Preplanned Studies

Real-World Treatment Adherence to Smoking Cessation Medications and Association with Treatment Outcome — 27 Centers, China, 2017–2022

Anqi Cheng[1]; Zhao Liu[1]; Xinmei Zhou[1]; Zheng Su[1]; Dan Xiao[1,#]; Chen Wang[2,3]; the China National Tobacco Cessation Cohort Study (CNTCCS) Study Group

Summary

What is already known about this topic?

Medication non-adherence significantly impedes smoking cessation efforts. While effective smoking cessation medications are accessible in China, real-world adherence and its correlation with treatment outcomes remain largely unexplored.

What is added by this report?

From December 2017 to January 2022, 1,120 participants were recruited from 27 centers in all seven geographical regions of China. Results revealed that only 38.2% of smokers adhered to the prescribed 12-week smoking cessation treatment and those with a higher education level were more likely to be adherent. In addition, smokers with good adherence were more likely to successfully quit smoking.

What are the implications for public health practice?

The data obtained could enhance our understanding of smoking cessation practices in China. Improving adherence is a crucial strategy to enhance the effectiveness of smoking cessation treatments and management provided to smokers.

Pharmacologic treatment is among the most effective tobacco cessation interventions, significantly enhancing the likelihood of quitting (*1*–*2*). However, medication non-adherence remains a substantial barrier, reducing smoking cessation rates in both clinical trials and real-world settings (*3*). In China, three types of licensed medications are available: nicotine replacement therapy (NRT), varenicline, and bupropion. Despite this, the relationship between treatment adherence to smoking cessation medications and treatment outcomes among Chinese smokers is largely unexplored. This study utilized data from the nationwide, multicenter China National Tobacco Cessation Cohort Study (CNTCCS) to assess real-world adherence to smoking cessation medications. The results revealed that only 38.2% of smokers adhered to medication treatment at the 12-week follow-up. Those with good adherence were significantly more likely to quit smoking [adjusted odds ratio (*OR*)=1.90, 95% confidence interval (*CI*): 1.46, 2.47, *P*<0.001]. Enhancing adherence is a crucial strategy to promote successful smoking cessation and reduce smoking prevalence.

The CNTCCS was conducted from December 2017 to January 2022 and is recognized as the first and largest cohort study on tobacco cessation in China (*4*). Potential smoking cessation centers were identified from a list of 366 clinics, compiled from a previous national survey on smoking cessation services. Inclusion criteria for the centers required the capability to provide smoking cessation medications and representation from all seven geographical regions of China. Ultimately, 27 centers were selected to participate (Supplementary Table S1, available at https://weekly.chinacdc.cn/). Recruitment was facilitated through posters displayed in each center. Eligibility criteria for participants included: 1) current smokers willing to quit, 2) aged 18–85 years, and 3) expired air carbon monoxide (CO) levels of at least 10 ppm. Exclusion criteria included severe cardiovascular or cerebrovascular diseases, neuropsychiatric disorders, significant liver or kidney impairment, severe psychiatric illnesses, pregnancy or breastfeeding, and allergies to cessation medications. All participants voluntarily joined the CNTCCS and provided informed consent.

All study physicians received standardized training. Following preliminary screenings, a baseline survey was conducted to gather information for each recruited participant. The collected data included demographic information (gender, age, ethnicity, education, marital status, and income), health-related characteristics (self-reported health status and comorbid diseases), tobacco-related characteristics [number of cigarettes smoked per day, duration of smoking, and results from the

Fagerstrom Test for Nicotine Dependence (FTND)] (*2*), and alcohol use. The Visual Analogue Scale was used to evaluate participants' self-awareness of the importance of quitting, self-confidence in quitting, and readiness to quit smoking, with scores of 1–3, 4–6, and 7–10 defined as weak, medium, and strong levels, respectively (*5*). Study physicians prescribed treatment regimens based on the China Clinical Guideline for Tobacco Cessation (2015 version) (*2*), considering current scientific evidence and the patient's preferences, especially for those with contraindications to medications due to specific comorbidities. All participants were advised to undergo 12 weeks of treatment and required to attend face-to-face visits at the study site at 1, 2, 4, 6, 9, 12, and 24 weeks after the treatment initiation. The follow-up questionnaire included self-reported information on smoking status and medication use. All data from each center were manually checked for completeness and accuracy by the research staff. An online Case Report Form (CRF) system, developed by the expert advisory panel, was used for data collection (https://jieyan.einmatrix.com).

