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A Population Study of Low-Rate Smokers: Quitting History and Instability Over Time

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Abstract

This study used one longitudinal and two cross-sectional population surveys to compare stability of low-rate daily smokers (≤5 CPD) with other daily smokers and occasional smokers. Most low-rate smokers do not maintain consumption level for long; 36% retained their smoking status after 20 months compared to 82% and 44% for regular daily and occasional smokers, respectively. Analysis revealed a dynamic process; established smokers of all consumption levels quit smoking as well as modified (decreased or increased) consumption level. Low-rate and occasional smokers quit at higher rates than regular daily smokers (odds ratios ≥ 3:1), but were continuously replenished by new members, many "converted" from regular dailysmokers. The overall trend is an increasing proportion of low-consumption smokers, even while smoking prevalence declines. The dynamic process described has implications for tobacco control efforts and for addiction theory.

Key words: Low-rate smokers, chippers, occasional smokers, smoking reduction, cessation, dynamics of smoking behavior.

Low-rate smokers consume five or fewer cigarettes per day (CPD). Their low consumption behavior is of theoretical and practical interest. Theoretically, there is the question of how many of them will maintain such a low daily consumption, given that nicotine regulation is generally ineffective when people smoke 5 CPD or less (Benowitz, Jacob, Kozlowski, & Yu, 1986). More practical questions include: how many of these low-rate smokers used to smoke more but cut down their CPD in response to anti-smoking campaigns, and whether the reduced consumption increases the probability of cessation.

Previous studies have shown that a subgroup of low-rate smokers maintains low consumption for an extended period of time. Shiffman called these smokers "chippers" and defined them as smokers who have maintained $\leq$ 5 CPD for at least two years (Shiffman, 1989). He and his colleagues demonstrated that chippers do not exhibit characteristic features of nicotine dependence (Shiffman, Paty, Gyns, Kassel, & Elash, 1995), even though they absorb the same amount of nicotine per cigarette and show similar cardiovascular responses as dependent smokers (Shiffman, Fischer, Zettler-Segal, & Benowitz, 1990; Shiffman et al., 1992). These studies, however, do not address the question of how many low-rate smokers in the general smoking population are chippers. Hence, the issue of how many low-rate smokers will maintain daily low consumption has not been resolved.

With regard to the probability of cessation, a lower consumption generally predicts a higher cessation rate (USDHHS, 1988). However, this is not always true (Hughes, 2000). Smokers who cut down CPD to a certain level may not share the characteristics of smokers who have always consumed that same level, and nicotine intake is only one of many factors that affect cessation rate. In fact, consumption that is consistently as low as 5 CPD suggests that factors other than nicotine regulation must also play a significant role in maintaining low-rate smoking behavior. How much these low-rate smokers are motivated to quit smoking has not been examined systematically.

From a motivational perspective, the fact that someone regularly consumes only a few cigarettes per day suggests two opposing scenarios. On the one hand, low-rate smokers may be relatively content with their smoking and not motivated to quit. They may perceive their low level of CPD as an insignificant threat to their health (or a greatly reduced threat if they previously smoked more) and their infrequent smoking as an adaptive behavior in a society restrictive to smoking. Because each cigarette still has utility for them (Shiffman et al., 1990), smoking a few cigarettes a day can be a middle ground, allowing them to enjoy the perceived benefits of smoking while appearing to reduce the potential harm. The behavior of physicians, who are reportedly less likely to advise low-rate smokers than heavy smokers to quit, supports this thinking (Owen, Kent, Wakefield, & Roberts, 1995). On the other hand, consuming only a few cigarettes a day may be an indication of smokers' ongoing motivation to quit. They are smoking at a low level because they have cut down their CPD in preparation of quitting, or they have tried to quit but relapsed and are smoking fewer cigarettes in anticipation of a new quit attempt (Swan & Denk, 1987; Hughes, 2000). If this is true, then low-rate smoker will be a highly unstable status. Of course, both these scenarios can be operating in a given population. An individual smoker's motivation to quit varies, but the focus here is on the overall stability of low-rate smokers as a group.

