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Time trends in smoking habits among Italian young adults

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Summary
Background: In most developed countries the prevalence of smoking habits is decreasing in men, while in women the prevalence seems to decline in Northern Europe but to increase in the Mediterranean area. The present research aims at assessing time trends in smoking habits in Italy.
Methods: In the frame of the Italian Study on Asthma in Young Adults (ISAYA) a random sample of the Italian population aged 20–45 years was administered a mailed questionnaire in 9 Italian centers between 1998 and 2000. Cumulative response was 72.7% (18873/25969). Kaplan–Meier survival curves and log-rank test were used to compare probability of remaining a life-time non-smoker across birth cohorts (1953–58, 1959–63, 1964–68, 1969–73, 1974–78). Probability to quit smoking was also evaluated among ever-smokers.
Results: Probability to persist as a non-smoker significantly increased across subsequent generations in both sexes. At the age of 20 years this probability amounted to 41.7% (95% CI 39.4–44.0%) in men and 52.7% (50.4–54.9%) in women

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born between 1953 and 1958, and it increased to 57% (54.8–59.1%) in men and 68.7% (66.6–70.7%) in women born in 1969-73, but no further decline in smoking habits was observed in the next birth cohort (1974–78). Also the probability to quit smoking significantly increased from the 1953–58 birth cohort to the 1969–73 one.

Conclusions: Smoking has declined among Italian young adults of both genders. Further efforts are necessary to promote active anti-smoking campaign, especially among adolescents, which are at higher risk of starting to smoke.

Introduction

At present about 1.1–1.2 billion people smoke in the world, and this figure is expected to increase to 1.6 billion in 2025.[1] In fact, while smoking is declining in most westernized countries,[2] it is substantially increasing in developing countries due to a growth in adult population and increased tobacco consumption.[3] In the United States the prevalence of smoking peaked at 57% among men in 1955 and at 34% among women 10 years later; thereafter, it decreased till the 1990s when it plateaued.[4] The tobacco sale rates declined during the 1980s,[5] while in Europe the decreasing trend started 10 years later, with an annual drop of about 2.9%.[6]

In developed countries nearly all studies report a decreasing trend in smoking among men; among women the proportion of smokers has been reported to decrease in Northern Europe (Sweden, UK, and Poland)[7–9] but to increase in Southern and Central Europe (Spain, Germany, and Hungary).[10–12] Moreover, women seem to be less likely to quit smoking than men.[13,14] Among youngsters, even in developed countries, smoking prevalence has been reported to increase.[8,15] In the States, among persons aged 18–24 years, the prevalence rose from 23% in 1991 to 27% in 2000.[16]

In Italy the National Institute of Statistics reported that smoking prevalence is decreasing in men, from 35.1% in 1993 to 31.2% in 2001, while remaining stable in women, being 16.4% in 1993 and 16.9% in 2001.[17,18] However, these prevalence values largely underestimate overall tobacco sale rates in Italy,[19] and are much lower than those reported by other surveys, which range between 41% and 43% in men and between 24% and 30% in women.[20,21] These discrepancies could arise from the different methods used in the different surveys: for instance, the National Institute of Statistics performed household face-to-face interviews,[22] while in the European Community Respiratory Health Survey (ECRHS) patients were interviewed at specialized clinics.[21] Moreover, in some studies the response rate was not reported preventing to rule out a possible self-selection bias.[23]

Recently, the Italian Branch of the Gallup International Association (DOXA) performed three times a survey on smoking habits on samples of the Italian population aged 15 years and over. Prevalence of smokers was 34.8% in 2001, 31.1% in 2002, 33.2% in 2003 among men, and 23.6%, 22.3%, 22.5% respectively among women.[24–26] A clear-cut declining trend in smoking was not apparent, but the period of investigation was too short to assess a possible trend in smoking prevalence.

The present investigation aimed at assessing possible temporal trends in smoking habits across Italian generations born from the 1950s to the 1970s during their life.

