"Real-world" effectiveness of smoking cessation treatments: a population study

Revision 2 based on second round of reviewer comments from Addiction

Daniel Kotz PhD [1,2*], Jamie Brown PhD [1], Robert West PhD[1]

[1]Department of Family Medicine, CAPHRI School for Public Health and Primary Care, Maastricht University Medical Centre, Maastricht, the Netherlands. [2] Cancer Research UK Health Behaviour Research Centre, University College London, WC1E 6BT, UK

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*Correspondence to: Dr. Daniel Kotz, Department of Family Medicine, CAPHRI School for Public Health and Primary Care, Maastricht University Medical Centre, PO Box 616, 6200 MD Maastricht, the Netherlands. E-mail: d.kotz@maastrichtuniversity.nl, web: www.daniel-kotz.de, phone: +31 43 3882893, FAX: +31 43 3619344

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ABSTRACT

Aims

There is a need for more evidence on the 'real-world' effectiveness of commonly used aids to smoking cessation from population-level studies. This study assessed the association between abstinence and use of different smoking cessation treatments after adjusting for key potential confounding factors.

Design

Cross-sectional data from aggregated monthly waves of a household survey: the Smoking Toolkit Study.

Setting

England.

Participants

10,335 adults who smoked within the previous 12 months and made at least one quit attempt during that time.

Measurements

Participants were classified according to their use of cessation aids in their most recent quit attempt: (1) medication (nicotine replacement therapy, bupropion, or varenicline) in combination with specialist behavioural support delivered by a National Health Service Stop Smoking Service;

(2) medication provided by the prescribing health care professional without specialist behavioural support; (3) nicotine replacement therapy (NRT) bought over-the-counter; (4) none of these. The main outcome measure was self-reported abstinence up to the time of the survey, adjusted for key potential confounders including tobacco dependence.

Findings

Compared with smokers using none of the cessation aids, the adjusted odds of remaining abstinent up to the time of the survey were 3.25 (95%CI=2.05-5.15) greater in users of prescription medication in combination with specialist behavioural support, 1.61 (95%CI=1.33-1.94) greater in users of prescription medication combined with brief advice, and 0.96 (95%CI=0.81-1.13) in users of NRT bought over-the-counter.

Conclusions

After adjusting for major confounding variables such as tobacco dependence, smokers in England who use a combination of behavioural support and pharmacotherapy in their quit attempts have almost three times the odds of success than those who use neither pharmacotherapy or behavioural support. Smokers who buy nicotine replacement therapy over the counter with no behavioural support have similar odds of success as stopping as those who stop without any aid.

INTRODUCTION

The World Health Organization (WHO) estimates that smoking kills nearly six million people each year.[1] Every year that someone continues to smoke after early middle age loses them 3 months of life expectancy.[2] It is therefore important that every quit attempt has the best possible chance of success. There is strong evidence from multiple randomized controlled trials that behavioural support and several medications improve the success of quit attempts.[3-9] However, population-based studies about the effectiveness of smoking cessation treatments in the "real world" have produced mixed results. This is particularly important because we are now in the implementation phase of Article 14 of the WHO Framework Convention on Tobacco Control which mandates signatory countries to promote smoking cessation in their populations[10,11]; so real-world evidence on effectiveness of treatment to aid cessation will have global impact. Real-world studies using observational designs cannot provide the same degree of confidence in causal associations as randomised trials because of the possibility of residual confounding but without them the generalizability of the randomised trial evidence will always be called into question. Thus both types of study are essential.

Some "real world" studies have reported a *lower* chance of successful quitting in smokers who used nicotine replacement therapy (NRT) or bupropion than in smokers who tried to quit without medication.[12-15] However, these studies did not adequately control for important confounding factors, most notably the fact that smokers who use these medications are more dependent on cigarettes.[16-19] Of the few studies that have attempted to control for such confounding, one US study[20] found a lower chance of successful quitting in users of NRT and bupropion compared with non-users of smoking cessation treatment whereas two multinational studies[18,21] found higher chances of quitting in users of NRT, bupropion, or varenicline. However, these did not investigate

the effect of behavioural support provided or distinguish between NRT bought over-the-counter versus obtained from a health care professional. This leaves a critical gap in the literature.