To answer these questions adequately, a study sample that is representative of the low-rate smoking population is needed so that conclusions about the overall stability of low-rate smoking can be generalized. The present study uses population surveys. The chief data source is a longitudinal population survey. The longitudinal design allows the comparison of

consumption level at different points of time without having to ask study participants to recall their previous consumption level, which can be biased by their current smoking status.

This study also takes advantage of the fact that a population survey includes smokers of all consumption levels, so that the stability of low-rate smokers can be compared to that of other smoking groups who smoke more or less. The comparison between groups provides a measure of relative magnitude of change in consumption, since even committed smokers are not expected to maintain absolute stability in consumption over time. The study divides smokers into three groups: low-rate daily smokers, regular daily smokers (>5 CPD), and occasional smokers who do not smoke daily. The stability of low-rate smokers is compared to the other two categories by examining how many of them maintain their consumption over time and how many of them quit smoking or otherwise modify their consumption level.

Methods

Sample

This study examines only established smokers: adults who are over 24 years of age and who have smoked for at least 5 years. Younger smokers who are still in the uptake stage may smoke only a few cigarettes per day but are likely to increase their consumption as they grow older (Janson, 1999). These are not considered true low-rate smokers (Shiffman, 1989) and are excluded from this study.

This study used three population surveys from California, the 1990 cross-sectional California Tobacco Survey (CTS), the 1990-1992 longitudinal CTS (a subset of the 1990 cross-sectional survey that were selected for follow-up), and the 1996 cross-sectional CTS. The six year period between 1990 and 1996 is one in which California had its largest drop in smoking prevalence (Pierce et al., 1998).

Survey methods for these data sets have been presented in detail elsewhere (Pierce et al., 1998) and thus will be only briefly described here. The 1990 and 1996 cross-sectional surveys used a modified Waksberg random-digit dialed telephone methodology (Waksberg, 1978). In the 1990 CTS, 42,790 households were sampled for a screening interview, with a response rate of 75.1%. All adults (18 years or older) who reported smoking in the previous 5 years (at the screening interview) were then scheduled for a detailed extended interview, as were 28% of other adults. The response rate for the extended survey of 24,296 adults was 75.3%.

A stratified random sample (N=9,310) of the 1990 CTS baseline survey was chosen to be in a longitudinal study. These survey participants were followed up in 1992, approximately 20 months later. Among the selected subjects, 4,642 completed follow-up interviews, for a response rate of 49.9% (Pierce et al., 1994). Thirty percent could not be located, 7.4% refused to be interviewed again, and the rest were unable to complete the survey because of death, incapacity or interruption. The smoking status and demographic breakdown for those who completed the follow-up interview and those who did not were similar (Pierce et al., 1994).

The 1996 cross-sectional survey used the same sampling method as the 1990 CTS. Among the 25,546 adults selected in 1996, 18,618 adults were gathered for extended study. The response rate for the extended interview was 72.9% (Pierce et al., 1998).

Measures

In the 1990 baseline survey and in the 1992 follow-up survey, respondents who answered "Yes" to the question, "Do you smoke cigarettes now?" were classified as current smokers, whereas established smokers who answered "No" to the question were classified as former

smokers. Current smokers were further divided into daily and occasional smokers based on the question, “Do you smoke cigarettes every day, or some days?" In the 1996 CTS, respondents were asked, "Do you smoke cigarettes every day, some days, or not at all?" Respondents who answered “Not at all" were classified as former smokers and the rest were classified as current smokers.

Daily smokers were further asked, “How many cigarettes on average do you smoke per day?” Occasional smokers were asked the following: (1) “On how many of the past 30 days did you smoke cigarettes?” and (2) “On the days that you did smoke, about how many cigarettes did you usually smoke per day?”

