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Predictors of Smoking Cessation Following Physicians' Counseling[1]

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Background. **The purpose of this study was, to identify predictors of quitting following general practitioners' (GP) anti-smoking counseling.**

Methods. **We studied determinants (characterized following the Precede framework) of successful quitting (1 year sustained abstinence, biochemically confirmed at 6- and 12-month follow-up) among 861 smokers randomized to the intervention groups based on repeated counseling (RC), RC+spirometric testing, and RC+nicotine gum, in a smoking cessation trial carried out in Turin, Italy.**

Results. **GPs' intervention worked best for male (OR= 2.30; 95%CI, 1.13–4.52) and married (OR=3.63; 95%CI, 1.37–9.59) smokers, for smokers who had maintained abstinence for at least 1 month in the past (OR=6.78; 95%CI, 1.56–29.52) or at their first quit attempt (OR= 10.91; 95%CI, 2.37–50.13), and for those who spontaneously reduced their coffee consumption (OR=3.30; 95%CI, 1.59–6.82); heavy smokers (>=20 cig/day OR= 0.48; 95%CI, 0.24–0.93) and those living with other smokers (>=1 smokers in the household: OR=0.44; 95%CI, 0.22–0.90) were less likely to give up. Previous anti-smoking advice by the GP represented a strong barrier to success for healthy smokers (OR=0.19; 95%CI, 0.07–0.52), but not for those reporting symptoms of shortness of breath (OR=0.63; 95%CI, 0.39–9.20). There were no interactions between predictors and treatment conditions.**

Conclusions. **Assessment of factors influencing quitting would allow GPs to tailor their message to address existing barriers and to help patients utilize their resources for change.**

Key Words: **smoking cessation; counseling; general practitioners.**

INTRODUCTION

Quitting smoking has been described as a cyclical process, in which environmental factors interact with smokers' characteristics at different stages of the cessation cycle [*1*]. By recognizing and magnifying those forces that favor cessation, physicians could implement more effective interventions and integrate their efforts in a more comprehensive anti-smoking strategy. Physicians should be able to elicit from smokers valuable information about their reasons for maintaining unhealthy habits, as well as about barriers and resources for change, to negotiate the adoption of new, healthier, behaviors [*2*].

A large amount of information is available with respect to determinants of quitting smoking. However, the narrow focus of several studies limits the relevance of their results to the population of smokers contacted in physicians' offices. This is the case for findings concerning smokers who volunteer for formalized quitting programs. They have already progressed to a stage where they are prepared to take action on their smoking and this preliminary process is likely to act as a self-selection mechanism, which makes it nearly impossible to determine the relation of volunteers to the source population of smokers or aspiring quitters [*3,4*]. Also, evidence from observational studies in the general population may not be transferable to the general practice setting, where the attempts to quit are not self-initiated, but prompted by individualized medical advice.

Only four studies have addressed the issue of identification of predictors of quitting, in the context of smoking cessation trials in general practice or primary care clinics [*5–8*]. Various determinants of short-term (4–6 months) success, as well as of long-term abstinence (1–3 years), have been identified. Conflicting findings have been reported, however, with respect to the role of health status, age, gender, and educational level. Also, the predictive role of individuals' pretreatment characteristics was assessed in these studies, referring to time

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intervals ranging from 4 months to 3 years, while 1 year sustained abstinence has been recommended as a standard end point to assess the efficacy of different anti-smoking interventions, since it is considered an indication of a consolidated modification of smoking habit [*9,10*]. Thus the interpretation of the reported findings is difficult in the absence of a uniform time reference for evaluating the process of change. Moreover, misclassification of smoking status may bias the results of these analyses. Indeed, deception rates varying between 7 and 28% have been described in the context of intervention trials [*11–15*], indicating that self-reports of smoking status may be inaccurate, particularly when smokers feel under pressure to give up, as is the case for subjects enrolled in cessation programs. Self-reported abstinence was biochemically validated in just one study [*6*], but the small number of ex-smokers (N=22) limits the strength of its conclusions.