The current study is the first with adequate power to assess the real-world effectiveness of medication for smoking cessation combined with behavioural support in comparison with unaided quitting using population-based survey data while adjusting for key potential confounding factors. In addition to controlling for dependence, the current study adjusted for a number of other factors that have been associated with both successful quitting and choice of treatment including age, sex, social grade, and previous quit attempts.[20,22-26] Importantly, this study also distinguishes between the provision of specialist behavioural support and brief advice. England is a country with the most extensive and comprehensive coverage of behavioural support and medications in the world, and the highest rate of use of these aids to cessation.[27] Therefore it is probably the only country where a population level study of this kind could be undertaken. Every smoker has ready access to behavioural support and medication that is either free or available at nominal charge. In addition, all the forms of NRT are available to be purchased over-the-counter. As these aids have been available for at least 10 years, the market is mature and any associations are not likely to reflect the fact that the interventions are novel. This makes England a unique environment for the assessment of the real-world effectiveness of different quitting methods.

METHODS

We used data from the "Smoking Toolkit Study": an ongoing research program designed to provide information about smoking cessation and factors that promote or inhibit it at a population level.[28,29] Each month a new sample of approximately 1,800 people aged 16 and over completes a face-to-face computer-assisted survey, of whom approximately 450 are smokers. The methods

have been described in full elsewhere and have been shown to result in figures for key variables such as smoking prevalence that are nationally representative.[28]

Study population

For the current study, we used aggregated data from respondents to the survey in the period from November 2006 (the start of the survey) to May 2012 (the latest wave of the survey for which data were available), who smoked cigarettes (including hand-rolled) or any other tobacco product (e.g., pipe or cigar) daily or occasionally at the time of the survey or during the preceding 12 months. We included those who made at least one quit attempt in the preceding 12 months, assessed by asking: "How many serious attempts to stop smoking have you made in the last 12 months? By serious attempt I mean you decided that you would try to make sure you never smoked again. Please include any attempt that you are currently making and please include any successful attempt made within the last year." We also asked how long ago the most recent quit attempt started and categorised respondents into those who started their quit attempt in the last week or up to 6 months ago and those who started their quit attempt more than 6 months ago.

Measurement of effect: use of smoking cessation treatments

The use of smoking cessation treatments was assessed only for the most recent quit attempt and included: (1) NRT on prescription (NRT Rx), bupropion, or varenicline in combination with specialist behaviour support (i.e., one-to-one or group behavioural support delivered by a National Health Service (NHS) Stop Smoking Service); (2) NRT Rx, bupropion, or varenicline in combination with brief advice (delivered by the prescribing health care professional); (3) NRT bought over-the-counter; (4) none of these.

Measurement of outcome: self-reported non-smoking

Our primary outcome was self-reported non-smoking up to the time of the survey. Respondents were asked: "How long did your most recent serious quit attempt last before you went back to smoking?". Those responding "I am still not smoking" were defined as non-smokers. Previous research has shown that self-reported abstinence in surveys of this kind is not subject to the kind of biases observed in clinical trials where there is social pressure to claim abstinence.[30,31]

