Smoking Cessation Rates in the United States: A Comparison of Young Adult and Older Smokers

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A key goal of tobacco control is to increase smoking cessation among young adults, because quitting at an early age increases the chances that a smoker will avoid the more serious health consequences of smoking.[1] During the 1980s and 1990s, older smokers (50 years and older) were the most successful quitters,[2,3] and annual rates of successful quitting increased for all age groups.[2] However, increases in cessation rates in the 1990s were greatest among young adults aged 20 to 34 years.[2] Furthermore, among young adult smokers, but not older smokers, the increase in cessation rates was higher in states with higher cigarette prices and highest of all in California, which had a comprehensive state-wide tobacco control program,[2] suggesting that environmental factors may especially influence cessation rates among young adults. Projecting these national trends, we hypothesized that by 2003, young adults may have been the most successful quitters of any age group. Understanding recent changing influences on successful quitting could help increase the effectiveness of public health programs that aim to encourage cessation.

Rates of successful quitting can differ between age groups because of differences in the proportion of smokers who try to quit, or because of differences in success rates among those who try. There is evidence that changes in the social norms surrounding smoking can lead to changes in the proportion of smokers who try to quit and that these norms can be influenced by tobacco-related news coverage[4] and mass media advertising campaigns,[5] both of which increased in the United States in the late 1990s with the Master Settlement Agreement and with the start of the American Legacy Foundation campaign.[6] Young people (aged 0–29 years) may be particularly responsive to such influences,[7] and throughout the 1990s, California's tobacco control program used targeted media campaigns to specifically influence social norms about smoking.[8]

Changes in social norms can also influence behavior associated with success in quitting.

Objectives. We compared smoking quit rates by age in a nationally representative sample to determine differences in cessation rates among younger and older adults.

Methods. We used data on recent dependent smokers aged 18 to 64 years from the 2003 Tobacco Use Supplement to the Current Population Survey (n = 31 625).

Results. Young adults (aged 18–24 years) were more likely than were older adults (aged 35–64 years) to report having seriously tried to quit (84% vs 66%, *P*<.01) and to have quit for 6 months or longer (8.5% vs 5.0%, *P*<.01). Among those who seriously tried to quit, a smoke-free home was associated with quitting for 6 months or longer (odds ratio [OR]=4.13; 95% confidence interval [CI]=3.25, 5.26). Compared with older smokers, young adults were more likely to have smoke-free homes (43% vs 30%, *P*<.01), were less likely to use pharmaceutical aids (9.8% vs 23.7%, *P*<.01), and smoked fewer cigarettes per day (13.2% vs 17.4%, *P*<.01).

Conclusions. Young adults were more likely than were older adults to quit smoking successfully. This could be explained partly by young adults, more widespread interest in quitting, higher prevalence of smoke-free homes, and lower levels of dependence. High cessation rates among young adults may also reflect changing social norms. (*Am J Public Health.* 2008;98:317–322. doi:10.2105/AJPH.2007.112060)

In particular, a decrease in levels of nicotine dependence among recent cohorts of smokers could partly explain higher rates of successful quitting among younger adults. Less-dependent smokers are more likely to successfully quit, presumably because of less-intense withdrawal symptoms.[9–11] Following the 1992 Environmental Protection Agency report classifying environmental tobacco smoke as a carcinogen,[12] there was a rapid increase in social norms supporting restrictions on smoking,[13] and increased restrictions on smoking at work and in public places have been associated with reduced levels of daily cigarette consumption.[14,15]

During the 1990s, an increasing proportion of smokers, particularly parents, banned smoking in the home.[16] There is a strong association between smoke-free homes and successful quitting,[17,18] perhaps in part because a lapse, for example after a meal, is less likely. It is possible that recent birth cohorts who took up smoking under these restrictions at home and work may develop lower levels of dependence than previous cohorts,[19] and they may themselves be more likely to live in a smoke-free home.

During the 1990s, pharmaceutical aids became available to help overcome withdrawal

symptoms, and these aids were associated with quitting success.[20,21] However, once these aids became easily available over the counter in 1996, their apparent effectiveness in population studies disappeared.[22,23] More in-depth analysis has suggested that effective use of pharmaceutical aids may be limited to smokers who are motivated to quit, such as those with a smoke-free home.[24] Thus, differences in patterns of use of pharmaceutical aids between age groups may also contribute to recent differences in quitting success rates.

We used a large nationally representative survey to compare US smoking cessation rates and associated tobacco-related behaviors between age groups. We compared attempted quitting rates across age groups each year as well as success rates among those who tried to quit smoking and explored whether there were important differences between age groups in prevalence of known correlates of cessation. We used multivariate logistic regression to establish whether differences in such correlates could account for differences in cessation rates, or whether younger smokers were quitting at higher rates than might be predicted by, for example, lower levels of addiction and a higher prevalence of smoke-free homes.