The three categories of smokers described in this paper are defined as follows: (1) Occasional smokers were those who did not smoke daily in the past 30 days. (2) Low-rate smokers were daily smokers who smoked ≤5 cigarettes per day. (3) Regular smokers were daily smokers who smoked more than 5 cigarettes per day.

Cessation in this paper was defined as “established smokers” in 1990 who reported “not smoking” in the 1992 follow-up survey, regardless of their length of abstinence. Quitting status in this study was self-reported without validation, as biochemical validation in such a survey setting would have made little difference (Velicer, Prochaska, Rossi, & Snow, 1992; Glasgow et al., 1993).

Statistical Methods

Each observation was weighted to take into account the sample design and to apply a post-stratification ratio adjustment thereby ensuring that the overall result was representative of California with respect to region, sex, age, race/ethnicity, and educational level. The WesVarPC software package was used to obtain weighted percentages, standard errors derived from a jack-knife procedure, and 95% confidence intervals (CI) (Efron, 1982; Westat, 1996). All percentages presented in this paper were population-weighted by the year of survey, which can be different from percentages calculated using survey sample sizes shown in the tables.

Results

Cigarettes per day (CPD) at baseline

At the 1990 baseline survey, low-rate smokers smoked on average 3.9 CPD (*95% CI* = ±0.2). The median was 4 CPD. In comparison, occasional smokers used cigarettes on average 15.0 days per month and consumed an average of 5.2 CPD on the days they did smoke (*95% CI* = ±0.5). Including nonsmoking days in the denominator, their CPD was 2.9 (*95% CI* = ±0.3). The median CPD for occasional smokers on their smoking days was also 4. In contrast, the median number of cigarettes for regular daily smokers was 20 CPD with a mean of 21.3 CPD (*95% CI* = ±0.4).

Quitting activities

Table 1 shows thatat the point of the 1990 cross-sectional survey, 58.7% of low-rate smokers reported that they had tried to quit in the past 12 months. They were significantly more likely to have tried to quit than regular smokers (38.5%). Low-rate smokers were also more likely to want to quit again (43.8% vs. 23.9%) and more likely to have quit for at least a year in the past (35.2% vs. 24.2%).

In all three measures of quitting, occasional smokers were also significantly different from regular smokers. None of the differences between occasional smokers and low-rate smokers reached statistical significance.

Cessation rate

Of those 1990 smokers who were followed longitudinally, 37.3% (*95% CI* = ±20.0) of low-rate smokers reported not smoking at the time of the 1992 survey. This cessation rate was significantly higher than that for regular daily smokers, 12.3% (*95% CI* = ±2.4). The odds ratio comparing cessation between low-rate and regular smokers was 3.7 to 1, when adjusted by demographic variables.

The cessation rate for occasional smokers, 36.4% (*95% CI* = ±16.8), was also significantly higher than thatfor regular smokers. The odds ratio comparing the cessation rates between occasional smokers and regular smokers was 3.8 to 1, when adjusted by demographic variables. The difference between the occasional smokers and low-rate smokers in cessation rate was not significant.

Comparable differences were observed if a more stringent definition of cessation was used. If cessation is defined as having abstained from smoking for at least 30 days, then 30.5% (*95% CI* = ±19.2) of low-rate smokers and 26.9% (*95% CI* = ±10.6) of occasional smokers had successfully quit smoking 20 months later. Both of these rates are significantly higher than the cessation rate for regular daily smokers (10.0%, *95% CI* = ±2.4).

Instability of low-rate smokers

In addition to some low-rate smokers quitting smoking, Table 2 shows other changes that occurred among the group. The top half of Table 2 represents the transitional probabilities between smoking categories from 1990 to 1992, a 20 month lag. About5.5% of 1990 low -rate smokers became occasional smokers in 1992 (the second row). Another 20.8% increased their consumption to become regular smokers. Only 36.4% of themremained low -rate smokers in 1992.

