ORIGINAL ARTICLE

Smoking Cessation in a Population-Based Cohort Study

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OBJECTIVE: To study the incidence rates and the determinants of smoking cessation in a population-based cohort.

MATERIAL AND METHODS: We used data from the Cornellà Health Interview Survey Follow-up Study. Subjects who declared they were daily smokers at baseline (1994) and had complete follow-up, with information on smoking status in 2002, entered into analysis. We calculated incidence rates and the relative risks of cessation (with 95% confidence intervals) using the Cox model.

RESULTS: Out of 353 daily smokers, 100 quit smoking during the follow-up period (cumulative incidence of 28.3%). The incidence rate of cessation was higher among men (42.34 per 1000 person-years) than among women (24.97 per 1000 person-years), with a relative risk of cessation of 1.69 (95% confidence interval, 1.02-2.79) for men. Age and level of education were associated with a higher relative risk of quitting in men.

CONCLUSIONS: The main determinants for smoking cessation are sociodemographic (sex, age, and level of education).

Key words: *Smoking. Quitting. Cessation. Cohort study.*

Abandono del consumo de tabaco en una cohorte de base poblacional

OBJETIVO: Estudiar la tasa de incidencia del abandono del consumo de tabaco en una cohorte de base poblacional, así como determinar las características asociadas a éste.

MATERIAL Y MÉTODOS: Los datos proceden del Estudio de Seguimiento de la Encuesta de Salud de Cornellà del Llobregat (ES.ESC). Los análisis se restringieron a los fumadores diarios identificados en la entrevista basal (año 1994) y con información completa en la encuesta de seguimiento (2002). Se calcularon las tasas de incidencia de abandono y el riesgo relativo (con su intervalo de confianza) de abandono del consumo de tabaco mediante un modelo de Cox.

RESULTADOS: De los 353 fumadores diarios, 100 dejaron de fumar durante el período de seguimiento (incidencia acumulada del 28,3%). La tasa de incidencia de abandono fue mayor en los varones (42,34/1.000 personas-año) que en mujeres (24,97/1.000 personas-año), con un riesgo relativo de abandono para los varones de 1,69 (intervalo de confianza del 95%, 1,02-2,79). La edad y el nivel educativo se asociaron a un riesgo relativo de abandono mayor en los varones.

CONCLUSIONES: Los principales determinantes del abandono del consumo de tabaco son sociodemográficos (sexo, edad y nivel de estudios).

Palabras clave: *Tabaquismo. Abandono. Cesación. Estudio de cohortes.*

Introduction

Smoking is a preventable risk factor, the reduction of which has health repercussions on the incidence and mortality rates of cancer and cardiovascular and respiratory diseases.[1,2] In Catalonia in 2002, 38% of men and 26.5% of women declared they were smokers.[3] The proportion of male smokers decreased with respect to previous years but the prevalence of smoking increased among females, particularly among the youngest. A similar trend can be observed for Spain as a whole. The latest Spanish National Health Survey carried out in 2001

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showed that 34.4% of the general adult population over 15 years of age were smokers (42.1% of men and 27.2% of women).[4] In men, prevalence increased from the 1950s until the mid-1970s, after which it stabilized for a decade and then started to decrease to the current level. In women, prevalence was very low until the 1970s, and since then it has increased until the present level.[5-7] Differences between the sexes and among social classes were also observed in the pattern of cessation. Over recent years, the percentage of men quitting has increased particularly among those with a higher level of education whereas among women cessation has only increased among those with university level education[8-10] and the rate is slightly higher in men than in women (34.1% compared with 28.4% in 1997).[8] No differences have been identified between the sexes with regard to desire to quit, previous attempts, and success in quitting smoking in studies carried out in other countries,[11] although a cross-sectional study in the United States of America showed that while women and men had the same probability of quitting smoking, women had more difficulty maintaining abstinence.[12]

The health risk caused by smoking is known to decrease progressively after quitting.[13] Nearly half of all smokers wish to quit.[4] Every year almost a third of all smokers try to quit smoking but less than 10% are successful.[13] Although the main obstacle to quitting is nicotine addiction, smoking and quitting are characterized by complex social and psychological determinants.[14] The comparison of the characteristics of ex-smokers with people who continue smoking is of interest when designing campaigns and specific interventions aimed at reducing the prevalence of smoking.

