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Unassisted Quitting and Smoking Cessation Methods Used in the United States: Analyses of 2010–2011 Tobacco Use Supplement to the Current Population Survey Data

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Abstract

Introduction: The study estimated the prevalence of unassisted quitting (ie, quitting without pharmacological aids or other interventions) among former smokers and identified the most common smoking cessation methods used by U.S. adult smokers who quit smoking between 2007 and 2011. Among long-term quitters, smoking-related behaviors and factors associated with using pharmacological methods and quitting unassisted were examined.

Methods: The analytic sample consisted solely of former smokers, including 3,583 "long-term quitters" (those who quit 1 to 3 years prior to the survey) and 2,205 "recent quitters" (those who quit within a year prior to the survey), who responded to the 2010–2011 Tobacco Use Supplement to the Current Population Survey.

Results: About 72% of former smokers quit unassisted, 26% used at least one pharmacological method, and 7% used at least one nonpharmacological method. The most common pharmacological methods were the nicotine patch (12%), Chantix/Varenicline (11%), and a nicotine gum/lozenge (8%). For long-term quitters, cutting back on cigarettes gradually and relying on social support were more commonly associated with pharmacological methods. Among long-term quitters, younger adults (18 to 44 years old), Non-Hispanic Blacks, Hispanics, those who were less nicotine dependent prior to quitting and those who did not visit a doctor in the past 12 months before quitting had higher odds of reporting unassisted quitting than quitting with pharmacological methods.

Conclusions: Unassisted quitting remains the predominant means of recent and long-term smoking cessation in the United States. Attempters may try different ways of quitting during the same quit attempt.

Implications: Unassisted quitting remains a much more common method for recent and long-term smoking cessation than use of pharmacological or nonpharmacological methods. Smokers may try different ways of quitting during the same quit attempt. Thus, population-based studies that investigate the use of particular methods while ignoring other ways of quitting may overestimate the benefits of certain methods for smoking cessation.

Smoking-related illnesses remain one of the leading causes of mortality and morbidity in the United States, and both policies (public ad campaigns) and legislation (smoking bans in public buildings) have been designed to discourage smoking and encourage quitting. With increased public awareness of the detrimental effects of smoking, many smokers attempt to quit using a variety of aids and supports,

and some of these attempts are successful. One of the most important questions for tobacco researchers is which cessation strategies are used during quit attempts in general and during successful, that is, long-term, quit attempts. Although several studies have examined this question, the estimates provided have varied considerably; thus, more precise estimates are needed to inform public policy and medical practice. In particular, it is important to account for the fact that smokers may try several methods while trying to quit smoking. Furthermore, along with pharmacological methods, it is important to consider behavioral interventions and unassisted quitting (ie, quitting without pharmacological aids or other interventions) and to determine the role of self-help behavioral strategies in successful quit attempts. This study sought to address these issues.

Smoking Cessation Methods

The types of smoking cessation methods that have been used to quit smoking are commonly discussed in the tobacco research community. The efficacy and benefits of pharmacological methods receive considerably more attention than the other topics, for example, unassisted quitting and behavioral interventions, despite the fact that pharmacological methods are not the most common strategies for quitting. Several researchers have discussed the global neglect of unassisted quitting within tobacco research.[1,2] For example, the vast majority of tobacco cessation papers (91%) published in English in 2007 and 2008 and cited on MEDLINE were devoted to pharmacological or nonpharmacological behavioral treatments, whereas only 9% were devoted to unassisted cessation.[1] Furthermore, about 90% of scientific publications addressing smoking cessation in Australia concerned pharmacological methods and only 10% of papers addressed unassisted quitting.[2]

Despite rapid development and wide advertisement of new smoking cessation medications over the past decades, unassisted cessation has always been the predominant means of attempting to quit and smoking cessation. Although the exact definition and estimated prevalence of unassisted quitting vary across studies, there is a general finding that the majority of smokers quit unassisted.[1,3,4] Analyses of the 2003 Tobacco Use Supplement to the Current Population Survey (TUS-CPS) revealed that about 64% of attempters did not use any methods when they tried to quit smoking (ie, unassisted quit attempts), 32% used at least one pharmacological treatment (such as nicotine patch, gum, lozenge, Bupropion, nicotine spray, or inhalator), and 9% used at least one behavioral intervention (counseling or self-help materials, eg, books).[5,6] Analysis of the 2000 National Health Interview Survey indicated that 78% of attempters quit unassisted, 22% used pharmacological methods (gum, patch, inhaler, spray, Bupropion, Zyban, or Wellbutrin), and 1% used behavioral interventions (counseling, smoking clinic, self-help materials, eg, booklets).[7] Analyses of a 10-year history of quit attempts reported in the 1986 Adult Use of Tobacco Survey revealed that about 85% of attempters quit unassisted; specifically, about 92% of long-term quitters and 80% of relapsers quit unassisted whereas only 1% of long-term quitters and 6% of relapsers quit using a nicotine gum.[8]