Methods

Study protocol

This study was performed in the frame of the Italian Study on Asthma in Young Adults (ISAYA),[27–29] a cross-sectional survey performed from 1998 to 2000 in 9 Italian centers: 6 centers (Torino, Verona, Udine, Pavia, Sassuolo, Ferrara) were located in the Po Valley in Northern Italy, one center (Pisa) in Tuscany, Central Italy, and two centers in the two major islands in Southern Italy (Sassari in Sardinia, Siracusa in Sicily). In each center 3000 individuals (1500 men and 1500 women) were randomly selected from the general population aged 20–45 years, using the registry of the local health authority. Selected individuals were sent by mail a screening questionnaire on smoking habits. Non-responders were contacted again first by mail and then by phone.

Screening questionnaire

The mailed questionnaire was the same screening questionnaire used in the ECRHS survey, integrated with additional questions on asthma, subjective

perception of outdoor pollution and smoking habits.[30] In particular, age of starting and stopping smoking and number of cigarettes consumed daily were also investigated.

Subjects were considered to have start smoking if they reported to have smoked at least one cigarette per day or one cigar a week for 1 year, and to have stopped smoking if smoking abstinence had lasted for at least 1 month.

Pack-years were calculated as years of smoking multiplied by the mean of 20-cigarette packs consumed daily.

Statistical analysis

Prevalences were compared by χ^2 test. Mann–Whitney test and Kruskal–Wallis test were used to evaluate significance of differences in the number of cigarettes smoked daily, age at initiation and at quitting of tobacco smoke, and pack-years, when appropriate. Non-parametric tests were used as these variables were not normally distributed.

Cumulative probability to remain a never-smoker at different ages was estimated by Kaplan–Meier method and compared among subsequent birth cohorts (1953–58, 1959–63, 1964–68, 1969–73, 1974–78) by the log-rank test. The same statistical procedures were used to evaluate cumulative probability of quitting smoke as a function of time elapsed since start smoking among all ever-smokers (current or ex-smokers). In the latter analysis, the birth cohort 1974–78 was skipped, as these subjects were too young to get insight into the pattern of smoking cessation. As age at onset and cessation of smoking was only available in years, steps in Kaplan–Meier curves are evenly spaced.

The influence of sex, birth cohort and occupation (clerk, manager /businessman, workman, student, housewife, unemployed/other job) on smoking initiation and cessation was evaluated by a Cox regression model, controlling for center and contact order (I postal contact, II postal contact, phone contact). Time to event was, respectively, age at smoking onset and time elapsed from smoking initiation to quitting smoking. The assumptions of proportional hazard over time made in the Cox model were met for all the variables tested according to graphical methods.[31] Significance level was set at 0.05 for main effects and at 0.01 for interactions.

Calculations were performed by STATA statistical software, version 7.0.

Results

Cumulative response percentage was 72.7% (18873/25969). Information on smoking habits was available for 18,790 subjects, corresponding to 99.6% of overall responders. The male to female ratio of the sample was close to 1, being 9261 (49.3%) men and 9518 (50.7%) women; mean age ($\pm$ standard deviation) was 33.1 ± 6.9 years, 33.1 ± 6.9 in men and 33.2 ± 6.9 in women. The prevalence of non-smokers was significantly lower and those of current smokers and ex-smokers were higher in men than in women ($P < 0.001$) (Table 1). At variance, when considering only ever-smoker subjects (current and past-smokers) the prevalence of ex-smokers was higher in women than in men (31.8% vs 29.1%; $P < 0.01$).

Average age at initiation of smoking was 17.2 ± 3.2 years (median 17, interquartile range 3 years); it was slightly lower in men than in women (respectively, 16.9 ± 3.1 and 17.4 ± 3.2 years, $P < 0.001$). Ex-smokers had started smoking at a younger age than current smokers (respectively, 16.8 ± 2.9 and 17.3 ± 3.2 years, $P < 0.001$). Average age at quitting smoking was 27.9 ± 6.3 years (median 27, interquartile range 9 years); women stopped smoking at a slightly lower age (respectively, 27.5 ± 6.1 and 28.2 ± 6.5 years; $P < 0.05$).

