Smoking relapse after 2 years of abstinence: findings from the VA Normative Aging Study

Elizabeth A. Krall, Arthur J. Garvey, Raul I. Garcia

Little is known about the risk of cigarette smoking relapse after 2 or more years of abstinence. The rates and predictors of late smoking relapse were estimated in 483 men who participated in a prospective study for up to 35 years. Subjects are participants in the VA Normative Aging Study, a prospective observational study of aging in men that began in 1963. Subjects are evaluated approximately every 3 years with physical examinations and questionnaires. Smoking, alcohol use, caffeine consumption, and socioeconomic variables were obtained by questionnaire, and weight and height were measured at clinical examinations every 3 years since 1963. Predictors of smoking relapse were identified using proportional hazards regression models. The rate of smoking relapse in the 2nd–6th years of abstinence fluctuated between 2 and 4% per year, and fell to less than 1% only after 10 years of abstinence. In multivariate regression models, coffee and alcohol consumption, and use of cigars or pipes significantly increased the risk of smoking relapse. A small risk of smoking relapse remains for at least 10 years after smoking cessation. Use of other tobacco products, coffee and alcohol increased the risk of late relapse. These findings may be useful in identifying those at highest risk for late relapse and for motivating former smokers to continue long-term abstinence.

Introduction

Many adult cigarette smokers try to quit at least once, but only half of the population who ever smoked report having successfully quit for more than a year or two (USDHHS, 1998). It is estimated that 60–90% of smokers who quit will relapse within 1 year (Garvey, Bliss, Hitchcock, Heinold, & Rosner, 1992; Mothersill, McDowell, & Rosser, 1988). Of those who remain abstinent for 1 year, the risk of relapse during the 2nd year after cessation has been estimated at 15% (Eisinger, 1971). Characteristics of persons who quit and remain

non-smokers for 1–2 years have been described in many different populations. Former smokers who are more likely to relapse are younger (Fiore *et al.*, 1990; Kirscht, Brock, & Hawthorne, 1987), have less education (Fiore *et al.*, 1990), are less health conscious (Kirscht *et al.*, 1987), had smoked more cigarettes (Garvey, Bosse, Glynn, & Rosner, 1983; Mothersill *et al.*, 1988), drink more alcohol (Garvey *et al.*, 1992; Zimmerman, Warheit, Ulbrich, & Auth, 1990), and have more friends or household members who also smoke (Matheny & Weatherman, 1998; Mermelstein, Cohen, Lichtenstein, Baer, & Kamarck, 1986). However, little is known about the risk of late smoking relapse, which may be defined as resuming smoking after 2 or more years of abstinence. Although the likelihood of relapse is assumed to decrease the longer one remains smoke-free, there are few studies that have followed former smokers long enough to estimate rates or determine predictors of late smoking relapse (Gilpin, Pierce, & Farkas, 1997). Studies of smoking and health outcomes indicate the benefits of quitting smoking on reducing the risk of pulmonary disease or tooth loss, for example, become apparent only after 2 or more years of abstinence, and the

Elizabeth A. Krall, PhD, Arthur J. Garvey, PhD, and Raul I. Garcia, DMD, Normative Aging Study, Massachusetts Veterans Epidemiology Research and Information Center, VA Boston Healthcare System, Boston, MA, USA; Elizabeth A. Krall and Raul I. Garcia, Department of Health Policy & Health Services Research, Boston University Goldman School of Dental Medicine, Boston, MA, USA; Arthur J. Garvey, Harvard School of Dental Medicine, USA.

Correspondence to: Elizabeth Krall, PhD, Department of Health Policy & Health Services Research, Boston University Goldman School of Dental Medicine, 715 Albany Street, Room B-324, Boston, MA 02118, USA. Tel: +1 (617)-638-6386; Fax: +1 (617)-638-6381; E-mail: kralle@bu.edu

disease risks do not decline to the level of non-smokers until a decade or more after quitting (Bosse, Sparrow, Rose, & Weiss, 1981; Krall, Dawson-Hughes, Garvey, & Garcia, 1997; LaCroix *et al.*, 1991). Such information could be useful for motivating some ex-smokers to continue long-term abstinence. The purposes of this analysis were (a) to estimate the rate of relapse after 2 or more years of abstinence, and (b) to identify social, demographic, and smoking behavior characteristics that are related to the risk of late smoking relapse in a cohort of men followed for more than three decades.