METHODS

Data Source

We used data from the 2003 Tobacco Use Supplement to the Current Population Survey (TUS-CPS),[25] a large federally sponsored household survey.[26] A detailed description of the methods used by the CPS has been previously reported.[27] Briefly, the CPS uses a monthly multistage area probability sample to select a nationally representative random sample of occupied housing units, with a response rate of over 92%. The 2003 TUS supplement asked detailed questions about smoking history and smoking cessation and was included on CPS surveys in February, June, and November and included both proxy and self-response data, with a self-response rate of over 61%. Only self-respondents were asked questions on quitting history. We categorized them into the following age groups: 18 to 24 years, 25 to 34 years, 35 to 49 years, and 50 to 64 years.

Smoking and Cessation Measures

We limited inclusion to those who reported a lifetime consumption of 100 cigarettes or more.[28] To reduce bias introduced by including people beginning to smoke, we used data from dependent smokers (i.e., those who had smoked daily for at least 6 months at some time, as determined from detailed questions on smoking history). We thereby included some former daily smokers who may have cut consumption or recently relapsed from a quit attempt.[29,30] To assess recent quitting history, we further limited analysis to recent smokers (i.e., those who had smoked within the previous 12 months).[3] The final sample was 36 625 recent dependent smokers. The proportion of each age group who met these criteria was 21.8% (95% confidence interval [CI]=19.6%, 24.0%) among 18- to 24-year-olds, 20.0% (95% CI=19.3%, 20.7%) among 25- to 34-year-olds, 21.5% (95% CI=20.9%, 22.1%) among 35- to 49-year-olds, and 19.1% (95% CI=18.3%, 20.0%) among 50- to 64-year-olds.

We reconstructed quitting history at 3 levels: (1) those who reported having seriously tried to quit in the past year, (2) those who reported having quit smoking for at least 1 day in the past year,[28,31] and (3) those who had quit for at least 6 months in the past year ("successful" quitters).[32,33] These categories of quitting are hierarchical: successful quitters are a subset of both categories 1 and 2, and those with a quit attempt of 1 day or longer are a subset of those who reported having seriously tried to quit.

Demographic, Behavioral, and Dependence Measures

The TUS-CPS ascertained gender, educational level, race/ethnicity, and age at first regular smoking, as well as standard self-report measures of dependence that have been validated as important predictors of cessation, including time from waking to first cigarette smoked and, for current smokers, the number of cigarettes smoked per day.[9,34] We report rates of smoking within 30 minutes of waking and the number of cigarettes per day (up to 40 or more).

Those smokers who had tried to quit were asked additional questions that assessed use of pharmaceutical aids during their most recent quit attempt including: nicotine gum, a patch, a nasal spray, lozenges, an inhaler, tablets, or prescription pills, such as Zyban, bupropion, or Wellbutrin. A workplace was counted as smoke free if the respondent reported being employed in a building outside the home in which smoking was "not allowed in any work areas." Agreement with the statement "No one is allowed to smoke anywhere inside your home" indicated the presence of a smoke-free home.

Statistical Methods

We used multivariate logistic regression to compare the adjusted odds of seriously trying to quit for the youngest and older age groups of recent dependent smokers. Model covariates were gender, race/ethnicity, educational attainment, smoking by age 15 years, smoking within 30 minutes of waking, and presence of a smoke-free home or workplace. Two similar logistic regression models compared the odds of (1) a 1-day quit and (2) a 6-month quit for age groups of smokers who were seriously trying to quit. These last 2 models also included as a covariate use of a pharmaceutical aid, because this information was available for those

TABLE 1—Population Prevalence of Factors Associated With Smoking Cessation Among Recent Dependent Smokers, by Age Group: Tobacco Use Supplement to the Current Population Survey, 2003