The average number of cigarettes smoked daily was 13.6 ± 8.3 (mean $\pm$ SD, median 12, interquartile range 12) among current smokers, 15.3 ± 8.7 (median 15, interquartile range 10) in men and 11.5 ± 7.1 (median 10, interquartile range 9) in women. The number of cigarettes per day and the

Table 1 Number of subjects and prevalence (95% confidence interval) of non-smokers, ex-smokers and current smokers.

	N. of subjects			Prevalence (95% CI)		
	Total	Males	Females	Total	Males	Females
Non-smokers	9731	4389	5342	51.8 (51.1–52.5)	47.4 (46.4–48.4)	56.1 (55.1–57.1)
Ex-Smokers	2748	1419	1329	14.6 (14.1–15.1)	15.3 (14.6–16.1)	14.0 (13.3–14.7)
Current smokers	6300	3453	2847	33.5 (32.9–34.2)	37.3 (36.3–38.3)	29.9 (29.0–30.8)

percentage of heavy smokers ($\geqslant$15 cigarettes/day) significantly decreased across subsequent generations, both in men and in women ($P < 0.001$) (Table 2). This pattern is shown in more detail in Fig. 1: the percent of ever smokers consuming 25 cigarettes daily or more was quite remarkable in the 1953–58 birth cohort (19.1% in men and 5.2% in women), but became negligible in people born in 1974–78 (3.8% in men and 1.1% in women).

With increasing age, the prevalence of smokers tended to decrease and that of ex smokers to increase in all birth cohorts. Cumulative smoke exposure of current smokers amounted to 8.5 (12.3) pack-years (median, interquartile range), 9.9 (13.5) pack-years in men and 7.2 (11.0) in women. Both in men and in women, the number of pack-years at all ages tended to decrease across subsequent generations, the difference being significant at 20 years ($P < 0.001$) (Table 3).

Cumulative probability to remain a life-time non-smoker, estimated by Kaplan–Meier curves, significantly increased across subsequent generations in both sexes (Fig. 2). At the age of 20 years this probability (95% Confidence Interval) amounted to 41.7% (39.4–44.0%) in men and 52.7% (50.4–54.9%) in women born between 1953 and 1958, and it increased progressively to 57% (54.8–59.1%) in men and 68.7% (66.6–70.7%) in women born 15 years later (1969–73) (test for trend: $P < 0.001$). However, the rising trend leveled off in the last birth cohort considered (1974–78), with a probability of not starting smoking by 20 years of 56.2% (53.6–58.7%) in men and 66.1% (63.6–68.4%) in women. In all birth cohorts, women were less likely to start smoking than men. The "Teens" were the critical age to start smoking, as shown in Table 2

and, in Fig. 2, by the sharp drop in the probability to remain never-smokers recorded between 13–14 and 20 years of age in both sexes and in all generations considered. A similar pattern in smoking initiation across subsequent generations was observed in multivariate survival analysis (Table 4). The risk of starting smoking, estimated by a Cox regression model, was the highest among blue collars and the lowest among students. A high risk was recorded also among unemployed men, but not among unemployed women (interaction sex-occupation: $P < 0.001$).

Also the probability to quit smoking significantly increased from the 1953-58 birth cohort to the 1969–73 one (Fig. 3). Fifteen years after smoking initiation, 21.3% (19.0–23.9%) of men and 22.9% (20.4–25.6%) of women born between 1953 and 1958 had managed to quit, while among people born in 1969–73 these percentages increased, respectively, to 30.4% (25.0–36.6%) and 40.8% (33.6–49.0%) (test for trend: $P < 0.001$). The increase in the probability to quit smoking across subsequent generations was more pronounced in women than in men: in the Cox model a significant interaction emerged between sex and birth cohort ($P = 0.005$; Table 5). Students were more likely to quit, while blue collars, unemployed and managers/businessmen were more likely to persist in smoking (Table 5).