Several studies in our area of research have identified sociodemographic variables associated with certain smoking distributions.[8,15-17] These studies are useful in observing tendencies but do not provide data on the incidence of cessation.[14] The objective of the present study was to analyze the incidence of smoking cessation and its determinants in a cohort taken from a representative sample of the general population of Cornellà de Llobregat, a town in the greater metropolitan area of Barcelona, Spain.

Material and Methods

Data for the present study was taken from the Cornellà Health Interview Survey Follow-Up Study, which used a population-based cohort taken from participants in the 1994 Cornellà Health Interview Study. In the baseline survey of 1994, 2500 people were personally interviewed (1237 men and 1263 women) in representation of the noninstitutionalized population of Cornellà de Llobregat.[18] Eight years later, after updating the vital status and addresses of the people who had participated in the Cornellà Health Interview Study using a computer link to the town census, direct contact was attempted with each of the 2500 participants (excluding those who were previously identified from the census as having died or moved away), and a telephone interview was performed.[19]

Follow-up data was obtained through 3 types of questionnaires. The first was a general questionnaire for participants who could answer for themselves (>14 years of age). The second was a questionnaire to be answered by a proxy, used when the participants were less than 15 years of age or not able to answer for themselves (the questionnaire followed the same structure as the first but questions that could not be answered by another person such as those asking for opinions, including those on smoking, were removed). Finally a questionnaire was designed for those people who did not want to participate in the follow-up interview. They were asked to respond only to questions on their perceived state of health, smoking status, and level of education. In this way at least some potentially informative variables could be collected in lieu of the complete questionnaire.

The analysis was limited to those people who had declared they were daily smokers in the baseline interview of 1994 (n=609) and of whom we had full follow-up information on smoking status in 2002 (n=353). Of the 609 daily smokers in the cohort in 1994, 378 (62.1%) answered the follow-up interview. Information on smoking status was not obtained for 5 disabled participants (0.8%) for whom the proxy questionnaire was used, 11 people (1.8%) who refused to participate in the study, 22 (3.6%) who had died during the follow-up period, 131 (21.5%) who had moved away, and finally, 62 people (10.2%) who could not be located. Participants who did not answer the follow-up questionnaire were a mean 4 years younger ($P<.05$) but there were no significant differences for level of education or chronic diseases in comparison with participants who were re-interviewed in 2002.

Smoking was defined according to the guidelines of the World Health Organisation,[20] who consider smokers to be people who smoke least 1 cigarette a day and ex-smokers people who quit smoking at least 6 months previously but who had smoked at least one cigarette a day in the past.

Cessation incidence rates were calculated according to the number of events (participants who quit smoking) and the population-period at risk expressed as 1000 person-years. Relative risk (RR) and confidence intervals (CI) were calculated for smoking cessation using the Cox regression model separately for men and women and adjusting for age, after finding that the assumption of proportional-hazard over time was fulfilled, indicating that the relation between 2 risk functions for any 2 individuals was constant over time. Becoming an ex-smoker (0: smoker; 1: ex-smoker) was the dependent variable or event. The starting point of the follow-up study was the date of the baseline interview and the end point for those who continued to smoke was the completion of the follow-up questionnaire and for those who quit smoking it was the date of cessation as stated in the follow-up interview. Participants who had died, moved away, could not be located, or who refused to respond to the brief questionnaire were excluded from the study as no updated information on smoking status was available.

The following independent variables from the 1994 baseline interview were analyzed: sociodemographic variables (sex, age, marital status, level of education, social class, employment situation, and birthplace); health and lifestyle variables (perception of health, presence of smoking-related diseases, physical examination, medical advice, alcohol use, and physical activity); and smoking variables such as number of cigarettes, age of onset, desire to quit, and the number of

TABLE 1
Sociodemographic Variables Associated With Cessation of Smoking. Cornellà Health Interview Survey Follow-Up Study*

