the individual’s cognitions are key factors in starting and successfully stopping smoking [42]. Smoking is a complex behaviour influenced by modifiable and non-modifiable determinants. Tobacco use is a global endemic and in most industrialised countries, in adults, it has been decreasing, but it remains at a higher level in adolescents and young adults and seems to be still increasing among girls [12, 21, 22, 43]. The exact timing, duration and magnitude of the smoking epidemic might vary significantly from one country to another and from male to female [44]. The tobacco industry recruits and retains smokers by associating its products with excitement, independence, sexuality and a “cool” style [33, 45]. The symbolic value of smoking, representing adolescent freedom and independence, is reinforced through tobacco advertising [32, 46, 47]; the harm to children and adolescents has become apparent [45]. A recent WHO report has revealed how commercial companies have successfully marketed cigarettes designed specifically for women [13, 48] and direct advertising devoted to the female population [19].

Addiction to smoking typically begins during childhood [17]. Recent studies raised questions about the model on the natural course of onset of cigarette use [49]. Up to now it had been conceptualised as a progressing sequential process through successive stages. Progression from first try to daily use was supposed to take 2 to 3 years and progression to nicotine dependence even more [50]. Nevertheless, symptoms of nicotine dependence have been shown to occur early after smoking onset [45, 51, 52]. Such elements certainly contribute to explain at least in part the lack of sustained impact of tobacco programmes for youths. Thus it is relevant to focus on early phases of smoking onset and it is important to understand which factors contribute to smoking initiation in adolescence, trajectories of use, expressions of dependence and quitting attempt both in girls and boys [31, 53]. Advances in medicine have made physicians more able to help young (and older) people quit smoking, but the consequences on health, the energy and cost involved in tobacco consumption control or in elaboration of legislative and regulatory measures to protect the population and to limit tobacco industry marketing tactics, should encourage public health authorities and governments to prevent children and youth from starting to smoke and to protect them from smoking exposure, either in the form of second hand or promotion exposure.

The question might be raised about the usefulness and relevance to analyse, (unpublished) data on French adolescent smoking behaviour (aged 8 to 25 years) collected in 1994, from the point of view of sex and gender. First, recent data has shown that there have not been structural changes as a socially acceptable behaviour to relieve anxiety in social situations [40]. It is possible that our findings reflect the influence of social stereotypes. Whether the negative cultural stereotype that existed in the past, still operates in contemporary society, portraying smoking as a male behaviour, an “unfeminine” action [32, 41], cannot be assessed in our study. In order to understand better the role that smoking plays as a “marker” of gender identity among youth populations, social constructions of adolescence as well as feminity/masculinity have to be more specifically examined [39].

From a more general point of view, as underlined by K. Slama, smoking is not simply a bad choice that information will turn around, nor is it a simple biological addiction than can be cured; the social environment and the individual’s cognitions are key factors in starting and successfully stopping smoking [42]. Smoking is a complex behaviour influenced by modifiable and non-modifiable determinants. Tobacco use is a global endemic and in most industrialised countries, in adults, it has been decreasing, but it remains at a higher level in adolescents and young adults and seems to be still increasing among girls [12, 21, 22, 43]. The exact timing, duration and magnitude of the smoking epidemic might vary significantly from one country to another and from male to female [44]. The tobacco industry recruits and retains smokers by associating its products with excitement, independence, sexuality and a “cool” style [33, 45]. The symbolic value of smoking, representing adolescent freedom and independence, is reinforced through tobacco advertising [32, 46, 47]; the harm to children and adolescents has become apparent [45]. A recent WHO report has revealed how commercial companies have successfully marketed cigarettes designed specifically for women [13, 48] and direct advertising devoted to the female population [19].