We studied the determinants of successful quitting following medical advice among unselected smokers enrolled in a large smoking cessation trial in Italy [*14*]. The outcome of interest was biochemically validated abstinence sustained over 1 year. The analysis was based on the Precede model proposed by Green [*16*]. This model incorporates concepts defined within the Health Belief Construct [*17,18*], but it recognizes the role of the complex relationships between internal and external determinants of behavior, taking into account additional factors that might be relevant to orientation of physician-delivered preventive interventions. According to this framework any given health behavior can be seen as a function of the collective influence of three kinds of factors classified as predisposing, enabling, and reinforcing factors. *Predisposing factors,* which include knowledge, attitudes, beliefs, and values as well as demographic factors, relate to the motivation of an individual to act [*16,* pp.69–70]. *Enabling factors* may be defined as the resources necessary to the implementation of a health behavior and include individual skills necessary to implement the desirable behavior [*16,* p.75]. *Reinforcing factors* include those environmental influences that determine whether health actions are supported [*16,* p.77].

The role of these factors was assessed over the standard reference time that has been recommended for the evaluation of the effectiveness of general practitioner-(GP) delivered anti-smoking interventions. The Precede model provided a useful conceptual framework for sorting determinants of behavioral change into categories convenient for designing a structured educational plan. Also, the results of our analysis were not flawed by the possible bias resulting from reliance on self-reporting, which might be at issue in similar studies in which no biochemical validation was performed.

In addition to the methodological aspects, it seems noteworthy to mention that this is, as for as we know, the only paper addressing this issue in a non-English-speaking country.

METHODS

Study Population

A randomized trial evaluating the effectiveness of four different interventions in general practice was performed in Turin, Italy (Minimal Intervention (C), one session of face to face counseling; Repeated Counseling (RC), subjects were to receive the same counseling as the first group, but they were also invited to four follow-up visits scheduled over 9 months; RC + nicotine gum, nicotine gum (2 mg) was offered in addition to the counseling intervention; RC + spirometry, subjects received, in addition to the counseling sessions, a written prescription for a spirometry). The methods adopted and the main results have been described in detail elsewhere [*14*].

Available evidence from studies conducted in general practice exploring the specific effect of additional maneuvers as a support of counseling by GPs is still inconclusive. Spirometry has been used in only one study [*12*], but it's specific contribution was not assessed. The effectiveness of nicotine gum has been demonstrated in clinical settings, while contradictory findings have been reported concerning the usefulness of such therapy among nonselected smokers in general practice [*19–21*]. Consistent with findings from other studies in which biochemical validation of self-reported quitting was performed [*11–13,15,22*], the results of our trial were not suggestive of an important role for nicotine gum (at least with respect to the 2-mg dose used in our study) and spirometric testing as independent determinants of quitting when used as a support to repeated counseling by the GP in a nonselected group of smokers. The effect of the RC interventions could thus be attributed mainly to anti-smoking counseling reinforced by follow-up visits. This effect could also be assumed as being substantially equivalent for all the smokers randomized to these three groups. As the effectiveness of repeated counseling has already been demonstrated in other trials [*12,13,23,24*], this assumption might not be valid for smokers allocated to the C group. Although the proportion of quitters was not significantly different in this group compared with the RC interventions, the statistical power for this comparison was low in our study. Moreover, the size of the C group (62 smokers enrolled; 2 quitters [*14*]) did not allow for testing for possible interaction effects in the analysis. Therefore, smokers randomized to this group were excluded from the analysis, which was then focused on the identification of predictors of successful quitting following repeated counseling.

Definition of Quitter

Those smokers, who reported having quit smoking at least 1 week before the follow-up interviews performed at 6 and 12 months after recruitment were asked to provide a urine sample for cotinine determination. According to the results of a recent review of 10 studies concerning self-initiated quit attempts [*25*], we defined as long-term quitters those subjects whose self-reported abstinence was biochemically verified at both 6- and 12-month assessments.