	18–24 years (n = 3 778)	25–34 years (n = 6 821)	35–49 years (n = 12 582)	50–64 years (n = 8 444)
Women, % (95% CI)	48.6 (46.6, 50.6)	45.8 (43.3, 48.2)	46.8 (45.3, 48.2)	45.3 (42.1, 48.4)
Highest education level attained, % (95% CI)				
Not a high school graduate	24.8 (22.6, 26.9)	15.5 (14.3, 16.8)	15.2 (14.1, 16.2)	17.6 (14.7, 20.5)
High school graduate	40.4 (38.1, 42.7)	39.2 (36.7, 41.7)	42.3 (39.8, 44.8)	36.9 (35.6, 38.2)
Some college	34.8 (32.5, 37.2)	45.3 (42.7, 47.9)	42.5 (40.3, 44.6)	45.5 (42.3, 48.6)
Race/ethnicity, % (95% CI)				
Non-Hispanic White	77.4 (75.5, 79.4)	74.8 (72.9, 76.7)	76.9 (75.6, 78.3)	79.4 (77.0, 81.7)
African American	8.9 (7.2, 10.5)	9.1 (8.1, 10.0)	11.2 (9.9, 12.6)	11.0 (9.9, 12.1)
Hispanic	8.1 (6.8, 9.5)	10.53 (9.1, 11.9)	7.3 (6.5, 8.2)	5.5 (3.6, 7.4)
Asian or other	5.6 (4.1, 7.0)	5.7 (4.6, 6.8)	4.5 (4.1, 5.0)	4.1 (3.4, 4.9)
Addiction measures				
No. cigarettes smoked per day,[a] mean (95% CI)	13.1 (12.8, 13.5)	14.2 (13.9, 14.4)	16.9 (16.7, 17.1)	18.1 (17.8, 18.3)
Smoked first cigarette within 30 min of waking, % (95% CI)	43.3 (41.3, 45.3)	47.1 (45.6, 48.5)	56.3 (55.2, 57.4)	59.5 (58.1, 60.6)
Age of smoking initiation < 15 y, % (95% CI)	40.1 (38.2, 41.9)	30.8 (29.5, 32.0)	29.8 (28.8, 30.8)	27.5 (26.3, 28.7)
Restrictions on smoking, % (95% CI)				
Smoke-free home	42.8 (41.0, 44.6)	42.7 (41.4, 44.0)	31.7 (30.8, 32.6)	27.5 (26.2, 28.8)
Smoke-free workplace	34.8 (33.0, 36.7)	37.3 (35.9, 38.7)	36.2 (35.2, 37.2)	29.6 (28.5, 30.8)

Note. CI = confidence interval.
[a]Among current smokers only.

seriously trying to quit. To avoid recall bias in the length of quit attempts, we assessed the odds of abstinence from smoking at the time of the survey in the latter 2 models, as was done in previous work.[2] Because the TUS-CPS did not have a question on consumption that was comparable for current and former smokers, we omitted it from the models.

We computed all estimates using the published TUS-CPS survey weights, which account for selection probabilities from the sampling design and adjust for survey nonresponse.[25,27] We computed variance estimates and 95% CIs using a jackknife methodology that is standard for the CPS, which uses the published weights with Fay's balanced repeated replication.[25,27] We used SAS-Callable SUDAAN version 9.0.1 (RTI International, Research Triangle Park, NC), modules PROC RLOGIST for weighted logistic regression and PROC CROSSTABS for weighted proportions.

RESULTS

Distribution of Sociodemographic Measures and Quitting Predictors by Age

Among recent dependent smokers, there was no gender difference across any of the 4 age groups (Table 1), and racial/ethnic composition was similar across age groups. With the expected exception that fewer 18- to 24-year-olds had completed high school or attended college, there were no differences in education across age groups.
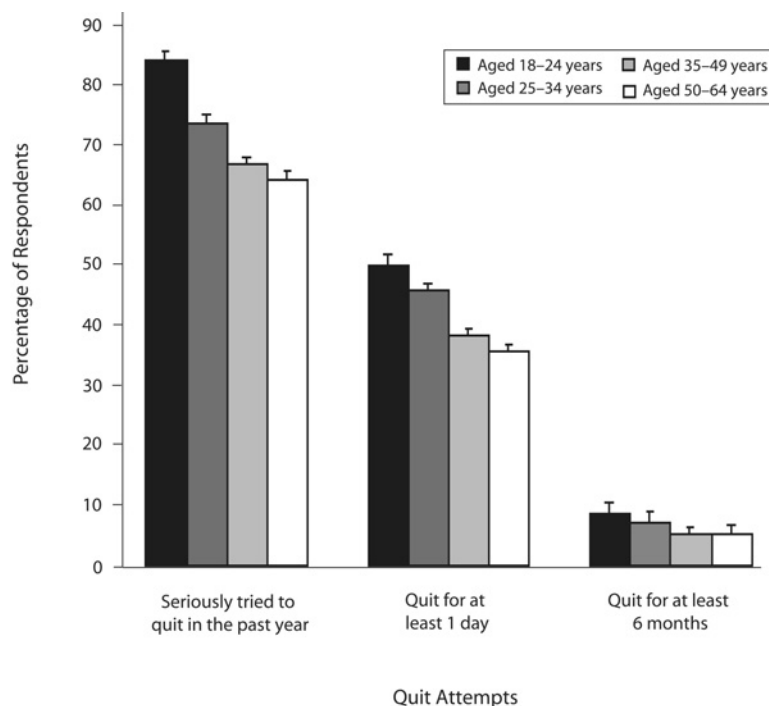
Both the proportion who reported smoking the first cigarette within 30 minutes of waking and average daily cigarette consumption increased with each older age group; both measures were approximately 38% higher in the oldest age group than in the youngest age group. Among the 3 oldest age groups, there was no difference in the proportion of smokers who had started smoking before age 15 years; however, this proportion was higher in the youngest age group, as would be expected assuming some in this group were beginning to smoke.