	Quitters†	Person-Years	Incidence/1000 Person-Years	Crude RR (95% CI)	Age-Ajusted RR (95% CI)
Men	65	1535.08	42.34		
Level of education					
No schooling	8	166.18	48.14	1	1
Primary	39	994.03	39.23	0.81 (0.38-1.73)	1.32 (0.60-2.91)
Secondary + tertiary	17	367.86	46.21	0.95 (0.41-2.21)	2.20 (0.86-5.66)
Birthplace					
Catalonia	23	724.06	31.76	1	1
Spain/abroad	42	811.02	51.79	1.61 (0.97-2.68)	1.08 (0.60-1.92)
Employment situation					
Currently employed	39	884.94	44.07	1	1
Unemployed	9	372.26	24.18	0.54 (0.26-1.13)	0.62 (0.30-1.29)
Disabled + retired	13	185.85	69.95	1.58 (0.84-2.96)	0.91 (0.44-1.87)
Student	4	76.70	52.15	1.19 (0.42-3.33)	2.59 (0.81-8.41)
Social Class‡					
IVa+IVb+V	46	1110.11	41.44	1	1
I+II+III	18	358.01	50.28	1.21 (0.70-2.09)	1.27 (0.73-2.19)
Age, years					
<45	28	887.96	31.53	1	1
≥45	37	647.11	57.18	1.79 (1.10-2.93)	1.79 (1.10-2.93)
Women	20	800.84	24.97		
Level of education					
No schooling + primary	10	496.32	20.15	1	1
Secondary + tertiary	10	304.52	32.84	1.66 (0.69-4.00)	1.85 (0.73-4.67)
Birthplace					
Catalonia	11	481.07	22.86	1	1
Spain/abroad	9	319.78	28.14	1.21 (0.50-2.93)	1.16 (0.41-3.29)
Employment situation					
Currently employed	9	311.22	28.92	1	1
Unemployed	1	137.15	7.29	0.26 (0.03 -2.02)	0.24 (0.03-1.97)
Housewife	6	212.41	28.25	0.97 (0.35-2.73)	0.81 (0.26-2.55)
Student	4	124.82	32.05	1.09 (0.34-3.55)	1.39 (0.36-5.42)
Social class‡					
IVa+IVb+V	13	472.88	27.49	1	1
I+II+III	7	289.42	24.19	0.89 (0.35-2.21)	0.86 (0.34-2.17)
Age, years					
<45	17	689.82	24.64	1	1
≥45	3	111.02	27.02	1.08 (0.31-3.70)	1.08 (0.32-3.70)

*CI indicates confidence interval; RR, relative risk.
†Date of cessation was not available for 15 cases.
‡IVa+IVb+V: manual workers (skilled and unskilled); I+II+III: nonmanual workers.

previous attempts.

Results

Out of 378 daily smokers from the 1994 survey, 25 were excluded because in the follow-up interview they declared they were occasional smokers (a variable that could not be analyzed) or because they presented inconsistent answers. Of the 353 daily smokers, 100 had quit smoking during the previous 8 years (28.3% accumulated incidence of smoking cessation), although 15 of them could not provide the date of cessation and were excluded from the analysis. When compared with ex-smokers with complete follow up there were no differences regarding age and sex but participants without knowledge of date of cessation had a lower level of education and worse state of perceived health.

Table 1 shows the incidence rate, RR and 95% CI of smoking cessation associated with sociodemographic variables. Differences were found for sex: the incidence of smoking cessation was higher in men (42.34/1000 person-years) than women (24.97/1000 person-years). Men had 1.69 (95% CI, 1.024-2.79) times more probability of quitting smoking than women. A significant positive tendency was found between level of education and probability of quitting smoking among men (χ^2=14.62; P<.01). The probability of cessation among men with secondary or tertiary level education

was double those with no schooling (RR=2.20; 95% CI, 0.86-5.66). Among women, despite a greater probability of smoking cessation among those with higher levels of education, the differences were not significant (RR=1.85; 95% CI, 0.73-4.67).

Age was a determining factor among men, such that those over 44 years of age had a higher probability of quitting smoking than younger men (RR=1.79; 95% CI, 1.10-2.19). This association was not observed among women (RR=1.08; 95% CI, 0.32-3.70).

