Acta med. rom., 35 (1997) 228-240

ONSET AND PERSISTENCE OF NICOTINE DEPENDENCE IN FEMALE ADOLESCENTS

INIZIO E PERSISTENZA DEL TABAGISMO FEMMINILE DURANTE L'ADOLESCENZA

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SUMMARY

Nicotine dependence has been consistently recognized in the last two decades as the leading cause of preventable disease and death in Western societies. Efforts aimed at increasing smoking cessation rates and reducing the onset of tobacco use among adolescents thus play a primary role in today's preventive medicine. In recent years, the number of female smokers has grown to become comparable to rates of male smokers in the general population. It is therefore important to focus on female smokers and to study their smoking habits and reasons for starting to smoke. This work summarizes epidemiological data on smoking in Italy and the U.S.A., presents the results of an ongoing survey of tobacco use and smoking-related attitudes in a sample of 281 medical and nursing school students at our University, and proposes a comprehensive model of smoking initiation and maintenance in female and male Italian adolescents, to possibly serve an hypothesis-driving function for future research in this field.

RIASSUNTO

La dipendenza da nicotina è stata identificata con sicurezza come la causa primaria di malattie e morte prevenibili nelle società occidentali. Pertanto gli sforzi miranti a favorire l'abbandono del fumo ed a ridurre il numero di adolescenti che iniziano a fumare ricoprono attualmente un ruolo di primaria importanza nella medicina preventiva. In questi ultimi anni, il numero di fumatrici è cresciuto, fino a raggiungere percentuali simili a quelle registrate tra i fumatori, rispetto alla popolazione generale. È pertanto importante concentrarsi sulla popolazione femminile, sia per quanto concerne la diffusione del tabacco, sia per lo studio delle ragioni che spingono ad iniziare a fumare. Questo lavoro riassume alcuni dati epidemiologici riguardanti la dipendenza da nicotina in Italia e negli U.S.A., presenta i risultati di uno studio sulla diffusione del fumo e sugli atteggiamenti riguardanti l'uso di tabacco effettuato su un campione di 281 studenti iscritti al corso di laurea in Medicina e Chirurgia oppure in Scienze Infermieristiche presso la nostra Università, e fornisce un modello interpretativo dei meccanismi di avvio e mantenimento della dipendenza da nicotina tra gli adolescenti di ambo i sessi nel contesto sociale italiano, potenzialmente utile per delineare ipotesi da verificare successivamente con studi mirati.

INTRODUCTION

Smoking has long been viewed as a "habit", and tobacco has often in history been regarded a medicinal drug (U.S. Department of Health and Human Services, 1988). Only in recent years has tobacco use been identified as an addiction, and "Nicotine Dependence" been defined a "psychiatric disorder", included in the Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association, 1994). Tobacco use indeed represents the single health hazard most diffused in the general population of the Western world and one leading to disease and death that could be entirely prevented, should tobacco use be eradicated (U.S. Department of Health and Human Services, 1988; Gold, 1995). Furthermore, the health benefits of smoking cessation have been confirmed by numerous studies (Samet, 1992). Depending on the physiological parameter or smoking-related disease under scrutiny, benefits either display an immediate onset after smoking cessation (Persico, 1992a) or arise with some latency and progressively build-up over time (Samet, 1992). The growing relevance given to smoking cessation and prevention efforts is thus quite justified.

The factors that drive toward experiencing with tobacco and that maintain approximately one-third of the population of western countries addicted to nicotine stem from a complex network of biological, psychological, and social factors. Nicotine displays complex pharmacological effects, best-described as central psychostimulation coupled with peripheral myorelaxation (Benowitz, 1992; Henningfield and Keenan, 1993; for review see Persico et al., 1989 and 1990). Most importantly, nicotine activates the mesolimbic-mesocortical dopaminergic pathways (Merlo-Pich et al., 1997), putatively mediating pleasurable sensations in physiological states such as food ingestion and sexual intercourse (Wise and Rompre, 1989). These same pathways are similarly activated by practically all drugs of abuse, artificially providing pleasurable effects in the absence of physiological activities normally linked to pleasure (Koob et al., 1993). The short-lived positive reinforcing effects of nicotine, coupled with the negative reinforcement produced by withdrawal symptoms rapidly arising after smoking cessation, powerfully stabilize daily nicotine use soon after initial contacts with tobacco (Benowitz, 1992; Henningfield and Keenan, 1993).