The proportion of smokers working in a smoke-free workplace did not vary across the 3 younger age groups, but it was lower in the oldest age group, as expected, because fewer people in this group were in the workforce. The proportion of smokers with a smoke-free home was significantly higher in the 2 youn-

Note. Prevalence is among recent dependent smokers.

FIGURE 1—Past-year prevalence of seriously attempting to quit smoking, quitting for at least 1 day, and quitting for at least 6 months, by age: Tobacco Use Supplement to the US Current Population Survey, 2003.

gest age groups (about 43%) than among 35- to 49-year-olds (31.7%) and 50- to 64-year-olds (27.5%). The 2 youngest age groups were 55% more likely to report a smoke-free home than those aged 50 to 64 years.

Quitting Status by Age

The proportion of recent dependent smokers who reported that they had seriously tried to quit in the past year (Figure 1) was highest among 18- to 24-year-olds (84%) and decreased with each older age group (to 64% among 50- to 64-year-olds). In particular, the difference between 18- to 24-year-olds and 35- to 64-year-olds (66%) was statistically significant (P<.01). The proportion of recent smokers who had quit for at least 1 day in the past year also was highest among the youngest age group (51%) and again decreased with each older age group, to 36% for the oldest age group (P<.01). The proportion of recent dependent smokers who had quit for at least 6 months in the past year was 8.5%, 7.0%, 5.0%, and 5.1% for the groups in ascending

order of age, and the difference between 18- to 24-year-olds and 35- to 64-year-olds (5.0%) was statistically significant (P<.01).

Among the subgroup who reported having seriously tried to quit, 58% had quit for 1 day or more, a proportion that did not vary significantly by age. The proportion of those who reported having seriously tried to quit and who had quit for 6 months or more varied by age (P<.01): 10.1% for 18- to 24-year-olds, 9.5% for 25- to 34-year-olds, 7.5% for 35- to 49-year-olds, and 7.9% for 50- to 64-year-olds. Among the 18- to 24-year-olds, 17% of those who quit for a day maintained a quit attempt for at least 6 months, a percentage that did not vary significantly from that of the other age groups.

Factors Associated With Attempted and Successful Quitting

In a multivariate logistic regression, there was no difference among recent dependent smokers in the odds of reporting having seriously tried to quit by gender, educational level, age of smoking initiation, or employment in a

TABLE 2—Adjusted Odds Ratios (AORs) and 95% Confidence Intervals (CIs) for Multivariate Logistic Regression Models of Attempted and Successful Smoking Cessation: Tobacco Use Supplement to the Current Population Survey, 2003

	Model A, AOR (95% CI)	Model B, AOR (95% CI)	Model C, AOR (95% CI)
Intercept	0.70 (0.41, 0.99)	0.05 (0.03, 0.07)	0.03 (0.01, 0.05)
Age, y			
18–24 (Ref)	1.00	1.00	1.00
25–34	0.53 (0.41, 0.68)	0.95 (0.76, 1.17)	0.87 (0.65, 1.16)
35–49	0.40 (0.33, 0.47)	0.83 (0.69, 0.99)	0.77 (0.60, 1.01)
50–64	0.36 (0.30, 0.43)	1.01 (0.79, 1.30)	0.98 (0.76, 1.25)
Gender			
Men (Ref)	1.00	1.00	1.00
Women	1.0 (0.93, 1.07)	1.16 (1.02, 1.31)	1.16 (0.96, 1.40)
Race/ethnicity			
Non-Hispanic White (Ref)	1.00	1.00	1.00
African American	1.67 (1.44, 1.95)	0.83 (0.50, 1.32)	0.63 (0.38, 1.03)
Hispanic	1.53 (1.29, 1.82)	0.90 (0.50, 1.61)	0.86 (0.24, 3.05)
Asian or other	1.56 (1.22, 1.29)	0.91 (0.61, 1.35)	0.80 (0.40, 1.60)
Education			
Not high school graduate (Ref)	1.00	1.00	1.00
High school graduate	0.90 (0.81, 1.01)	1.15 (0.87, 1.53)	1.05 (0.60, 1.50)
Some college	0.91 (0.79, 1.05)	1.58 (0.97, 2.56)	1.46 (0.73, 2.19)
Age of smoking initiation < 15 y			
No (Ref)	1.00	1.00	1.00
Yes	0.92 (0.80, 1.06)	0.99 (0.79, 1.25)	1.06 (0.84, 1.28)
Smoked first cigarette within 30 min of waking			
No (Ref)	1.00	1.00	1.00
Yes	0.76 (0.70, 0.83)	1.05 (0.90, 1.22)	0.96 (0.67, 1.25)
Smoke-free workplace			
No (Ref)	1.00	1.00	1.00
Yes	0.94 (0.70, 1.28)	1.18 (0.64, 2.15)	1.28 (0.96, 1.72)
Smoke-free home			
No (Ref)	1.00	1.00	1.00
Yes	1.21 (1.12, 1.30)	4.03 (3.50, 4.63)	4.13 (3.25, 5.26)
Used a pharmaceutical aid			
No (Ref)	NA	1.00	1.00
Yes	NA	1.25 (1.04, 1.49)	1.1 (0.89, 1.35)