Addiction to smoking typically begins during childhood [17]. Recent studies raised questions about the model on the natural course of onset of cigarette use [49]. Up to now it had been conceptualised as a progressing sequential process through successive stages. Progression from first try to daily use was supposed to take 2 to 3 years and progression to nicotine dependence even more [50]. Nevertheless, symptoms of nicotine dependence have been shown to occur early after smoking onset [45, 51, 52]. Such elements certainly contribute to explain at least in part the lack of sustained impact of tobacco programmes for youths. Thus it is relevant to focus on early phases of smoking onset and it is important to understand which factors contribute to smoking initiation in adolescence, trajectories of use, expressions of dependence and quitting attempt both in girls and boys [31, 53]. Advances in medicine have made physicians more able to help young (and older) people quit smoking, but the consequences on health, the energy and cost involved in tobacco consumption control or in elaboration of legislative and regulatory measures to protect the population and to limit tobacco industry marketing tactics, should encourage public health authorities and governments to prevent children and youth from starting to smoke and to protect them from smoking exposure, either in the form of second hand or promotion exposure.

The question might be raised about the usefulness and relevance to analyse, (unpublished) data on French adolescent smoking behaviour (aged 8 to 25 years) collected in 1994, from the point of view of sex and gender. First, recent data has shown that there have not been structural changes
since the period of the survey. Up to 34% of adolescents were still regular smokers in France in 2005 (ESCAPAD data). Illicit drug use and alcohol consumption has not declined. Lastly, sexual behaviours in adolescents remain stable. More importantly, our results contribute towards strengthening the idea that specific tobacco control campaigns aimed at girls and young women are needed. The young adults who were aged 8 to 25 in 1994 are now 25 to 38 years old; several of them are parents of preteens and teenagers at risk of initial experimentation or uptake of tobacco. A better understanding and awareness of factors that influenced their own behaviour towards smoking might help these young adults to be more cautious about the teenager’s susceptibility to adults and parental attitudes and to be more proactive in preventing them from smoking. These factors taken together might provide useful guidelines in designing public health interventions or tobacco control interventions, as part of school-based but also as family and general tobacco control programmes.

To conclude, our results evidence the fact that sex-related (puberty), gender-specific (environmental tobacco smoking, alcohol consumption, drug abuse) or sex/gender (regular sexual intercourse) are influential in relation to smoking behaviour in French adolescents. Due to the previous considerations, additional investigations and confirmation would prove useful.

Acknowledgements: We are grateful to Maureen Ben-Davies, University of North Carolina, Medical School, Chapel Hill, NC, USA, who made the initial statistical analysis of the data. We thank all the students who participated in this study.