Table 2 shows the incidence of cessation, RR and 95% CI associated with health and lifestyle variables. No association was found between smoking cessation and perceived health or the presence, past or current, of smoking related diseases. Men who said they had an annual medical examination were more likely to quit smoking (RR=1.97; 95% CI, 1.20-3.24); this relation, however, was not found among women (RR=2.23; 95% CI, 0.80-6.27). Systematic advice to quit smoking from doctors to their patients was not associated with smoking cessation among members of our cohort. Likewise, physical activity and alcohol use were not predictors of smoking in this cohort.

Table 3 shows the variables related to smoking but no clear pattern emerges with respect to number of cigarettes smoked daily or age of onset. Desire to quit did not appear to be related to either cessation of smoking or the number of previous attempts to quit in men. In

TABLE 2
Health and Lifestyle Variables Associated With Smoking Cessation. Cornellà Health Interview Survey Follow-Up Study*

	Quitters†	Person-Years	Incidence/1000 Person-Years	Crude RR (95% CI)	Age-Adjusted RR (95% CI)
Men					
Smoking-related diseases					
No	40	1067.50	37.47	1	1
Yes	25	467.58	53.47	1.43 (0.70-2.36)	1.12 (0.67-1.89)
Self-perceived health status					
Good health	54	1325.31	40.74	1	1
Poor health	11	209.76	52.44	1.30 (0.68-2.49)	1.01 (0.52-1.96)
Medical advice					
No	29	660.72	43.89	1	1
Yes	36	874.35	41.17	0.93 (0.57-1.52)	0.84 (0.51-1.37)
Physical examination					
No	38	1160.54	32.74	1	1
Yes	27	374.53	72.09	2.22 (1.35-3.63)	1.97 (1.20-3.24)
Physical activity					
Sedentary	17	376.09	45.20	1	1
Active	48	1158.98	41.41	0.92 (0.53-1.60)	1.05 (0.60-1.83)
Alcohol					
>32 g/day	18	381.22	47.22	1	1
11.3-32 g/day	15	416.61	36.00	0.77 (0.39-1.54)	1.02 (0.50-2.06)
≤11.2 g/day	13	253.36	51.31	1.09 (0.53-2.22)	1.48 (0.71-3.11)
Abstemious	8	219.15	36.50	0.79 (0.34-1.82)	1.08 (0.46-2.53)
Women					
Smoking-related diseases					
No	17	639.38	26.59	1	1
Yes	3	161.46	18.58	0.70 (0.20-2.38)	0.68 (0.20-2.33)
Self-perceived health status					
Good health	17	719.54	23.63	1	1
Poor health	3	81.30	36.94	1.46 (0.43-5.00)	1.41 (0.40-4.95)
Medical advice					
No	13	448.60	28.98	1	1
Yes	7	352.25	19.87	0.71 (0.28-1.77)	0.69 (0.27-1.74)
Physical examination					
No	15	684.50	21.91	1	1
Yes	5	116.35	42.97	2.24 (0.80-6.28)	2.23 (0.80-6.27)
Physical activity					
Sedentary	5	194.52	25.70	1	1
Active	15	606.32	24.74	0.95 (0.34-2.62)	0.89 (0.31-2.57)
Alcohol					
Any consumption	8	275.84	29.00	1	1
Abstemious	5	210.72	23.73	0.84 (0.27-2.56)	0.85 (0.28-2.59)

*CI indicates confidence interval; RR, relative risk.
†Date of cessation was not available for 15 cases.

TABLE 3
Smoking Variables Associated With Cessation. Cornellà Health Interview Survey Follow-Up Study*