Methods

Subjects

The subjects in this analysis were men who participated in the VA Normative Aging Study (NAS), a closed-panel prospective study of aging that was begun in the 1960s and is still ongoing (Bell, Rose, & Damon, 1966). Subjects gave informed consent on forms approved by the Subcommittee on Human Studies of the VA Boston Healthcare System. At the study baseline, the NAS enrolled 2280 men between the ages of 21 and 84 years who were free of chronic disease and lived in the greater Boston metropolitan area. Participants return to the study site approximately every 3 years, at which time they receive comprehensive clinical examinations and complete questionnaires. While the majority of the participants are veterans, they are not patients of the VA healthcare system and receive medical care from private health care providers. The mean age of participants at baseline was 41 ± 8 years and in 1999 was 73 ± 7 years (range = 54–97 years). This analysis includes only those 483 men who were cigarette smokers at the NAS baseline but quit at a subsequent examination.

Measurements

Smoking history was obtained by an interviewer-administered questionnaire at the baseline examination. Data were collected about age at which the subject started smoking, current and maximum number of cigarettes per day, and use of cigars and pipes. At each subsequent examination, information on current status and dose of cigarettes, cigars and pipes was updated. Relapse was defined as a report of current cigarette use at one or more examinations following a report of having been a former smoker. In 1972 and 1976, study participants received mailed surveys that included additional questions on situations in which they smoked and reasons for quitting, if applicable. Subjects were asked to report the number of cigarettes smoked while having cocktails before dinner, during or after dinner when eating out or at home, and at mealtimes throughout the day. They were also asked if there were occasions when they smoked more than usual such as when drinking alcoholic beverages, when hungry, or at family functions.

Additional information collected at each examination included body weight and height, marital status, and alcohol and caffeine consumption. Body weight was measured on a beam balance and current height measured with a stadiometer. Body mass index (BMI) was computed as the ratio of weight to the square of height (kg/m^2). Marital status was categorized as currently married or not. Information on alcohol and caffeine consumption was obtained from items on the Cornell Medical Index (Broadman, Erdmann, Lorge, & Wolff, 1949). The respective questions were, *Do you usually take two or more alcoholic drinks a day?* and *Do you drink more than six cups of coffee or tea a day?* More detailed alcohol data were obtained from questionnaires mailed at four separate times between 1983 and 1991. Subjects reported the number of drinks of alcohol (from beer, wine, and distilled spirits) typically consumed each day in the year preceding each mailed questionnaire. One drink was assumed to be equivalent to 12 ounces of beer, 4 ounces of wine, or 1.5 ounces of distilled spirits. These detailed data were available for 350 men who smoked at the NAS baseline and were still active participants on these dates.

At the baseline examination, subjects reported their educational level and maximum adult weight prior to baseline. Education was dichotomized into completed college or not. Maximum body mass index was computed using baseline height and maximum adult weight.

Statistical analysis

T tests and χ^2 statistics were used to compare characteristics of men who relapsed to those who remained abstinent during follow-up.

Characteristics of men that predicted the risk of smoking relapse were identified by stepwise proportional hazards regression analysis (SAS, Cary, NC, USA). Proportional hazards analysis estimates the likelihood of an event (smoking relapse) when the final status of the event is known for some subjects but unknown (censored) for others because they were either lost to follow-up or there is a possibility that the event could yet occur after the last time point used in the analysis. Subjects who did not relapse before their last available examination contributed information for as long as they were observed. In the models, the dependent variable was the number of years abstinent before relapse or the last available examination. Years abstinent were computed as the length of time from the quit date to either the first examination they reported smoking again, or the last available examination if never relapsed. The date of relapse was not reported. When a subject relapsed, it was not detected until the following examination so the period of abstinence was assumed to end at the midpoint between examinations. Because the average time between examinations was almost 4 years, it was not feasible to accurately measure smoking relapse within a period of less than 2 years. Independent variables considered for inclusion in the model were the age smoking began; duration smoked prior to quitting;

