Duration of Smoking Abstinence and Success in Quitting

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Background: For most smokers, quitting is a difficult process. Many smokers try to quit repeatedly before they succeed, with some relapsing even after a lengthy period of abstinence. Few population-based cohort studies have examined relapse among former smokers. Quantification of the relationship between the duration of abstinence and the likelihood of continued abstinence is important for the evaluation of ongoing public health interventions and the design of smoking-cessation programs.

Purpose: We analyzed longitudinal data from a large, representative population cohort of former smokers and estimated the probability of future relapse for different durations of abstinence at baseline (e.g., 1 to <3 months and 3 to <6 months).

Methods: From the 1990 California Tobacco Survey that used a random-digit-dialed computer-assisted telephone survey to interview 24,296 California adults (baseline interview) from June 1990 through February 1991, a stratified random sample of 4,642 adults was interviewed from March 1992 through July 1992. Both surveys assessed smoking status using standard questions about the lifetime use of 100 cigarettes and the self-classification of current smoking: 1) “Have you smoked at least 100 cigarettes in your lifetime?” and 2) “Do you smoke cigarettes now?” We included all 1,449 former smokers at baseline interview who answered “yes” to the first question and “no” to the second and who also provided a valid date at both of the surveys when asked, “When did you last smoke regularly?” All data were weighted to account for the study design and to ensure that the estimates were representative of the California population by age, sex, race/ethnicity, education, and geographic region.

Results: Only about 12% of the former smokers who had quit for less than 1 month at baseline remained continuously abstinent at the follow-up interview. This percentage increased to 25% for those who had quit from 1 to less than 3 months; it increased again to 52% if the duration of quitting was from 3 to less than 6 months, but it increased only slightly to 59.2% for those who had quit from 6 to less than 12 months. Overall, the likelihood of remaining continuously abstinent until the follow-up interview was about 90% for former smokers who had quit for 3 months or longer and 95% for those who had quit for 1 year or longer.

Conclusions and Implications: We suggest that self-reported cessation for more than 3 months be considered as an intermediate criterion for success both in longitudinal studies and the cross-sectional evaluation of community interventions. If a more stringent criterion is needed, we recommend self-reported cessation for at least 1 year. [J Natl Cancer Inst 1997; 89:572-6]

For most smokers, quitting is a difficult process. Many smokers try to quit repeatedly before they succeed (1,2), with some relapsing even after a lengthy period of abstinence (2,3). Currently, in the United States there are several population-based tobacco control programs with goals to encourage successful cessation (1,4-7). Evaluation of these programs generally relies on estimates of point prevalence—a measure of the percent of the population currently smoking that is based on self-report of current smoking status. Some short-duration former smokers will inevitably relapse, and if public health programs result in more short duration quit attempts but not more long-term cessation, point prevalence may not be the best evaluation measure. Instead, an estimate that incorporates some measure of successful cessation is needed (1,8,9). Also, further understanding of duration of abstinence and relapse should aid the design of effective relapse prevention programs and help determine optimal follow-up time.

Clinic-based cessation programs have long documented that duration of abstinence is the major predictor of long-term success (1,10,11). In a review and evaluation of smoking cessation programs, Schwartz (12) suggested, without presenting supportive evidence, that 1 year was an optimal follow-up period for program evaluation, although a 6-month period was acceptable. The great majority of smokers quit by themselves (13), and abstinence rates likely differ from those observed in the clinical setting. Cohen et al. (14) summarize quitting rates for 10 longitudinal self-help studies but had difficulty defining successful cessation because of the different definitions and lengths of follow-up.

Previous studies that have examined the issue of relapse after long intervals of abstinence have relied on nonrepresentative samples or have been fairly small. The Cancer Prevention Study of the 1960s found that among 65,709 male volunteers 30-89 years of age who quit at baseline, 37.3% were smoking again 2 years later (15). Among a subset of this sample, aged 50-69 years and abstinent 2-4 years, 5-9 years, and 10 or more years at baseline, current smoking at follow-up was 8.7%, 4.1%, and 2.2%, respectively (16). Another longitudinal population study conducted in Michigan in 1980 reported that 40% of recent quitters (<6 months; n = 97) were smoking at follow-up 2 years later (17).

In this report, we analyzed longitudinal data from a large, representative population cohort of former smokers and estimated the probability of future relapse for different durations of abstinence at baseline.

Methods

The 1990 California Tobacco Survey used a random-digit-dialed computer-assisted telephone survey to interview 24,296 California adults from June 1990 through February 1991. A stratified random sample of 4,642 adults was interviewed from March through July 1992, with the probability of selection much higher for those who reported smoking within 5 years of the baseline interview (18).

