Letter

Predictors of Short-term Relapse after Successful Smoking Cessation among Patients Attending Smoking Cessation Clinics in China, 2019–2021: A Retrospective Cohort Study

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The Chinese government promotes smoking cessation through smoking cessation clinics (SCCs). This study aimed to identify factors associated with relapse and provide evidence to inform interventions that reduce relapse risk. Participants were SCC patients aged ≥ 18 years who enrolled between June 2019 and December 2021, completed follow-up assessments at one and three months, and reported abstinence at one month. Short-term relapse was defined as self-reported smoking at the three-month follow-up. Treatments included counseling, first-line cessation medications, and traditional Chinese medicine (TCM). Logistic regression was used to identify factors associated with short-term relapse. Among 10,724 eligible SCC patients, 11.6% experienced short-term relapse. Factors positively associated with relapse included the number of previous quit attempts (1–5 attempts: *OR* = 1.422, 95% *CI*: 1.254–1.613, > 5 attempts: *OR* = 1.382, 95% *CI*: 1.057–1.808), high perceived difficulty in quitting (*OR* = 1.297, 95% *CI*: 1.061–1.586), and moderate (*OR* = 1.383, 95% *CI*: 1.174–1.629) or weak (*OR* = 1.517, 95% *CI*: 1.251–1.841) willingness to quit. Factors negatively associated with relapse included having a college degree or higher (*OR* = 0.796; 95% *CI*: 0.650–0.973), high confidence in quitting (*OR* = 0.786; 95% *CI*: 0.629–0.983), and use of TCM (*OR* = 0.276; 95% *CI*: 0.158–0.482). Enhancing self-efficacy in quitting appears crucial for preventing short-term relapse. The use of TCM may reduce relapse risk and warrants further investigation.

Key words: Smoking cessation; Relapse; Predictors

In 2018, approximately 308 million people were smokers in China[1]. Because tobacco dependence is a chronic disease[2], quitting smoking requires professional support. The Chinese government launched a centrally subsidized tobacco control project in 2009, mandating each province to establish smoking cessation clinics (SCCs)[3]. This retrospective cohort study evaluated the short-term quitting rates of these clinics and identified relapse risk factors to provide insights for improving cessation efforts in China.

We conducted a retrospective cohort study among patients who successfully quit smoking after enrolling in SCCs between June 2019 and December 2021. The setting included 448 project hospitals across 29 of mainland China's 31 provinces (excluding Beijing and Qinghai owing to data limitations). In the SCCs, trained practitioners provided cessation interventions and conducted follow-up assessments over time. Patients aged ≥ 18 years who completed follow-up visits at one and three months and reported abstinence at the first follow-up were eligible.

Interventions for smoking cessation included counseling; counseling combined with first-line medications (varenicline, bupropion, or nicotine replacement therapy [NRT]); or counseling combined with traditional Chinese medicine (TCM), including Chinese herbal therapy and acupuncture. In accordance with clinical practice guidelines for smoking cessation, counseling followed the 5As model (Ask, Advise, Assess, Assist, and Arrange follow-up) and the 5Rs model (Relevance, Risks, Rewards, Roadblocks, and Repetition)[4]. Each counseling session lasted at least 10 minutes. Practitioners determined the treatment approach primarily based on the patient's level of nicotine dependence.

Smoking status was assessed by self-report at follow-up. Patients were considered abstinent if they answered "no" to either of the following questions, "Have you smoked since your first SCC visit?" or "Have you smoked in the past 7 days?" Short-term

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relapse was defined as patients who reported abstinence at the one-month follow-up but reported smoking at the three-month follow-up.

The Fagerström Test for Nicotine Dependence (FTND) was used to assess nicotine dependence. Self-efficacy for quitting smoking was evaluated by asking patients to rate their confidence in quitting, perceived importance of quitting, and perceived difficulty of quitting on scales from 1 (not at all) to 10 (extremely confident, important, or difficult, respectively). Willingness to quit was assessed based on the urgency with which patients wished to quit; the greater the urgency, the stronger the willingness. Inactive occupational status included students, retirees, and the unemployed.