Table 1.   Characteristics of 483 male cigarette smokers at baseline (1961–1970) and prior to relapse by relapse status (mean±SD or %)

Characteristic	Quit & relapsed	Quit & remained abstinent	p
n	93	390	
Age at baseline examination	40 ± 6	40 ± 8	0.35
Age started smoking (years)	18 ± 4	18 ± 4	0.97
Years smoked prior to quitting	31 ± 9	33 ± 10	0.17
Maximum number of cigarettes/day	33 ± 16	34 ± 17	0.88
Maximum body mass index prior to baseline (kg/m^2)	27.5 ± 3.1	27.1 ± 3.3	0.35
Gain in weight since quitting (kg/year)[a]	0.13 ± 1.17	0.18 ± 0.47	0.67
% subjects drink >6 cups coffee/day[a]	20%	9%	0.002
% subjects drink 2 or more alcoholic drinks/day[a]	32%	26%	0.24
% subjects drink 5 or more alcoholic drinks/day (n in subset)[b]	13% (75)	7% (275)	0.09
% subjects with college education	16%	23%	0.17
% married[a]	90%	85%	0.36
% smoke cigar or pipe[a]	23%	9%	0.001
% with another smoker in household[c]	47%	47%	0.98

p value for difference between groups, by t-test (continuous variables) or χ^2 test (categorical variables).
[a] Most recent value, at examination just prior to relapse or at last available examination (if not relapsed).
[b] Data first obtained in 1983.
[c] Data obtained in 1973.

maximum number of cigarettes smoked per day; baseline education; maximum BMI; change in weight after quitting smoking; presence of another smoker in the household; and most recent status of pipe/cigar use, marital status, and alcohol and coffee consumption from the Cornell Medical Index. Most recent status was defined as the status at the examination just prior to smoking relapse, or at the last available examination if never relapsed. Independent variables entered the models at $p<0.10$ and remained if the p values were less than 0.05.

The proportional hazards model was repeated in the subgroup of 350 men with detailed alcohol information, in which the cut point for the dichotomous alcohol consumption variable was set at five drinks per day.

Results

The 483 men included in this analysis had, on average, begun smoking at age 18, smoked for more than three decades before quitting, and smoked about 1.5 packs per day during their heaviest period of use (Table 1). Two per cent of the men were Black, and the largest ethnic group was of British or Irish ancestry (41%). A large proportion of the men was married, possibly a reflection of the NAS recruitment aim to enroll subjects with stable employment who were likely to remain in the Boston area for many years.

Ninety-three of the 483 men (19%) eventually relapsed after 2 or more years of abstinence (mean ± SD
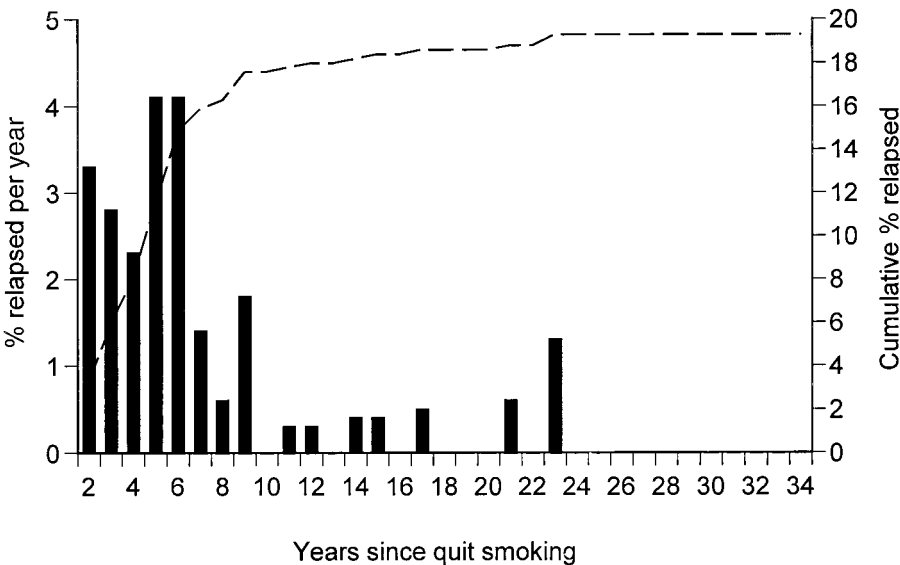