Discussion

The main results of the present study are:

(1) In Italy, younger generations seem to smoke less than older ones: in particular, the probability to

Table 2 Smoking details according to gender and birth cohort.

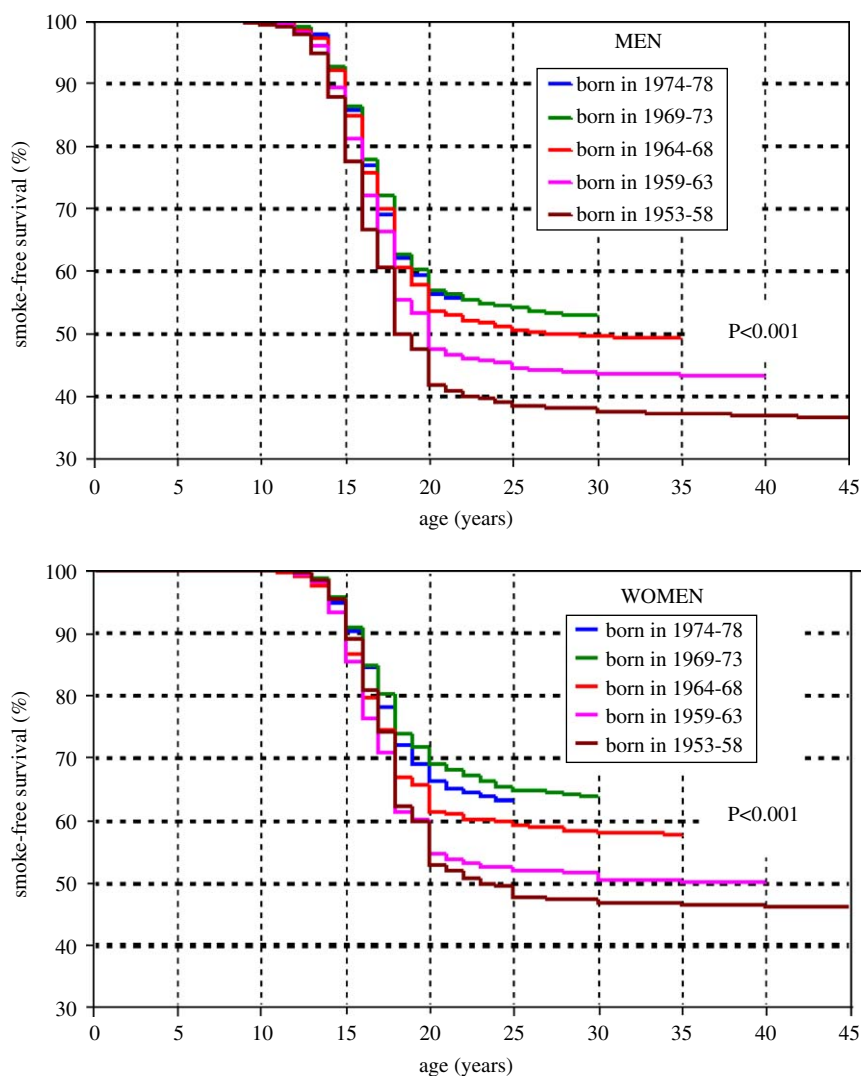|	Birth cohort				
	1953–58	1959–63	1964–68	1969–73	1974–78
Men					
Age at interview	42.8 (1.6)	37.6 (1.5)	32.8 (1.5)	27.8 (1.5)	23.2 (1.4)
Age at initiation	17.0 (3.6)	17.0 (3.2)	17.1 (3.1)	17.0 (2.8)	16.5 (2.2)
Age at quitting	31.7 (7.0)	28.8 (5.9)	26.6 (4.4)	24.0 (3.2)	20.8 (2.0)
Cigarettes/day	17.7 (10.3)	16.6 (9.4)	15.1 (8.8)	13.7 (7.2)	12.2 (6.9)
Heavy smokers	66.3% (63.5–69.1)	61.3% (58.4–64.3)	55.7% (52.7–58.7)	50.6% (47.4–53.8)	39.5% (35.8–43.2)
Women					
Age at interview	42.8 (1.6)	37.7 (1.5)	32.8 (1.5)	27.8 (1.5)	23.1 (1.5)
Age at initiation	18.0 (3.6)	17.4 (3.4)	17.1 (3.2)	17.5 (2.9)	16.9 (2.3)
Age at quitting	31.0 (6.8)	28.2 (5.5)	26.2 (4.6)	24.1 (3.3)	20.7 (2.2)
Cigarettes/day	12.2 (7.6)	11.7 (7.5)	11.5 (7.5)	9.9 (6.7)	9.2 (5.9)
Heavy smokers	41.1% (38.1–44.1)	37.8% (34.7–40.8)	35.0% (31.9–38.1)	27.0% (23.7–30.3)	22.7% (19.1–26.3)