The prevalence of pharmacological methods for smoking cessation increased significantly from 1992 to 2010, from about 21% (prior to 2000) to 31% in 2010,[9] with a more rapid increase in the 1990s when the first few medications became available, for example, nicotine gum was the main pharmacological smoking cessation prescription method before 1992, nicotine patches became available as a prescription medicine in the late 1991, and in 1996 both these methods became available over-the-counter.[7,9,10] However, another

recent study showed only a 2.4% increase in prevalence of using pharmacological methods from 2003 to 2010–2011 (a period that includes the introduction of Varenicline in 2006), suggesting that users of such products are replacing old products with new ones, rather than new products increasing the number of new users of pharmacological products.[11]

Other studies have attempted to measure changes in the prevalence of unassisted smoking cessation over the years. However, this task is difficult due to the diverse definitions of unassisted smoking cessation used across studies, differences in the types of smoking cessation methods considered, and small (close to 0) percentages for some specific methods. One study determined that the prevalence of unassisted cessation decreased in the United States from about 80% prior to 1983 to 50% in 2006–2009 for long-term quitters and from 76% to 44% for relapsers.[12] However, the quality of that study may be low,[3] because the sample included only 1,078 current and former smokers who responded to a panel survey in 2009, and the study tried to assess the history of quit attempts occurring prior to 1983, in 1984–1995, 1996–1999, 2000–2005, and 2006–2009, leading to relatively small sample sizes for some periods.

Studies designed to determine the key factors associated with using pharmacological and nonpharmacological methods for smoking cessation have shown that more nicotine-dependent smokers,[5–8] women,[6,8] wealthier,[6,13] and more educated[6,8] smokers have higher odds of trying to quit assisted, that is, using a pharmacological or a nonpharmacological method, than unassisted. Age was also associated with assisted quit attempts: Older smokers were more likely (perhaps not significantly) to try to quit assisted than teenagers and young adults (ie, 18–24 year olds).[6,8] In addition, attempters covered by private or military insurance were more likely to use an assisted method compared to attempters covered by Medicare, Medicaid, or no insurance;[7] and subjects who believed that medications ease quitting were more likely to use pharmacological methods.[13] Health care provider's advice to quit smoking was also shown to be a significant predictor of assisted quitting.[7]

Behavioral Strategies Used While Trying to Quit Smoking

Smokers may use multiple behavioral strategies when trying to quit, for example, giving up cigarettes all at once or gradually cutting back on cigarettes.[8] The majority of smokers are more likely to quit by giving up cigarettes all at once with no aids.[8] Long-term quitters are more likely than relapsers to quit by giving up cigarettes all at once with no aids, while relapsers are slightly more likely to attempt to quit via gradually cutting back on cigarettes than are long-term quitters.[8]

Some smokers rely on social support during their quit attempts;[5,14] for example, the overall rate of using social support among attempters is about 24%.[5] The rate of relying on social support is especially high (about 66%) among attempters who use a nonpharmacological method, probably because nonpharmacological methods (eg, counseling, a helpline) usually involve social support; among attempters who used a pharmacological method the rate was about 37%.[5]

Study Goals

While there have been a number of important findings related to smoking cessation,[15–17] the main limitation of prior research studies is that most have examined smoking cessation methods individually and ignored the possibility that some smokers use several strategies while trying to quit smoking, for example, smokers might try to quit via giving up cigarettes all at once and then start using a nicotine

patch while gradually reducing the number of cigarettes smoked per day. Ignoring the possibility that respondents may use multiple strategies could lead to inaccurate prevalence estimates and to large variability in estimates across different studies.

In this study, we considered possible combinations of pharmacological and nonpharmacological smoking cessation methods and examined smoking-related behaviors. The study goals were to (1) estimate the prevalence of unassisted quitting and identify the most prevalent pharmacological and nonpharmacological smoking cessation methods used between 2007 and 2011 among U.S. adult former smokers; (2) assess the importance of social support and smoking-related behaviors while trying to quit smoking for long-term quitters who used pharmacological methods or quit unassisted, and (3) identify the key sociodemographic and smoking-related factors associated with long-term smoking cessation using pharmacological methods and quitting unassisted. An additional goal (4) was to assess importance of specific doctor's recommendations, for example, prescribed a medication pill or suggested setting a specific quit date, when advising smokers to quit smoking.

We note that the study did not assess efficacy of any smoking cessation methods: The topic of efficacy is outside of the scope of this paper; thus literature addressing benefits and efficacy of pharmacological and other smoking cessation methods is not discussed. The study used self-reported information from recent and long-term former smokers. Therefore, the findings are potentially subject to response bias, for example, some respondents could have difficulties recalling events from their past.[18–24]

Methods

In this study, we analyzed the 2010–2011 TUS-CPS data for former smokers who reported that they quit smoking within the past 3 years prior to the survey,[25] that is, who quit within the period 2007–2011. The analytic samples consisted of "long-term quitters" (those who quit 1–3 years prior to the survey) and "recent quitters" (those who quit within a year prior to the survey). To account for the complex design of the TUS-CPS,[25] we used built-in procedures in the survey package in SAS/STAT9.4,[26] for example, Rao-Scott chi-square (RS) tests which can be used for analyses of contingency tables from complex surveys.[27,28] We report p values adjusted for multiplicity via the Bonferroni method (the overall significance level was 5%).

