Tobacco smoking among students in an urban area in Northern Italy

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Summary

Introduction. *Tobacco smoking, which usually begins in teenage, is one of the most important lifestyle risk factors for chronic diseases and a major public health problem worldwide.*
The aims of the study were to determine the prevalence of tobacco smoking and the mean age of initiation among adolescents in Genoa (Italy) and to identify some socio-demographic predictors that could be associated with the onset of smoking.
Materials and methods. *2,301 randomly selected students (14-19 years old) in Genoa completed an ad hoc questionnaire. The Kaplan-Meier method was used to evaluate the instantaneous risk of experimenting with smoking. A multivariate logistic regression model was used to determine whether current or previous smoking status was associated with socio-demographic characteristics.*
Results. *59.5% of respondents had tried smoking, while 35.6% defined themselves as current smokers. No difference*

in current smoking prevalence emerged between males and females (35.2% and 35.9%, respectively, p = 0.83). The mean age on initiation was 13.5 years for males and 13.9 years for females. The instantaneous probability of trying smoking changed with age, reaching a maximum at 14 years. Subjects who tried smoking before this age were more inclined to continue smoking.
The probability of being a current smoker was significantly higher among students from unmarried-parent families and those attending vocational and technical secondary schools.
Conclusions. *There is a great need for the activation of new health promotion interventions and enforcement of those already existing, in order to raise awareness of the damage caused by smoking among adolescents, especially those belonging to high-risk groups.*

Introduction

Cigarette smoking is one of the most important lifestyle risk factors for chronic diseases [1], which are responsible for a high number of deaths worldwide [2]. Throughout the world, more than 5 million deaths each year are due to tobacco smoking and, if the current rising trend persists, this figure is expected to reach a billion by the end of the 21st century [3]. Tobacco smoking has been classified by the International Agency for Research on Cancer (IARC) as having a Group I carcinogenic effect in humans, and about 70 carcinogens have been identified in tobacco smoke [4]. The leading smoking-attributable diseases are cancers and respiratory and cardiovascular diseases [5]. Gallus et al. reported 71,445 deaths (52,707 males and 18,738 females) attributable to smoking in 2010 in Italy (12.5% of total mortality). These deaths are due to lung cancer, other malignant neoplasms, cardiovascular disease and non-neoplastic respiratory diseases [6].
Tobacco smoking is a major public health problem worldwide. The majority of smokers start smoking in adolescence and approximately two thirds try smoking by the age of 15 [7]. The hazards of smoking depend on a variety of factors, such as age on initiation, the

number of cigarettes smoked per day, degree of inhalation, nicotine and tar content, and filter type [5]. Cigarette smoking among the young is associated with numerous health problems during childhood/adolescence and with an increase in health problems in adulthood [1, 8].
The age at which an individual starts smoking determines the probability of addiction, the likelihood of stopping and the risk of adverse health outcomes [9]. In a recent survey conducted in the United Kingdom (UK), 53% of adolescents reported having smoked at least one whole cigarette by the age of 16 years [10]. The Health Behavior in School-aged Children (HBSC) study, carried out in Europe, reported the following weekly smoking prevalence rates among the young: 2% among 11-year-olds, 8% among 13-year-olds and 24% among 15-year-olds [11].
The process of becoming a smoker develops through phases of preparation, initiation, experimentation, regular smoking and addiction, with progression from the first to the fifth phase lasting on average 2-3 years [12].
Adolescent smoking may be associated with socio-demographic, environmental, behavioral and personal factors [13]. The individual's level of education may also

influence smoking initiation, the more highly educated being less likely to smoke [14]. The question of whether a lower socio-economic status of parents influences the onset of smoking in their children remains open. Several studies have documented an inverse relationship between adolescent smoking and parental socioeconomic variables, such as education and social class, in that a higher level of adolescent smoking has been observed in families with lower socioeconomic status [13, 15]. Other studies, however, have not found such a link [16 ,17].

In order to implement early health-promotion measures, especially among high-risk groups, it is essential to ascertain the prevalence of tobacco smoking among adolescents, the ages when smoking is first experienced and becomes regular, and related risk factors.

The aims of the present study were to determine the prevalence of smoking and the mean age on initiation among adolescents in Genoa (Italy) and to identify socio-demographic predictors that could be associated with the onset of smoking.