Biological factors are indeed important in contributing to the maintenance of nicotine dependence, and are partly responsible for the typical pattern of repeated failures that generally precedes successful smoking cessation attempts (Schachter, 1982). It cannot, however, adequately explain the onset of the addictive process itself, whose psycho-social roots likely display gender differences, as reflected by distinct patterns of tobacco use in males and females belonging to identical age groups (see below).

The quest for factors playing a role in smoking initiation must start from epidemiological studies which have, so far, been most extensively conducted in the United States. We shall now briefly review these studies, and summarize data on patterns of nicotine use as assessed in males and females belonging to all age groups both in Italy and the United States. Given the lack of comprehensive studies on the Italian adolescent population, we shall then provide data from an ongoing study on smoking prevalence and attitudes on tobacco-related issues, surveyed among medical and nursing students at L.I.U.C.B.M., mostly aged 18 to 22. These data will then both lead to and be interpreted within the framework of a smoking onset and maintenance model, generated to serve as a basis for future research.

TOBACCO USE IN MEN AND WOMEN: EPIDEMIOLOGICAL STUDIES

The epidemiology of tobacco use in the United States has been monitored by the U.S. Department of Health and Human Services. The seventies and eighties display a steady decrease in the number of smokers, reaching 29.1% of the population in 1987 from the 40.7% recorded in 1966 (Fiore, 1992). Most profound decreases have been recorded in the male population, where smokers have gone from 50.8% down to 31.7% in those same years; interestingly, the female population has displayed a much lesser trend, going from 32.0% to 26.8%. In reference to the teenage population, approximately 25% of American high school students, ranging between 14 and 18 years of age, has experimented with cigarette smoking, while 10-15% smokes half-pack or more daily (U.S. Department of Health and Human Services, 1988). Whereas the former figure may represent an underestimation of first contacts with nicotine, the latter suggests that a consistent share of teenagers already displays significant degrees of addiction to nicotine (Gold, 1995). Again, in this age group more women than men experiment with cigarettes or smoke daily (F: M = 19.8%: 16.9% for experimenting and 11.6%: 10.7% for smoking daily) (U.S. Department of Health and Human Services, 1988). Since 90% of American smokers report having begun smoking by age 21 (U.S. Department of Health and Human Services, 1989), these figures clearly support projections of cigarette smoking rates being higher among women than men in the year 2000 (F: M = 22.7%: 19.9%) (Fiore, 1992).

These gender differences must be viewed within the framework of a complex multifactorial epidemiology, whereby other factors such as racial and ethnic group, educational level and geographical location have a major impact and interact with gender (U.S. Department of Health and Human Services, 1988; Fiore, 1992). Nonetheless, even accounting for these other factors, it is clear from epidemiological studies carried out in the United States that (1) more teenage girls than boys are experimenting with tobacco and becoming addicted to nicotine and that (2) smoking cessation occurs less frequently among women than men.

Data collected from epidemiological studies performed in Italy substancially mirror these trends, despite specificities stemming from obvious cultural and socioeconomic differences. Also in Italy the eighties have been characterized by a steady decrease in the number of smokers, reaching 25.1% of the population in 1994 from the 34.9% recorded in 1980 (Fig. 1) (ISTAT, 1996). Again, it is males who display most prominent decreases, going from 54.3% down to 34.1% in those years. Females show a steady 16.7% of smokers, due to a balance between increasing numbers of quitters (up from 1.4% to 13.0% of the general population) and newly addicted individuals (never smokers down from 81.9% to 69.0%) (Fig. 1). Italian female smokers report a later age of smoking onset (approximately 20% start after age 22 vs 7% of males), fewer cigarettes smoked per day (approximately 10 on average, against 15 smoked daily by males), smoking cessation occurring at a somewhat earlier age and more rarely connected with the onset of smoking-related illnesses than in men (ISTAT, 1994). These epidemiological data confirm that (1) also in Italy tobacco use is spreading at a much faster rate among teenage girls than boys, and that (2) although women apparently become less severely addicted, their smoking behavior may also be less sensitive to the onset of smoking-related illnesses and to health-related interventions.

Studies focused on the Italian adolescent population are lacking. We have therefore decided to assess tobacco use and attitudes toward smoking-related issues among medical and nursing school students enrolled at our University. This research project, now entering its fifth year of progress, has already yielded some interesting results, which are briefly summarized in the following section.

TOBACCO USE IN A SAMPLE OF MEDICAL AND NURSING SCHOOL STUDENTS AT L.I.U.C.B.M.