References

1. Brady KT, Randall CL. Gender differences in substance use disorders. Psychiatric Clin North Am 1999; 22: 241-52.
2. Nolen-Hoeksema S, Hilt L. Possible contributors to the gender differences in alcohol use and problems. J Gen Psychol 2006; 133: 357-74.
3. Gold DR, Wang X, Wypij D, Speizer FE, Ware JH, Dockery DW. Effects of cigarette smoking on lung function in adolescent boys and girls. N Engl J Med 1996; 335: 931-7.
4. Risch HA, Howe GR, Jain M, Burch JD, Holowaty EJ, Miller AB. Are female smokers at higher risk for lung cancer than male smokers? A case-control analysis by histologic type. Am J Epidemiol 1993; 138: 281-93.
5. Zang EA, Wynder EL. Differences in lung cancer risk between men and women: examination of the evidence. J Natl Cancer Inst 1996; 88: 183-92.
6. Han MK, Postma D, Mannino D, et al. Gender and COPD: Why it Matters. Am J Respir Crit Care Med 2007; 176: 1179-1184.
7. Melgert BN, Ray A, Hylkema MN, Timens W, Postma DS. Are there reasons why adult asthma is more common in females?Curr Allergy Asthma Rep 2007; 7: 143-50.
8. Troisi RJ, Speizer FE, Willett WC, Trichopoulos D, Rosner B. Menopause, postmenopausal estrogen prepa-rations, and the risk of adult-onset asthma. A prospective cohort study. Am J Respir Crit Care Med 1995; 152: 1183-8.
9. Caracta CF. Gender differences in pulmonary disease. Mt Sinai J Med 2003; 70: 215-24.
10. Kreuzer M, Gerken M, Heinrich J, Kreienbrock L, Wichmann HE. Hormonal factors and risk of lung cancer among women? Int J Epidemiol 2003; 32: 263-71.
11. European Commission. Health statistics- Key data on health 2002- Data 1970-2001. http://ehp.niehs.nih.gov/.
12. Hublet A, De Bacquer D, Valimaa R, et al. Smoking trends among adolescents from 1990 to 2002 in ten European countries and Canada. BMC Public Health 2006; 6: 280.
13. Women and the tobacco epidemics: challenges for the XXIst century. The World Health Organization in collaboration with the Institute for Global Tobacco Control Johns Hopkins School of Public Health ed: The World Health Organization; 2001.
14. ESPAD 2003 (European School Survey Project on Alcohol and other Drugs). Observatoire Français des Drogues et des Toxicomanies et Institut National de la Sante et de la Recherche Médicale.Premiers résultats de l’enquête ESPAD 2003 en France. Consommations de substances psychoactives des élèves de 12 à 18 ans. Evolutions entre 1993 et 2003. www.oftd.fr and www.drogues.gouv.fr, 2004.
15. Choquet M, Morin D, Hassler C, Ledoux S. Is alcohol, tobacco, and cannabis use as well as polydrug use increasing in France? Addict Behav 2004; 29: 607-14.
16. Barrueco M, Cordovilla R, Hernandez Mezquita MA, et al. [Sex differences in experimentation and tobacco consumption by children, adolescents and young adults]. Arch Bronconeumol 1998; 34: 199-203.
17. Braverman MT, Svendsen T, Lund KE, Aaro LE. Tobacco use by early adolescents in Norway, Eur J Public Health 2001; 11: 218-24.
18. Galanti MR, Rosendahl I, Post A, Gilljam H. Early gender differences in adolescent tobacco use-the experience of a Swedish cohort. Scand J Public Health 2001; 29: 314-7.
19. Differences in worldwide tobacco use by gender; findings from the Global Youth Tobacco Survey. J Sch Health 2003; 73: 207-15.
20. Beck F, Legleye S, Peretti-Watel P, Spilka S. [Smoking in adolescents.]. Rev Mal Respir 2006; 23: 681-93.
21. Schiaffino A, Fernandez E, Borrell C, Salto E, Garcia M, Borras JM. Gender and educational differences in smoking initiation rates in Spain from 1948 to 1992. Eur J Public Health 2003; 13: 56-60.
22. Costanza MC, Salaman J, Lopez AD, Morabia A. Gender differentials in the evolution of cigarette smoking habits in a general European adult population from 1993-2003. BMC Public Health 2006; 6: 130.
23. Davy M. Time and generational trends in smoking among men and women in Great Britain, 1972-2004/05. Health Stat Q 2006: 35-43.
24. Beck F, Legleye S, Spilka S, et al. Drug usage levels in France in 2005 - An analysis of the data from the 2005 Health Barometer, relating to psychoactive substance use practices among the adult population. Tendences 2006; 48.
25. Ernster V, Kaufman N, Nichter M, Samet J, Yoon SY. Women and tobacco: moving from policy to action. Bull World Health Organ 2000; 78: 891-901.
26. Baudier F. [Smoking prevention in France from 1997 to 1999]. Sante Publique 2001; 13: 403-10.
27. Moreau D, Ledoux S, Choquet M, Annesi-Maesano I. Prevalence and severity of asthma in adolescents in France, Cross-sectional and retrospective analyses of a large population-based sample. Int J Tuberc Lung Dis 2000; 4: 639-48.
28. Herman-Giddens ME, Slora EJ, Wasserman RC, et al. Secondary sexual characteristics and menses in young girls seen in office practice: a study from the Pediatric
SEX AND GENDER DIFFERENCES IN TOBACCO SMOKING AMONG ADOLESCENTS IN FRENCH SECONDARY SCHOOLS

Research in Office Settings network. Pediatrics 1997; 99: 505-12.

29. Lee PA, Guo SS, Kulin HE. Age of puberty; data from the United States of America. *Apniss* 2001; 109: 81-8.

30. Bratberg GH, Nilsen TI, Holmen TL, Vatten LJ. Sexual maturation in early adolescence and alcohol drinking and cigarette smoking in late adolescence: a prospective study of 2,129 Norwegian girls and boys. *Eur J Pediatr* 2005; 164: 621-5.