Note. NA = not applicable. Odds are from multivariate logistic regression, with adjustment for all listed variables. Model A presents the odds of having seriously tried to quit in the past year, among recent dependent smokers. Model B presents the odds of abstinence for 1 day or more at time of survey, among recent dependent smokers who reported having seriously tried to quit. Model C presents the odds of abstinence for 6 months or more at time of survey, among recent dependent smokers who reported seriously trying to quit.

smoke-free workplace (Table 2, model A). Members of other racial/ethnic groups were much more likely to report having seriously tried to quit than were non-Hispanic Whites. Regarding smoking dependence, as assessed by whether the first cigarette was smoked within 30 minutes of waking, smokers with a high level of dependence were less likely to report having seriously tried to quit than were those who were less dependent (adjusted odds ratio [AOR]=0.76; 95% CI=0.70, 0.83). Those with a smoke-free home were more likely to report having seriously tried to quit than were those with fewer restrictions at home (AOR=1.21; 95% CI=1.12, 1.30). After adjustment for covariates, the relative odds of

an 18- to 24-year-old trying to quit were almost double those of a 25- to 34-year-old and more than double those of a 35- to 64-year-old (AOR=2.68; 95% CI=2.22, 3.12).

In a second multivariate logistic regression, among those who reported having seriously tried to quit, there was no difference in the odds of quitting for 1 day or longer by race/ethnicity, educational level, age of smoking initiation, dependence level, or employment in a smoke-free workplace (Table 2, model B). Women were 16% more likely to quit for 1 day or longer than were men (AOR=1.16; 95% CI=1.02, 1.31). Those aged 35 to 49 years were less likely to quit for at least 1 day than were 18- to 24-year-olds (AOR=0.83; 95% CI=0.69, 0.99). Use of a pharmaceutical aid was associated with a 25% increase in the adjusted odds of trying to quit. Regardless of age, a smoke-free home was strongly associated with quitting for at least 1 day (AOR=4.03; 95% CI=3.50, 4.63).

In a third model, among those who seriously tried to quit, there was no difference in the adjusted odds of quitting for 6 months or more by race/ethnicity, gender, education, age of smoking initiation, dependence level, smoke-free workplace, or use of pharmaceutical aids (Table 2, model C). Those who reported a smoke-free home were much more likely to quit for 6 months or more (AOR=4.13; 95% CI=3.25, 5.26). After adjustment for these covariates, differences between age groups in the estimated odds of quitting were not statistically significant.

The use of any pharmaceutical aid during the most recent quit attempt was 19.4% overall and 6.3% for nicotine gum, 11.8% for a patch, less than 1.0% for a nasal spray, 1.2% for lozenges, 1.3% for an inhaler, 1.4% for tablets, and 6.2% for an antidepressive prescription such as Zyban, bupropion, or Wellbutrin. Use of any pharmaceutical aid during the most recent quit attempt increased significantly with each higher age group, from 9.7% (95% CI=8.5%, 10.9%) among 18- to 24-year-olds to 25.5% (95% CI=24.2%, 26.9%) among 50- to 64-year-olds, representing a 2.6-times increase (Table 3). In the oldest age group, only 34.8% (95% CI=24.1%, 45.5%) of those who used an aid also reported having a smoke-free home. Among 35- to 49-year-olds, the proportion who quit for 6 months or

TABLE 3—Pharmaceutical Aids, Smoke-Free Homes, and Quitting Success Among Smokers Who Seriously Tried to Quit, by Age Group: Tobacco Use Supplement to the Current Population Survey, 2003