Among the four smoking categories shown in Table 2, low-rate smokers seemed to be the least stable one; even less stable than occasional smokers, 44.2% of whom remained in the same category at the follow-up survey. In comparison, regular daily smokers and former smokers were much more stable.

It should be noted that the former smoker category in Table 2 included all those who had quit smoking before the 1990 baseline survey. Some of them might have quit smoking many years ago. If only those former smokers who had quit within 12 months prior to the survey were analyzed, then 77.1% of the former smokers remained in the same category. They were still significantly more stable than either low-rate smokers or occasional smokers.

Where did the low-rate smokers come from?

The bottom half of Table 2 examined the same set of data from a different angle. It used smoking status in 1992 as an anchor of analysis and looked back at the smoking status in 1990. Given that so many smokers either quit smoking or modified their consumption level, the purpose of this analysis was to determine the origin of the 1992 low-rate smokers. These column percentages revealed that, of all the low-rate smokers in 1992, 13.4% of them used to be occasional smokers in 1990, 40.0% were regular smokers, and 24.6% were former smokers.

Only 22.0% of low-rate smokers in 1992 were low-rate smokers in 1990. In other words, over three quarters of low-rate smokers in 1992 came from other categories, with the greatest number from regular smokers.

Occasional smokers in 1992 had a similar story. About 29% of occasional smokers used to be regular smokers in 1990. Overall, more than half of occasional smokers in 1992 were in different categories in 1990.

Changing proportions of low-rate smokers and occasional smokers

The data in Table 2 would predict that the proportion of low-consumption smokers (low-rate smokers and occasional smokers) among current smokers would increase with time. The transitional rates from regular smokers to low-consumption smokers (2.3% to low-rate and 3.2% to occasional smokers) were lower than the other way around (20.8% from low-rate and 13.0% from occasional smokers). However, regular smokers was a much larger group. As a result, the absolute number of regular smokers changing to low-consumption smokers could exceed the change from the opposite direction, even though the transitional rates for the former were lower. For example, in this 1990 data set there were 180 occasional smokers. The population-weighted percentages showed that 13% of them progressed to regular smoking by 1992, a total of 23 smokers ($180 \times .13 \approx 23$). During that same period only 3.2% of regular smokers became occasional smokers ($1524 \times .032 \approx 49$). The absolute number of smokers going from regular daily smoker to low-consumption smoker is more than double the smokers changing in the opposite direction.

A comparison between the 1990 and 1996 cross-sectional surveys showed that low-consumption smokers had indeed increased. In fact, this increase occurred in the context of a large drop in smoking prevalence. From 1990 to 1996, smoking prevalence for Californians who were 25 years or older dropped from 22.4% to 17.9%. The smoking initiation rate did not change during this period. Thus, this drop must have come from a greater number of current smokers quitting smoking, rather than a decrease in the number of non-smokers becoming newly established smokers (Pierce et al., 1998). Table 3 shows that the proportion of low-rate smokers among current smokers in the same age group increased, from 5.6% in 1990 to 6.8% in 1996. The proportion of occasional smokers also increased from 13.0% to 16.5%. Combining low-rate and occasional smokers, the proportion of these low-consumption smokers increased significantly from 18.6% (*95% CI* = $\pm$1.3) in 1990 to 23.3% (*95% CI* = $\pm$1.4) in 1996. Even adjusting the data from 1996 by the difference in demographic variables between 1990 and 1996, the proportion of low-consumption smokers in 1996 remained significantly higher than in 1990, 18.6% (*95% CI* = $\pm$1.3) vs. 21.9% (*95% CI* = $\pm$1.4).

Table 3 also shows the proportion of occasional smokers and low-rate smokers within each demographic group in 1990 and in 1996. In both surveys, there was a slightly higher proportion of low-rate smokers among women. The age group 25-44 had a consistently higher proportion of occasional smoking in both 1990 and 1996, but the relationship between age and low-rate smoking was less consistent. Hispanics, Blacks, and Asians all had higher proportions of occasional and low-rate smokers than Whites. Higher education was associated with a higher level of occasional smoking.