Definitions of Study Measures

The pharmacological methods included a nicotine patch; a nicotine gum or nicotine lozenge; a nicotine nasal spray or nicotine inhaler; medications such as Chantixor Varenicline; Zyban®, Bupropion, or Wellbutrin; and another prescription medication (not specified). Note that the pharmacological methods include both over-the-counter aids and prescription medications. The nonpharmacological methods included a telephone helpline or quitline; one-on-one counseling; a stop smoking clinic class or support group; Internet sites or a Web-based program; and acupuncture or hypnosis. The respondents were asked to report all pharmacological and behavioral methods used when trying to quit smoking. The corresponding binary measures were defined using yes/no responses to the survey questions,[25] for example, the measure "using Chantix/Varenicline while trying to quit smoking" was based on a response (yes, no) to the question "When you quit smoking completely, did you use any of the following products: A prescription pill called Chantix or Varenicline?" If a former

smoker reported using none of the surveyed pharmacological or nonpharmacological methods, then he/she was said to quit unassisted.

The self-help behavioral measures included gradually cutting back on cigarettes, switching to smokeless tobacco such as chewing tobacco or snuff; switching to regular cigars, cigarillos, little filtered cigars or pipes filled with tobacco; switching to a "lighter" cigarette; giving up cigarettes all at once, and specific quitting plans associated with giving up cigarettes all at once (eg, trying to quit as soon as one made the decision to quit); and whether respondents relied on social support (ie, help or support from friends or family) while trying to quit smoking.[25] The respondents were asked to report all self-behavioral aids used. Binary measures were constructed based on yes/no responses to the survey questions,[25] for example, the measure corresponding to giving up cigarettes all at once while trying to quit smoking was based on the question "When you quit smoking completely, did you do any of the following (please mention all methods, whether or not you think they were effective): Did you try to give up cigarettes all at once?" Specific quitting plans associated with giving up cigarettes all at once were based on a categorical response to the question "Please tell me which is true about when you completely quit smoking by giving up cigarettes all at once: (1) I tried to quit as soon as I made the decision, (2) I planned the quit attempt for later the same day, (3) I planned the quit attempt for a date in the future, and (4) I decided to quit after having not smoked for some other reason."

One measure of prior nicotine dependence, smoking within 30 minutes of awakening, was constructed using the exact time (in minutes) between awakening and smoking the first cigarette of the day, and responses to the follow-up question: "During the 12 months before you quit smoking, would you say you smoked your first cigarette of the day within the first 30 minutes of awakening?" The follow-up question was asked of respondents who could not provide the exact time between awakening and smoking. The binary measure differentiated between smoking the first cigarette of the day within 30 minutes of awakening and smoking it more than 30 minutes after awakening (during the 12 months before quitting).

Several measures corresponding to a doctor's (where "a doctor" refers to "a medical doctor" or "a dentist") specific recommendations when advising smokers to quit were defined. Respondents who indicated that they visited a doctor in the past 12 months before completely quitting smoking reported whether a doctor advised them to quit smoking. Those respondents who indicated that they were advised to quit also reported the doctor's specific recommendations. For example, a survey question asked "In the 12 months before you quit smoking, when a medical doctor advised you to quit smoking, did the doctor also suggest that you call or use a telephone helpline or quitline?" Similar questions were used to assess specific dentist's recommendations. The complete list of surveyed recommendations included a suggestion to use a telephone helpline or quitline; a recommendation to use a smoking cessation class, program, or counseling; a recommendation or prescription for a nicotine product such as a patch, gum, lozenge, nasal spray or inhaler; a prescription for a pill such as Chantix, Varenicline, Zyban, Bupropion, or Wellbutrin; and a suggestion to set a specific date to stop smoking.

Analytic Approach

To address goal 1 (ie, to estimate the prevalence of assisted and unassisted quitting), we considered 5,788 former smokers (recent and long-term quitters); Table 1 presents the summary statistics for this sample. To address goals 2 and 3 (ie, to identify attributes of