	18–24 years, % (95% CI)	25–34 years, % (95% CI)	35–49 years, % (95% CI)	50–64 years, % (95% CI)
Used pharmaceutical aid during most recent quit attempt	9.7 (8.5, 10.9)	16.3 (15.1, 17.5)	22.4 (21.3, 23.5)	25.5 (24.2, 26.9)
Pharmaceutical aid users with smoke-free home	47.5 (36.6, 58.3)	51.2 (46.4, 57.3)	41.3 (38.2, 44.5)	34.8 (24.1, 45.5)
Successfully quit smoking[a]				
Used pharmaceutical aid during quit attempt	7.3 (3.7, 11.0)	8.1 (5.5, 10.8)	9.3 (7.9, 10.6)	8.3 (6.6, 10.0)
Did not use pharmaceutical aid	8.7 (7.3, 10.1)	7.9 (6.9, 8.9)	5.2 (4.5, 5.80)	6.4 (5.5, 7.30)

[a]Abstinent for 6 months or more at time of survey.

more was significantly higher among those who used an aid.

DISCUSSION

Data from the 2003 TUS-CPS shows that among smokers with at least a 6-month history of daily smoking, those aged 18 to 24 years successfully quit smoking (i.e., for at least 6 months) at higher annual rates than did their counterparts aged 35 to 64 years. This new finding was expected from cessation trends during the 1990s.[2,3] The younger smokers' success rate was higher in part because a much higher proportion of them reported having seriously tried to quit in the past year than did older smokers. In this study, young adults had a much higher prevalence of smoke-free homes, as has previously been reported,[16,17,24,35,36] as well as lower levels of addiction, and both factors are associated with attempted cessation in the literature and in our statistical models. However, the proportion of young adults who reported an interest in quitting was much greater than could be accounted for by these and other factors in our multivariate analysis. Indeed, the adjusted odds ratio of trying to quit was nearly twice as high for 18- to 24-year-olds as for 25- to 34-year-olds. It is possible that social norms against smoking are much stronger among these youngest adult smokers, and this may be reflected by a high level of interest in quitting.

Among those who reported seriously trying to quit, a higher proportion of the youngest adults quit for at least 6 months during the past year than did older smokers. However, this difference by age was no longer significant in our multivariate models after we adjusted for covariates. In this statistical analysis, as in previous work, the strongest independent predictor of longer-term abstinence was presence of a smoke-free home. This suggests that among those who tried to quit, the higher success rates experienced by the youngest adults were explained by a greater prevalence of smoke-free homes, lower levels of dependence, and other favorable tobacco-related factors.

This study replicates previous work on the difficulty of quitting successfully.[28] Well over half of those in each age group reported seriously trying to quit, but approximately 40% of those who tried were not able to quit for even 1 day. This proportion was independent of age despite large differences between age groups in dependence levels. In our multivariate models, use of a pharmaceutical aid increased the probability of abstinence from smoking for at least 1 day, and use of such assistance was over twice as common among older smokers than among 18- to 24-year-olds. Thus, greater use of pharmaceutical aids appears to have allowed older smokers to achieve rates of 1-day abstinence comparable to those of 18- to 24-year-old smokers.

Among those who quit for 1 day, fewer than 20% were able to quit for 6 months or more, a proportion that did not significantly differ among age groups. Raising this low success rate has been a goal of tobacco control for many years, and there was early promise that pharmaceutical aids would lead to such an increase.[20] However, population-based research has questioned their effectiveness,[23,37] suggesting that for higher success rates, smokers need a smoke-free home in addition to a pharmaceutical aid.[24] Only one third of 50- to 64-year-old users of

pharmaceutical aids reported a smoke-free home, which presents an educational opportunity for tobacco control programs.

Some expected associations with cessation were not apparent in this study. Educational level was not a prognostic factor in our models, which may reflect sampling bias in educational attainment in the youngest age group, because it is likely that some 18-year-olds who would later go on to college had not completed high school at the time of the survey. Many studies have reported that African American smokers have more difficulty quitting than do non-Hispanic White smokers. In this study, African Americans were less likely to successfully quit; however, they were more likely to report trying to quit. This interest in quitting could result from stronger antismoking norms in the African American community. That such norms exist has been postulated as one reason for the much lower rate of smoking initiation among African Americans in recent years.[38]

A strength of this cross-sectional survey is its use of a large representative sample of recent dependent smokers; a weakness is that reporting of recent quit attempts depends on participants' recall of events. Smokers may forget short quit attempts.[33] Current quitters may overestimate how much they smoked just before they quit, perhaps reporting their highest-ever level of consumption. Because of this potential effect, we did not include reported consumption 12 months ago in our multivariate models and relied on "time to first cigarette" as our measure of dependence. Quit attempts in which a pharmaceutical aid was used may be more memorable than other quit attempts, which would lead to an overestimate of the importance of pharmaceutical aids in achieving short-term abstinence in our statistical models. Further, use of pharmaceutical aids may be much more prevalent among smokers who have low self-efficacy for quitting, and this would lead to an underestimate of the importance of pharmaceutical products as an aid to successful quitting. However, previous research has demonstrated that the efficacy of these aids declines over time, regardless of potential recall bias. Smokers may institute a smoke-free home as a cessation strategy during a quit attempt, which would lead to an overestimate of the importance of a smoke-free home in maintaining abstinence in our study. Finally, as in any population survey, nonresponse

tended to vary with educational level and other demographic factors. However, response rates in the CPS are among the highest in survey research, and the data have been appropriately weighted to minimize any resulting bias.