The CNTCCS complied with all relevant ethical regulations and received approval from the Institutional Review Boards at all study centers. The clinical trial registration number is ChiCTR1800016919.

Adherence to smoking cessation treatment was defined as taking more than 80% of prescribed medication from baseline to the 12-week follow-up. Participants who did not meet this criterion were considered non-adherent (*5*–*6*). The primary outcome was adherence at 12 weeks. Secondary outcomes included adherence at 1, 2, 4, 6, and 9 weeks; CO-validated 7-day point abstinence rate at 1, 2, 4, 6, 9, and 12 weeks; and factors associated with adherence at 12 weeks. Statistical analyses were conducted using SPSS (version 19.0; SPSS, Inc., Armonk, NY, USA.). Categorical variables were presented as numbers (percentages), and the chi-square test was used for comparisons. Logistic regression analysis measured the relationship between potential influencing factors and adherence at 12 weeks, as well as between adherence and successful smoking cessation at 12 weeks, with *OR*s and 95% *CI*. A significance level of 0.05 (two-tailed) was used to define statistical significance.

A total of 2,943 participants with reliable data were recruited in the CNTCCS. Among them, 1,852 participants were prescribed smoking cessation medication. Of these, 742 participants were lost to follow-up, resulting in 1,120 participants included in this analysis. Baseline characteristics are summarized in Supplementary Table S2 (available at https://weekly.chinacdc.cn/). Overall, 94.5% of the participants were male, with an average age of 52.9±13.6 years. Additionally, 90.5% were married, 44.9% had a college education or higher, and 33.1% had a monthly income exceeding 6,000 Chinese Yuan (CNY). Regarding smoking behavior, 60.4% reported smoking more than 20 cigarettes per day, and 75.3% had smoked for at least 20 years. For nicotine dependence, 41.4% showed moderate dependence (FTND=3–6), and 25.6% showed severe dependence (FTND≥7). Of all participants analyzed, 40.4%, 51.5%, and 8.1% were treated with varenicline, bupropion, and NRT, respectively.

The adherence rate gradually decreased from 83.5% at the 1-week follow-up to 38.2% at the 12-week follow-up. This trend was observed across all three types of medications: in the varenicline group, adherence dropped from 85.5% at 1 week to 33.6% at 12 weeks; in the bupropion group, from 83.8% at 1 week to 45.1% at 12 weeks; and in the NRT group, from 72.1% at 1 week to 17.6% at 12 weeks (Figure 1A). Multivariable logistic regression analysis indicated that participants with higher education levels were significantly more likely to adhere to smoking cessation treatment (middle and high school: *OR*=2.73, 95% *CI*: 1.58, 4.72, *P*<0.001; college and higher: *OR*=3.47, 95% *CI*: 1.98, 6.09, *P*<0.001) compared to those with primary school education or less (Table 1).

The CO-validated 7-day point abstinence rates of participants who adhered to their medication regimen were consistently higher than those of non-adherent participants across all follow-up intervals: at 1 week, 29.7% *vs.* 20.8% (*P*=0.007); at 2 weeks, 45.4% *vs.* 23.2% (*P*<0.001); at 4 weeks, 50.4% *vs.* 33.3% (*P*<0.001); at 6 weeks, 64.8% *vs.* 37.3% (*P*<0.001); at 9 weeks, 62.8% *vs.* 50.9% (*P*<0.001); and at 12 weeks, 60.7% *vs.* 47.5% (*P*<0.001) (Figure 1B). After adjusting for variables such as gender, age, ethnicity, marital status, education, monthly income, self-reported health status, alcohol use, daily cigarette consumption, smoking duration, FTND score, perceived importance of quitting, self-confidence in quitting, readiness to quit, and the specific medication allocated, adherence to smoking cessation medication at 12 weeks was significantly associated with higher CO-validated 7-day point abstinence rates (*OR*=1.90, 95% *CI*: 1.46, 2.47, *P*<0.001). This significant association remained consistent across each specific