Descriptive statistics were used to summarize demographic characteristics and tobacco use assessments. Continuous variables are presented as means and standard deviations (SDs), and categorical variables as frequencies and percentages. Comparisons were made using chi-square tests. Logistic regression was performed to identify factors associated with relapse. Variables that were significant in bivariate analyses were included in the regression model. *P*-values < 0.05 were considered statistically significant. Odds ratios (*OR*s) and two-sided 95% confidence intervals (*CI*s) were calculated for identified predictors. Data cleaning was performed using Python (version 3.7.11; Python Software Foundation, Fredericksburg, VA, US), and statistical analyses were conducted using SPSS (version 28; IBM Corporation, Armonk, NY, US). The study was approved by the Chinese Center for Disease Control and Prevention's Ethical Review Committee (ERC number 202214).

During the study period, 10,724 participants met the inclusion criteria and comprised the study cohort. The mean age was 51.0 ± 15.2 years; 95.9% were male; 69.8% had a high school education or less; 70.4% were in inactive occupational status; and 49.7% reported a monthly family income of 5,000 CNY (Chinese Yuan) or higher. The mean BMI was 23.2 ± 3.1. All participants were initially cigarette smokers; 59.6% had moderate or high nicotine dependence (FTND scores of 4 and above), and 42.2% had made at least one previous quit attempt.

In the study cohort, 15.2% of patients were prescribed first-line smoking cessation medications, with an average duration of use of 30 days; 4.2% used TCM.

The three-month relapse rate was 11.6% (1,241 patients). Table 1 presents the characteristics of participants by relapse status. Relapse was significantly associated with younger age, higher

Table 1. Baseline characteristics and relapse rates at three-month follow-up visits of SCC patients in China, 2019–2021

Characteristic	Total cohort *n* (%)	Relapsed *n* (%)	χ^2	*P* value
Overall relapse rate				
Demographic characteristics				
Age group (years)	10,724 (100)	1,241 (11.6)		
< 40	2,810 (26.2)	342 (12.2)	8.132	**0.017**
40–59	4,563 (42.6)	555 (12.2)		
≥ 60	3,351 (31.2)	344 (11.6)		
Sex				
Male	10,282 (95.9)	1,202 (11.7)	3.404	0.065
Female	442 (4.1)	39 (8.8)		
Educational status				
Primary school or below	2,597 (24.2)	282 (10.9)	7.350	**0.025**
High school	4,889 (45.6)	611 (12.5)		
College degree or above	3,238 (30.2)	349 (10.8)		
Occupational status				
Inactive	7,561 (70.5)	858 (11.3)	1.250	0.264
Active	3,164 (29.5)	383 (12.1)		

Continued

Characteristic	Total cohort *n* (%)	Relapsed *n* (%)	χ^2	*P* value
Family income/ month (CNY)				
< 5,000	4,557 (42.5)	486 (10.7)	6.731	**0.035**
≥ 5,000	5,334 (49.7)	658 (12.3)		
Don't know or won't say	833 (7.8)	97 (11.6)		
Body mass index group (kg/m^2)				
< 18.4 (underweight)	616 (5.7)	63 (10.2)	9.344	**0.025**
18.5–23.9 (normal)	5,929 (55.3)	648 (10.9)		
24.0–27.9 (overweight)	3,507 (32.7)	438 (12.5)		
≥ 28.0 (obese)	671 (6.3)	92 (13.7)		
Smoking status				
Nicotine dependence group (score)				
0–3 (low)	4,336 (40.4)	467 (10.8)	4.867	0.089
4–6 (moderate)	4,113 (38.4)	505 (12.3)		
≥ 7 (high)	2,275 (21.2)	269 (11.8)		
Number of previous quit attempts				
None	6,205 (57.9)	630 (10)	34.111	**< 0.001**
1–5	3,998 (37.3)	556 (13.7)		
> 5	521 (4.9)	70 (13.1)		
Motivation scores				
Importance of quitting				
0–3 (low)	284 (2.6)	33 (11.6)	2.31	0.315
4–6 (moderate)	1,525 (14.2)	194 (12.7)		
7–10 (high)	8,915 (83.1)	1014 (11.4)		
Confidence in quitting				
0–3 (low)	837 (7.8)	114 (13.6)	44.775	**< 0.001**
4–6 (moderate)	2,792 (26)	410 (14.7)		
7–10 (high)	7,095 (66.2)	717 (10.1)		
Difficulty in quitting				
0–3 (low)	1,406 (13.1)	128 (9.1)	10.565	**0.005**
4–6 (moderate)	3,049 (28.4)	351 (11.5)		
7–10 (high)	6,270 (58.5)	762 (12.2)		
Willingness to quit				
Within 7 days (strong)	8,282 (77.2)	867 (10.5)	43.521	**< 0.001**
Within 30 days (moderate)	1,428 (13.3)	215 (15.1)		
30 days later (weak)	1,014 (9.5)	159 (15.7)		
Interventions				
Counseling	8,644 (80.6)	991 (11.5)	47.092	**< 0.001**
TCM or other therapies & counseling	449 (4.2)	13 (2.9)		
First-line medications & counseling	1,631 (15.2)	237 (14.5)		

