



Predictors of long-term smoking cessation in patients with COPD: results from a randomised controlled trial


To the Editor:

In Western countries, cigarette smoking is the most important risk factor for the development of chronic obstructive pulmonary disease (COPD) [1]. Besides, patients with COPD who continue to smoke have a higher prevalence of respiratory symptoms, more accelerated decline in lung function and higher mortality rate than nonsmokers [1]. Therefore, smoking cessation is the single most effective way to prevent COPD and reduce its progression [1]. The Cochrane Review on smoking cessation interventions for people with COPD shows that evidence-based smoking cessation interventions exist, but the chances of successful quitting are still relatively low in this group of smokers [2]. The effectiveness of such interventions can depend on the characteristics of the patient [3]. Knowing which patient characteristics are associated with successful quitting might facilitate the design of more effective smoking cessation interventions for patients with COPD.

We used data from a randomised controlled smoking cessation trial to identify patient-specific predictors for long-term abstinence. This trial was originally designed to assess the efficacy of confronting smokers with newly found airflow limitation to facilitate smoking cessation (ISRCTN 64481813) [4]. A total of 296 smokers with mild-to-moderate COPD were randomly allocated to confrontational counselling with a nurse and administered nortriptyline for smoking cessation (experimental group), regular counselling with a nurse and nortriptyline (control group 1), or “care as usual” for smoking cessation by their general practitioner (control group 2) [4, 5]. Inclusion criteria were as follows: a smoking history of ≥ 10 pack-years; competency in reading and speaking Dutch; reporting of at least one respiratory symptom (cough, sputum production, or shortness of breath); and a post-bronchodilator forced expiratory volume in one second (FEV₁)/forced vital capacity (FVC) $< 70\%$ in combination with post-bronchodilator FEV₁ $> 50\%$ predicted [1, 6]. Exclusion criteria were as follows: having contraindications for the use of nortriptyline; prior respiratory diagnosis; and having undergone spirometry during the preceding 12 months [4, 5].

The primary outcome for the current analysis was cotinine-validated prolonged abstinence from smoking from weeks 5–52 after the target quit date, as defined in the original trial [4]. From all data collected during baseline measurements of the trial (*i.e.* prior to randomisation), we selected candidate predictors of abstinence based on theory and existing evidence; we selected various demographic, health and smoking characteristics, as well as those of social influence. Seventy-five participants had one or more missing values, which we imputed by using multiple imputation techniques. We entered 21 predictor variables into the initial logistic regression model and adjusted the model for group allocation (even though abstinence rates did not differ significantly between groups [4]). We then used manual backward elimination ($p < 0.02$) to determine the best-fit model.

After 52 weeks, 30 of the 296 participants (10%) were still abstinent and 266 participants (90%) had relapsed to smoking (table 1; the 21 variables from the initial model are indicated with an asterisk). After manual backward elimination, three variables remained significant predictors of abstinence. The odds of abstinence were: 3.23 times higher in participants with a high level of education than in participants with a low level of education (95% CI 1.03–10.15); 1.03 times higher per point increase in general health

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TABLE 1 Baseline characteristics of study participants who were abstinent from weeks 5–52 and those who relapsed to smoking

	Total	Prolonged abstinence	Sustained smoker	Final prediction model	
				OR	95% CI
Subjects n	296	30	266		
Demographic characteristics					
Age years [#]	54.0±7.5	53.3±6.6	54.1±7.6		
Females [#]	111 (37.5)	11 (36.7)	100 (37.6)		
Level of education [#]					
Low	89 (30.1)	5 (16.7)	84 (31.6)	1	
Moderate	134 (45.3)	14 (46.7)	120 (45.1)	1.79	0.60–5.32
High	73 (24.7)	11 (36.7)	62 (23.3)	3.23	1.03–10.15
Health characteristics					
BMI	25.1±4.1	25.2±3.5	25.0±4.2		
FEV1 % pred post bronchodilation [#]	81.6±15.5	81.9±14.9	81.5±15.6		
GOLD status					
Mild	157 (53.0)	18 (60)	139 (52.3)		
Moderate	139 (47.0)	12 (40)	127 (47.7)		
COPD health status					
Respiratory symptoms ^{#,¶}	2.0±1.1	1.8±0.7	2.0±1.1		
Physical state ^{#,¶}	0.9±0.8	0.8±0.7	0.9±0.8		
Level of shortness of breath ^{#,+}	1.5±1.0	1.4±0.7	1.5±1.0		
Mental health					
Anxiety ^{#,§}	5.8±3.9	5.3±2.8	5.9±4.0		
Depression ^{#,§}	4.4±3.7	3.4±3.1	4.5±3.8		
Perception of health ^{#,f}	49.6±17.3	56.8±18.5	48.8±17.0	1.03	1.01–1.06
Health change ^{#,f}	43.5±16.7	47.5±13.7	43.1±17.0		
Physical role impairment ^{#,f}	76.2±35.8	88.3±25.2	74.8±36.5		
Smoking characteristics					
Cigarettes per day	23.6±8.9	21.4±9.2	23.8±8.8		
Pack-years	43.5±18.9	37.7±17.3	44.2±19.0		
Level of nicotine addiction ^{#,##}	4.6±1.5	4.4±1.4	4.6±1.5		
Previous attempts to quit n [#]	4.0±4.4	3.6±4.0	4.0±4.5		
Previous use of aids for smoking cessation					
Counselling	25 (8.4)	2 (6.7)	23 (8.6)		
Nicotine replacement therapy	190 (64.2)	16 (53.3)	173 (65.0)		
Bupropion	69 (23.3)	7 (23.3)	62 (23.3)		
Alternative	119 (40.2)	9 (30)	110 (41.4)		
Health concern ^{#,¶¶}	3.9±0.9	3.9±1.0	3.9±0.9		
Importance of risk reduction ^{#,++}	4.3±0.9	4.4±0.7	4.3±1.0		
Risk perception ^{#,§§}	4.0±0.9	3.9±0.8	4.0±0.8		
Self-exempting beliefs ^{#,ff}	2.3±0.6	2.3±0.6	2.3±0.6		
Social influence					
Smoking status of partner [#]					
Nonsmoker	150 (50.7)	15 (50)	96 (36.1)	1.55	0.59–4.07
Smoker	103 (34.8)	7 (23.3)	135 (50.8)	1	
N/A (no partner)	43 (14.5)	8 (26.7)	35 (13.2)	3.89	1.23–12.31