Sources of Information

For the *recruitment questionnaire,* GPs asked all smokers enrolled in the trial for their consent to answer a phone interview scheduled within 2 weeks after the initial counseling session. This recruitment interview collected information concerning smoking history, adoption of health-promoting behaviors, environmental support, knowledge of health effects of smoking, presence of symptoms attributed to smoking, and sociodemographic characteristics. Additional information concerning health status, as well as possible changes in health during the follow-up period, was derived from the *12-month follow-up questionnaire.*

Characterization of Determinants

Predisposing Factors

Attitudes and beliefs. Adoption of health protective behaviors, such as habitual use of seat belts and engagement in regular physical exercise, was considered an indicator of individuals' *attitudes* toward efforts aimed at improving health expectancy through habit modification. Attitude toward nonsmokers was measured by requiring smokers to report how often they ask nonsmokers for their consent before lighting a cigarette. Since personal experience of disease might influence individuals' beliefs about health hazards of smoking, we collected information about history of smoking-related symptoms, chronic cough, shortness of breath (SOB), or chronic disease. Indeed, health impairment has been associated with perceived risk [*18,26–28*]. *Belief in the ability to quit* was measured at the time of recruitment interview as expected difficulty in quitting.

Smoking-related variables. Cigarette consumption was expressed as cigarettes per day at the time of recruitment visit. Time to the first cigarette in the morning, an item derived from the Fagerstroem Tolerance Questionnaire [*29*], which has been reported to perform well in discriminating ex-smokers from continuing smokers [*30*], was used as a measure of dependence. Other variables considered included duration of smoking habit, age at starting smoking, number of previous quit attempts, and duration of the longest abstinence period. We also classified past quit attempts taking into account duration of abstinence, assumed as an indicator of the "seriousness" of the intention to give up.

Sociodemographic variables. This set of variables included age, gender, birthplace, marital status, education, and occupational level, coded according to the Italian National Census description of occupations [*31*] and collapsed into three job categories: white collar, blue collar, and tradesmen. As it has been reported that organizational factors may influence the probability of quitting, after adjusting for occupational level [*32,33*], we explored this issue using the job decision latitude scale proposed by Karasek [*34*]. Indeed, smoking has been described as an adaptive behavior, often maintained as a way to handle environmental stress [*35–37*]. A higher degree of decision-making freedom in stressful work situations might thus facilitate a habit change.

Enabling Factors

Past experience of successful behavioral change was considered an indicator of individuals' skills in dealing with problems related to the modification of established habits. Items concerning previous experiences of behavioral change included also the indication of the trigger of that decision (autonomous decision vs medical advice).

Reinforcing Factors

To account for the large variations in the reported number of friends and job colleagues, we used in our analysis the proportion of smokers over the total number of friends/colleagues mentioned. Previous medical advice was represented on a dichotomous scale, including in the same category smokers reporting only advice to reduce tobacco consumption ($N = 32$) and those mentioning an invitation to stop smoking completely ($N = 441$).

Analysis

Adjusted odds ratios were computed by unconditional logistic regression. Variable selection was based on statistical significance (P value <0.1) in the univariate analysis and on existing evidence concerning the role of the three classes of factors considered. In particular, gender, educational level, and diagnosis of chronic disease were tested in the multivariate models, based on the findings from recent Italian National Health Surveys, which were suggestive of an influence of these factors on the process of quitting [*38*]. Based on available evidence [*39–43*], the analysis of effect modification was focused on possible interrelationships across age, gender, amount of smoking, health status, and physician's advice. We also investigated possible modifications of the effect of some determinants of quitting among smokers exposed to a specific intervention. A series of separate models was built to test the role of

some factors (i.e., job-related variables for employed subjects or planned pregnancy for women) that could be taken into account to tailor anti-smoking messages to more specific subgroups of smokers. The groups considered for these restricted models included subjects who are not living alone, employed subjects, and female smokers. The potential determinants of interest in each case were entered together with the other significant predictors identified in the first stage of the analysis. The consequences of excluding smokers randomized to the C group were explored by building a predictive model in which these smokers were retained.