education, higher family income, higher BMI, at least one previous quit attempt, lower confidence in quitting, higher perceived difficulty in quitting, weaker willingness to quit, and use of medication.

Table 2 presents factors associated with relapse based on logistic regression analysis. Factors positively associated with three-month relapse included the number of previous quit attempts (1–5 attempts: *OR* = 1.422, 95% *CI*: 1.254–1.613; > 5 attempts: *OR* = 1.382, 95% *CI*: 1.057–1.808), high perceived difficulty in quitting (*OR* = 1.297, 95% *CI*: 1.061–1.586), and moderate (*OR* = 1.383, 95% *CI*: 1.174–1.629) or weak (*OR* = 1.517, 95% *CI* 1.251–1.841) willingness to quit. Patients aged ≥ 60 years (*OR* = 0.822, 95% *CI*: 0.648–0.987), those with a college degree or higher (*OR* = 0.796; 95% *CI*: 0.650–0.973), those with high confidence in quitting (*OR* = 0.786; 95% *CI*: 0.629–0.983), and those who used TCM therapy (*OR* = 0.276; 95% *CI*: 0.158–0.482) were less likely to relapse (Table 2).

In our 29-province study of over 10,000 smokers enrolled in SCCs in China between 2019 and 2021 who had successfully quit smoking by one month after enrollment, 11.6% relapsed by three months. Factors significantly associated with relapse included the number of previous quit attempts, self-perceived difficulty in quitting, and self-reported willingness to quit. Factors significantly associated with not relapsing were older age, higher educational attainment, greater confidence in quitting ability, and the use of TCM. These findings provide evidence supporting SCC-based cessation methods for preventing short-term relapse. The potential benefit of TCM in reducing relapse risk warrants further investigation.

The observed 11.6% short-term relapse rate is consistent with findings from international studies[5]. Definitions of relapse vary across the literature, as many trials assess abstinence over six months or longer. A meta-analysis reported one-year relapse rates ranging from 5% to 17%[6]. To improve comparability, future longitudinal research should adopt extended follow-up durations and standardized relapse assessment criteria.

Studies examining the relationship between past quit attempts and relapse have produced conflicting results. Lin et al. found that prior quitting experience was associated with a lower risk of relapse at six months[7], whereas other studies reported that multiple quit attempts increased relapse risk[8]. Our findings support the latter interpretation, suggesting that repeated unsuccessful attempts may undermine confidence and increase vulnerability to relapse.

Low self-efficacy is a well-documented predictor of smoking relapse. Individuals who doubt their ability to quit may perceive the process as more challenging than it actually is, which can increase stress and depressive symptoms and impair problem-solving. Our study corroborates these findings: patients who perceived quitting as highly difficult were more likely to relapse, whereas those with greater confidence were less likely to do so. This association may reflect the central role of self-efficacy in sustaining motivation and perseverance during the quitting process.