Both surveys assessed smoking status using standard questions on lifetime use of 100 cigarettes and self-classification of current smoking: 1) “Have you

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See “Notes” following “References.”
smoked at least 100 cigarettes in your lifetime?” and 2) “Do you smoke cigarettes now?” We included former smokers at baseline who answered “yes” to the first question and “no” to the second and who provided a valid date at each survey when asked, “When did you last smoke regularly?” If the year given was the present or past one, the month needed to be specified as well. Former smokers who reported smoking a year before the baseline interview were asked, “How many cigarettes were you smoking per day at this time 12 months ago?” No other consumption data for former smokers was collected. We also analyzed the use of other tobacco products (cigars, pipes, chewing tobacco, or snuff) at baseline. Respondents who reported ever using one of these products were asked, “Do you currently use [the product] every day, some days, or not at all?”

We called respondents continuously abstinent if they reported a quit date at follow-up that was before the baseline interview date. Current smoking at follow-up was another outcome. Recyclers were defined as former smoker at follow-up, with a quit date after the baseline interview. Baseline duration of abstinence was computed as the elapsed time from the quit date to the interview date.

All respondents in the full 1992 longitudinal sample, which included never smokers, long-term former smokers, recent quitters, and current smokers, were assigned a base weight to account for the probability of initial interview and reinterview that differed according to baseline smoking status. Next, a poststratification procedure was applied to ensure that estimates are representative of the California population by age, sex, race/ethnicity, education, and geographic region (18,19). An ideal procedure would adjust just the sample analyzed to the population of former smokers, but adequate estimates of such population totals are not available.

**Data Analysis**

Weighted percentages are reported together with 95% confidence intervals (CIs) based on variance estimates from a jackknife procedure (19,20). Subgroups defined by duration of abstinence at baseline were compared with respect to demographics by use of a special chi-squared procedure (21) for complex sample designs as implemented in the statistical analysis package, WesVarPC (22). Reported cigarette consumption 1 year before the baseline interview was compared for those who had quit for 1 year or less. WesVarPC was also used to perform a logistic regression with demographic variables and duration of abstinence at baseline as the independent variables and continuous abstinence (see above) as the dependent variable. We report adjusted (all demographic variables) odds ratios (ORs) from the logistic regression together with their 95% CIs.

**Results**

There were 1449 former smokers at baseline who had provided valid information concerning when they quit smoking, which represents 91% of the potential sample. The median intersurvey interval was 20.3 months (range, 14.6–24.7 months).

Fig. 1 shows the percentage of respondents who were continuously abstinent and who reported current smoking at follow-up grouped according to duration of abstinence at baseline. Only 12% of those who had not smoked for a month or less at baseline were still quit at follow-up, and almost 50% were currently smoking. The remainder were recyclers. Continuous abstinence increased to 25% for those who had abstained for 1 but less than 3 months; however, the percent currently smoking did not decrease. For those quit 3 but less than 6 months at baseline, continuous abstinence more than doubled to 52% and current smoking dropped to 25%. The group that had abstained for 1 but less than 2 years showed another large increase in continuous abstinence to 76% and a drop in current smoking to below 10%. Not until duration of abstinence was 3 but less than 4 years did the rate of continuous abstinence exceed 90%. It should be noted that within each of the above groups, especially those for shorter cessation, relapse is not necessarily homogeneous. For instance, a subgroup that quit for 3 but less than 4 months will have a different rate of continuous abstinence than the subgroup that quit for 4 but less than 6 months.

Table 1 examines different potential cut points as criteria for successful cessation. Considering that everyone was abstinent at baseline, 87.5% were still abstinent at follow-up, 6.0% were recyclers, and 6.5% reported current smoking at follow-up. Among those who had quit for less than 3 months at baseline, nearly half were currently smoking at follow-up. However, among those who had quit for 3 months or longer at baseline, fewer than 5% were currently smoking at follow-up and over 90% remained abstinent. Of those who had quit for 1 year or longer at baseline, only 2% were currently smoking at follow-up and nearly 95% were continuously abstinent. The percentage of recyclers decreased with greater cut points.