Table 1. Sample Summary

Characteristic	Recent quitters		Long-term quitters		Total	
	Count	Percent[a]	Count	Percent[a]	Count	Percent[a]
Age (y)						
18–24	273	18.5	278	11.8	551	14.3
25–44	914	43.0	1,598	44.9	2,512	44.2
45–64	738	31.3	1,348	33.6	2,086	32.7
65+	201	7.3	438	9.8	639	8.9
Gender						
Male	1,054	54.5	1,812	53.1	2,866	53.3
Female	1,072	46.5	1,850	46.9	2,922	46.7
Race/ethnicity						
Non-Hispanic White	1,776	78.7	3,121	80.8	4,897	80.0
Non-Hispanic Black	176	10.5	266	8.9	442	9.5
Hispanic	174	10.8	275	10.3	449	10.5
Highest level of education						
High school or less	996	47.8	1,607	43.4	2,603	45.0
Some college or higher	1,130	52.2	2,055	56.6	3,185	55.0
Marital status						
Married	930	41.4	1,876	49.2	2,806	46.3
Widowed, divorced, or separated	554	24.0	882	21.8	1,436	22.6
Never married	642	34.6	904	29.0	1,546	31.1
Labor force status						
Employed	1,280	59.8	2,309	64.0	3,589	62.5
Unemployed	195	11.3	277	8.5	472	9.5
Not in labor force	651	28.8	1,076	27.5	1,727	28.0
Region						
Northeast	441	18.1	736	17.2	1,177	17.6
Midwest	582	24.5	1,056	26.1	1,638	25.5
South	487	35.1	1,110	36.5	1,726	36.0
West	2,126	22.3	760	20.1	1,247	20.9
Metropolitan status						
Metropolitan	1,648	84.3	2,778	81.9	4,426	82.8
Non-metropolitan	478	15.7	884	18.1	1,362	17.2
Survey mode[a]						
Telephone	1,370	61.7	2,470	66.5	3,840	64.7
Personal visit	744	38.3	1,179	33.5	1,923	35.3
Visiting a doctor[a]						
Did not visit a doctor	668	34.9	1,275	37.9	1,943	36.8
Visited a doctor	1,458	65.1	2,387	62.1	3,845	63.2
Smoking the first cigarette within 30 minutes of awakening[a]						
No	1,075	54.7	1,871	54.5	2,946	54.6
Yes	962	45.3	1,644	45.5	2,606	45.4
SAD[a] Mean (*SE*), y	0.33 (0.01)		2.00 (0.02)		1.38 (0.02)	
Sample size (population count)	2,126 (2,880, 444)		3,662 (4,850, 427)		5,788 (7,730, 871)	

SAD = smoking abstinence duration.

[a]Percentages are based on the population counts; Survey mode was unknown for 25 respondents; Visiting a doctor refers to visiting a medical doctor or dentist in the past 12 months prior to the last quit attempt; Smoking within 30 minutes of awakening was unknown for 236 respondents.

successful, ie, long-term, cessation), we limited the analysis to 3,583 long-term quitters who either used pharmacological methods (1,050, 26.1%) or quit unassisted (2,533, 73.9%). When assessing specific quitting plans associated with giving up cigarettes all at once, we considered 2,898 long-term quitters who reported that they tried to give up cigarettes all at once and who reported their quitting plans.

To identify the most important predictors of using pharmacological methods (versus quitting unassisted), we considered all factors listed in Table 1. We fitted simple logistic regressions and examined each factor's relative contribution in terms of Akaike's information criterion (AIC).[29] To ease the presentation, we report AIC values that

are based on log-likelihood, rescaled to the sample.[30] Then a multiple logistic regression model was built using an analog of a backward elimination approach (with a 10% significance level for elimination).

To assess goal 4 (ie, specific doctor's recommendations), we limited analysis to 1,334 respondents who indicated that they had visited a doctor during the past 12 months before quitting and who had been advised by a doctor to quit. However, sample sizes with respect to some specific recommendations were relatively small, for example, while 1,334 respondents reported whether a doctor recommended or prescribed at least one pharmacological method, only 396 respondents reported whether a doctor recommended to use a

smoking cessation class, program, or counseling. Therefore, these analyses should be viewed with caution.

Results

Prevalence of Assisted and Unassisted Quitting (Goal 1)

The majority of former smokers (3,960, 71.6%) quit unassisted, whereas 1,396 (21.9%) used only pharmacological methods, 307 (4.4%) used both pharmacological and nonpharmacological methods, and 125 (2.1%) used only nonpharmacological methods. Smokers who used at least one pharmacological method were more likely to use at least one nonpharmacological method as well when compared to those smokers who did not use any pharmacological methods; specifically, 16.8% of former smokers who used a pharmacological method to quit also used a nonpharmacological method, whereas only 2.8% of those who did not use a pharmacological method used a nonpharmacological method (RS = 267.7, *df* = 1, *p* < .0001). In addition, 1,269 (19.6%) smokers used exactly one pharmacological method, 308 (4.8%) used two pharmacological methods, and 126 (1.8%) used three or more pharmacological methods.

Table 2 illustrates that 26.3% of former smokers used pharmacological methods to quit (either alone or combined with other approaches), and among the pharmacological methods, a nicotine patch, the medications Chantix or Varenicline, and a nicotine gum or nicotine lozenge were most commonly used. Among those former smokers who used at least one pharmacological method, 74.8% used exactly one pharmacological method, 18.2% used exactly two methods, 7.0% used three or more methods, and 16.7% used nonpharmacological methods; the most commonly used methods were a nicotine patch (45.9%), Chantix or Varenicline (41.8%), and a nicotine gum or nicotine lozenge (31.1%).

Among the nonpharmacological methods (see Table 2), the most prevalent methods included a telephone helpline or quitline, one-on-one counseling, and a stop smoking clinic class or support group. However, overall, each of these methods was used by only about 2% of quitters. The prevalence of each of these methods was significantly higher (all *p* values < .0001) for former smokers who used pharmacological methods than those who did not use pharmacological methods. The respective rates for each of these methods among former smokers who used pharmacological methods and those who did not use pharmacological methods are 6.2% and 0.5% for a telephone helpline or quitline, 4.8% and 0.9% for one-on-one counseling, and 5.3% and 0.9% for stop smoking clinic classes or support groups.