Measurement of potential confounders

We measured variables potentially associated with the use of smoking cessation treatments and that may also have an effect on the outcome. These potential confounders were chosen a priori. The most important factor was cigarette dependence for which we used two questions. First, time spent with urges to smoke was assessed by asking: "How much of the time have you felt the urge to smoke in the past 24 hours? Not at all (coded 1), a little of the time (2), some of the time (3), a lot of the time (4), almost all of the time (5), all of the time (6)". Second, strength of urges to smoke was measured by asking "In general, how strong have the urges to smoke been?": slight (1), moderate (2), strong (3), very strong (4), extremely strong (5). This question was coded "0" for smokers who responded "not at all" to the previous question. These two ratings have been found in this population to be a better measure of dependence (more closely associated with relapse following a quit attempt) than other measures.[32] Demographic characteristics we took into account were age, sex, and social grade (measured on an ordinal scale: AB = managerial and professional occupations, C1 = intermediate occupations, C2 = small employers and own account workers, D = lower supervisory and technical occupations, and E = semi-routine and routine occupations, never workers, and long-term unemployed). Furthermore, we measured the number

of quit attempts in the last year prior to the one in question, and time since the quit attempt in question was initiated.

Data analyses

Simple associations between potential confounders and use of the smoking cessation treatments were assessed with ANOVA for continuous variables and Pearson's χ^2 for categorical variables. Tukey's post-hoc procedure was used for multiple comparisons of the two measures of tobacco dependence.

Our measure of dependence (strength of urges to smoke) assumed that the score *relative to other smokers* would stay the same from pre- to post-quitting. Thus a measure taken after the quit attempt would reflect, relative to other smokers in the same position (i.e., having stopped or failed to stop), what it would have been prior to it. The absolute score would reduce between these two occasions but this reduction would not be affected substantially by the method of quitting. If a method of quitting reduced strength of urges to smoke more than another method, this would tend to underestimate the effectiveness of that intervention because the smokers using this method would appear to be less dependent. If it increased the strength of urges it would overestimate the method's effectiveness by making it seem that the smokers were more dependent than they actually were. To test for this bias we examined in an ANCOVA whether the difference in strength of urges to smoke in smokers versus quitters varied as a function of the method of quitting, adjusting for the time since the quit attempt started. Although the power to detect such an interaction in the population would be relatively low, our interest is only in whether the interaction exists in this sample since it is that which could artificially inflate or deflate our estimate of the association between quitting method and success.

For our primary analysis, we used a multiple logistic regression model in which we regressed the outcome measure (self-reported non-smoking compared with smoking) on the effect measure (use of each of the three smoking cessation treatments compared with no use of such treatments), adjusted for the above mentioned confounders and year of the survey. We also included two interaction terms: (1) between time since last quit attempt and time spent with urges, and (2) between time since last quit attempt and strength of urges to smoke. These interaction terms were used to account for the fact that urges to smoke following the quit attempt will be influenced by whether the respondent is currently abstinent and the duration of abstinence. However, we also ran this model after excluding the two interaction terms in a sensitivity analysis.

The sample size in our study provided 99% power to detect an odds ratio of 3.0 for the comparison of medication on prescription + specialist behavioural support versus no treatment, and 94% power to detect an odds ratio of 1.5 for the comparison of medication on prescription + brief advice versus no treatment (effect sizes estimated from randomised controlled trials).

In addition to the model from the primary analysis ("fully adjusted model"), we constructed a simple model including only the effect measure ("unadjusted model") and a model that included the effect measure, year of the survey and all confounders except for the two measures of tobacco dependence and their interaction terms ("partially adjusted model") to show the extent of confounding effects of tobacco dependence.

In a sensitivity analysis we excluded respondents who had used telephone counselling for smoking cessation during their most recent quit attempt; very few smokers in England use this form of treatment so it is not possible to assess its association with abstinence. In the primary analysis these smokers were conservatively counted in the "no treatment" group unless they had also used medication whereas in the sensitivity analysis they were excluded from the analysis.

All analyses were repeated in the two subsamples of respondents who had started their most recent quit attempt less versus more than 6 months ago in order to assess the occurrence of differential recall bias. It has been suggested that smokers who try to stop unaided forget failed quit attempts more quickly than those who use treatment.[16] In the presence of such bias the long-term effectiveness of smoking cessation treatments would be underestimated. However, a positive association would provide evidence for lasting treatment effects of a kind that have been questioned by previous researchers.[12]

All analyses were performed with complete cases. Respondents with missing data on one or more of the variables were excluded (5.5% of the initial sample).