Figure 1.   Percentage of ex-smokers who relapse each year (bars) and cumulative percentage (line) after having been abstinent for at least 2 years. The total number of men is 483. Of these, 93 relapsed at some time during the study observation period. The numerator for each incidence rate is the number of men who relapsed in a given year and the denominator is the number of non-smokers followed in that year.

Table 2. Predictors of risk of late smoking relapse in men (n = 350)[a]

Predictor	Risk ratio and (95% confidence interval)
Smoke cigar or pipe[bc]	2.89 (1.64–5.09)
Coffee intake>6 cups/day[bcd]	2.33 (1.28–4.25)
Alcohol intake ≥5 drinks/day[ce]	2.08 (1.06–4.05)

[a] Results of stepwise proportional hazards regression. Variables are listed in the order in which they entered into the model. Variables that did not reach significance at $p<0.05$ were number of cigarettes per day, duration smoked, age started smoking, marital status at the most recent examination, change in weight since quitting, and presence of another smoker in household in 1973.
[b] Value at examination just prior to relapse or at last available examination (if not relapsed)
[c] Dichotomous variable, yes or no.
[d] From Cornell Medical Index
[e] From mailed questionnaires in 1983–1991. Mail questionnaire data were available on 350 men who were cigarette smokers at the NAS baseline.

years abstinent = 6 ± 4). Men who relapsed drank more coffee and tea, were more likely to smoke a pipe or cigar than men who remained abstinent (Table 1), and had a greater tendency to drink five or more alcoholic beverages per day. Ethnicity was not related to relapse status.

Figure 1 shows the annual incidence rates and cumulative percents of men who relapsed. Between the 2nd and 6th years post-cessation, 2–4% of the men relapsed each year. This rate fell to less than 2% per year between years 7 and 10. Only after 10 years did the annual percentage of men who relapsed decline to less than 1% and remain at that level. More than half of the men who relapsed did so after having been abstinent for 4 years.

In multivariate analysis in the total group of 483 men, factors that were significantly related to the risk of relapse were coffee consumption level (>six cups/day) and cigar or pipe smoking. Alcohol consumption as measured by the Cornell Medical Index (<2 vs. ≥2 drinks per day) was not significantly related to the risk of relapse. However, in the subset of 350 men who completed the expanded alcohol questionnaires, alcohol intake of five drinks or more per day was a significant predictor of smoking relapse, along with coffee consumption and cigar and pipe smoking (Table 2).

Additional smoking behaviors information obtained from the two mailed surveys were also examined by relapse status. There were no significant associations between relapse and tendency to smoke with cocktails, or other occasions when drinking alcohol, with meals, or at family occasions.

Of those former smokers who had already relapsed by 1976 when they completed the last mailed smoking questionnaire (n = 76), the most common reasons given for resumption of smoking were that they became too nervous or tense when not smoking (reported by 61% of men), felt they were addicted and could not stop (45%), missed the pleasure and taste (47%), and felt pressured by friends and family members who smoked (40%).

Discussion

Smoking relapse within the first year after quitting is estimated at 60–90%. The wide range of this estimate may reflect the variation in success between persons who quit on their own and those who enroll in smoking cessation programs. The risk of relapse becomes more remote as one makes it past 1 or 2 years of abstinence, but to our knowledge, few studies of long-term relapse rates have been conducted. Gilpin et al. (1997) reported that fewer than 10% of former smokers relapse after 4 years of continuous abstinence. We observed a similar pattern of relapse in our study cohort. A total of 9% of the men relapsed in years 2–4, and another 8% relapsed in years 5 and 6. Because of their decades-long participation in the NAS, these subjects may be more health-conscious and therefore at less risk of late relapse than the general population of older men.