Table 2 also illustrates that the patterns of smoking cessation methods used are similar for recent and long-term quitters. The only significant differences corresponded to using the patch (RS = 4.1, *df* = 1, *p* = .0433) and any nonpharmacological methods (RS = 7.9, *df* = 1, *p* = .0050): In each case, the prevalence was significantly higher for recent quitters than for long-term quitters; due to low percentages, "another pill" and specific nonpharmacological methods were not considered.

Goal 2: Self-Help Behaviors of Long-Term Quitters While Trying to Quit Smoking

The most common behaviors while trying to quit smoking (see Table 3) were giving up cigarettes all at once and gradually cutting back on cigarettes. This pattern applies to all long-term quitters. The

majority of quitters (70.1%) reported exactly one behavior, 17.6% reported two behaviors, 5.6% reported three or more behaviors, and 6.7% reported none of these behaviors. Overall 30.6% of quitters reported relying on social support. In addition, it was common to use a number of different smoking-related behaviors, especially for quitters who quit unassisted. For example, among 573 quitters who quit unassisted and tried gradually cutting back, 66.7% also tried giving up cigarettes all at once. Among 455 quitters who used pharmacological methods and tried gradually cutting back, 56.6% tried giving up all at once.

Among former smokers who tried giving up cigarettes all at once (see Table 3), the majority of respondents (overall, 63.8%) indicated that they tried to quit as soon as they made the decision; the percentage was significantly higher for respondents who reported quitting unassisted (69.6%) than for those who reported quitting with a pharmacological method (46.6%). On the other hand, the percentage of respondents who planned their quit attempt for a date in the future was higher for those who quit using pharmacological methods (37.5%) than those who quit unassisted (11.6%). No significant differences were detected with respect to planning the quit attempt for later the same day and decisions to quit after having not smoked for some other reason.

Also, gradually cutting back on cigarettes; switching to regular cigars, cigarillos, little filtered cigars or pipes filled with tobacco; and switching to a "lighter" cigarette; as well as relying on social support were significantly more common for quitters who used pharmacological methods than for those who quit unassisted, while giving up cigarettes all at once was significantly more common for quitters who quit on their own than for those who used pharmacological methods, see Table 3.

In addition, several self-help behaviors were associated with use of specific pharmacological methods while trying to quit smoking. In particular, giving up cigarettes all at once was significantly negatively associated with using a nicotine patch (RS = 10.8, *df* = 1, *p* = .0010), nicotine gum or lozenge (RS = 4.1, *df* = 1, *p* = .0419), nicotine nasal spray or inhaler (RS = 16.9, *df* = 1, *p* < .0001), Chantix or Varenicline (RS = 84.3, *df* = 1, *p* < .0001), Zyban, Bupropion, or Wellbutrin (RS = 10.7, *df* = 1, *p* = .0011). However, gradually cutting back on cigarettes was significantly positively associated with using a nicotine patch (RS = 40.9, *df* = 1, *p* < .0001), nicotine gum or lozenge (RS = 56.9, *df* = 1, *p* < .0001), spray or inhaler (RS = 11.1, *df* = 1, *p* = .0009), Chantix or Varenicline (RS = 49.8, *df* = 1, *p* < .0001), Zyban, Bupropion, or Wellbutrin (RS = 25.3, *df* = 1, *p* < .0001). Switching to smokeless tobacco, that is, chewing tobacco or snuff, was only significantly (positively) associated with using a nicotine gum or lozenge (RS = 24.6, *df* = 1, *p* < .0001). Switching to "lighter" cigarettes was significantly positively associated with using a nicotine patch (RS = 29.4, *df* = 1, *p* < .0001), gum or lozenge (RS = 36.3, *df* = 1, *p* < .0001), spray or inhaler (RS = 7.3, *df* = 1, *p* = .0070), Chantix or Varenicline (RS = 14.1, *df* = 1, *p* = .0002), and Zyban, Bupropion, or Wellbutrin (RS = 68.7, *df* = 1, *p* < .0001). Also switching to regular cigars, cigarillos, little filtered cigars or pipes filled with tobacco was only significantly (positively) associated with using a gum or lozenge (RS = 12.1, *df* = 1, *p* = .0005).

Goal 3: Attributes of Long-Term Quitting via Pharmacological Methods Versus Unassisted

The most important predictors of using a pharmacological method (versus quitting on one's own) during the successful quit attempt are age (AIC = 3,916; *p* < .0001), seeing a doctor in the past 12 months

Table 2. Smoking Cessation Methods Used to Quit Smoking

Method	Recent quitters		Long-term quitters		Total	
	Count	Percent[a]	Count	Percent[a]	Count	Percent[a]
Pharmacological methods	653	27.5	1,050	25.6	1,703	26.3
Nicotine patch	316	13.4	440	11.3	756	12.1
Nicotine gum or lozenge	199	8.6	322	7.9	521	8.2
Nicotine nasal spray or inhaler	20	0.8	28	0.8	48	0.8
Chantix or Varenicline	247	10.1	498	11.5	745	11.0
Zyban, Bupropion, or Wellbutrin	71	2.9	132	3.0	203	2.9
Other prescription medication	5	0.1	20	0.4	25	0.3
Behavioral interventions	192	8.0	240	5.6	432	6.5
Telephone helpline or quitline	75	2.5	80	1.7	155	2.0%
One-on-one counseling	64	2.4	63	1.6	127	1.9
Stop smoking clinic class or support group	57	2.4	76	1.9	133	2.1
Internet- or Web-based program	41	1.8	51	1.5	92	1.4
Acupuncture or hypnosis	35	1.7	56	1.4	91	1.5

[a]Percentages are based on the population counts depicted in Table 1.