The analysis was performed employing the LOGIST procedure in the SAS package [*44*]. The likelihood ratio χ^2 was used to test the terms in the final model.

RESULTS

GPs approached 1,006 smokers for recruitment; 923 (91.7%) of them gave their consent to be enrolled in the trial and 861 subjects were randomized to the three RC groups considered for this analysis. Of these 861 smokers, 782 (90.8%) completed the recruitment interview (refusals, 6.4%; not traced, 2.8%), 742 (86.2%) completed the 12-month follow-up interview (refusals, 6.6%; not traced, 7.2%), and 689 smokers (88.1% of those who completed the recruitment interview) completed both questionnaires. The overall proportion of validated ex-smokers at 1-year follow-up was 5.8% (N =50) in the three RC groups.

Univariate Analysis

Predisposing factors. Marital status appeared to be the only important predictor of success among the *sociodemographic factors* considered (Table 1A): smokers who were married, or living common-law, were significantly more likely to quit than those who were single, divorced, or widowed (OR=3.62; 95%CI, 1.50–8.76). Smokers performing jobs requiring lower skill level and characterized at the same time by low degree of control over work pace showed a lower tendency to quit (OR =0.34; 95%CI, 0.11–1.08). The probability of quitting was instead not significantly different across occupational levels.

Pretreatment *smoking history* was associated with the probability of successful quitting (Table 1B). Heavier smokers (20 cigarettes per day or more) were less likely to quit, compared with smokers reporting lower levels of consumption (OR=0.56; 95% CI, 0.31–1.01). A clear trend was apparent, favoring those smokers reporting longer duration of previous episodes of abstinence. Also, while the absolute number of attempts did not play any role, smokers reporting at least one sustained episode of abstention in the past were more likely to succeed, compared with those who tried only to reduce their tobacco consumption or who maintained cessation for periods shorter than 1 month (OR=7.58; 95%CI, 1.79–32.05). Interestingly enough, assuming this latter group as the reference, the likelihood of success was also high for smokers at their first quit attempt (OR=8.83; 95%CI, 1.99–39.20).

TABLE 1A

Univariate Analysis: Predisposing Factors

Demographic factors	OR	95% Confidence interval
Marital status (N = 782)		
Single/widowed/divorced	1	
Married/living common law	3.62	(1.50–8.76)
Age (years) (N = 861)		
20–29	1	
30–39	1.25	(0.55–2.85)
40–49	0.91	(0.38–2.15)
50+	1.12	(0.48–2.62)
Gender (N = 861)		
Females	1	
Males	1.53	(0.82–2.84)
Birthplace (N = 779)		
Northern Italy	1	
Other regions	1.34	(0.74–2.42)
Educational Level (degree achieved) (N = 781)		
Elementary school/no degree	1	
Intermediate degree	1.35	(0.63–2.89)
High school/university degree	1.45	(0.62–3.34)
Occupational Level (N = 600)		
Blue collar	1	
Tradesmen	0.44	(0.13–1.53)
White collar	0.79	(0.39–1.56)
Job decision latitude (N = 600)		
Intermediate/high	1	
Very low	0.34	(0.11–1.08)

Apparently a positive *attitude* toward prevention of disease, as inferred from reports of engagement in health-protective behaviors, was not associated with the likelihood of giving up tobacco (Table 1C). Attitude toward nonsmokers showed a somewhat paradoxical effect: those smokers who declared they usually asked present nonsmokers for their permission to smoke tended to be less likely to quit (OR=0.58; 95%CI, 0.32–1.05). Direct *perception of ill health consequences* of smoking did not represent a sufficient cue for giving up tobacco (Table 1C). Such trend was not modified for smokers reporting a recent diagnosis (within the previous 2 years) of cardiovascular or respiratory illness (data not shown). Similarly *degree of confidence in personal capability* to succeed in quitting was not associated with smokers' likelihood to give up.