Materials and methods

STUDY DESIGN AND POPULATION

This cross-sectional study was conducted in Genoa, Italy, between 2008 and 2010. About 30% of the city's secondary schools (high schools, technical schools and vocational schools) were randomly selected to participate in the study. Within each school, nearly 10% of the students were recruited by age-class (14-16 years and 17-19 years) by means of a randomized stratified sampling method. The boards of each school gave a permission for the testing the students.

As schooling is obligatory up to the age of 16 years in Italy, we recruited a higher number of subjects in the 14-16-year age-class (2:1) [18].

SMOKER DEFINITION

We have adopted the World Health Organization (WHO) definition of smoker that defines a smoker as a person who smokes either daily or occasionally [19].

QUESTIONNAIRE

We use an anonymous *ad hoc* questionnaire to record socio-demographic characteristics (gender, age, nationality, type of educational institution attended, family context, parents' education) and smoking habits (past and present smoking habits, age on first smoking experience). Questionnaires were self-administered and, in order to encourage openness and honesty in the answers, confidentiality and secrecy were ensured by avoiding any questions regarding the identity of the respondents. During administration of the questionnaire, physicians were available to explain the questions.

All questionnaires were checked on the basis of quality control.

SOCIO-DEMOGRAPHIC CHARACTERISTICS

Nationality, which was self-defined by the participants, was categorized as Italian or Foreign.

The type of family was subdivided into traditional and non-traditional. We considered married-parent families to be traditional, while any other family structure (e.g. single-parent family, remarried parent, etc) was defined as a non-traditional family. This distinction was prompted by the fact that several studies have reported different patterns of smoking among adolescents from families in which the parents are not married [20-22].

The educational level of the mother and father was classified as: high (high-school level or higher) or medium/low (middle-school level or lower).

The educational level of the participants was determined according to the type of educational institution attended. In Italy, the second phase of secondary education is broken down into 3 types of institution: high school, technical school and vocational school. High school is usually attended by students who want to continue their education at university; graduation from a technical school qualifies the individual to practice a technically skilled profession (e.g. chartered surveyor, accountant); vocational schools offer specialized training for specific occupations, such as electricians, designers etc. The data were dichotomized into two groups: (i) low educational level, which comprised vocational/technical schools and (ii) high educational level, which comprised high schools. This subdivision was based on the fact that, according to the Italian National Statistics Institute (ISTAT), more than 95% of high-school graduates continue their education at university, while the percentage of graduates from vocational (29%) and technical schools (53%) who try to enter university is significantly lower [23].

STATISTICAL ANALYSIS

Quantitative variables are expressed as means and standard deviations (SD), and qualitative variables as frequencies and percentages with 95% Confidence Intervals (95% CI). Student's t test was used to estimate differences in age on first smoking experience between the different categories. The Kaplan-Meier product-limit method was used to evaluate the hazard rate of trying smoking at any age for males and females. The hazard rate is the instantaneous probability of smoking onset [9, 24]. In particular, age of the first cigarette was chosen as a dependent variable (for subjects declared to experiment with smoking at least once) while subjects who had never smoked were registered as censored observations. Fisher's exact test was performed to compare current smoking status among males and females and to ascertain whether there was a difference in smoking continuation between subjects who tried the first cigarette before or after the age of 14 years. Univariate logistic regression was first performed to determine whether smoking status (current and previous) was associated with gender, age-class, nationality, type of family, and parents' and participants' educational level. Multivariate logistic regression was then performed in order to

reduce confounding biases. The multivariate analysis considered significant variables obtained from the univariate analysis, in order to determine any association of each variable with current smoking status and previous smoking experience. Statistical analysis was performed by means of the SPSS 17.0 (SPSS, Chicago) software. A $p < 0.05$ was considered significant.