According to the behavior change model, smokers who plan to quit within 30 days are in the preparation stage, reflecting strong commitment to change[9]. In our study, weaker willingness to quit was associated with a higher likelihood of relapse, possibly due to insufficient motivation among patients with less urgent quitting intentions.

Optimal smoking cessation strategies typically combine behavioral counseling with first-line medications. However, our study found that neither approach (alone or in combination) significantly reduced relapse. While pharmacotherapy has shown mixed effects globally—reducing early relapse (*HR* = 0.71–0.84 at 2 weeks) but increasing later relapse risk (*HR* = 1.29–1.54 at 1–6 months)[10]—these patterns may reflect suboptimal treatment duration rather than true causality. Medications may temporarily suppress cravings without addressing underlying triggers, thereby increasing the risk of relapse after discontinuation.

Barriers such as high cost and lack of insurance coverage often result in abbreviated treatment. In our study, the average medication duration was only 30 days, considerably shorter than the 12-week course recommended by the World Health Organization. TCM use showed promise in reducing short-term relapse, although small sample sizes and limited supporting evidence prevent definitive conclusions. Continued use of TCM may reflect its accessibility in settings where first-line pharmacotherapies are limited or unavailable.

Older adults (≥ 60 years) and college-educated smokers were less likely to relapse, likely due to greater health awareness among older patients and higher cognitive capacity and treatment adherence among more educated patients.

A major strength of this study is its large sample size compared to earlier similar studies conducted in China. By including SCCs in 29 of the 31 provinces in mainland China, our study is reasonably nationally representative.

However, several limitations should be noted. First, the observational design precludes causal inference. Second, smoking and abstinence were self-reported without biochemical validation. Third,

Table 2. Factors associated with relapse at the three-month follow-up visit of SCC patients in China, 2019–2021

Predictor	*P* value	*OR* (95% *CI*)
Age group (years)		
< 40		1
40–59	0.551	0.954 (0.819–1.113)
≥ 60	**0.036**	0.822 (0.684–0.987)
Educational status		
Primary school or below		1
High school degree	0.589	1.045 (0.89–1.229)
College degree or above	**0.026**	0.796 (0.65–0.973)
Family income/ month (CNY)		
< 5,000		1
≥ 5,000	0.090	1.126 (0.981–1.292)
Don't know or won't say	0.565	1.072 (0.847–1.356)
BMI score group (kg/m^2)		
< 18.4 (underweight)		
18.5–23.9 (normal)	0.750	1.046 (0.793–1.379)
24.0–27.9 (overweight)	0.243	1.185 (0.891–1.575)
≥ 28.0 (obese)	0.171	1.275 (0.900–1.805)
Past-year quit attempts		
None		1
1–5 times	**< 0.001**	1.422 (1.254–1.613)
> 5 times	**0.018**	1.382 (1.057–1.808)
Confidence in quitting		
0–3 (low)		1
4–6 (moderate)	0.286	1.135 (0.899–1.432)
7–10 (high)	**0.035**	0.786 (0.629–0.983)
Difficulty in quitting		
0–3 (low)		1
4–6 (moderate)	0.246	1.139 (0.914–1.419)
7–10 (high)	**0.011**	1.297 (1.061–1.586)
Willingness to quit		
within 7 days (strong)		1
within 30 days (moderate)	**< 0.001**	1.383 (1.174–1.629)
30 days later (weak)	**< 0.001**	1.518 (1.251–1.841)
Intervention methods		
Counseling		1
TCM & counseling	**< 0.001**	0.276 (0.158–0.482)
First-line medications & counseling	0.071	1.159 (0.988–1.359)

the study assessed only short-term (three-month) relapse; longer-term follow-up is needed to evaluate sustained abstinence. Finally, due to higher smoking prevalence among men and greater social stigma toward female smokers, women are underrepresented in SCC populations, limiting generalizability.

In conclusion, patients' willingness to quit, confidence in their ability to quit, and adherence to treatment are critical factors for preventing relapse and achieving long-term cessation. Therefore, practitioners should prioritize psychological interventions that enhance self-efficacy and ensure adherence to standardized medication protocols, including the recommended treatment duration.

Competing Interests The authors declare that they have no conflict of interest.

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