This ongoing study has thus far involved 281 individuals, 190 females and 91 males; this sample includes 176 medical students (F: M= 85: 91), and 105 nursing students (all females), corresponding to 95.6% of our total student body. Importantly, 92.8% (261/281) of the total sample surveyed thus far is 18-23 years old. The questionnaire designed for this survey includes (I) a section to be filled by all participants, including demographic information, a general question on current and past tobacco use, family history for smoking-related diseases, attitudes toward smoking doctors and nurses and toward tobacco use on campus; and specific subsections to be filled (IIa) by current smokers, with 31 questions including the 6 questions of the Fagerstrom Dependence Questionnarie (Heatherton et al., 1991), the Reasons for Smoking Questionnaire (Ikard et al., 1969) presented as a single question, and the remaining questions covering smoking habits,













Figure 1 - Trends in smoking prevalence between 1980 and 1994 in the Italian population (Istat, 1996).

history of tobacco use, cessation attempts and withdrawal symptoms, as well as attitudes toward smoking related diseases and future cessation efforts; (IIb) by former smokers, with 27 questions covering issues similar to the ones assessed in current smokers; and (IIc) by never smokers, answering 1 question on attitudes toward smokers.

Tobacco use differs significantly between men and women in our sample (Table I). Men display higher-than-expected frequencies of experimenters and "chippers" (Shiffman, 1989), who report having smoked less than 100 cigarettes in their whole life, and especially of former smokers, who have quit for at least one month. Females, on the other hand, report higher frequencies of never-users and daily smokers addicted to nicotine. The distribution displayed in table I leads to an overall chi-squared of 12.71 (3df), corresponding to a highly significant 2-tailed p = 0.00531.

Male smokers (N = 19) do confirm an earlier age of onset for both daily smoking (mean \pm S.D. = 16.3 \pm 1.1 years vs 17.7 \pm 2.1 in 55 female smokers) and first tobacco use (13.8 \pm 2.4 vs 15.3 \pm 3.0). The intensity of nicotine dependence is similar between males and females (Table II). Fagerstrom Dependence scores (Heatherton et al., 1991) are quite low for both men and women, suggesting that these individuals are still at a relatively early stage of their "smoking career". However, significant percentages of young smokers have failed to reduce the number of cigarettes smoked daily or to quit smoking (table II), confirming that nicotine has rapidly introduced these subjects into the addictive cycle. This hypothesis is further supported by withdrawal symptoms reported by the vast majority of 51 young smokers who ever did try to quit (Table III). The preliminary data summarized in table III suggest that smoking cessation may be fol-

TABLE I

Lifetime number of cigarettes smoked	Students (N=281)	Females (N=190)	Males (N=91)	
None	26.0%	28.9%	19.8%	
	73	55	18	
<100	42.3%	39.5%	48.4%	
	119	75	44	
≥100, but I have now quit for at least 1 month	5.3% 15	$2.6\% \\ 5$	$\frac{11.0\%}{10}$	
≥100, and I am presently smoking	26.3%	28.9%	20.9%	
	74	55	19	

SELF-REPORTED LIFETIME TOBACCO USE IN A SAMPLE OF 281 MEDICAL AND NURSING SCHOOL

T.able II

INTENSITY OF NICOTINE DEPENDENCE IN 74 STUDENTS CURRENTLY SMOKING

	Smokers (N=74)	Females (N=55)	Males (N=19)
Fagerstrom dependence scores (mediam ± seminterquartilic range; range 0-10)	2.0 ± 1.0	2.0 ± 1.0	2.5 ± 0.5
Percentage with Fagerstrom Dependence score ≥5	$6.8\% \\ 5$	$7.3\% \\ 4$	5.3% 1
Percentage answering Yes to Question B23: Did you ever entirely change your plans to buy cigarettes, when you discovered you had run out of them?	45.9% 34	$47.2\% \\ 26$	44.4% 8
Percentage answering Yes to Question B24: Did you ever try to reduce the number of cigarettes you smoke or to switch to a lighter brand?	83.8% 62	83.6% 46	84.2% 16
Percentage answering Yes to Question B25: Did you ever try to give up smoking altogether?	$58.1\% \\ 43$	$\frac{58.2\%}{32}$	57.9% 11