RESULTS

The study population consisted of 10,335 respondents; 8,932 (86.4%) who smoked and 1,403 (13.6%) who were abstinent at the time of the survey. The unadjusted abstinence rates were 19.1% (N=39) for users of medication on prescription in combination with specialist behavioural support, 15.2% (N=259) for users of prescription medication combined with brief advice, 10.2% (N=322) for users of NRT bought over-the-counter, and 14.8% (N=783) for those using none of these treatments. A subgroup of 6,510 respondents (63.0% of the full study population) had

started their last quit attempt less than 6 months ago and 3,825 (37.0%) had started their last quit attempt more than 6 months ago. Demographic and smoking-related characteristics of the full sample are shown in Table 1. The characteristics of the two subsamples of smokers who had started their last quit attempt more versus less than 6 months ago were similar (not shown in the table).

A total of 1,910 respondents (18.5%) had used some form of prescription medication during their most recent quit attempt. Among these respondents, the majority had used NRT Rx (58.1%, N=1,110), followed by varenicline (28.2%, N=538), and bupropion (10.9%, N=208). The remaining 2.8% (N=54) of respondents had used some combination of these medications.

The use of treatments was associated with age, sex, time since last quit attempt started and the two measures of dependence (time spent with and strength of urges to smoke) (Table 2). The use of treatments also differed according to social grade. The post-hoc comparisons showed more time spent with urges to smoke and stronger urges to smoke in the three groups that used smoking cessation medication compared with the group that did not use medication (all $p<0.001$).

Table 3 shows the differences in strength of urges to smoke in smokers versus non-smokers, stratified by method of quitting. As would be expected strengths of urges to smoke were higher in smokers than in quitters and in those smokers using more intensive methods of quitting. However, the mean differences in strength of urges between smokers and quitters were not different across the methods of quitting: The interaction term between smoking status (smokers versus quitters) and method of quitting in the ANCOVA of the strength of urges adjusted for the time since quit attempt started was not statistically significant ($p=0.44$).

There was evidence of preferential recall of quit attempts made 6+ months ago if medication on prescription or behavioural support was used but not if NRT bought over-the-counter was used. Thus, reported rates of use of medication in combination with specialist behavioural support and use of prescription medication combined with brief advice were *higher* in respondents who had started their most recent quit attempt more than 6 months ago compared with the subsample who had started less than 6 months ago (2.5% vs. 1.7% for medication combined with specialist behavioural support and 17.7% vs. 15.8% for medication combined with brief advice, $p<0.01$). Reported use of NRT over-the-counter was similar within the subsamples (29.9% vs. 30.5%), whereas the reported rate of no treatment use was *lower* within the subsample of respondents who had started their most recent quit attempt more than 6 months ago than in the subsample who had started less than 6 months ago (49.9% vs. 52.1%, $p<0.01$).

Table 4 shows that in the full sample, the fully adjusted odds (model 4) of non-smoking in users of medication on prescription in combination with specialist behavioural support were 3.25 times higher compared with the no-treatment group. The odds were 2.02 times higher compared with the group that used prescription medication combined with brief advice (not shown in the table). In the latter group, the odds were 1.61 times higher compared with the no-treatment group. The use of NRT bought over-the-counter was not associated with abstinence (OR=0.96). These odds ratios were similar to the odds ratios of the fully adjusted model excluding the two interaction terms (model 3). The relative magnitudes of the odds ratios from the fully adjusted model (model 4) with the unadjusted model (model 1) and the partially adjusted model 2 show the large confounding effects of cigarette dependence.