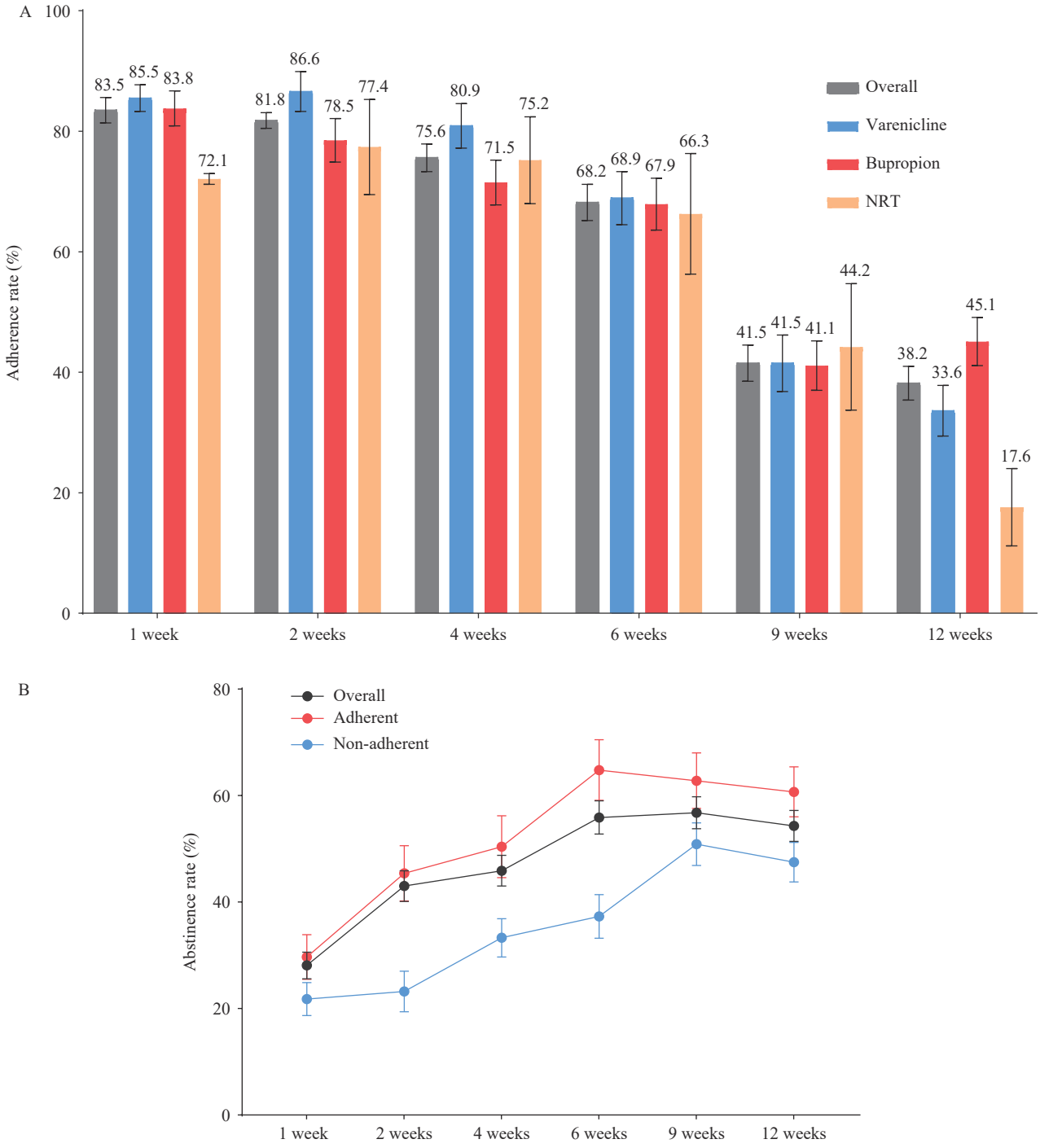

FIGURE 1. Participants' adherence rate and abstinence rate at different time points of smoking cessation treatment in 27 centers, China, 2017–2022. (A) Adherence rate, overall and stratified by medication used, at different time points. (B) Abstinence rates, overall and stratified by adherence group, at different time points.
Abbreviation: NRT=nicotine replacement therapy.

medication (Table 2).

Additionally, there was little difference in adherence rates before and after the coronavirus disease 2019 (COVID-19) lockdown period, except for 12-week adherence to varenicline (Table 3).