Enabling factors. A facilitating effect of past experience of behavioral change was apparent in relation only to coffee drinking. Smokers reporting having been able to implement a previous resolution to reduce their coffee consumption were more likely to quit (OR = 2.43;

TABLE 1B

Univariate Analysis: Predisposing Factors

Smoking-related variables	OR	95% Confidence interval
Cigarettes smoked per day (*N* = 782)		
1–19	1	
20+	0.56	(0.31–1.01)
Duration of previous abstinence (*N* = 545)		
0	1	
1–6 months	5.87	(0.77–44.85)
7–12 months	9.34	(1.10–79.53)
13+ months	12.88	(1.57–105.62)
History of previous attempts to quit (*N* = 782)		
Reduced average amount/abstinence <1 month	1	
Abstinence <1 month in 1 or more attempts	7.58	(1.79–32.05)
No previous quit attempt	8.83	(1.99–39.20)
Number of previous attempts to quit (*N* = 782)		
None	1	
1	1.05	(0.49–2.24)
2	0.73	(0.33–1.60)
3–4	1.39	(0.56–3.49)
5+	1.14	(0.37–3.54)
Level of dependence (*N* = 781)		
First cigarette in bed	1	
First cigarette after morning coffee	1.41	(0.54–3.69)
First cigarette later during the day	2.56	(0.83–7.91)
Age at starting smoking (*N* = 780)		
<15	1	
15–18	1.20	(0.62–2.32)
19+	0.50	(0.19–1.31)

TABLE 1C

Univariate Analysis: Predisposing Factors

Attitudes/beliefs	OR	95% Confidence interval
Predicted difficulty in quitting (*N* = 770)		
Very difficult	1	
Quite difficult	1.87	(0.90–3.88)
Quite easy/very easy	1.55	(0.69–3.47)
Symptoms attributed to smoking (*N* = 781)		
No symptom	1	
Minor complaints/cough	1.20	(0.60–2.39)
Symptoms of specific illness	0.65	(0.29–1.47)
Symptoms of shortness of breath (*N* = 741)		
No	1	
Yes	1.24	(0.69–2.22)
Symptoms of chronic cough (*N* = 741)		
No	1	
Yes	0.75	(0.40–1.41)
Diagnosis of chronic disease		
Cardiovascular (*N* = 741)		
No	1	
Yes	1.00	(0.46–2.20)
Respiratory (*N* = 741)		
No	1	
Yes	1.34	(0.65–2.76)
Sport activity (*N* = 782)		
Rarely	1	
Seasonal	1.47	(0.77–2.81)
Regular	0.91	(0.39–2.11)
Use of seat belts (*N* = 779)		
Never or rarely	1	
Just for long trips	0.47	(0.14–1.58)
Always	0.74	(0.37–1.46)
Attitude toward nonsmokers (*N* = 782)		
Rarely or never asks for nonsmokers' permission to smoke	1	
Always asks for nonsmokers' permission to smoke	0.58	(0.32–1.05)

95%CI, 1.27–4.65) (Table 1D). The trigger for this decision seemed important, as smokers who reduced coffee following medical advice did not show an increased probability of success (OR=0.63; 95%CI, 0.08–4.79).

Reinforcing factors. Subjects living with one or more smokers showed a significantly lower probability of quitting compared with subjects living with nonsmokers (OR=0.45; 95%CI, 0.24–0.83) (Table 1D). The proportion of smoking friends did not show any significant effect, while among employed smokers the probability of success was significantly reduced when 50% or more of coworkers were regular smokers (OR=0.24; 95%CI, 0.11–0.54). The quantity of smokers seemed to be at issue, as reported colleagues' attitudes toward smokers' quit attempts did not seem to influence the probability of quitting. Smokers who had already been invited by their GP to stop or to reduce their tobacco consumption showed a lower tendency to quit compared with those who did not report any previous anti-smoking advice (OR=0.59; 95%CI, 0.33–1.07).