Table 3. Self-Help Behaviors of Long-Term Quitters While Trying to Quit Smoking

Behavior and Rao-Scott test results for significant differences[a]	Used pharmacological methods		Quit unassisted	
	Count	Percent[a]	Count	Percent[a]
Help or support from friends or family (RS = 90.7)[a]	484	45.8	642	25.2
Giving up cigarettes all at once (RS = 70.0)[a]	754	71.6	2,191	85.6
When completely quit smoking by giving cigarettes all at once				
Tried to quit as soon as made the decision (RS = 79.4)[a]	333	46.6	1,482	69.6
Planned the quit attempt for later the same day	47	6.4	95	4.6
Planned the quit attempt for a date in the future (RS = 153.7)[a]	288	37.5	257	11.6
Decided to quit after having not smoked for some other reason (RS = 9.4, *p* = .0021)	72	9.5	324	14.3
Gradually cutting back on cigarettes (RS = 114.4)[a]	455	43.9	573	23.9
Switching to				
Smokeless tobacco, ie, chewing tobacco or snuff	39	4.0	88	3.4
Regular cigars, cigarillos, little filtered cigars or pipes filled with tobacco (RS = 4.5, *p* = .0342)	44	4.3	73	2.8
"Lighter" cigarette (RS = 44.1)*	105	9.7	97	3.6
Total sample size (population count)	1,050 (1,239, 492)		2,533 (3,508, 575)	

[a]All tests are based on 1 degree of freedom; percentages are based on the population counts.

*$p < .0001$; *p* values and test statistics for nonsignificant comparisons are not presented.

before quitting smoking (AIC = 3,920; $p < .0001$), race/ethnicity (AIC = 3,964; $p < .0001$), marital status (AIC = 4,023; $p < .0001$), smoking within 30 minutes of awakening in the past 12 months before quitting (AIC = 3,749; $p < .0001$), and region (AIC = 4,087; $p = .0485$). Specifically, simple logistic regressions resulted in the following estimates (unadjusted for the other characteristics). The odds of using pharmacological methods for 18- to 24-year-old ($p < .0001$; OR = 0.113; CI = 0.057–0.222) and 25- to 44-year-old quitters ($p = .0002$; OR = 0.575; CI = 0.432–0.766) were smaller than the odds of using pharmacological methods for 65+ year-old quitters, while there was no significant difference between the odds of using pharmacological methods for 45- to 64- and 65+ year-old quitters. Also, the odds of using pharmacological methods for Non-Hispanic Blacks ($p < .0001$; OR = 0.198; CI = 0.109–0.357) and Hispanics ($p < .0001$; OR = 0.375; CI = 0.258–0.545) were smaller than the odds of using pharmacological methods for Non-Hispanic Whites.

The odds of using pharmacological methods for quitters who were married ($p < .0001$; OR = 2.151; CI = 1.699–2.722) and those who were widowed, divorced, or separated ($p < .0001$; OR = 2.164; CI = 1.682–2.784) were larger than the odds for those who have never been married. The odds of using pharmacological methods were positively associated with prior smoking within 30 minutes of awakening ($p < .0001$; OR = 3.091; CI = 2.554–3.741) and visiting a doctor 12 months prior to quitting ($p < .0001$; OR = 3.051; CI = 2.462–3.780). No significant differences were detected when specific regions were compared to the western region of the United States. The other factors were not significant.

The final model (Wald Chi-Square = 252.5, *df* = 17, $p < .0001$) contained two significant interactions, that is, between age and highest level of education ($p = .0186$) and between age and survey mode ($p = .0393$), as well as several main effects, that is, all factors included in the interactions and the ones depicted in Table 4. After

Table 4. Analysis of Long-Term Quitters: Model-Based Odds Ratio of Quitting Using Pharmacological Methods Versus Unassisted Quitting for Main Effects Not Included in the Interactions; Nonsignificant *p* Values Are Not Presented

Comparison	Point estimate	95% Wald confidence limits	
Race/ethnicity (*p* < .0001)			
Non-Hispanic Black versus Non-Hispanic White (*p* < .0002)	0.368	0.249	0.545
Hispanic versus Non-Hispanic White (*p* = .0002)	0.287	0.152	0.542
Employment status (*p* = .0325)			
Employed versus not in labor force (NS)	1.270	1.001	1.612
Unemployed versus not in labor force (*p* = .0200)	1.663	1.130	2.450
Smoking within 30 minutes of awakening: Yes versus No (*p* < .0001)	2.622	2.116	3.249
Visiting a doctor: Yes versus No (*p* < .0001)	2.587	2.014	3.324

NS = nonsignificant.

multiplicity adjustments, the follow-up comparisons within each age group were not significant between the education levels and survey modes. Table 4 presents the results for main effects not included in the interactions. Results of the overall comparisons between age groups, education levels, and survey modes were similar to the ones based on the comparisons unadjusted for the other covariates.