DISCUSSION

After 12 weeks of follow-up, only 38.2% of smokers adhered to the allocated smoking cessation medication. A higher adherence rate was observed among those

TABLE 1. Factors associated with medication adherence to smoking cessation treatment at 12-week follow-up in 27 centers, China, 2017–2022.

Characteristics	*N*	Adherent participants, *N* (%)	Adjusted *OR** (95% *CI*)	*P* value
Gender				
Women	62	27 (43.5)	1.00 (Ref.)	
Men	1,058	401 (37.9)	0.76 (0.45–1.31)	0.330
Age, years				
<40	248	89 (35.9)	1.00 (Ref.)	
40–49	196	74 (37.8)	1.18 (0.78–1.80)	0.431
50–59	289	119 (41.2)	1.20 (0.81–1.77)	0.376
60 and above	387	146 (37.7)	1.07 (0.72–1.57)	0.751
Ethnicity				
Others	61	17 (27.9)	1.00 (Ref.)	
Han	1,059	411 (38.8)	1.55 (0.96–2.82)	0.148
Marriage				
Single	83	32 (38.6)	1.00 (Ref.)	
Married	1,014	391 (38.6)	1.01 (0.60–1.69)	0.970
Separated/divorced/widowed	23	5 (21.7)	0.45 (0.15–1.42)	0.174
Education				
Primary school or below	95	19 (20.0)	1.00 (Ref.)	
Middle and high school	522	202 (38.7)	2.73 (1.58–4.72)	<0.001
College and higher	503	207 (41.2)	3.47 (1.98–6.09)	<0.001
Monthly income, CNY				
<1,000	50	17 (34.0)	1.00 (Ref.)	
1,000–2,999	215	84 (39.1)	1.19 (0.61–2.34)	0.605
3,000–5,999	485	211 (43.5)	1.42 (0.75–2.70)	0.281
6,000–9,999	244	69 (28.3)	0.74 (0.37–1.47)	0.389
>10,000	126	47 (37.3)	1.07 (0.51–3.49)	0.855
Self-reported health status				
Poor	220	83 (37.7)	1.00 (Ref.)	
Average	529	196 (37.1)	1.04 (0.65–1.65)	0.875
Good	371	149 (40.2)	1.03 (0.64–1.53)	0.907
Cardiovascular diseases at baseline				
No	999	385 (38.5)	1.00 (Ref.)	
Yes	121	43 (35.5)	0.99 (0.64–1.53)	0.957
Cancer at baseline				
No	1,067	409 (38.3)	1.00 (Ref.)	
Yes	53	19 (35.8)	1.11 (0.59–2.10)	0.740
Respiratory diseases at baseline				
No	770	295 (38.4)	1.00 (Ref.)	
Yes	350	133 (37.9)	0.93 (0.67–1.28)	0.650
Depression at baseline				
No	1,179	416 (38.6)	1.00 (Ref.)	
Yes	41	12 (29.3)	0.67 (0.18–2.46)	0.546

Continued

Characteristics	*N*	Adherent participants, *N* (%)	Adjusted *OR** (95% *CI*)	*P* value
Anxiety at baseline				
No	1,180	415 (38.4)	1.00 (Ref.)	
Yes	40	13 (32.5)	1.28 (0.78–1.30)	0.966
Alcohol use				
No	460	180 (39.1)	1.00 (Ref.)	
Yes	660	248 (37.6)	1.01 (0.78–1.30)	0.966
Cigarettes smoked per day				
1–9	51	18 (35.3)	1.00 (Ref.)	
10–19	392	160 (40.8)	1.14 (0.61–2.16)	0.690
20–29	502	193 (38.4)	0.99 (0.52–1.86)	0.963
30 and above	175	57 (32.6)	0.87 (0.44–1.74)	0.693
Smoking duration, year				
1–9	36	13 (36.1)	1.00 (Ref.)	
10–19	241	82 (34.0)	0.86 (0.40–1.84)	0.697
20–29	275	101 (36.7)	1.07 (0.50–2.27)	0.862
30 and above	568	232 (40.8)	1.44 (0.69–3.01)	0.336
FTND				
0−3	369	140 (37.9)	1.00 (Ref.)	
4–6	464	174 (37.5)	1.02 (0.75–1.37)	0.924
7 and above	287	114 (39.7)	1.13 (0.80–1.60)	0.498
Self-awareness of the importance of quitting				
Weak	146	57 (39.0)	1.00 (Ref.)	
Medium	325	112 (34.5)	1.16 (0.45–2.97)	0.759
Strong	645	256 (39.7)	1.35 (0.52–3.49)	0.537
Self-confidence in quitting				
Weak	154	60 (39.0)	1.00 (Ref.)	
Medium	407	138 (33.9)	1.07 (0.42–2.73)	0.896
Strong	555	227 (40.9)	1.37 (0.51–3.68)	0.529
Self-readiness in quitting				
Weak	163	66 (40.5)	1.00 (Ref.)	
Medium	335	115 (34.3)	0.58 (0.24–1.40)	0.225
Strong	618	244 (39.5)	0.55 (0.22–1.38)	0.550