To preserve adequate cell sizes for the logistic regression, we compare only two levels of each demographic variable except race/ethnicity and four categories for duration of abstinence as baseline. Univariate results are presented in Table 2. There is a significant trend to older age with increased duration of abstinence at baseline. Also, whites are more likely and Hispanics are less likely to have been abstinent longer at baseline. Although there was a trend for more light smokers (<15 cigarettes/day) in the group who had quit for 3 but less than 12 months at baseline compared with those who had quit for less than 3 months, it was not statistically sig-
Table 1. Abstinence at follow-up for different quit duration cut points at baseline

<table>
<thead>
<tr>
<th>Cut point</th>
<th>No. of subjects</th>
<th>Continuously abstinent*</th>
<th>Recyclers†</th>
<th>Currently smoking‡</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;3 mo</td>
<td>122</td>
<td>17.6 ± 9.2</td>
<td>36.8 ± 21.3</td>
<td>45.5 ± 19.2</td>
</tr>
<tr>
<td>≥3 mo</td>
<td>1327</td>
<td>91.5 ± 2.0</td>
<td>4.2 ± 1.4</td>
<td>4.3 ± 1.2</td>
</tr>
<tr>
<td>&lt;6 mo</td>
<td>183</td>
<td>29.6 ± 11.0</td>
<td>31.9 ± 15.1</td>
<td>38.5 ± 13.4</td>
</tr>
<tr>
<td>≥6 mo</td>
<td>1266</td>
<td>92.7 ± 1.8</td>
<td>3.7 ± 1.3</td>
<td>3.6 ± 1.1</td>
</tr>
<tr>
<td>&lt;1 y</td>
<td>290</td>
<td>41.5 ± 13.9</td>
<td>24.3 ± 10.6</td>
<td>34.2 ± 11.4</td>
</tr>
<tr>
<td>≥1 y</td>
<td>1159</td>
<td>94.9 ± 1.5</td>
<td>3.0 ± 1.3</td>
<td>2.0 ± 0.8</td>
</tr>
<tr>
<td>&lt;2 y</td>
<td>443</td>
<td>52.7 ± 10.6</td>
<td>21.2 ± 8.1</td>
<td>26.1 ± 7.9</td>
</tr>
<tr>
<td>≥2 y</td>
<td>1006</td>
<td>96.4 ± 1.5</td>
<td>2.1 ± 1.2</td>
<td>1.5 ± 0.8</td>
</tr>
<tr>
<td>&lt;3 y</td>
<td>603</td>
<td>60.3 ± 8.9</td>
<td>18.9 ± 6.6</td>
<td>20.8 ± 6.4</td>
</tr>
<tr>
<td>≥3 y</td>
<td>846</td>
<td>97.3 ± 1.2</td>
<td>1.3 ± 0.8</td>
<td>1.3 ± 0.8</td>
</tr>
</tbody>
</table>

*Former smokers at follow-up who reported a quit date before the baseline interview.
†Former smokers at follow-up who reported a quit date between the baseline and follow-up interviews.
‡At follow-up, answered ‘‘yes’’ when asked if they smoke now.

Table 2. Demographic characteristics according to duration of abstinence at baseline

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Months abstinent at baseline*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt;3 years (n = 122)</td>
</tr>
<tr>
<td>Male</td>
<td>64.6 ± 14.8</td>
</tr>
<tr>
<td>Age, &gt;45 y</td>
<td>21.6 ± 10.0</td>
</tr>
<tr>
<td>Some college</td>
<td>39.9 ± 13.6</td>
</tr>
<tr>
<td>Race/ethnicity</td>
<td>White</td>
</tr>
<tr>
<td></td>
<td>Black</td>
</tr>
<tr>
<td></td>
<td>Hispanic</td>
</tr>
<tr>
<td></td>
<td>Asian/other</td>
</tr>
<tr>
<td>Cigarettes/day</td>
<td>&lt;15</td>
</tr>
<tr>
<td></td>
<td>15-24</td>
</tr>
<tr>
<td></td>
<td>≥25</td>
</tr>
</tbody>
</table>

*Values in columns = weighted percentages ± 95% confidence intervals. NA = not available.
†One year before baseline interview.

Discussion

These results provide quantitative population data to support the conclusions of earlier studies (10,11,14,16) that found that the duration of abstinence is an excellent predictor of continued long-term abstinence (10,11,14,16). More than 50% of former smokers abstinent for 3 but less than 6 months remained continuously abstinent until follow-up, which represented a substantial increase from those who had quit for 1 but less than 3 months; however, the rate for those who had quit for 6 but less than 12 months was only marginally higher (Fig. 1). Thus, for longitudinal studies, 3 months may be a reasonable follow-up period to assess intermediate success. Also, for evaluation of population interventions using cross-sectional surveys, a criterion of at least 3 months’ cessation may prove to be a fairly stable measure of the prevalence of successful former smokers. Another sizable increase in continuous abstinence occurs for those who have quit for 1 but less than 2 years. However, the rate of continuous abstinence does not exceed 90% until smokers have been abstinent for 3 but less than 4 years. Moreover, we were unable to identify a duration of abstinence after which former smokers had no risk of relapse. Thus, no definition of successful cessation can be absolute.