Data from the CPS-TUS demonstrated that dependent smokers aged 18 to 24 years were more likely to successfully quit smoking than were dependent smokers aged 35 to 64 years. This was due in part to more widespread interest in quitting among the youngest adults, and it could only be explained in part by their higher prevalence of smoke-free homes and lower levels of dependence. It is likely that high cessation rates among 18- to 24-year-olds also reflect changing social norms over the previous decade. Future tobacco control efforts aimed at increasing cessation among young adult smokers should continue to target social norms. ∎

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Contributors

K. Messer did the statistical analysis. K. Messer and J.P. Pierce were responsible for the study design and analysis plan, interpretation of the analysis, and drafting of the article. D.R. Trinidad and W.K. Al-Delaimy reviewed the article for important intellectual content.

Human Participant Protection

No protocol approval was needed for this study.

References

1. Doll R, Peto R, Boreham J, Sutherland I. Mortality in relation to smoking: 50 years' observations of male British doctors. *BMJ.* 2004;328:1519.

2. Messer K, Pierce JP, Zhu S-H, et al. The California Tobacco Control Program's effects on adult smokers, 1: smoking cessation. *Tob Control.* 2007;16:85−90.

3. Gilpin EA, Pierce JP. Demographic differences in patterns in the incidence of smoking cessation: United States 1950−1990. *Ann Epidemiol.* 2002;12:141−150.

4. Pierce JP, Gilpin EA. News media coverage of smoking and health is associated with changes in population rates of smoking cessation but not initiation. *Tob Control.* 2001;10:145−153.

5. Pierce JP, Dwyer T, Frape G, Chapman S, Chamberlain A, Burke N. Evaluation of the Sydney "Quit. For Life" anti-smoking campaign, part 1: achievement of intermediate goals. *Med J Aust.* 1986;144:341−344.

6. Healton CG, Haviland ML, Vargyas E. Will the Master Settlement Agreement achieve a lasting legacy? *Health Promot Pract.* 2004;5:12S−17S.

7. Steinberg L. *Adolescence.* 6th ed. New York, NY: McGraw-Hill; 2002.

8. Bal DG, Kizer KW, Felten PG, Mozar HN, Niemeyer D. Reducing tobacco consumption in California. Development of a statewide anti-tobacco use campaign. *JAMA.* 1990;264:1570−1574.

9. Kozlowski LT, Porter CQ, Orleans CT, Pope MA, Heatherton T. Predicting smoking cessation with self-reported measures of nicotine dependence: FTQ, FTND, and HSI. *Drug Alcohol Depend.* 1994;34:211−216.

10. Farkas AJ, Pierce JP, Zhu SH, et al. Addiction versus stages of change models in predicting smoking cessation. *Addiction.* 1996;91:1271−1280, discussion 1281−1292.

11. Pierce JP, Farkas AJ, Gilpin EA. Beyond stages of change: the quitting continuum measures progress towards successful smoking cessation. *Addiction.* 1998; 93:277−286.

12. US Environmental Protection Agency. *Respiratory Health Effects of Passive Smoking: Lung Cancer and Other Disorders.* Washington, DC: Office of Research and Development, US Environmental Protection Agency; 1992. Pub EPA/600/6−90/006F. Available at: http://cfpub2.epa.gov/ncea/cfm/recordisplay.cfm?deid=2835. Accessed January 31, 2007.

13. Gilpin EA, Lee L, Pierce JP. Changes in population attitudes about where smoking should not be allowed: California versus the rest of the USA. *Tob Control.* 2004;13:38−44.

14. Borland R, Chapman S, Owen N, Hill D. Effects of workplace smoking bans on cigarette consumption. *Am J Public Health.* 1990;80:178−180.

15. Hopkins DP, Husten CG, Fielding JE, Rosenquist JN, Westphal LL. Evidence reviews and recommendations on interventions to reduce tobacco use and exposure to environmental tobacco smoke: a summary of selected guidelines. *Am J Prev Med.* 2001;20:67−87.