Goal 4: Specific Doctor's Recommendations When Advising Smokers to Quit Smoking

When advising smokers to quit smoking, doctors most commonly prescribed a medication pill such as Chantix, Varenicline, Zyban, Bupropion, or Wellbutrin (70.6%), recommended or prescribed a nicotine patch, gum, lozenge, spray or inhaler (65.7%), suggested setting a specific quit date (60.0%), suggested using a telephone helpline or quitline (57.0%), or suggested using a smoking cessation class, program, or counseling (49.4%). Among smokers who were advised to quit, at least one pharmacological method was recommended or prescribed to 83.5% of smokers and at least one behavioral intervention was suggested to 64.3% of smokers. There was only one significant difference when the percentages were compared between recent and long-term quitters: 62.3% of recent quitters reported that they were advised to use a telephone helpline or quitline while only 53.2% of long-term quitters reported that they were advised to do so (RS = 4.5, *p* = .0348).

There was a significant association between receiving a doctor's prescription or recommendation to use a pharmacological method (an other-the-counter or a prescription medication) and using a pharmacological method (RS = 119.6, *df* = 1, *p* < .0001). Specifically, among 1,133 respondents whose doctor prescribed or recommended a pharmacological method, 65.1% of respondents used at least one pharmacological method, while among 201 respondents who did not get such advice only 19.1% used at least one pharmacological method. However, the association between a doctor's recommendation to use a behavioral intervention and using a behavioral intervention was not significant; among 654 respondents whose doctors recommended using a behavioral intervention, 16.4% used at least one behavioral intervention, while among 299 who did not get such a recommendation, 11.4% used a behavioral intervention.

There was also a significant association between receiving a doctor's prescription (or recommendation) to use a smoking cessation product (such as nicotine patch, gum, lozenge, spray, or inhaler) and using one of these products (RS = 26.7, *df* = 1, *p* < .0001); among 650 respondents who were recommended or prescribed such a smoking cessation product, 38.8% used a product, while out of 317 respondents who did not receive such a suggestion, only 17.7% used a

product. Similarly, there was a significant association between a doctor's prescription to use a smoking cessation pill (such as Chantix, Varenicline, Zyban, Bupropion, or Wellbutrin) and using a smoking cessation pill (RS = 339.8., *df* = 1, *p* < .0001); among 764 respondents who were prescribed a smoking cessation pill, 70.5% used a pill, while out of 290 who did not get such a prescription, only 5.9% (19) used a pill. The latter result—that a few smokers for whom a doctor did not prescribe a medication actually used a prescription medication—may be due to smokers' already having a prescription for a pill at the time of their doctor's appointment or discussing a pill during the appointment but getting the prescription later on.

Discussion

Our study indicates that (based on self-reports) unassisted quitting accounted for about 72% of smoking cessation (including recent cessation) and about 74% of successful (ie, long-term) smoking cessation in the United States in the time period around 2007–2011. These estimates are within the range of values found in previous studies of successful quit attempts: from 64% to 78% based on recent studies[5–7] and from about 67% to 75% based on earlier studies.[1,8] Therefore, our findings do not indicate that there was a drastic decrease in the prevalence of unassisted cessation in the United States.

Our findings also confirm that pharmacological methods are more prevalent than nonpharmacological methods alone or combinations of pharmacological and nonpharmacological methods. About 26% of former smokers used at least one pharmacological method and about 7% used at least one nonpharmacological method. These percentages are also within the range reported in previous studies, that is, from 22% to 32% for pharmacological cessation and about 9% for nonpharmacological cessation.[5,7] Among quitters who used pharmacological methods, the majority used a nicotine patch, the medications Chantix or Varenicline, or a nicotine gum or nicotine lozenge. Also, among quitters who used pharmacological methods, 25% used more than one pharmacological method and 17% used a behavioral intervention in addition to a pharmacological method. However, the order in which these cessation strategies were used is not known. These findings highlight that it is not sufficient for researchers to assess only the prevalence of a certain smoking cessation method because smokers may try multiple methods while trying to quit smoking.

The majority of long-term quitters reported that they tried to give up cigarettes all at once while trying to quit smoking, and this behavior was significantly more common among those who quit

unassisted. Giving up cigarettes all at once was also significantly negatively associated with each specific pharmacological method (ie, using a nicotine patch; nicotine gum or lozenge; nicotine nasal spray or inhaler; Chantix or Varenicline; Zyban, Bupropion, or Wellbutrin). Gradually cutting back on cigarettes, on the other hand, was significantly more common for quitters who used pharmacological methods than for those who quit unassisted. Gradually cutting back on cigarettes was also significantly positively associated with each specific pharmacological method. These associations could be due specific recommendations for use of pharmacological treatments. For example, Chantix/Varenicline should be taken for 1 week prior to a quit attempt and 12 more weeks during the quit attempt.[31] During this period, the medication is expected to lessen the smoking cravings and reduce the nicotine dependence.[31]

The study also explored whether long-term quitters tried to quit smoking as soon as they made the decision to quit or planned to quit smoking at a future time. The majority of former smokers reported that they tried to give up cigarettes all at once as soon as they made the decision to quit smoking, that is, without prior planning. A significantly higher percentage (70%) was associated with quitting unassisted than quitting with a pharmacological method (47%). Planning the quit attempt for a date in the future, gradually cutting back on cigarettes, and relying on social support were more common among former smokers who quit with a pharmacological method than those who quit unassisted. This pattern could be due to the use of pharmacological methods which usually require smokers to plan the quit attempt, participate in behavioral interventions, and seek additional social support.[13,32,33] While planning a quit attempt in the future (instead of immediately quitting smoking) could be indicative of a lower commitment to quitting and a lower chance of success,[32] checking this claim is outside of the scope of this study.