A total of 114 respondents (1.1%) reported having used telephone counselling during their most recent quit attempt. The percentage of telephone counselling users was higher in the group that used medication on prescription in combination with NHS counselling (7.4%) than in the other two treatment groups and the no-treatment group (percentages between 0.6-1.2%). Excluding these respondents from the primary analysis increased the association between non-smoking and use of medication on prescription in combination with specialist behavioural support (fully adjusted OR=3.51, 95%CI=2.19-5.61), but did not change the association with the other two treatments.

In smokers who started their quit attempt more than 6 months ago, the fully adjusted odds of non-smoking in users of medication on prescription in combination with specialist behavioural support were 2.32 (95%CI=1.15-4.67) times higher compared with the no treatment group, whereas the odds were not statistically significantly higher in users of prescription medication combined with brief advice (OR=1.26, 95%CI=0.91-1.76).

DISCUSSION

Use of prescription medication in combination with specialised behavioural support during attempts to quit smoking was associated with the success of such attempts as was use of prescription medication with limited support. No such association was detected for NRT bought over-the-counter.

Our adjusted odds ratio of 1.61 in users of prescription medication combined with brief advice compared with non-users of treatment was similar to that from meta-analyses of randomized placebo-controlled trials [6,7,8]. Our estimated effectiveness of adding behavioural support to medication (OR=2.02) was slightly higher than would be expected from a meta-analysis performed

for the US guidelines.[33] It is noteworthy that adjusting for dependence made a substantial difference to these odds ratios and emphasises the importance in this kind of study of adequately controlling for this very substantial confounder.

Our findings conflicted with those from a meta-analysis of the effectiveness of NRT bought over-the-counter.[34] Preferential recall of quit attempts using this method does not appear to explain this finding. We cannot rule out an effect of unmeasured confounding factors but it should be noted that this ought to have undermined the observed effects of behavioural support and medication on prescription, yet we were able to detect these effects. If NRT over-the-counter has become ineffective in England, this represents a considerable financial and opportunity cost for smokers and steps need to be taken urgently to address this.

As noted in the introduction, findings from similar studies to ours without adequate adjustment for cigarette dependence[12-15,20] cannot be relied upon. This rules out most cross-sectional surveys because the most commonly used measure of cigarette dependence uses number of cigarettes smoked and time to first cigarette of the day. When smokers relapse they tend to do so with reduced consumption which can lead to a false estimation of prior dependence. We avoided this by using a validated measure involving ratings of current urges to smoke and statistically adjust for whether this was during normal smoking or a period of abstinence.[32] However, our findings with regard to medication are consistent with many prospective real-world studies.[18,21,25,35-38]

Studies of the kind reported here do not in themselves allow causal inferences of the association between treatment and outcome but they are essential to examine how far the findings from randomized trials generalize to population samples. We reduced the risk of confounding further

than any previous study by adjusting for cigarette dependence, age, sex, social grade, and previous quit attempts. However, residual confounding may have occurred as not all factors associated with self-selection of treatment were measured in our survey, such as co-morbidity[39] or psychological distress[40]. Motivation to quit may also be positively associated with both use of treatment and success. However, population studies have generally not found an association between motivation to quit and success of quit attempts.[41] Finally, our survey is limited by the fact that it does not contain data on medication adherence.

The value of ratings of strength of urges to smoke as a measure of dependence in cross-sectional research would have been reduced if different methods of stopping had been found differentially to be linked to lower or higher levels of urges in abstinent smokers. For example, a method of stopping that led to a relatively higher reduction in urges might underestimate the effectiveness of that method by making it seem that those using it were less dependent. However, we did not find evidence in this population data set that urges to smoke in smokers versus quitters differed as a function of method. It is very unlikely, therefore, that our dependence measure led to substantial overestimation or underestimation of the effectiveness of the different methods.