Environmental smoking policy and low-rate smoking behavior

Finally, Table 4 shows that low-rate smokers in 1996 were significantly more likely to report having a complete ban in their workplace than regular smokers (56.7% and 42.4%). They

were also much more likely to have a smoke-free policy in their home (47.0%, and 26.5%, respectively). Occasional smokers seem to be even more likely than low-rate smokers to have a smoke-free home, but the difference is not statistically significant.

Discussion

The data from this study indicate that low-rate smokers, though smoking only a few cigarettes a day, were not content with their smoking status. A majority of them tried to quit, a much higher percentage than that seen in regular dailysmokers. Low-rate smoking in general is a highly unstable status. Only a minority of low-rate smokers maintained their low CPD for a 20-month period of study. Among those who changed, most of them quit smoking. Some became occasional smokers and others increased their consumption to become regular daily smokers. Meanwhile, many new low-rate smokers came into existence, mostly from regular daily smokers who reduced their consumption. The general picture emerging from these data is a dynamic process in which low-rate smokers exit out of their category faster than regular daily smokers, but are continuously replenished by new members .

Figure 1 presents a schematic description of this dynamic process, showing that change can occur at all levels of consumption and in both directions. Regular smokers may cut consumption to become low-rate smokers; some of them go on to become occasional smokers or to quit completely. Regular smokers may also quit cold turkey and become former smokers directly. However, some former smokers may slip to smoking occasionally at first and then relapse to smoking daily (low-rate or regular smoking). They may also relapse directly to low-rate smoking or regular daily smoking. Low-rate or occasional smokers may increase their consumption and go back to being regular smokers. The net result, at least in California where these data were obtained, is that more regular smokers become low-rate or occasional smokers than the other way around.

The dynamic process illustrated in Figure 1 provides a conceptual framework to think about the results obtained in this study. In the following discussion, we will examine the three questions raised in the introduction by applying the data from this study to the model illustrated in Figure 1.

How many low-rate smokers maintain their level of consumption?

Table 2 shows thatthe majority of low-rate smokers in the general smoking population do not maintain their daily low consumption for very long. Only about 36% of low-rate smokers in 1990 maintained their low CPD 20 months later. In contrast, about 82% of regular smokers and 95% of former smokers in 1990 remained in the same categories in 1992. These results support conclusions from other longitudinal studies on the stability of smoking status (Janson, 1999; McCarthy, Zhou, & Hser, 2001), which showed that light smokers ($\leq$ 6 CPD) were much less stable groups compared to regular smokers. Those studies included many young smokers; those under 25 years old were actually over-sampled in the analysis. The current study excluded anyone under 25 years old or who had not smoked for 5 years. The results still indicate that low-consumption smoking among the established smokers was a highly unstable status.

The lack of stability among low-rate smokers was chiefly due to their high rate of quit attempts, which in turn led to high cessation rate (37%). But a substantial percentage (21%) also went on to smoke more cigarettes. Given that many low-rate smokers used to be regular smokers, it is likely that some of these smokers returned to their original consumption level

which provided a higher level of nicotine. Also, a smaller percentage (6%) of them stopped smoking daily and became occasional smokers, which makes it unlikely that nicotine regulation is the explanation for their continued smoking.

How many low-rate smokers are "converted" low-rate smokers?

Table 2 (bottom half) shows that 40% of low-rate smokers in 1992 were regular daily smokers in 1990. This confirms previous studies from cross-sectional surveys that showed many low-rate smokers were "converted" from regular smokers (e.g., Hajek, West, & Wilson, 1995; Shiffman, Paty, Kassel, Gnys, & Zettler-Segal, 1994). This study demonstrates, however, that converting can come from the other direction, from those who used to smoke less. Table 2 (bottom half) showed that about 38% of low-rate smokers in 1992 came from those who were occasional smokers or former smokers in 1990. Because the analysis excluded anyone who was still in the uptake stage, these occasional and former smokers were established smokers before the baseline survey in 1990. This means that the change from occasional and former smokers to low-rate smokers represents a process of relapse rather than uptake of new smokers.