31. Patton GC, McMorris BJ, Toumbourou JW, Hemphill SA, Donath S, Catalano RF. Puberty and the onset of substance use and abuse. *Pediatrics* 2004; 114: e300-6.

32. Waldron I. Patterns and causes of gender differences in smoking. *Soc Sci Med* 1991; 32: 989-1005.

33. Stjerna ML, Lauritzen SO, Tillgren P. “Social thinking” and cultural images: teenagers’ notions of tobacco use. *Soc Sci Med* 2004; 59: 573-83.

34. Challier B, Chau N, Predine R, Choquet M, Legras B. Associations of family environment and individual factors with tobacco, alcohol, and illicit drug use in adolescents. *Eur J Epidemiol* 2000; 16: 33-42.

35. Ruangkanchanasetr S, Plitponkarnpim A, Hettrakul P, Kongsaok R. Youth risk behaviour survey: Bangkok, Thailand. *J Adolesc Health* 2005; 36: 227-35.

36. Tomori M, Zalar B, Kores Plesnicar B, Ziberl S, Stergar E. Smoking in relation to psychosocial risk factors in adolescents. *Eur Child Adolesc Psychiatry* 2001; 10: 143-50.

37. Michaud PA, Suris JC, Deppen A. Gender-related psychological and behavioural correlates of pubertal timing in a national sample of Swiss adolescents. *Mol Cell Endocrinol* 2000; 254-255: 172-8.

38. Rhee H. Relationships between physical symptoms and pubertal development. *J Pediatr Health Care* 2005; 19: 95-103.

39. Nichter M. Smoking: what does culture have to do with it? *Addiction* 2003; 98 Suppl 1: 139-45.

40. Sonntag H, Wittchen HU, Hofler M, Kessler RC, Stein MB. Are social fears and DSM-IV social anxiety disorder associated with smoking and nicotine dependence in adolescents and young adults? *Eur Psychiatry* 2000; 15: 67-74.

41. Cooper WH, Kohn PM. The social image of the young female smoker. *Br J Addict* 1989; 84: 935-41.

42. Slama K. Current challenges in tobacco control. *ITLD* 2004; 8: 1160-72.

43. Charlton A. Changing patterns of cigarette smoking among teenagers and young adults. *Paediatr Respir Rev* 2001; 2: 214-21.

44. Lopez AD. A descriptive model of the cigarette epidemic in developed countries. *Tobacco Control* 1994; 3: 242-7.

45. DiFranza JR, Wellman RJ, Sargent JD, Weitzman M, Hipple BJ, Winickoff JP. Tobacco promotion and the initiation of tobacco use: assessing the evidence for causality. *Pediatrics* 2006; 117: e1237-48.

46. Lam TH, Chung SF, Betson CL, Wong CM, Hedley AJ. Tobacco advertisements: one of the strongest risk factors for smoking in Hong Kong students. *Am J Prev Med* 1998; 14: 217-23.

47. Shahey O, Fernandez E, Thun M, Schiaffino A, Dowluck S, Cokkinides V. Cigarette advertising and female smoking prevalence in Spain, 1982-1997: case studies in International Tobacco Surveillance. *Cancer* 2004; 100: 1744-9.

48. Carpenter CM, Wayne GF, Connolly GN. Designing cigarettes for women: new findings from the tobacco industry documents. *Addiction* 2005; 100: 837-51.

49. Klein J. Adolescents and smoking: the first puff may be the worst. *CMJA* 2006; 175: 262-3.

50. Breslau N, Fenn N, Peterson EL. Early smoking initiation and nicotine dependence in a cohort of young adults. *Drug Alcohol Depend* 1993; 33: 129-37.

51. Wellman RJ, DiFranza JR, Savageau JA, Dussault GF. Short term patterns of early smoking acquisition. *Tob Control* 2004; 13: 251-7.

52. Gervais A, O’Loughlin J, Meshedfedayi G, Bancej C, Tremblay M. Milestones in the natural course of onset of cigarette use among adolescents. *Cmaj* 2006; 175: 255-61.

53. Patton GC, Carlin JB, Coffey C, Wolfe R, Hibbert M, Bowes G. The course of early smoking: a population-based cohort study over three years. *Addiction* 1998; 93: 1251-60.