Reliance on recall is inevitable in population studies of this kind and even in prospective studies it is an issue unless one stimulates quit attempts. In our study, with the quit attempt having occurred up to 12 months ago, the scope for recall bias is significant.[20,42] This would tend to reduce the ability to detect an effect and does not undermine the finding of a significant benefit of behavioural support plus medication. The effect sizes for medication with specialist behavioural support or with brief advice were lower in smokers who started their quit attempt more than 6 months ago than in smokers who started their quit attempt less than 6 ago. This finding may be a

result of differential recall bias. We found some evidence in our study that the use of prescription medication during a quit attempt, especially when combined with specialised behavioural support, was recalled better than no use of treatment during a quit attempt (we did not find evidence of recall bias in usage of NRT bought over-the-counter). Our finding may, however, also be a result of reduced long-term effectiveness of prescription medication when prescribed with brief advice only.

To maximize statistical power, we combined the prescription of NRT, bupropion, and varenicline in our study. It would be useful to compare these medications with each other once sufficient samples have been accumulated.

We defined our measure of outcome as whether or not participants had remained abstinent from the quit date to the time of the survey. Another approach would have been to assess how long participants reported having been abstinent since their quit date, even if they had relapsed by the time of the survey. We decided not to use this measure because of added noise and potential bias with smokers recalling the point at which they had relapsed, bearing in mind that they make different interpretations on what constituted relapse (e.g. was it the first lapse, or return to daily smoking?). It was not feasible in our large population study to biochemically validate self-reported non-smoking. This would be a serious limitation in randomized controlled trials because of the possibility of differential likelihood of falsely claiming abstinence by participants in the active treatment.[43] However, in population surveys the misreporting rate is low.[30,31]

A major strength of our study is the use of a very large, representative sample of the English population – sufficient to permit detection of an effect of behavioural support despite its low

frequency. Our study included all smokers aged 16 years or older including those who smoke less than 10 cigarettes per day, a group that constitutes one third of current smokers.[44] Furthermore, we used aggregated data from monthly surveys over a period of 5.5 years and therefore eliminated potential bias from the fact that the rate of attempts to quit in smokers is different at different times of the year.

Conclusions and recommendations

This is the first evidence from a population sample of the real-world effectiveness of the combination of behavioural support and stop-smoking medication as recommended by the US Department of Health and Human Services guidelines[33] once adequate adjustment is made for confounding particularly by cigarette dependence. We also confirmed the effectiveness of stop-smoking medication provided with minimal support by health professionals, at least in the short term. Importantly, we did not detect an effect of NRT bought over-the-counter.

Health care professionals should know that smokers who seek treatment differ from smokers who try to quit unaided in that they have more difficulties quitting. In those smokers, a combination of evidence-based medication combined with expert behavioural support is recommended. More research is urgently needed on real world effectiveness of nicotine replacement therapy bought over the counter.

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CONTRIBUTORSHIP STATEMENT

RW designed the Smoking Toolkit Study and outlined the manuscript. DK analysed the data for this manuscript and wrote the first full draft of the manuscript. All authors contributed to the writing of subsequent versions and approved the final version.

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Table 1: Sample characteristics (N=10,335)

Age, mean (SD)	39.5 (15.6)
Female sex	54.0 (5,576)
Social grade	
AB	10.7 (1,105)
C1	22.9 (2,371)
C2	22.7 (2,351)
D	18.8 (1,945)
E	24.8 (2,563)
Current non-smokers	13.6 (1,403)
Time since last quit attempt started	
<=1 to 26 weeks	63.0 (6,510)
26 to 52 weeks	37.0 (3,825)
Number of quit attempts in the past year	
1	64.5 (6,661)
2	21.9 (2,264)
3	7.6 (783)
4 or more	6.1 (627)
Use of smoking cessation treatments	
Medication on prescription + specialist behavioural support	2.0 (204)
Medication on prescription + brief advice	16.5 (1,706)
NRT bought over-the-counter	30.3 (3,128)
None of the above	51.3 (5,297)
Time spent with urges to smoke, mean (SD)	3.0 (1.3)
Strength of urges to smoke, mean (SD)	2.0 (1.2)

Figures are presented as percentage (N), unless stated otherwise. Medication on prescription included nicotine replacement therapy (NRT), varenicline or bupropion. Time spent with urges to smoke: 1 (not at all) to 6 (all the time). Strength of urges to smoke: 0 (no urges) to 5 (extremely strong urges).