Years of age and number of cigarettes/day are expressed as mean (standard deviation); prevalence of heavy smokers ($\geqslant$15 cigarettes/day) among ever-smokers is expressed as percentage (95% confidence interval).
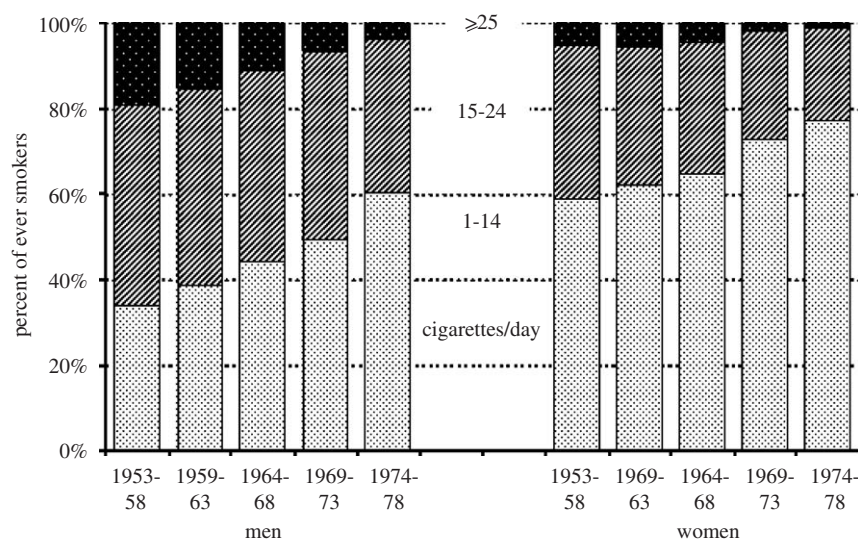
Figure 1 Distribution of ever smokers according to gender, birth cohort and number of cigarettes per day.

Table 3 Prevalence of smokers and ex-smokers, and number of pack-years (interquartile range) among ever smokers according to gender, age and birth cohort.

	Birth cohort				
	1953–58	1959–63	1964–68	1969–73	1974–78
Men					
Smokers at 20	59.3	52.5	46.5	42.7	41.2
25 years	56.5	49.7	43.8	40.6	—
30 years	50.5	44.7	39.2	—	—
35 years	44.4	40.7	—	—	—
Ex-smokers at 20	1.8	2.1	1.8	1.6	2.9
25 years	6.0	6.3	6.1	5.3	—
30 years	12.3	11.7	11.2	—	—
35 years	18.5	15.7	—	—	—
Pack-years at 20	3.0 (1.2–5.0)	2.5 (1.0–4.5)	2.0 (1.0–4.0)	2.0 (1.0–4.0)	2.0 (0.9–3.6)
25 years	6.8 (3.5–10)	6.0 (3.5–9.0)	5.3 (3.0–9.0)	5.3 (2.5–8.0)	—
30 years	10.5 (6.0–15)	10.0 (5.0–14)	8.4 (4.5–13)	—	—
35 years	14.0 (7.5–20)	12.8 (7.0–19)	—	—	—
Women					
Smokers at 20	48.9	45.2	38.0	31.2	32.1
25 years	47.7	42.3	34.8	30.3	—
30 years	43.2	36.8	30.8	—	—
35 years	39.1	32.8	—	—	—
Ex-smokers at 20	1.4	1.9	1.9	1.5	2.1
25 years	5.2	6.4	6.3	5.1	—
30 years	10.2	12.6	11.2	—	—
35 years	14.3	17.0	—	—	—
Pack-years at 20	1.5 (0.5–3.0)	1.6 (0.6–3.0)	1.5 (0.6–3.0)	1.3 (0.5–2.5)	1.1 (0.5–2.3)
25 years	3.8 (1.8–6.8)	4.0 (2.0–7.0)	4.0 (2.0–7.0)	3.2 (1.4–5.4)	—
30 years	6.0 (3.0–10.5)	6.0 (2.8–10.5)	6.0 (3.0–10.5)	—	—
35 years	8.5 (4.0–14.3)	8.0 (3.8–14.3)	—	—	—