Overall, 78% of the established low-rate smokers in 1992 did not maintain low-rate smoking for the previous 20 months. Only about 22% of low-rate smokers in the general smoking population could be properly called chippers using Shiffman's (1989) definition.

This study further indicates that the change in consumption seems to be induced in part by external pressure. Table 4 shows that low-rate and occasional smokers in 1996, many of whom used to be regular smokers in previous years, reported greater levels of worksite and home restrictions on smoking than regular smokers. One may argue that this is because California had a particular strong anti-smoking campaign. But other studies have reported similar results, showing an increased low-rate smoking rate in response to environmental restriction of smoking (Baile, Gibertini, Ulschak, Snow-Antle, & Hann, 1991; Brigham, Gross, Stitzer, & Felch, 1994; Burns, Shanks, Major, Gower, & Shopland, 2000; Conrad, Campbell, Edington, Faust, Vilnius, 1996; Hennrikus, Jeffrey, & Lando, 1996; Jeffrey et al., 1994; Petersen et al., 1988). It is difficult to ascertain if the original intention in reduction was to smoke fewer cigarettes to accommodate others or whether it was in preparation for complete cessation. Some of the low-rate smokers might even have quit but later relapsed to smoke fewer cigarettes than they did originally, as Figure 1 suggests.

Does reduction in CPD increase the probability of cessation?

If the transitional probabilities in Table 2 are applied to the process illustrated in Figure 1, we can deduce that reduction of consumption to $\leq$ 5 CPD will lead to a higher cessation rate over time. Simply put, if low-rate smokers have a higher cessation rate than regular smokers and if most low-rate smokers, in turn, are converted from regular smokers, then the transition from regular smoking to low-rate smoking will lead to a higher cessation rate. This transition to low-rate smoking, however, can come from gradual reduction or from quit-and-relapse. The current debate on smoking reduction has often focused on its merits as a preparation for a quiting (Cinciripini, Wetter, & McClure, 1997; Hughes, 2000). The results from this study suggest that it might be useful to investigate the minimum CPD one needs to reach before gaining significant benefit in quitting. This is important for a public health approach to tobacco control since, unlike in clinical research, it is often not feasible to monitor the exact process smokers use to reduce their consumption. Previous work has shown that reducing to less than 15 CPD increased the chance of successful quitting, whereas reductions that failed to reach this level did not (Farkas,

1999). This study confirms the usefulness of knowing that smokers reduced their consumption below a specific CPD, even if it is unclear how the reduction was achieved. Five CPD is a unique cut-off point because nicotine regulation generally becomes ineffective at this level (Benowitz et al., 1986) and those who maintain $\leq$ 5 CPD for an extended period of time are not nicotine dependent, even if they used to smoke much more (Shiffman et al., 1994). While this study does not measure the length of time the "converted low-rate smokers" maintained their reduced consumption before quitting completely, the public health implication of the data is clear: tobacco control efforts that increase the proportion of low-rate smokers among current smokers will lead to a higher cessation rate in the population.

One limitation of this study is that the transitional probabilities shown in Table 2 (top half) only represent the net change between these smoking categories measured at two time points (baseline and follow-up). There might have been more frequent quitting and relapsing in the 20-month period than is reflected here, especially among those who were striving to maintain abstinence after quitting (Swan & Denk, 1987). In fact, it is logically possible that all of the changes from higher to lower consumption in Table 2 came from quit-and-relapse rather than gradual cutting down. Future studies with more frequent follow-up or more extensive questionnaires are needed to ascertain the exact proportions of smokers among the general smoking population who cut down gradually or who quit and relapse to a lower consumption rate.