	Quitters†	Person-Years	Incidence/1000 Person-Years	Crude RR (95% CI)	Age-Adjusted RR (95% CI)
Men					
No. cigarettes/day					
≤10	22	423.46	51.95	1	1
11-20	28	745.48	37.56	0.72 (0.41-1.27)	0.78 (0.44-1.36)
≥20	15	342.95	43.74	0.84 (0.43-1.61)	0.83 (0.43-1.61)
Age of onset, years					
≤15	23	579.34	39.70	1	1
16-18	25	627.82	39.82	0.99 (0.56-1.73)	1.15 (0.64-2.05)
≥19	17	327.91	51.84	1.30 (0.69-2.44)	1.20 (0.64-2.24)
Desire to quit					
No	18	474.47	37.94	1	1
Yes	47	1060.60	44.31	1.18 (0.69-2.03)	1.24 (0.72-2.14)
Previous attempts to quit					
No	38	923.06	41.17	1	1
Yes	27	612.01	44.12	1.08 (0.66-1.77)	1.04 (0.64-1.71)
Women					
No. of cigarettes/day					
≤10	12	404.99	29.63	1	1
≥11	8	395.85	20.21	0.67 (0.28-1.65)	0.66 (0.27-1.62)
Age of onset, years					
≤18	12	540.62	22.20	1	1
≥19	8	260.22	30.74	1.39 (0.57-3.40)	1.38 (0.49-3.89)
Desire to quit					
No	7	330.81	21.16	1	1
Yes	13	470.03	27.66	1.22 (0.48-3.06)	1.19 (0.47-3.03)
Previous attempts to quit					
No	9	513.96	17.51	1	1
Yes	11	286.88	38.34	2.13 (0.88-5.13)	2.11 (0.87-5.10)

*CI indicates confidence interval; RR, relative risk.
†Date of cessation was not available for 15 cases.

women, however, number of previous attempts did seem to be associated with a high rate of cessation although the level of association was not significant (RR=2.11; 95% CI, 0.87-5.10).

Discussion

Our study is consistent with the literature[14] in finding that sociodemographic variables are the main determinants of cessation. Rates of cessation in our population are similar to those obtained in other studies.[21-24] Men showed a higher probability of quitting smoking than women, even though results from cross-sectional survey studies do not show differences between sexes in smoking cessation.[11] In our study, older men had higher rates of smoking cessation and participants with secondary and tertiary levels of education had higher rates of cessation than those without schooling or with a primary level education. That this pattern of smoking cessation was different depending on sex and level of education could be explained by the stage the tobacco epidemic in Spain is in and by the innovation diffusion theory which proposes that a new behavior is first adopted by people with a high level of education and later spreads through the rest of society.[25] Earlier studies on the Spanish population have shown this model to be applicable in Spain.[6,7,10,26] Some authors, however, have argued that differences in the level of education could be attributable to psychosocial factors.[14] People with higher levels of education could be more sensitized to the antismoking message, have more opportunities to quit, suffer fewer stressing daily-life situations, and have more exemplary role models available with respect to smoking.[27]

In the cross-sectional analysis of the 1994 Cornellà Health Interview Survey, age was shown to be the main predictor of smoking cessation, but level of education was not,[17] results consistent with those presented after 8 years of follow up. In the 1994 Health Survey of Catalonia, characteristics associated with cessation were higher smoking intensity, healthy lifestyles, and higher levels of education.[15] Prospective studies have also shown an inverse relation between cessation and the number of cigarettes smoked daily and low level of education.[21,28-30]

Regarding the potential limitations of the study, in the first place the size of the sample of smokers was small

and stratifying the analysis by sex reduced the statistical power thereby limiting the ability to detect predictors of smoking cessation. However, the sex differential in the smoking epidemic necessitates separate analysis of men and women.[9,14] Moreover, smoking information was collected from 62.3% of the cohort, and a selection bias may have occurred as two thirds of the losses from the cohort were due to participants dying or moving away before the second interview. These natural losses could have influenced the results if, as can be expected, high intensity smokers had higher rates of mortality or were more likely to move away than moderate smokers. If this was the case, it would have led to overestimation of the rates of cessation of high intensity smokers in those remaining in the cohort.

The use of self-reported smoking status can cause errors in classification in intervention studies of smoking cessation[31] but is an adequate form of classifying smokers in observational, epidemiological studies such as this.[13,31]

Identifying the characteristics of people who quit smoking and factors that determine cessation is central to designing interventions for groups that are more likely to quit successfully. This information is also useful for concentrating efforts on groups with high prevalence of smoking that to date have responded little to interventions. Smoking cessation is a dynamic process of change,[32] so as well as identifying the sociodemographic characteristics related to smoking, discovering what motivates smokers to make an effort to quit and how they can be helped to maintain abstinence is essential.[33,34]

The multiple factors related to smoking cessation obliges programs aimed at controlling smoking to be plural and focus on aspects such as price, publicity, and health awareness, social acceptability, and nicotine dependence.[35-37]

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