This study also identified some characteristics of men who relapse two or more years after quitting cigarettes. These characteristics were: (1) use of cigars and pipes, and (2) high levels of coffee and alcohol intake. Although alcohol level as measured by the Cornell Medical Index (two or more drinks/day) was not significantly associated with increased smoking relapse in the total group of men, this consumption level is often regarded as moderate. In further analyses in the subset with more detailed alcohol data, alcohol use emerged as a predictor of smoking relapse when consumption reached the higher level of five or more drinks/day. The detailed alcohol consumption data were not available prior to 1983, but a previous analysis of this cohort indicates alcohol use by these men has been relatively stable since the study baseline (Glynn, Bouchard, LoCastro, & Laird, 1985). Our findings on alcohol are consistent with several previous studies that indicate heavy drinkers are less likely to quit smoking successfully than non-drinkers (Zimmerman et al., 1990) or lighter drinkers (Garvey et al., 1992). It is interesting that the relationship with alcohol appears more dependent on the amount of alcohol consumed than on the social situations in which it is consumed. We found that men who relapsed were as likely to have smoked while drinking cocktails or on other occasions when alcohol was consumed as those men who did not relapse. There are several possible explanations for these findings. Alcohol consumption is often accompanied by cues and temptations to smoke, and frequent exposure to these cues can erode the resolve to not smoke. With greater quantities of alcohol, there may also be a decrease in vigilance so that ex-smokers who drink are less able to resist the cues and temptation to smoke (O'Connell, Cook, Gerkovich, Potocky, & Swan, 1990; Tiffany, 1990). We also observed an

increased risk among men with high levels of coffee consumption, a habit that is strongly associated with cigarette use as well (Talcott, Poston, & Haddock, 1998). Interestingly, in a multivariate analysis, Swan *et al.* (1988) found no difference in alcohol or coffee consumption between male ex-smokers who abstained for at least 1 year and those who relapsed. Differences in characteristics of the study cohorts such as length of abstinence, motivation to quit smoking, and usual consumption levels of coffee and alcohol may contribute to the discrepant findings.

Smokers frequently gain weight after quitting (Bosse, Garvey, & Costa, 1980), and a high body mass has been associated with increased risk of relapse at 2 years in men (Nides *et al.*, 1995). In our cohort, we found no evidence to suggest that weight gain may have been a motivation for resuming smoking. The rate of weight gain in men who relapsed was not different than the rate in men who remained abstinent. Smoking relapse after 1 or 2 years of abstinence becomes less common with increasing age (Fiore *et al.*, 1990; Kirscht *et al.*, 1987), lighter cigarette use and shorter duration of smoking in some but not all studies (Fiore *et al.*, 1990; Garvey *et al.*, 1983; Gilpin *et al.*, 1997; Mothersill *et al.*, 1988). These factors were less important in predicting late relapse in our study cohort.

The strength of our study is the ability to measure changes in smoking behavior, physical measures, and other characteristics over a longer follow-up period than previously reported. Limitations of this study include the absence of information on number and length of brief periods of relapse that may have occurred between examinations, reliance on self-reported smoking information, and the fact that the study population consisted primarily of white males. It is unclear whether women have these low rates of late relapse. The risk of 1-year relapse does not appear to differ by sex (Garvey *et al.*, 1992). It is possible that late relapse rates will also be similar in women, but more data are needed to address this issue. In addition, there was no information on whether the men quit smoking without outside help, used nicotine replacement, or participated in group interventions. Finally, there may be other factors associated with smoking relapse that could not be measured ideally with this study design. For example, questionnaires administered every few years will miss acute episodes of stress that can precipitate relapse.

In summary, former cigarette smokers who remain abstinent for at least 2 years have a risk of relapse of 2–4% each year within the 2nd through 6th years, but this risk decreases to less than 1% annually after 10 years of abstinence. Predictors for late smoking relapse in this group of men were use of cigars and pipes, consumption of more than six cups of coffee per day, and consumption of five or more alcoholic drinks per day. The findings suggest that although efforts to keep recent quitters from relapse may have their greatest impact within the first 2 years after smoking cessation, smokers retain some risk of relapse for at least 10 years.

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