Abbreviation: *OR*=odds ratio; *CI*=confidence interval; Ref.=reference; FTND=Fagerstrom Test for Nicotine Dependence; CNY=Chinese Yuan.

* Adjusted for gender, age, ethnicity, marital status, education, monthly income, self-reported health status, alcohol use, cigarettes smoked per day, smoking duration, FTND, self-awareness of the importance of quitting, self-confidence in quitting, and readiness to quit.

with higher education levels. Furthermore, medication adherence significantly impacted smoking cessation outcomes. These findings suggest that more intensive management of adherence to smoking cessation medication is essential to enhance the effectiveness of pharmaceutical interventions in smoking treatment practices.

In our study, 16.5% of participants were non-adherent to smoking cessation medication at the 1-week follow-up. This aligns with previous literature indicating that 20% of smokers who receive prescriptions for smoking cessation medication never fill them (*3*). This is concerning because initiation is a fundamental phase, and medication use during the first few weeks predicts the effectiveness of a full-course smoking cessation treatment (*6*). The American

TABLE 2. Association between participants' medication adherence to smoking cessation treatment and successful quitting at 12-week follow-up in 27 centers, China, 2017–2022.

Group	*N*	Abstinent participants, *N* (%)	adjusted *OR** (95% *CI*)	*P* value
Overall				
Non-adherent	692	329 (47.5)	1.00 (Ref.)	
Adherent	428	260 (60.7)	1.90 (1.46–2.47)	<0.001
Varenicline				
Non-adherent	300	165 (55.0)	1.00 (Ref.)	
Adherent	152	93 (61.2)	1.23 (1.06–1.55)	0.041
Bupropion				
Non-adherent	317	130 (41.0)	1.00 (Ref.)	
Adherent	260	158 (60.8)	2.45 (1.70–3.52)	<0.001
NRT				
Non-adherent	75	34 (45.3)	1.00 (Ref.)	
Adherent	16	9 (56.3)	1.67 (1.22–1.97)	0.026

Abbreviation: *OR*=odds ratio; *CI*=confidence interval; Ref.=reference; NRT=nicotine replacement therapy.
* Adjusted for gender, age, ethnicity, marriage, education, monthly income, self-reported health status, alcohol use, cigarettes smoked per day, smoking duration, Fagerstrom Test for Nicotine Dependence, self-awareness of the importance of quitting, self-confidence in quitting, and self-readiness in quitting, allocated medication.

TABLE 3. Participants' adherence rates at various time points during smoking cessation treatment, stratified by medication type and time period, across 27 centers in China from 2017 to 2022.

Medication	*n*	Adherence rate, %					
		1 week	2 weeks	4 weeks	6 weeks	9 weeks	12 weeks
Overall							
2017–2019	884	83.7	80.7	75.1	67.6	42.3	38.3
2020–2022	236	82.8	86.0	77.8	70.3	38.8	37.7
P value		0.721	0.061	0.410	0.452	0.357	0.858
Varenicline							
2017–2019	360	85.7	86.0	80.8	69.7	43.2	36.7
2020–2022	92	84.9	89.4	81.4	65.9	35.2	21.7
P value		0.839	0.389	0.888	0.490	0.178	0.007
Bupropion							
2017–2019	451	83.8	76.3	70.7	65.9	40.4	44.8
2020–2022	126	84.0	79.9	73.8	72.5	42.2	47.2
P value		0.933	0.919	0.767	0.113	0.802	0.638
NRT							
2017–2019	73	74.2	78.8	79.0	70.7	42.9	19.2
2020–2022	18	63.6	71.4	62.0	56.9	50.0	11.1
P value		0.325	0.468	0.078	0.111	0.626	0.421

Abbreviation: NRT=nicotine replacement therapy.