Results

A total of 2,500 students aged 14-19 years were invited to participate in the study, 61 of whom declined (response rate of 97.6% [95% CI: 96.9-98.1]). As few students refused to participate, the reasons for refusal were not investigated. The study therefore involved 2,439 students (926 males and 1,513 females). We excluded 138 questionnaires from the analysis on the basis of quality control. Thus, the pool of eligible participants consisted of 2,301 students (901 males [39.2%, 95% CI: 37.2-41.2] and 1,400 females [60.8%, 95% CI: 58.8-62.8]). The mean age of participants was 15.8 (SD 1.6) years (males: 15.6 [SD 1.6]; females: 16.0 [SD 1.6]). The socio-demographic characteristics of participants are reported in Table I.
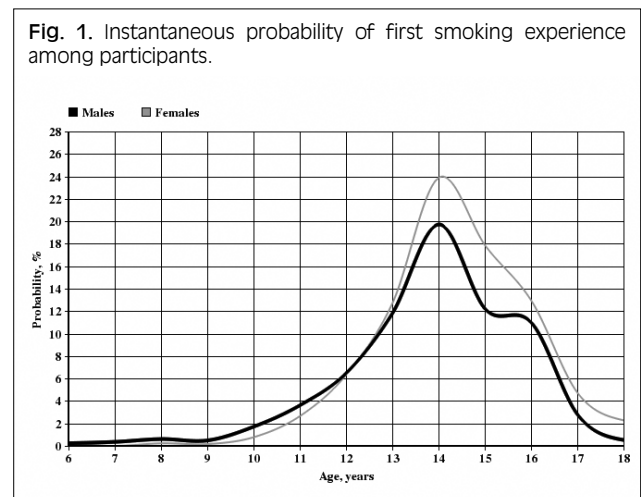
Of the students interviewed, 59.5% (95% CI: 57.4-61.6) stated having experimented with cigarette smoking at least once, and 35.6% (95% CI: 33.3-38.0) defined themselves as current smokers. The prevalence of smoking at the time of the study was similar among males and females (males: 35.2% [95% CI: 31.4-39.1]; females: 35.9% [95% CI: 32.9-38.9], p=0.83).

The mean age on first smoking experience was 13.5 (SD 1.7) years among current smokers and 13.8 (SD 1.8) years among subjects who had tried smoking at least once; this difference proved statistically significant ($p < 0.001$). Subjects who tried their first cigarette before 14 years of age were more inclined (p<0.001) to continue smoking than those who experimented with smoking at the age of 14 years or later (56.0% [95% CI: 51.5-60.5] vs. 41.6% [95% CI: 38.0-42.2]).

The mean age on first smoking experience differed significantly ($p < 0.001$) between males (13.5 years, SD 1.9) and females (13.9 years, SD 1.7). There was no difference in the mean age on first smoking experience between Italians and foreigners (13.8 and 13.9 years, respectively, p = 0.72), between students from traditional and non-traditional families (13.8 years for both), between low/medium and high educational level of the mother (13.8 years for both), between low/medium and high educational level of the father (13.9 and 13.8 years, respectively, p = 0.38), or between the educational levels of students: low educational level and high educational level (13.8 years for both).

The instantaneous probability of trying smoking changed substantially with age for both males and females (Fig. 1). Indeed, between the ages of 6 and 11 years, the risk of trying smoking was seen to increase slowly; after the

Fig. 1. Instantaneous probability of first smoking experience among participants.

Tab. I. Socio-demographic characteristics of participants.

Variable		Number (%)	95% CI
Nationality	Italian	2,174 (94.5)	93.5-95.3
	Foreign	81 (3.5)	2.8-4.3
	Not available	46 (2.0)	-
Age-class, years	14-16	1,536 (66.8)	64.8-68.6
	17-19	765 (33.2)	31.3-35.2
Family context	Traditional family	1,888 (82.1)	80.4-83.6
	Non-traditional family	311 (13.5)	12.2-15.0
	Not available	102 (4.4)	-
Type of secondary school	Vocational school	321 (14.0)	12.6-15.4
	Technical school	189 (8.2)	7.2-9.4
	High school	1,564 (68.0)	66.0-69.8
	Not available	227 (9.9)	-
Mother's level of education	High	1,631 (70.9)	69.0-72.7
	Medium/low	501 (21.8)	20.1-23.5
	Not available	169 (7.3)	-
Father's level of education	High	1,480 (64.3)	62.3-66.2
	Medium/low	590 (25.7)	23.9-27.5
	Not available	231 (10.0)	-

Tab. II. Univariate logistic regression for the main variables.