Multivariate Analysis

After adjusting for those factors included in the predictive model concerning all enrolled smokers (Table 2), gender emerged, in addition to marital status, among the *sociodemographic variables* as a significant predictor, men being more likely to quit than women (OR=2.30; 95%CI, 1.13–4.52). Age and educational level did not show any influence on the likelihood of quitting. Considering *smoking-related variables*, heavy smoking (one pack/day or more) showed a strong negative association with quitting (OR=0.48; 95%CI, 0.24–0.93). Smokers reporting previous episodes of sustained abstinence (OR=6.78; 95%CI, 1.56–29.52), but also those who never tried to quit (OR=10.91; 95%CI, 2.37–50.13), showed high chance of success, compared with those reporting shorter abstinence periods or just a reduction in their average tobacco consumption.

TABLE 1D

Univariate Analysis

	OR	95% Confidence interval
Enabling factors		
Reduced coffee consumption (*N* = 764)		
No	1	
Autonomous decision	2.43	(1.27–4.65)
Medical advice	0.63	(0.08–4.79)
Followed a slimming diet (*N* = 782)		
No	1	
Autonomous decision	0.76	(0.26–2.19)
Medical advice	0.43	(0.13–1.42)
Reduced alcohol consumption (*N* = 782)		
No	1	
Autonomous decision or medical advice[a]	1.27	(0.63–2.54)
Increased physical exercise (*N* = 709)		
No	1	
Autonomous decision	1.04	(0.52–2.19)
Medical advice	1.82	(0.17–10.91)
Reinforcing factors		
Number of smokers in the household (*N* = 782)		
None	1	
1 or more	0.45	(0.24–0.83)
Proportion of smoking friends (*N* = 782)		
No friend	1	
Smoking friends <50%	0.91	(0.25–3.33)
Smoking friends >=50%	0.85	(0.25–2.90)
Proportion of smoking coworkers (*N* = 605)		
Smoking colleagues <50%	1	
Smoking colleagues >=50%	0.24	(0.11–0.54)
Expected attitude of coworkers (*N* = 600)		
Supportive	1	
Discouraging	1.23	(0.16–9.62)
Neutral	1.67	(0.21–13.02)
Previous GP's advice (*N* = 781)		
No	1	
Yes	0.59	(0.33–1.07)

[a] no quitters in the group reporting medical advice; the 2 categories have been lumped

Among the *enabling factors*, previous resolution to follow a slimming diet was not associated with an increased probability of success, neither among men nor among women. A spontaneous reduction of coffee consumption appeared instead as a strong predictor of successful quitting (OR=3.30; 95%CI, 1.59–6.82).

The effect of GPs' advice was modified in relation to the presence of symptoms of SOB. Previous advice to quit represented a strong negative *reinforcing factor* only among asymptomatic smokers (OR=0.19; 95%CI, 0.07–0.52), while it did not influence the probability of quitting among smokers who reported symptoms of SOB at the time of recruitment (OR = 0.63; 95%CI, 0.39–9.20). Despite restricting the analysis to those smokers who mentioned at least one significant friend, we found no indication of an effect of friends' smoking habits on the probability of success.

The role of environment as a reinforcing factor, however, was confirmed by the results of the analysis restricted to those smokers who did not live alone (Table 2). In this group the likelihood of success decreased sharply when the smoker was living with at least one other regular smoker (OR = 0.44; 95%CI, 0.22–0.90). The effect of the other determinants identified in the model fitted on the whole group was substantially unchanged, although the role of gender (OR = 2.03; 95%CI, 0.95–4.34) seemed to be slightly reduced.