Thoracic Society's Clinical Practice Guideline recommends that health professionals counsel patients about the relative safety and efficacy of pharmacological therapies to promote adherence when treatment is initiated (*7*). Implementation is another critical phase of medication adherence. Our results indicated a decrease in adherence over time, with better adherence observed for participants using varenicline and bupropion at 12 weeks. This is consistent with previous studies in China. For NRT, the adherence rate is reported to be 16% (*8*), while for varenicline/bupropion, 48.5% of participants

demonstrated good adherence (*5*). The reasons for these adherence disparities across different medications may be attributed to several factors. Varenicline is highly efficacious, and bupropion is relatively inexpensive, both of which may promote continued use. Conversely, NRT, as an over-the-counter medication, is often limited in availability in most Chinese hospitals. Despite the convenience and popularity of e-commerce, there remains a mistrust of online medication purchases (*3*), contributing to non-adherence to prescribed NRT. The decline in adherence to varenicline following COVID-19 may also be due to its unavailability in 2021. Given the significant correlation between adherence and abstinence rates, improving the sustainable availability of medications is crucial for enhancing adherence and achieving better smoking cessation outcomes.

Non-adherence can be both intentional and unintentional, influenced by a person's motivations and capabilities. Intentional non-adherence primarily relates to perceptions of medication treatment, while unintentional non-adherence pertains to practical factors such as medication availability and affordability (*9*). Our study indicates that a higher education level is associated with better adherence, which is logical as education correlates with knowledge, beliefs, and socioeconomic status, thereby influencing adherence factors. Current interventions targeting increased medication adherence vary widely in content and characteristics (*10*). Further in-depth research is necessary to identify effective adherence interventions for Chinese smokers, particularly those with lower education levels.

To the best of our knowledge, CNTCCS is the first and largest cohort study on tobacco cessation in China, providing a comprehensive view of real-world adherence to smoking cessation medications.

However, this study has several limitations. First, adherence data were self-reported by participants, which may introduce bias. Second, the lost-contact rate was relatively high (nearly 40%), partially due to the COVID-19 pandemic. Third, there were relatively few participants using the NRT treatment regimen, potentially causing some bias in the results. Finally, although the 27 centers were selected to provide diverse inclusion across the country, they may not fully represent all smoking cessation centers in China.

In conclusion, although evidence-based smoking cessation interventions have been implemented, adherence to medication treatment among smokers in China remains low. Our results indicate that better adherence to medication is significantly associated with successful quitting. Therefore, it is necessary to develop effective strategies and policies to facilitate medication adherence, thereby enhancing the effectiveness of smoking cessation treatments.

Conflicts of interest: No conflicts of interest.

Acknowledgements: We thank all participants and supporters of China National Tobacco Cessation Cohort Study.

Funding: Chinese Academy of Medical Sciences (CAMS) Initiative for Innovative Medicine (CAMS 2021-I2M-1-010), Heilongjiang Province Scientific and Technological Research Project (2022ZXJ03C02), and National Key R&D Program of China (Grant No. 2017YFC1309400).

doi: 10.46234/ccdcw2024.100

[#] Corresponding author: Dan Xiao, danxiao@263.net.

[1] Department of Tobacco Control and Prevention of Respiratory Disease, Center of Respiratory Medicine, China-Japan Friendship Hospital; WHO Collaborating Center for Tobacco Cessation and Respiratory Diseases Prevention; National Center for Respiratory Medicine; National Clinical Research Center for Respiratory Diseases; Institute of Respiratory Medicine, Chinese Academy of Medical Sciences, Beijing, China; [2] Department of Pulmonary and Critical Care Medicine, Center of Respiratory Medicine, China-Japan Friendship Hospital; WHO Collaborating Center for Tobacco Cessation and Respiratory Diseases Prevention; China National Center for Respiratory Medicine; China National Clinical Research Center for Respiratory Diseases, Beijing, China; [3] Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing, China.