TABLE III

INTENSITY OF NICOTINE DEPENDENCE IN 74 STUDENTS CURRENTLY SMOKING

Nicotine withdrawal symptoms	Smokers (N=51)	Females (N=39)	Males (N=12)
Craving for cigarettes	64.7% 33	$\begin{array}{c} 66.7\% \\ 26 \end{array}$	58.3% 7
Increased hunger and/or body weight	41.2% 21	43.6% 17	$\frac{33.3\%}{4}$
Irritability	27.5% 14	30.8% 12	$\frac{16.7\%}{2}$
Restlessness	21.6% 11	$25.6\% \\ 10$	$\frac{8.3\%}{1}$
Anxiety	$15.7\% \\ 10$	$25.6\% \\ 10$	-
Difficulty concentrating	13.7% 7	$\frac{10.3\%}{4}$	$\frac{25.0\%}{3}$
Drowsiness	$9.8\% \\ 5$	5.1%	$\frac{25.0\%}{3}$
Headache	$9.8\% \\ 5$	10.3%	$\frac{8.3\%}{1}$
Gastrointestinal symptoms	2.0% 1	2.6% 1	-
None	15.7% 8	$\frac{12.8\%}{5}$	$\frac{25.0\%}{3}$

lowed in girls by higher levels of anxiety, restlessness, irritability and increased hunger, whereas boys may display excessive drowsiness and difficulty concentrating, compatible with well-known attention-enhancing properties of nicotine (Persico et al., 1990). Interestingly, withdrawal symptoms most frequently reported by female smokers in their quitting attempts also characterize pathological Premenstrual Dysphoric Disorder (American Psychiatric Association, 1994). Correlations between menstrual and nicotine withdrawal symptoms have already been supported by other studies (Pomerleau et al., 1992).

Answers to the 18 items of the Reasons for Smoking Questionnaire (Ikard et al., 1969) provide no evidence for differences in self-perceived motivations for smoking, except for significantly enhanced use of tobacco by girls to control negative affect (Fig. 2). The families of smoking students display percentages of smokers much higher than the national average, and there may be higher rates of smoking mothers in the families of male smokers and viceversa an excess of



Fig. 2 — Differences in Reason for Smoking Questionnaire scores (Ikard et al., 1969) between 55 females and 19 male students. Scores are expressed as median \pm semi-interquartilic range. * Mann-Whitney U=345.5; Z=2.2032; 2-tailed P=0.0276.

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TABLE IV

	Smokers (N=74)	Females (N=55)	Males (N=19)
Father	36.6%	38 507	91.607
Taurci	26	20	6 51.0 <i>%</i>
Mother	36.6%	34.6%	42.1%
	26	18	8
Sisters or brothers	34.2%	37.6%	26.9%
Girlfriend or boyfriend	40.0%	43.4%	29.4%
	28	23	5

CURRENT TOBACCO USE BY CLOSE RELATIVES OF 71 STUDENTS SMOKING DAILY

nal surveys (Istat, 1994): Males 45-64 years old = 40.15%. 15-24 years old = 30.6%.

> Females 45-64 years old = 15.6%. 15-24 years old = 18.2%.

smoking fathers and brothers among female smokers (Table IV). The onset of smoking-related health disorders is viewed as "probable" by 69.1% of 55 smoking females and 57.9% of 19 smoking males. However, a relevant 29.6% of 27 female smokers with one or more family member struck by lung cancer uses tobacco on a daily basis against only 11.8% of 17 male smokers with the same family history. This suggests that awareness of smoking-related health hazards, coupled with the living example of cancer-stricken smokers in the family, may possibly bear more impact in preventing daily smoking among men rather than women.

A COMPREHENSIVE MODEL OF SMOKING INITIATION AND MAINTENANCE IN FEMALE AND MALE ADOLESCENTS

The epidemiological data described above depict tobacco use in the general population and among Italian adolescents; furthermore, our ongoing project is providing relevant information on smoking-related attitudes among young people. Neither, however, directly explain the reasons behind the onset and maintenance of smoking in adolescents and in the general population. We shall now attempt to interpret these data within the framework of a comprehensive model of smoking initiation and maintenance, which these data, in turn, help support and further define. Four stages can possibly be discriminated in the life of a smoker:

(I) The "seeding" phase, when children aged approximately 3 to 10 are made object of messages depicting the ideal smoker as "strong", "winning", "likable", or simply "normal", either through cartoons and commercials specifically aimed at this share of the population or through routine exposure to smoking by role-model figures such as parents, teachers, pediatricians, clergy, and so on.