Among employed smokers (data not shown), while gender no longer showed any influence on individuals' likelihood to quit, occupation-related determinants came out as influential factors among sociodemographic variables. Lower autonomy in organizing work activity was associated with a lower probability of quitting (OR = 0.24; 95%CI, 0.06–0.98); compared with blue-collar workers, white-collar workers were less likely to comply with GPs' counseling (OR = 0.40; 95%CI, 0.16–0.98). Also, attitude toward nonsmokers emerged as a significant predictor in this group: smokers claiming they usually ask for nonsmokers' permission to smoke were less likely to quit (OR = 0.42; 95%CI, 0.18–0.94). Environmental negative reinforcement, represented by coworkers' smoking habits (50% or more smoking coworkers: OR = 0.26; 95%CI, 0.11–0.60) and by presence of smokers in the household (one or more regular smokers living in the same household: OR = 0.34; 95%CI, 0.14–0.81) seemed to be highly influential. The probability of quitting among smokers who mentioned having been advised by their GP to stop was low, independent of eventual symptoms of SOB (OR = 0.41; 95%CI, 0.18–0.93).

Pregnancy (data not shown) represented a powerful trigger for change among female smokers (OR = 4.85; 95%CI, 1.26–18.64). A lower number of cigarettes smoked appeared as the only other significant predictor of successful quitting among women. Conclusions concerning determinants of quitting among women are, however, limited by the low number of quitters (*N* = 13) among women enrolled in our trial.

The predictive roles of all the factors were not modified across different interventions. Also, the inclusion in the analysis of those smokers randomized to the C group would not produce any change in the results presented.

DISCUSSION

The results of our analysis substantially confirmed that successful quitting can be described as the result of the collective influence of different groups of factors.

TABLE 2

Multivariate Model

	All subjects recruited n = 685		Subjects who are not living alone n = 632	
	OR	95% Confidence interval	OR	95% Confidence interval
Marital Status				
Single/widowed/divorced	1		1	
Married/living common-law	3.63	(1.37–9.59)	2.99	(1.01–8.87)
Gender				
Females	1		1	
Males	2.30	(1.13–4.52)	2.03	(0.95–4.34)
No. of cigarettes smoked per day				
<20	1		1	
20+	0.48	(0.24–0.93)	0.49	(0.24–0.98)
History of previous attempts to quit				
Reduced average amount/abstinence <1 month	1		1	
Abstinence >=1 month in 1 or more attempts	6.78	(1.56–29.52)	13.42	(1.77–101.59)
No previous quit attempt	10.91	(2.37–50.13)	21.91	(2.78–172.91)
Reduced coffee consumption				
No	1		1	
Autonomous decision	3.30	(1.59–6.82)	3.29	(1.54–7.03)
Medical advice	0.68	(0.08–5.45)	0.70	(0.09–5.73)
Previous GP's advice				
No	1		1	
Yes (no symptom)	0.19	(0.07–0.52)	0.18	(0.06–0.50)
Previous GP's advice when shortness of breath reported	0.63	(0.39–9.20)	0.64	(0.37–9.73)
Symptoms of shortness of breath				
No	1		1	
Yes (no advice)	0.79	(0.31–2.03)	0.66	(0.25–1.77)
No. of smokers in the household				
None	—	—	1	
1 or more	—	—	0.44	(0.22–0.90)

Their relative influence tended to vary across different subgroups of smokers. GPs' intervention worked best for male and married smokers, for lighter smokers (<20 cigarettes per day), for smokers at their first quit attempt and for those who had maintained abstinence for at least 1 month in the past, for those who were living with nonsmokers, and for those who had been able to reduce spontaneously their coffee consumption. Asymptomatic smokers who reported having been advised to stop in the past were instead less likely to give up. This strong negative effect of previous GP's counseling was not observed only among smokers who experienced symptoms of SOB, which would suggest that GPs tended to reiterate a restricted range of messages, emphasizing primarily health hazards. Therefore, a more precise awareness of factors influencing cessation would allow GPs to maximize effectiveness and efficiency of their anti-smoking efforts by tailoring their message to help patients utilize their resources for behavioral change. Indeed, even if biomedical explanations represent a component of patient-oriented counseling, advice is likely to be more effective if it conveys practical indications and incorporates individuals' experience of behavioral modification. The higher success rate observed among smokers who reported at least one previous episode of sustained abstinence, as well as among those who were able to reduce their coffee consumption, confirmed in fact that successful quitters can take advantage of the skills accumulated through past experience of change of smoking habits or in gaining control over another addictive behavior.