The analysis of the longitudinal survey was also limited by its sample size. While it was sufficiently large to allow analysis of stability of low-rate smokers and apply the population weights to generalize to the general smoking population in California, it was not large enough to provide results by specific demographic groups. For example, even though a notable ethnic group difference in low-rate and occasional smokers was found in both the 1990 and 1996 cross-sectional surveys, further analysis of transitional probabilities among these smoking categories by ethnic group in the longitudinal survey was not possible. This prevents us from any attempt to estimate if the ethnic differences in the proportion of low-consumption smokers will translate into differences in cessation rates among these groups. It should be noted, however, that analyses on cessation rates in this study were all adjusted by gender, age, ethnicity and education level.

In light of this study's findings regarding the instability of low-rate smoking, it may be useful for future surveillance studies to list low-rate smokers as a separate category from other daily smokers. Compared to regular smokers who consumed a little more than one pack a day, low-rate smokers consumed on average 4 CPD. This was actually 1 cigarette less than what occasional smokers consumed on the days they smoked. Their cessation rate, similar to that for occasional smokers, was more than three times that of regular daily smokers. Low-rate smoker status is often indicative of previous engagement in quitting or significant reduction in consumption. Therefore, a separate category for low-rate smokers can be a useful index for gauging the effect of an anti-smoking campaign on quitting as well as on the consumption reduction that affects future cessation rates.

The results from this study also raise a new question. If the dynamic process depicted in Figure 1 continues to operate in places like California, the average consumption level per smoker will keep declining. Does this mean that the level of nicotine dependence among the smoking population will continue to drop accordingly? Shiffman and colleagues (1994) have examined "converted chippers" who used to smoke $\geq$ 15 CPD and concluded that they have much in common with native chippers who never smoked more, i.e. they both exhibit little sign of

nicotine dependence. How long someone has to be a converted chipper before he or she starts looking more like a native chipper than a regular smoker is unknown. What is clear is that nicotine dependent smokers can change to become non-dependent smokers if they reduce consumption level to $\leq$ 5 CPD and maintain it. The cited study required chippers to be smoking $\leq$ 5 CPD for at least two years. Given that the withdrawal symptoms for those who quit smoking generally subside within a month (Gross & Stitzer, 1989; Hughes, 1990), it seems that smokers who reduce their consumption to $\leq$ 5 CPD would take considerably less than two years to adjust to their new smoking level. The small number of low-rate smokers who could be considered chippers (22%) also indicates that the requirement of maintaining low smoking for two years may be overly restrictive and exclude many whose level of dependence might actually have changed. In other words, the data from this study suggests that this "change from dependent smokers to non-dependent smokers" may occur quite frequently in the natural setting. A theory on nicotine addiction, therefore, needs to account for these "natural" phenomena that do not usually present themselves to a clinical study.

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Table 1 Quitting Behavior Among Current Smokers in 1990

	Occasional Smoker	Low-rate Smoker	Regular Smoker
	N = 693	N = 316	N = 6054
	% (95% CI)	% (95% CI)	% (95% CI)
Tried to quit in past 12 months	67.4 (62.5-72.3)	58.7 (52.3-65.2)	38.5 (36.9-40.2)
Intend to quit within 1 month	49.5 (44.6-54.3)	43.8 (34.6-53.0)	23.9 (22.4-25.5)
Quit for at least 1 year	43.3 (37.3-49.3)	35.2 (29.9-40.4)	24.2 (23.1-25.2)

All percentages are weighted. CI = Confidence interval. Data source: 1990 California Tobacco Survey (cross-sectional survey).