The study also indicates that the odds of using pharmacological methods during a successful quit attempt may differ between subpopulations of quitters. We detected that the odds within a certain age group may depend on highest level of education and survey mode, however, the follow-up comparisons within each age group did not indicate any significant differences. Overall, younger (18–44 years old) quitters had lower odds, while 45- to 64-year-old quitters had similar odds of using pharmacological methods when compared to 65+ year-old quitters. We also detected significant overall effects of other factors, such as race/ethnicity, employment status, smoking within 30 minutes of awakening, and seeing a doctor in the past 12 months before quitting on the odds of using a pharmacological method or quitting unassisted. The odds of using a pharmacological method were lower for Non-Hispanic Blacks and Hispanics than for Non-Hispanic Whites, but higher for unemployed respondents (when compared to those who were not in the labor force), those who smoked within 30 minutes of awakening during the 12 months before quitting and those who had seen a doctor 12 months prior to quitting. No differences were detected with respect to marital status, metropolitan status, or region when controlling for the other factors.

The study indicates that higher levels of nicotine dependence and visiting a doctor are associated with increased odds of quitting using a pharmacological method rather than quitting unassisted. In addition, the study attempted to assess relationships between doctor's specific recommendations when advising smokers to quit smoking and the smoking cessation methods used to quit smoking. The results (based on relatively small sample sizes for some comparisons) indicate that while pharmacological and behavioral methods were recommended to the majority of smokers, pharmacological methods were more commonly prescribed (or suggested) than were behavioral interventions. However, a significant association between a doctor's recommendation and the method used was observed only with respect to pharmacological methods: A pharmacological method was more commonly used by smokers who were prescribed (or advised to use) at least one pharmacological method; no significant association was observed between a doctor's recommendation to use a behavioral intervention and using that behavioral intervention. While the results indicate that doctors prescribed or suggested using pharmacological methods for smoking cessation more commonly than they did behavioral interventions, there could be a confounding effect that heavier smokers are more prone to seek a doctor's advice and a prescription for a smoking cessation medication and thus more commonly use pharmacological methods.[5,34] However, it also could be that doctors encourage patients to try to quit using a smoking cessation medication more often than to quit with no aids.

The study also shows that switching to smokeless tobacco, "lighter" cigarettes, or other tobacco products remains a prevalent behavior among smokers who try to quit. However, the efficacy of these strategies has not been confirmed in evidence-based studies.[35] Instead of these strategies, smokers should be encouraged to use smoking cessation methods for which efficacy has been demonstrated.

The study has several limitations. First, the study relied on self-reported data that, potentially, are subject to a response bias, for example, social desirability bias,[36–39] or telescoping.[20–23] The second limitation concerns not considering specific information on various quit attempts. Such factors are likely to be significant and could be more important than some of the factors we considered. Future studies might explore possible diverse interpretations of the TUS-CPS survey questions and reword the questions more explicitly, for example, so that the survey measures refer to the last quit attempt. Future studies might also assess whether specific quitting plans associated with giving up cigarettes all at once are related to other factors, for example, doctor's recommendations to set a specific quit date.

In addition, while we did not investigate potential differences in rates of seeing a doctor 12 months prior to quitting among Hispanic, Non-Hispanic Black, and Non-Hispanic White quitters, the access to healthcare may drastically vary across these subpopulations; for example, Hispanics are three times as likely as Non-Hispanic Whites to lack a regular health care provider.[40] Thus, access to healthcare could be another important predictor of using a pharmacological smoking cessation method. We also note that the efficacy of smoking cessation methods remained outside of the scope of this study: We examined methods that were used while trying to quit smoking, but whether or not these methods actually caused the smoking cessation remains unknown, especially because some former smokers used multiple methods.

The increased attention to pharmacological smoking cessation methods in the tobacco research literature may result in the general misconception that these methods account for the majority of successful quit attempts in the United States. However, even though more pharmacological smoking cessation methods became available to smokers since the early 1990s, the rates of quit attempts and smoking cessation did not significantly increase in 1991–2010 in the United States.[9] In addition, our study showed that in the general population, unassisted quitting remains a much more common method of smoking cessation as well as long-term smoking abstinence. While pharmacological methods can help eliminate physical nicotine dependence and ease quitting, the topic of pharmacological

smoking cessation should not overshadow the topic of unassisted quitting in either the media or tobacco control research, and more attention should be drawn to motivating current smokers to quit in order to increase the overall rates of smoking cessation.

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Declaration of Interests

None declared.

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