Table 2: Associations between characteristics of the sample and use of smoking cessation treatments

Variable	Medication on prescription + specialist behavioural support (N=204)	Medication on prescription + brief advice (N=1,706)	NRT bought over-the-counter (N=3,128)	None of the other (N=5,297)	P
Age, mean (SD)	46.5 (14.1)	43.3 (14.8)	40.8 (15.0)	37.2 (15.9)	***
Sex					
Male	34.3 (70)	42.4 (724)	45.4 (1,424)	48.0 (2,541)	***
Female	65.7 (134)	57.6 (982)	54.5 (1,704)	52.0 (2,756)	
Social grade					
AB	13.7 (28)	9.4 (160)	11.1 (348)	10.7 (569)	**
C1	21.1 (43)	20.1 (343)	23.4 (732)	23.7 (1,253)	
C2	25.0 (51)	23.4 (399)	21.5 (671)	23.2 (1,230)	
D	14.2 (29)	19.5 (332)	18.0 (564)	19.3 (1,020)	
E	26.0 (53)	27.7 (472)	26.0 (813)	23.1 (1,225)	
Time since quit attempt started					
<=1 to 26 weeks	53.4 (109)	60.3 (1,028)	63.4 (1,984)	64.0 (3,389)	**
26 to 52 weeks	45.6 (95)	39.7 (678)	36.6 (1,144)	36.0 (1,908)	
Number of quit attempts in the past year					n.s.
1	64.7 (132)	67.6 (1,153)	63.0 (1,970)	64.3 (3,406)	
2	22.1 (45)	20.9 (356)	22.5 (703)	21.9 (1,160)	
3	6.9 (14)	6.0 (103)	8.5 (266)	7.6 (400)	
4 or more	6.4 (13)	5.5 (94)	6.0 (189)	6.2 (331)	
Time spent with urges to smoke, mean (SD)	3.3 (1.3)	3.2 (1.4)	3.2 (1.2)	2.8 (1.2)	***
Strength of urges to smoke, mean (SD)	2.3 (1.3)	2.2 (1.2)	2.2 (1.1)	1.8 (1.1)	***

Figures are presented as percentage (N), unless stated otherwise. Medication on prescription included nicotine replacement therapy (NRT), varenicline or bupropion. Time spent with urges to smoke: 1 (not at all) to 6 (all the time). Strength of urges to smoke: 0 (no urges) to 5 (extremely strong urges). *p<0.05, **p<0.01, ***p<0.001, n.s. = not statistically significant (p>=0.05).

Table 3: Differences in unadjusted measurements of strength of urges to smoke in smokers versus non-smokers, stratified by method of quitting

Method of quitting	(N)	Mean (SD) strength of urges to smoke in smokers	(N)	Mean (SD) strength of urges to smoke in non-smokers	Mean difference (95% CI) in strength of urges to smoke
Medication on prescription + specialist behavioural support	(165)	2.59 (1.10)	(39)	1.31 (1.66)	1.29 (0.73-1.85)
Medication on prescription + brief advice	(1,447)	2.43 (1.05)	(259)	1.05 (1.31)	1.38 (1.21-1.55)
NRT bought over-the-counter	(2,806)	2.33 (1.03)	(322)	1.06 (1.24)	1.28 (1.14-1.42)
None of the above	(4,514)	2.02 (1.03)	(783)	0.76 (1.16)	1.26 (1.17-1.35)

Medication on prescription included nicotine replacement therapy (NRT), varenicline or bupropion. Strength of urges to smoke: 0 (no urges) to 5 (extremely strong urges). The mean difference in strength of urges to smoke was not different across the methods of quitting (p=0.44 for the interaction term between smoking status (smokers vs. quitters) and method of quitting adjusted for the time since the quit attempt started).