Table 2. A Comparison of Smoking Status in 1990 and in 1992 Follow-up Survey

1990	1992					
	Occasional Smoker %	Low-rate Smoker %	Regular Smoker %	Former Smoker %		
Row Percent:					Total	N
Occasional Smoker	44.2	6.4	13.0	36.4	100.0	180
Low-rate Smoker	5.5	36.4	20.8	37.3	100.0	52
Regular Smoker	3.2	2.3	82.2	12.3	100.0	1524
Former Smoker	1.5	0.9	2.3	95.3	100.0	1371
Column Percent:						
Occasional Smoker	47.6	13.4	1.7	2.5		
Low-rate Smoker	1.7	22.0	0.8	0.8		
Regular Smoker	29.0	40.0	93.4	7.2		
Former Smoker	21.7	24.6	4.1	89.5		
Total	100.0	100.0	100.0	100.0		
N	167	63	1371	1526		

All percentages are weighted. Data source: 1990-1992 California Tobacco Survey (longitudinal follow-up).

Table 3 Proportion of current smokers in 1990 and 1996, California.

	1990			1996		
	Occasional Smoker N=940 % (± CI)	Low-rate Smoker N=368 % (± CI)	Regular Smoker N=6538 % (± CI)	Occasional Smoker N=1034 % (± CI)	Low-rate Smoker N=410 % (± CI)	Regular Smoker N=5314 % (± CI)
	13.0(1.0)	5.6(0.6)	81.4(1.2)	16.5(1.4)	6.8(0.8)	76.7(1.4)
Gender						
Male	13.6(1.2)	4.3(0.8)	82.1(1.8)	16.9(2.0)	5.9(1.2)	77.2(2.2)
Female	12.1(1.4)	7.3(1.4)	80.6(2.0)	16.0(1.8)	8.0(1.4)	76.0(1.8)
Age(yrs)						
25-44	15.2(1.0)	6.2(0.8)	78.6(1.2)	20.2(2.0)	7.9(1.2)	71.9(2.0)
45-64	9.6(2.4)	4.3(1.2)	86.1(2.5)	11.5(1.6)	5.0(1.0)	83.5(1.6)
65+	8.6(2.7)	7.3(2.9)	84.1(3.5)	9.9(3.1)	5.5(2.0)	84.6(3.5)
Ethnicity						
Hispanic	27.5(4.5)	13.5(3.3)	59.0(5.3)	29.9(4.7)	15.2(3.1)	54.9(4.7)
White	8.7(1.0)	3.3(0.6)	88.1(1.2)	12.4(1.2)	3.6(0.6)	84.0(1.0)
Black	21.2(5.9)	8.7(3.1)	70.1(6.9)	18.0(3.5)	11.3(3.1)	70.7(5.1)
Asian/PI	13.6(3.1)	10.0(3.3)	76.4(4.3)	17.8(6.3)	10.0(3.1)	72.2(6.7)
Other	8.6(4.1)	1.5(1.6)	89.9(3.9)	16.0(5.5)	5.3(4.3)	78.7(7.3)
Education(yrs)						
<=12	11.5(1.4)	5.7(1.0)	82.8(1.6)	14.8(1.8)	7.2(1.4)	78.0(2.0)
>12	15.3(1.6)	5.5(0.8)	79.2(2.0)	18.6(2.0)	6.3(1.0)	75.1(1.8)

All percentages are weighted. Numbers in parentheses are 95% confidence intervals (CI).
Data source: 1990 and 1996 California Tobacco Surveys (cross-sectional surveys).

Table 4 Percentage of Smokers in Smoke-free Home and Worksites in 1996

	Occasional Smoker	Low-rate Smoker	Regular Smoker
N	901	504	5414
	% (95% CI)	% (95% CI)	% (95% CI)
Worksite completely smoke-free	55.7(51.2-60.2)	56.7(51.4-62.1)	42.4(40.9-43.9)
Home completely smoke-free	53.3(49.4-57.1)	47.0(41.5-52.6)	26.5(25.2-27.7)

All percentages are weighted. CI = Confidence interval. Data source: 1996 California Tobacco Survey (cross-sectional survey).

***Figure 1*. A schema for dynamic change of consumption**