Data are presented as mean±SD or n (%), unless otherwise stated. BMI: body mass index; FEV1: forced expiratory volume in 1 s; % pred: % predicted; GOLD: Global Initiative for Chronic Obstructive Lung Disease; COPD: chronic obstructive pulmonary disease; N/A: not applicable. #: variable included in the starting prediction model; ¶: 0–6, level of respiratory symptoms and mental/physical complaints; +: 0–5, degree of shortness of breath; §: 0–21, level of anxiety/depression; f: 1–100, level of perceived health/better health than previous year/level of physical role impairment; ##: 0–10, level of nicotine dependence; ¶¶: "How worried are you about acquiring a disease or disorder that is caused by smoking (such as a serious heart or lung disease)?" on a scale of 1–5, where 5=very worried; ++: "How important is it to you to reduce your risk of acquiring a disease or disorder that is caused by smoking?" on a scale of 1–5, where 5 is the highest level of importance; §§: "How high do you estimate your risk of acquiring a serious disease within the next 10 years if you do not stop smoking?" on a scale of 1–5, where 5=highest level of risk; ff: 1–5, level of self-exempting beliefs.

perception (scale 1–100, 95% CI 1.01–1.06); and 3.89 times higher in participants without a partner compared to smokers with a partner who also smoked (95% CI 1.23–12.31).

Our findings suggest firstly that smokers with COPD and a low level of education are much less likely to quit smoking successfully. This social gradient has been reported previously in the general smoking

population [7] and in smokers with COPD [8], and might be explained by the influence of the social environment [9], higher levels of nicotine dependence [10] and psychological distress in more disadvantaged smokers [9, 11].

Secondly, smokers with COPD and better self-perceived general health seemed to be more likely to quit smoking successfully. A previous study showed that when one's health deteriorates, based on the Global Initiative for Chronic Obstructive Lung Disease (GOLD) A-D criteria, the motivation for quitting increases [8]. We are not aware of any other studies that use subjective health measures and can only speculate that in our study, the perception of better health might have been associated with stronger self-efficacy to refrain from smoking, resulting in more successful attempts to quit.

Thirdly, when comparing the baseline characteristics of successful and unsuccessful quitters, the latter seemed more likely to have a partner who also smoked. In the final prediction model, not having a partner at all predicted abstinence. Unfortunately, we were unable to confirm whether these participants were indeed living without a partner. Therefore, these results should be interpreted with caution.

In our study, nicotine dependence was not associated with abstinence, possibly because the participants were selected using very strict criteria, resulting in a very homogeneous group of heavy smokers.

Finally, psychological distress, including depressive symptoms, might contribute to the unsuccessful attempts of smokers to quit [11–14]. The chances of having depressive symptoms are high in patients with COPD, regardless of their smoking status [15]. All participants of the present study had a low level of depressive symptoms. The main reason for this finding was probably the exclusion of smokers who used antidepressants [4]. However, smokers that relapsed seemed to report a greater number of depressive symptoms at baseline than those who successfully quit. Nevertheless, no significant differences emerged from the prediction model.

We excluded smokers who took antidepressants and those with previously undetected severe airflow limitation, thereby limiting the external validity of our findings. The controlled circumstances of the trial, on the other hand, can be seen as a strength, as the risk of confounding was reduced. The sample size (n=296) for the current analysis limited the statistical power to determine significant predictors. We observed differences in baseline characteristics between those who became abstinent and those who relapsed; however, these characteristics did not emerge as predictors of successful quitting in the final model. We combined the three intervention groups to obtain a more substantial group size to predict successful quitting. We included "group allocation" as a variable in the model to correct for any effects of the different interventions on long-term abstinence. Unfortunately, the sample size was too small to further correct for this by including interaction terms in the model or conducting sensitivity analyses for the three intervention groups separately.

In conclusion, COPD patients with a high level of education, more favourable general health perception and those living without a partner, appeared to be more likely to successfully quit smoking in the long term. Healthcare providers should take the health perceptions and social environments of patients into account to facilitate successful quitting in COPD patients.

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