Figure 2 Cumulative probability to persist as a non-smoker at different ages, estimated by Kaplan–Meier method, among subsequent birth cohorts (1953–58, 1959–63, 1964–68, 1969–73, 1974–78). Significance of differences was derived by the log-rank test. Upper panel = men; lower panel = women.

persist as a never-smoker and, if not, the probability to quit smoking have both increased from people born in the 1950s to people born in the early 1970s. This favorable trend has leveled off thereafter during the 1970s.

(2) The decline in smoking initiation is consistent both in men and women, while the increase in smoking cessation seems slightly faster in women.

(3) The lowest socioeconomic classes (blue collars and unemployed) are more likely to start smoking and less likely to quit. On the contrary, among university students the probability of smoking initiation is the lowest and the probability of smoking cessation is the highest.

The present multicentre survey documents a declining trend in smoking prevalence in Italy.

Younger generations seem to smoke less than older ones: in particular, the probability to persist as a never-smoker and, if not, the probability to quit smoking have both increased from people born in the 1950s to people born in the early 1970s. This favorable trend, similar to that recorded in most westernized countries,[2,4–6] could be the result of effective anti-smoking campaign among teen-agers and young adults. Unfortunately, the trend has apparently leveled off in people born during the 1970s. In fact, the decline seems to have stopped in people younger than 25 years, as in the present investigation, or even reversed, as in British and American surveys.[15,16] From 1990 to 2000 smoking prevalence has increased among white American youngsters aged 18–24 years by 10% in males and by 12% in females, reaching a final value of 34–36%[15]; at present, in the States the rate of current

Table 4   Risk of smoking initiation as a function of birth cohort, gender and occupation.

	Hazard Ratio (95% CI)		P value
Birth cohort			<0.001
1953–58	1		
1959–63	0.90 (0.85–0.96)		
1964–68	0.76 (0.71–0.80)		
1969–73	0.68 (0.63–0.73)		
1974–78	0.77 (0.71–0.84)		
Occupation	Men	Women	<0.001
Clerk	1	0.89 (0.83–0.95)	
Manager/businessman	1.20 (1.10–1.30)	0.89 (0.79–1.00)	
Blue collar	1.48 (1.37–1.60)	1.13 (1.01–1.26)	
Student	0.75 (0.66–0.86)	0.66 (0.58–0.76)	
Housewife	1.11 (0.36–3.44)	0.91 (0.83–1.00)	
Unemployed/other	1.39 (1.27–1.52)	0.90 (0.81–1.00)	

Hazard ratios of smoking initiation and significance levels were computed by a Cox regression model, including sex, birth cohort, occupation, center and contact order.

smoking sharply increases from middle school to high school.[32] In two British general practices the proportion of current smokers and heavy smokers (⩾20 cigarettes per day) increased in the age class 16–24 years in both sexes from 1993 to 2001.[8] Also in Canada and in eastern Finland smoking prevalence peaks at the age of 21 years.[33,34] Of note, very large proportion of smokers are occasionally found among Italian high-school students.[35]

In agreement with the current literature,[36] individuals from lower socioeconomic classes were more likely to smoke and less likely to quit than those from higher socioeconomic classes. According to Rogers' theory of diffusion of innovations, new behaviors are early adopted by higher socioeconomic classes.[37] This further supports that today's innovative process is smoking cessation.