Table 4: Unadjusted and adjusted odds of self-reported non-smoking in the full sample and in the two subsamples of respondents who started their quit attempt less/more than 6 months ago

Smoking cessation treatment	OR (95%CI)			
	Model 1	Model 2	Model 3	Model 4
Full sample (N=10,335)				
Medication on prescription + specialist behavioural support (N=204)	1.36 (0.95-1.95)	1.47 (1.02-2.11)	2.97 (1.93-4.59)	3.25 (2.05-5.15)
Medication on prescription + brief advice (N=1,706)	1.03 (0.89-1.20)	1.02 (0.87-1.19)	1.59 (1.32-1.91)	1.61 (1.33-1.94)
NRT bought over-the-counter (N=3,128)	0.66 (0.58-0.76)	0.63 (0.55-0.74)	0.95 (0.81-1.12)	0.96 (0.81-1.13)
None of the above (reference) (N=5,297)	1	1	1	1
Subsample: quit attempt started <6 months (N=6,510)				
Medication on prescription + specialist behavioural support (N=109)	1.45 (0.90-2.34)	1.83 (1.12-3.01)	3.80 (2.17-6.67)	4.35 (2.35-8.03)
Medication on prescription + brief advice (N=1,028)	1.21 (1.00-1.46)	1.20 (0.98-1.46)	1.78 (1.42-2.23)	1.78 (1.42-2.24)
NRT bought over-the-counter (N=1,984)	0.60 (0.60-0.84)	0.68 (0.57-0.82)	0.97 (0.80-1.00)	1.00 (0.82-1.22)
None of the above (reference) (N=3,389)	1	1	1	1
Subsample: quit attempt started >6 months (N=3,825)				
Medication on prescription + specialist behavioural support (N=95)	1.27 (0.74-2.17)	1.14 (0.66-1.98)	2.32 (1.15-4.67)	2.32 (1.15-4.67)
Medication on prescription + brief advice (N=678)	0.78 (0.60-1.01)	0.74 (0.57-0.98)	1.26 (0.91-1.76)	1.26 (0.91-1.76)
NRT bought over-the-counter (N=1,144)	0.59 (0.46-0.75)	0.56 (0.44-0.71)	0.87 (0.66-1.15)	0.87 (0.66-1.15)
None of the above (reference) (N=1,908)	1	1	1	1

Model 1 = unadjusted. Model 2 = adjusted for age, sex, social grade, number of quit attempts in the last year prior to the one in question, time since last quit attempt started, and year of the survey. Model 3 = adjusted for the variables from model 2 and time spent with urges to smoke, strength of urges to smoke. Model 4 = adjusted for the variables from model 2 and the interaction terms time since last quit attempt started * time spent with urges, time since last quit attempt started * strength of urges to smoke. Medication on prescription included nicotine replacement therapy (NRT), varenicline or bupropion. OR = odds ratio, 95%CI = 95% confidence interval around OR.

Supplementary Table E1: Percentage (95%CI) non-smokers in each treatment condition stratified by strength of urges to smoke in the full sample (N=10,335)

Smoking cessation treatment	Strength of urges to smoke‡	Non-smoker
Medication on prescription + specialist behavioural support	Low (N=117)	25.6 (17.7-33.6)
	High (N=87)	10.3 (3.9-16.7)
Medication on prescription + brief advice	Low (N=1,030)	21.1 (18.6-23.6)
	High (N=676)	6.2 (4.4-8.0)
NRT bought over-the-counter	Low (N=2,033)	13.8 (12.3-15.3)
	High (N=1,095)	3.8 (2.7-5.0)
None of the above	Low (N=4,011)	17.7 (16.5-18.6)
	High (N=1,286)	5.8 (4.5-7.0)

‡Split by median: low strength of urges to smoke = scores 0 to 2, high = scores 3 to 5. 95%CI = 95% confidence interval.