Intervention by GPs should provide as well the necessary support to help patients overcome existing barriers to success. The well-recognized role of environmental pressure [*45*] was confirmed in relation to family and work environment while, as already observed in other studies [*46,47*], friends did not play an important role in these age groups. Also, GPs' counseling could hardly counterbalance societal pressures favoring maintenance of smoking among women. Indeed, it has been suggested that tobacco advertising campaigns linking smoking to desirable role models may favor a lower awareness of smoking-related risks among women [*48,49*], who continue to be elusive when it comes to smoking cessation, as already reported by several surveys [*30,38,50,51*].

Consistent with the hypothesis that stress is one of the major determinants of whether a smoker can ever

consolidate behavioral change [*35*], the impact of GPs' advice was low as well among smokers whose jobs allowed few opportunities to develop alternative strategies to cope with stress. No association between quitting smoking and job strain was reported in a survey [*52*] using an index based on the same stress construct applied in our study. However, job characteristics at the time of quitting might have been quite different from those measured at the time of the survey.

Finally, as already reported from previous studies [*5,6,8,38,50,53,54*], heavier smokers found it rather difficult to give up. The encouraging preliminary results of a program offering GPs the opportunity to refer these "hard core" smokers to specialized clinics for more intensive support [*55*] might represent a promising option to enhance the effectiveness of GPs' interventions.

Findings concerning the predictive roles of these factors are consistent with existing evidence from studies conducted in other countries. Nonetheless, as smoking is a culturally influenced behavior, it cannot be excluded that the effect of specific determinants might be different in another cultural context.

The lower quit rates observed among white-collar workers, contrary to what has been reported in other studies [*56,57*], might be explained, for example, by the fact that in Italy subjects from higher socioeconomical level tend to be less likely to consider the GP as a source of lifestyle counseling. Recognition of doctor's role in helping patients to quit already emerged in another study as a factor distinguishing quitters from continuing smokers [*6*]. Similarly, subjects claiming they usually take into account nonsmokers' rights apparently assumed that their smoking behavior was not a matter of negotiation with their GP. They felt free to enjoy it, as long as it did not damage, or was accepted by, other people. Counseling should probably reinforce in this case perception of the individual risk profile.

Although complete information was available for only 80% of the subjects recruited, it seems unlikely that these possible differences determined the observed trends. Indeed, it was already shown [*58*] that heavier smokers are less likely to accept health interviews, and both diseased subjects, as well as those who live alone, tend to be overrepresented among subjects lost at follow-up. However, nonrespondents tend also to be less likely to quit [*58*].

Recent literature suggests that different stages with respect to individuals' disposition toward smoking cessation can be identified [*1*] and that investing physicians' energy in counseling those smokers who are ready for behavioral change may bring forth better cessation rates [*59*]. The role of the factors considered in our analysis may well be different when considering cessation among smokers motivated to make a quit attempt. As the objective of the study was to evaluate the impact of physician-delivered counseling when offered to all smokers entering the GP's office, we did not plan on evaluating smokers' motivation. However, even when targeting undifferentiated smokers, a more intensive involvement of GPs in anti-smoking counseling can have an immediate impact. Consistently with findings of population surveys [*60–62*], about 40% of the smokers recruited in this trial could not remember having been advised to quit in the past, while 23% had apparently never undertaken steps toward action, not even by trying to reduce their daily consumption. Medical advice may represent an appropriate trigger for these subjects to attempt to stop, which, for many of them, can be relatively easy. Moreover, while the estimates based on general population surveys [*38,60,63,64*] indicated that the educational gap in quitting rates will continue to widen [*65,66*], the absence of an effect of educational level on the probability of success supports the findings from similar studies among smokers exposed to individualized physicians' counseling [*5,6,8*] indicating that implementing GPs' interventions might limit the negative effect of lower education on the impact of anti-smoking efforts.

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