Our results strongly support the need for promoting an aggressive strategy (e.g., increasing the retail price of tobacco products, implementing smoking-prevention media campaigns, and decreasing minors' access as part of comprehensive tobacco-control programs) to prevent smoking among youth, especially of lower socioeconomic classes. The critical age is 14–20 years when they become more susceptible to peer pressure and other influence.[38] Targeting youth in an anti-smoking evidence-based strategy will reduce the number of smokers since almost all smokers began smoking when they were in their teens.

Recently two European studies reported that smoking prevalence had not decreased in Italian women.[18,39] Differently from those studies, in the present Italian investigation smoking declined similarly both among men and among women and only a very mild increase in smoking was recorded

among women from the 1969–73 birth cohort to the 1974–78 birth cohort. This discrepancy could be attributed, at least in part, to different age ranges and age classes. Indeed, those European surveys studied people aged 25–79 years who were either considered as a whole or grouped into 20-year classes, while the present investigation focused on people aged 20–45 years, grouped into 5-year classes. So, we probably concentrated on the recent declining phase of the "smoking epidemic" among Italian women, while missing the previous rising phase. A decline in smoking habits among Mediterranean women, if confirmed by further studies, would be particularly relevant to public health, as maternal smoking has pronounced deleterious effects on respiratory health in children.[40]

The present research has some limitations. First of all, self-selection can bias prevalence estimates, when response percentage is low, because current smokers tend to be late responders in postal surveys.[41–43] However, in the present investigation response percentage was high enough (72.7%) to rule out major biases.[23]

Second, reports of smoking or of abstinence in this survey were not verified with biochemical methods. However, in population surveys the percentage of smokers falsely declaring themselves as non-smokers seems to be quite low.[44] In Italy, Olivieri et al.[45] found a good agreement (Cohen's $k = 0.93$) between self-reported smoking consumption or abstinence and serum cotinine levels. However, other Italian authors found that official tobacco sale rates exceeded self-reported cigarette consumption by 25–35%.[24] Thus, Italian population seems to report correctly its smoking status
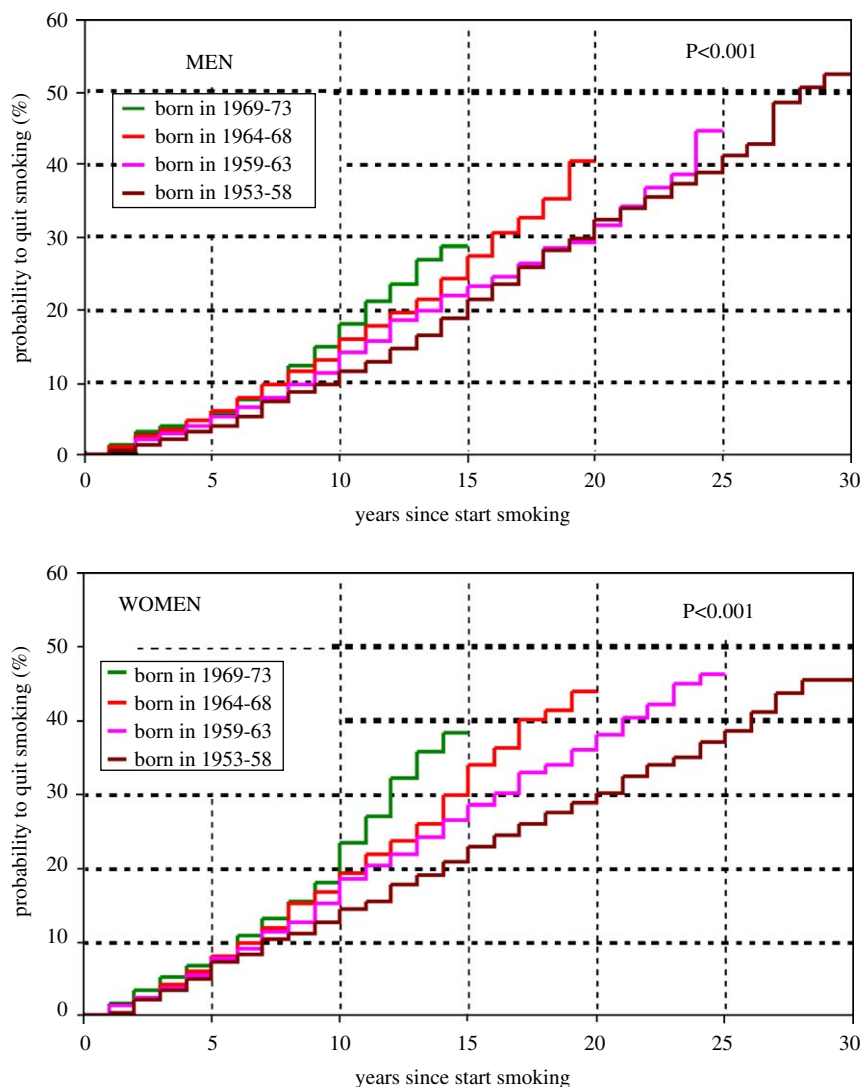
Figure 3 Cumulative probability to quit smoking among ever-smokers (current or ex-smokers) as a function of time since start smoking, estimated by Kaplan–Meier method, among subsequent birth cohorts (1953–58, 1959–63, 1964–68, 1969–73). Significance of differences was derived by the log-rank test. Upper panel = men; lower panel = women.