(II) The "harvest" phase, when the message sown during childhood is reactualized by the anxieties and low self-esteem typically characterizing adolescents approximately between 11 and 21 years of age (Carmody, 1989). At this stage, self-esteem and perception of one's physical appearance tend to be lower among girls than boys (Minigawa et al., 1993). These deficiencies, coupled with cigarette availability, peer pressure, a dysfunctional family, and low enforcement of smoking bans at home and in school (Waldron et al., 1990; Moss et al., 1992), can precipitate daily tobacco use especially among girls. As most evident in the U.S., also cigarette advertisement aimed at adolescents insists on the same line as during the preceding phase, but definitely hinges more heavily on smoking as a source of sex appeal, which may be a very powerful motivational trigger for both men and women at this age (Gold, 1995). Interestingly, many of these factors predicting smoking initiation during adolescence also appear to predict relapse into smoking following cessation in adults (West et al., 1977).

(III) The "maintenance" phase, when the natural addictive properties of nicotine are further reinforced by messages stressing not only the "strenght" and the "sex appeal" of the smoker, but also his/her independence from restriction that society is "unjustly" and forcefully trying to impose by limiting freedom of tobacco use. For this purpose, the tobacco industry has undertaken several initiatives, typically designed for the "stabilized" adult smoker roughly 22 to 50 years old, namely "smokers' clubs" or "centers for information on tobacco", aimed at influencing public opinion or lobbying at the political level to prevent smoking bans from being passed by the Parliament or from being enforced.

(IV) The potential "loss" of the client, when after 50 years of age chances of developing smoking-related diseases or mere medical advise induce many smokers to quit. Several factors come into play in the selection of "hard-core" smokers who do not quit even at this stage. In a small sample of Italian smokers we have tentatively identified predictors of relapse present prior to smoking cessation, including active medical problems (especially if smoking-related), past psychiatric history, presence of smokers in the family, longer sleep duration and

higher number of self-reported awakenings per night (Persico, 1992b). Predictors of relapse detectable during the first 4 weeks after smoking cessation include persistent nicotine withdrawal, single "slips" into smoking, longer sleep duration, increased number of nights with awakenings, and perhaps persistently increased hunger (Persico, 1992b). Many of these factors had already been identified by research conducted on larger samples in the U.S.A., although this study underscores for the first time, to our knowledge, the potential relevance of a healthy sleeping function in prevention of relapse into tobacco use after smoking cessation (Persico, 1992b).

The model summarized above clearly underscores the role of an "aesthetic" ideal of smoker, charming, appealing, energetic and happy, created through decades after World War II by the tobacco industry, with the (at times involuntary) aid of the movie industry and of the press, an ideal reaching deep down the roots of our society. To be accepted by her peers, an adolescent girl must be thin and charming: we have been "programmed" through the years to interpret a relatively neutral signal, the cigarette, as a vehicle of charm. Furthermore, our ideal of feminine beauty, imposing thinness as an undisputed rule, prevents many smoking women from quitting or favors relapse into smoking for fear of gaining weight (U.S. Department of Health and Human Services, 1988; Carmody, 1989; Pierce et al., 1989).

It is therefore critical that smoking cessation programs be tailored especially for female adolescent smokers, also to include optional interventions by a dietician, to be started approximately two to three months after smoking cessation when success has been firmly established (U.S. Department of Health and Human Services, 1996). In fact, the epidemiological data previously summarized suggest that the motivational triggers underpinning smoking onset and maintenance in women nowadays appear more powerful and longer-lasting than those that underlie smoking in men. Only counteracting fears at this same "aesthetic" level, we may boost motivation to quit and improve smoking cessation rates. Interventions focused on the health hazards of tobacco use, traditionally designed for older smoking populations and typically carried out in collaboration with pneumologists or internists, may yield very disappointing outcomes if automatically applied onto younger smokers, especially females. Messages such as: "You must gain at least 50 kilograms to even up the health risks you run due to tobacco" (Gold, 1995) may at times help convincing older men to stop smoking; however, they will consistently discourage teenage girls, because tobacco is far better at this age than the perpetual scorn reserved to those who dare infringe today's socially-accepted canons of beauty and charm.

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ACKNOWLEDGEMENTS

The authors wish to thank Stevens S. Smith, Michael Fiore, Jack Henningfield, and Karl-Olov Fagerstrom, for helpful discussion and contribution to designing the questionnaire employed in our survey; Paola Binetti for her coltaboration and support to this research project, and Riccardo Adriani for helping create the computerized data set.