Since any cut point chosen will include all former smokers who have abstained at least this long, the ‘‘sensitivity’’ for predicting continuous abstinence will be high. For instance, using abstinence for a day as the cut point (all of the subjects in the present study), 88% will still be abstinent at follow-up an average of nearly 2 years later (Table 1). If 3 months is the criterion, 92% will remain abstinent. Within 3 years as a criterion, 97% will remain abstinent.

It is possible that some demographic or other subgroups of former smokers have a different level of risk of relapse than the population in general. For instance, former smokers who maintain their addiction to nicotine by use of other tobacco products may be more likely to remain continuously abstinent than those using no tobacco products. However, since only 2% of ex-smokers reported daily use of other tobacco products, it is unlikely that the results of this study are appreciably influenced. Previous studies (23-26) have identified demographic, psychosocial, and other factors (including former level of addiction) that are related to future relapse. Multivariate logistic regression in our sample indicated that older quitters are more likely to remain continuously abstinent at follow-up than younger ones, no doubt because they had already been abstinent longer at baseline. However, since the group that had quit for less than 3 months at baseline contains relatively fewer younger smok-
ers than the group that had quit for 3 but less than 12 months, perhaps the criterion for intermediate successful cessation in younger smokers should be longer than the 3 months we generally suggest.

Fewer than one in eight former smokers who had abstained for a month or less at baseline were continuously abstinent over the next 2 years (Fig. 1). This low abstinence rate was expected from outcomes documented in clinic studies (27). However, these low rates may also reflect social desirability pressures that lead some smokers to misreport their smoking status (28), so that our sample of former smokers may actually contain a few current ones. Indeed, the validity of self-reported smoking status has been investigated by comparing self-reports with reports of smoking status by another adult in the household or a significant other (29). Discrepancy was particularly likely for very recent (<1 month) self-reported quitters. However, only about 3% of all recent former smokers reported quitting in the last month at both baseline and follow-up. This small fraction could be perennial "former smokers" or they could be recyclers. The rate of recycling is the highest for smokers who have abstained for less than 3 months, suggesting that some of these smokers are in the midst of one of several attempts to abstain, which may ultimately lead to success. The recycling rate decreases with greater cut points as more and more former smokers achieve long-term abstinence.

Previous population studies (1,2,30) have shown that about one third of all smokers make at least one attempt to quit in the course of a year, and that this proportion can approach one half during mass-media antismoking campaigns (18,31). If tobacco control interventions increase the number of smokers making an attempt or the number of attempts a smoker makes, point prevalence may be an unstable surveillance or evaluation measure. A survey conducted during a period of intense intervention would likely show a lower prevalence and a higher quit ratio (quotient of all smokers who have quit to all ever smokers) than a similar survey conducted before the intervention or 6 to 12 months later, when most of the quitters had relapsed. Counting those who had quit for 3 months or less as smokers would produce a slightly higher prevalence estimate, but such an estimate would likely be more stable and better suited to evaluate the long-term effectiveness of tobacco control efforts.

Our results appear to justify those surveys, which oversampled those who have smoked within the past 5 years to determine knowledge and attitudes, and to characterize behavior of participants at risk of smoking in the near future (19,30,32). Moreover, besides issues of recall, these data support the decision to use a 1-year interval before the interview for assessment of recent quitting behavior (19,32). Some smokers who have abstained for less than 1 year may have recycled through several attempts in the year before they were surveyed again.

The high probability of relapse early after an attempt to quit was a major consideration in the design of a telephone counseling cessation program (33). Clients are called at 1, 3, 7, 14, and 30 days after quitting. Our study indicates that significant relapse occurs still later, even after withdrawal has been successfully negotiated. Whether it is cost-effective to extend the counseling beyond 1 month— and, if so, the identification of an optimal schedule—will require further research. When asked why they returned to smoking, many long-term quitters cite a stressful life event (26). Cessation programs should be sure to warn quitters against using cigarettes as a coping mechanism and should assist them in identifying and developing alternative coping strategies.

References


Notes

Supported by contract 92-16010 from the California Department of Health Services, Tobacco Control Section, Sacramento, and by Public Health Service grant CA07092 from the National Cancer Institute, National Institutes of Health, Department of Health and Human Services. Work was performed during the tenure of J. P. Pierce’s Established Investigatorship from the American Heart Association.

Manuscript received September 16, 1996; revised January 17, 1997; accepted February 18, 1997.