but to under-report number of cigarettes smoked daily.

Third, the definition of ex-smokers was not the most rigorous available, as an abstinence of just 1 month was required.[46] It is well-known from the current literature that many smokers success to quit tobacco for a few months, but later on mostly they relapse.[47] Moreover, the studied population was too young (20–45 years) to fully investigate the extent and the determinants of smoking cessation, which has been shown to occur at a mean age of 42.4 years in Italian men and 39.1 years in women.[25]

Finally, the present estimates could have been affected by a recall bias: individuals tend to attribute the onset of a habit or a disease to an

age closer to the time of interview than the true age at onset (telescoping bias).[48] Hence, the age at smoking initiation and cessation could have been over-estimated by the interviewed. Nevertheless, no telescoping bias was detected in a similar epidemiological context, i.e. the Italian branch of the ECRHS: age at start smoking, reported by 313 subjects interviewed twice 8.6 years apart, was 0.01 ± 2.01 years lower (mean $\pm$ SD) in the second interview with respect to the first one, and no significant difference was observed among different birth cohorts.

In conclusion, smoking is confirmed to be a dangerous habit present today in a high percentage of the Italian population. A reduction in smoking habits is apparent across generations, until those of

Table 5 Risk of smoking cessation as a function of birth cohort, gender and occupation.

	Hazard ratio (95% CI)		P value
Occupation			<0.001
Clerk	1		
Manager/businessman	0.83 (0.74–0.93)		
Blue collar	0.79 (0.70–0.89)		
Student	1.14 (0.84–1.54)		
Housewife	1.06 (0.92–1.22)		
Unemployed/other	0.82 (0.71–0.94)		
Birth cohort	Men	Women	0.005
1953–58	1	0.84 (0.72–0.97)	
1959–63	1.06 (0.92–1.22)	1.12 (0.96–1.30)	
1964–68	1.25 (1.08–1.46)	1.36 (1.16–1.59)	
1969–73	1.33 (1.10–1.61)	1.69 (1.40–2.05)	

Hazard ratios of smoking cessation and significance levels were computed by a Cox regression model, including sex, birth cohort, occupation, center and contact order.

the early 1970s, but further educative and preventive efforts are needed to avoid an even possible resumption in the youngest.

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