Current smoking status			
Variable	OR	95% CI	p value
Females vs. males	1.03	0.83-1.27	0.79
17-19 years vs. 14-16 years	1.97	1.59-2.43	<0.001
Foreigners vs. Italians	0.96	0.54-1.71	0.88
Non-traditional family vs. traditional family	1.62	1.22-2.15	0.001
Low/medium vs. high level of mother's education	1.44	1.12-1.84	<0.01
Low/medium vs. high level of father's education	1.31	1.04-1.65	<0.05
Low educational level vs. high educational level of participants	1.56	1.22-1.98	<0.001
Smoking experience			
Females vs. males	1.27	1.07-1.52	<0.01
17-19 years vs. 14-16 years	1.81	1.50-2.19	<0.001
Foreigners vs. Italians	1.02	0.63-1.65	0.94
Non-traditional vs. traditional family	2.21	1.67-2.94	<0.001
Low/medium vs. high level of mother's education	1.26	1.02-1.57	<0.05
Low/medium vs. high level of father's education	1.31	1.07-1.61	<0.01
Low educational level vs. high educational level of participants	1.88	1.50-2.34	<0.001

age of 12 years, there was a rapid increase, the maximum value (23.9% for females and 19.7% for males) being reached at 14 years. Subsequently, the risk diminished progressively, though this diminution was less marked between the ages of 15 and 16 years, especially among males.

Univariate logistic regression showed a significantly higher probability of being a smoker/experimenting smoking for higher age (17-19 years), non-traditional family context, low/medium education of parents, lower education of participants, and sex (for previous smoking experience only) (Tab. II). However, on multivariate logistic regression, only age, type of family and participants' educational level remained significant (Tab. III).

Discussion

Participation in the study was very high and the students showed considerable interest in smoking-related issues. The majority of interviewees stated that they had smoked at least once in their life. The prevalence of cigarette smoking among our respondents was higher than in some studies conducted in Italy in the same period as our research. Indeed, Gallus et al. reported a prevalence of 25.1% for 15-24-year-old males and 18.4% for 15-24-year-old females [6]. A survey conducted by the Italian Institute of Health (ISS) reported a prevalence of 21.9% among subjects aged 15-24 years [25] and Tramacere et al. found current-smoker prevalence rates among subjects aged 15-24 years of 29.6% and 23.3% in males and females, respectively [26].

The higher percentages in our study than in the three above-mentioned studies could be associated with the different definition of "current smoker" used in different studies. For instance, our "current smoker" definition was a person who smokes either daily or occasionally [19], while in the study conducted by Gallus et al., a current smoker was defined as someone who had smoked 100 or more cigarettes in his/her life [6]. The different forms of questionnaire administration may also influence the data collected. For instance, it has been shown that household surveys yield lower adolescent smoking rates than school-based surveys [27, 28].

Tab. III. Multivariate logistic regression for the main variables considered.

Current smoking status			
Variable	OR	95% CI	p value
17-19 years vs. 14-16 years	1.96	1.53-2.51	<0.001
Non-traditional vs. traditional family	1.44	1.02-2.04	<0.05
Low/medium vs. high level of mother's education	1.16	0.85-1.56	0.35
Low/medium vs. high level of father's education	1.06	0.81-1.40	0.67
Low educational level vs. high educational level of participants	1.39	1.06-1.81	<0.05
Smoking experience			
Females vs. males	1.11	0.90-1.35	0.33
17-19 years vs. 14-16 years	1.69	1.36-2.10	<0.001
Non-traditional vs. traditional family	2.22	1.57-3.14	<0.001
Low/medium vs. high level of mother's education	1.04	0.81-1.35	0.73
Low/medium vs. high level of father's education	1.11	0.87-1.40	0.40
Low educational level vs. high educational level of participants	1.75	1.37-2.40	<0.001

Our findings are in line with those of other studies. The Italian data from the HBSC study revealed prevalence rates of current smoking among 15-year-olds of 23% and 22% for females and males, respectively [11]; our study found a prevalence rate of current smoking among 15-year-olds of 20.7% (data not shown). A study conducted among 13-18-year-old students in Lombardy (Northern Italy) found prevalence rates of current smoking of 26.5% among 15-year-olds and 33.2% among 18-year-olds [29].

The mean age at which our respondents had first experienced smoking was 13.8 years, and the majority had smoked by the age of 16. This finding is in line with previous research in Italy and other Western European countries [11]. Moreover, in our study, males started smoking earlier than females. This finding is also in line with other research. Indeed, the European Tobacco Control Report revealed that boys started smoking earlier in almost all countries [11].