16. Gilpin EA, White MM, Farkas AJ, Pierce JP. Home smoking restrictions: which smokers have them and how they are associated with smoking behavior. *Nicotine Tob Res.* 1999;1:153−162.

17. Farkas AJ, Gilpin EA, Distefan JM, Pierce JP. The effects of household and workplace smoking restrictions on quitting behaviours. *Tob Control.* 1999;8:261−265.

18. Borland R, Yong HH, Cummings KM, Hyland A, Anderson S, Fong GT. Determinants and consequences of smoke-free homes: findings from the International Tobacco Control (ITC) Four Country Survey. *Tob Control.* 2006;15(suppl 3):iii42−iii50.

19. Pierce JP, Naquin M, Gilpin E, Giovino G, Mills S, Marcus S. Smoking initiation in the United States: a role for worksite and college smoking bans? *J Natl Cancer Inst.* 1991;83:1009−1013.

20. Fiore MC. US public health service clinical practice guideline: treating tobacco use and dependence. *Respir Care.* 2000;45:1200−1262.

21. Silagy C, Lancaster T, Stead L, Mant D, Fowler G. Nicotine replacement therapy for smoking cessation. *Cochrane Database Syst Rev.* 2004:CD000146.

22. Thorndike AN, Biener L, Rigotti NA. Effect on smoking cessation of switching nicotine replacement therapy to over-the-counter status. *Am J Public Health.* 2002;92:437−442.

23. Pierce JP, Gilpin EA. Impact of over-the-counter sales on effectiveness of pharmaceutical aids for smoking cessation. *JAMA.* 2002;288:1260−1264.

24. Gilpin EA, Messer K, Pierce JP. Population effectiveness of pharmaceutical aids for smoking cessation: what is associated with increased success? *Nicotine Tob Res.* 2006;8:661−669.

25. Tobacco Use Supplement to the Current Population Survey. National Cancer Institute, Cancer Control and Population Sciences. 2003. Available at: http://riskfactor.cancer.gov/studies/tus-cps. Accessed January 31, 2007.

26. National Cancer Institute and Centers for Disease Control and Prevention Co-Sponsored Tobacco Use Special Cessation Supplement to the Current Population Survey (2003). Washington, DC: US Dept of Commerce, Census Bureau; 2006. Available at: http://riskfactor.cancer.gov/studies/tus-cps/info.html. Accessed January 30, 2007.

27. Current Population Survey: design and methodology. Technical paper 63RV. Washington, DC: US Dept of Commerce, Census Bureau; 2002. Available at: http://www.census.gov/prod/2002pubs/tp63rv.pdf. Accessed January 30, 2007.

28. *Reducing the Health Consequences of Smoking: 25 Years of Progress. A Report of the Surgeon General.* Rockville, Md:, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention; 1989. Publication (CDC) 89-8411.

29. Gilpin E, Cavin SW, Pierce JP. Adult smokers who do not smoke daily. *Addiction.* 1997;92:473−480.

30. Zhu SH, Sun J, Hawkins S, Pierce J, Cummins S. A population study of low-rate smokers: quitting history and instability over time. *Health Psychol.* 2003; 22:245−252.

31. Hatziandreu EJ, Pierce JP, Lefkopoulou M, et al. Quitting smoking in the United States in 1986. *J Natl Cancer Inst.* 1990;82:1402−1406.

32. Pierce JP, Gilpin EA. A minimum 6-month prolonged abstinence should be required for evaluating smoking cessation trials. *Nicotine Tob Res.* 2003;5:151−153.

33. Gilpin E, Pierce JP. Measuring smoking cessation: problems with recall in the 1990 California Tobacco Survey. *Cancer Epidemiol Biomarkers Prev.* 1994;3:613−617.

34. Fagerstrom KO. Measuring degree of physical dependence to tobacco smoking with reference to individualization of treatment. *Addict Behav.* 1978;3:235−241.

35. Norman GJ, Ribisl KM, Howard-Pitney B, Howard KA. Smoking bans in the home and car: do those who really need them have them? *Prev Med.* 1999;29: 581−589.

36. Pizacani BA, Martin DP, Stark MJ, Koepsell TD, Thompson B, Diehr P. A prospective study of household smoking bans and subsequent cessation related behaviour: the role of stage of change. *Tob Control.* 2004;13:23−28.

37. Hartman AM. What does US National Population Survey Data reveal about effectiveness of nicotine replacement therapy for smoking cessation? Paper presented at: World Conference on Tobacco or Health; July 12−15, 2006; Washington, DC.

38. Trinidad DR, Messer K, Gilpin EA, Al-Delaimy W, White MM, Pierce JP. The California Tobacco Control Program's effect on adult smokers, 3: similar effects for African Americans across states. *Tob Control.* 2007;16: 96−100.