Subjects who experienced cigarette smoking before 14 years of age were more likely to carry on smoking than those who tried their first cigarette at the age of 14 years or later [9, 30].

Figure 1 shows that the risk trying smoking increases after the age of 11 years, and that this increase occurs after students move from elementary school to the first phase of secondary education; subsequently, the highest risk occurs after students transfer from the first phase to the second phase of secondary education (at the age of 14 years). Other researchers have also reported this trend [9].

On moving from childhood to adolescence, and in the first phase of adolescence, profound biological, social and relational changes take place. As personal identity forms, adolescents distance themselves from the family and forge closer bonds with peer groups, which become a new point of reference. Thus, adolescents feel the need to share emotions and experiences with their peers in order to feel part of the group. In terms of lifestyle, peer-group influence is a factor of primary importance and, according to previous research, the social exchange of cigarettes is one of the main sources of smoking among teenagers [31, 32]. In general, the influence of peer smoking is stronger than that of parental smoking, and this difference increases over time. However, the beneficial effect of having non-smoking friends seems to be greater than the deleterious effect of having friends who smoke [30]. Thus, the process of emulation and identification with the peer group could also be exploited as a strategy for the prevention of smoking [33].

After the age of 14 years, the risk of trying smoking decreases rapidly; interestingly, the decline in the risk of starting smoking appears to be less marked between the ages of 15 and 16 years, especially among males; this might be explained by the fact that 16 is the legal age limit for the purchase of tobacco products in Italy.

Our study highlights the importance of social and demographic factors that determine smoking habits. Regarding age, our study found a significantly higher prevalence of smoking among older students (17-19 years)

than younger ones. Moreover, the highest percentage of smoking was seen among students attending vocational and technical secondary schools, a finding consistent with those of other studies [34, 35]. In addition, regular smoking proved to be statistically associated with a non-traditional type of family. Again, this is in line with previous research, which has suggested a higher risk of taking up smoking among adolescents living in single-parent families [21, 22] and step-parent families [20, 22]. Many authors have found that adolescents from less educated families are at greater risk of starting smoking [36]. This is very probably linked with the fact that parents with a low socio-economic status are more likely to be smokers [37], and parental smoking is a well-known predictor of smoking among offspring [38, 39]. In our study, a lower level of parental education was statistically associated with a higher prevalence of smoking among offspring in the univariate regression model; on multivariate regression, however, it did not prove significant.

In agreement with these observations and the WHO recommendations, curbing smoking should be an integral part of health policy objectives; these should include promoting healthy lifestyles and preventing the damage caused by smoking, through the adoption of multi-sector strategies and raising awareness among young people [40]. Moreover, in order to target adolescents at high risk of starting smoking, promotional and educational interventions should take into account differences in social, cultural, geographical and economic contexts. In this regard, the Italian Ministry of Health has activated a project "Gaining Health - Making healthy choices easier" (*"Guadagnare Salute - Rendere facili le scelte salutari"*) which provides multi-sector intervention to promote healthy lifestyles, not only by persuading smokers to give up smoking or to smoke less, but also by discouraging young people from starting [41]. The key points of this program are: the implementation of educational campaigns that target subjects by age, sex, family and work contexts; school-based programs; regulation of the sale of tobacco products; raising consumer awareness; the promotion of specific educational programs on smoking among doctors, healthcare workers and voluntary associations; strengthening anti-smoking centers and the development of initiatives for women (mothers and pregnant women). Indeed, our study reveals a great need for the prompt activation and enforcement of these interventions, the message to young people being that they can be successful and appreciated without smoking, and that smoking is harmful to the health of everyone.

The present study displays some limitations. First, our questionnaire did not contain items on the type and intensity of smoking (such as number of cigarettes smoked). Second, we did not investigate other social and environmental factors (such as parents' and friends' smoking) that can prompt young people to start smoking.

In conclusion the findings of our study highlight the fact that tobacco smoking is a major problem among adolescents and that the early onset of smoking is linked to a

high probability of continuing to smoke. Therefore, reducing smoking among adolescents is one of the most important challenges for public health authorities.

Finally, our study revealed great interest in smoking and smoking-related issues among adolescents. It would therefore be useful to introduce programs of health education into the secondary school curriculum, in order to promote a healthy lifestyle. Furthermore, a potentially effective approach may be the adoption of the peer education method, which has had great success in other programs of health promotion among young people.

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