Submitted: April 26, 2023; Accepted: May 16, 2024

REFERENCES

1. Cahill K, Stevens S, Perera R, Lancaster T. Pharmacological interventions for smoking cessation: an overview and network meta-analysis. Cochrane Database Syst Rev 2013;2013(5):CD009329. https://doi.org/10.1002/14651858.CD009329.pub2.
2. National Health and Family Planning Commission of the People's Republic of China. Guideline on China clinical smoking cessation (2015). Chin J Health Manage 2016;10(2):88-95.http://dx.doi.org/10.3760/cma.j.issn.1674-0815.2016.02.003. (In Chinese).
3. Pacek LR, McClernon FJ, Bosworth HB. Adherence to pharmacological smoking cessation interventions: a literature review and synthesis of correlates and barriers. Nicotine Tob Res 2018;20(10):1163 – 72. https://doi.org/10.1093/ntr/ntx210.
4. Liu Z, Qin R, Hu XJ, Liu LJ, Xu SQ, Shi GC, et al. Real-world tobacco cessation practice in China: findings from the prospective, nationwide multicenter China National Tobacco Cessation Cohort Study (CNTCCS). Lancet Reg Health West Pac 2023;39:100826. https://doi.org/10.1016/j.lanwpc.2023.100826.
5. Qin R, Liu Z, Zhou XM, Cheng AQ, Cui ZY, Li JX, et al. Adherence and efficacy of smoking cessation treatment among patients with COPD in China. Int J Chron Obstruct Pulmon Dis 2021;16:1203 – 14. https://doi.org/10.2147/COPD.S301579.
6. Raupach T, Brown J, Herbec A, Brose L, West R. A systematic review of studies assessing the association between adherence to smoking cessation medication and treatment success. Addiction 2014;109(1):35 – 43. https://doi.org/10.1111/add.12319.

7. Leone FT, Zhang YQ, Evers-Casey S, Evins AE, Eakin MN, Fathi J, et al. Initiating pharmacologic treatment in tobacco-dependent adults. An official American thoracic society clinical practice guideline. Am J Respir Crit Care Med 2020;202(2):e5 – 31. https://doi.org/10.1164/rccm.202005-1982ST.
8. Lam TH, Abdullah ASM, Chan SSC, Hedley AJ, Hong Kong Council on Smoking and Health Smoking Cessation Health Centre (SCHC) Steering Group. Adherence to nicotine replacement therapy versus quitting smoking among Chinese smokers: a preliminary investigation. Psychopharmacology (Berl) 2005;177(4):400 – 8. https://doi.org/10.1007/s00213-004-1971-y.
9. Hollands GJ, Naughton F, Farley A, Lindson N, Aveyard P. Interventions to increase adherence to medications for tobacco dependence. Cochrane Database Syst Rev 2019;8(8):CD009164. https://doi.org/10.1002/14651858.CD009164.pub3.
10. Nieuwlaat R, Wilczynski N, Navarro T, Hobson N, Jeffery R, Keepanasseril A, et al. Interventions for enhancing medication adherence. Cochrane Database Syst Rev 2014;2014(11):CD000011. https://doi.org/10.1002/14651858.CD000011.pub4.

SUPPLEMENTARY MATERIAL

SUPPLEMENTARY TABLE S1. List of China National Tobacco Cessation Cohort Study Centers, China, 2017–2022.

No.	Name of study centers	Principal investigator	City
1	China-Japan Friendship Hospital	Dan Xiao	Beijing
2	The First Affiliated Hospital of China Medical University	Xuejun Hu	Shenyang
3	The First People's Hospital of Baiyin City	Lijun Liu	Baiyin
4	Tongji Hospital Affiliated to Tongji Medical College of Huazhong University of Science and Technology	Suqin Xu	Wuhan
5	Shanghai Ruijin Hospital	Guochao Shi	Shanghai
6	The First Affiliated Hospital of Harbin Medical University	Hong Zhou	Harbin
7	The First Affiliated Hospital of Guangxi Medical University	Jing Bai	Nanning
8	Beijing Luhe Hospital	Chunmei Zhang	Beijing
9	Henan Provincial People’s Hospital	Yong Qi	Zhengzhou
10	Beijing Hospital	Wei Zhou	Beijing
11	The People's Hospital of Nanping City	Shuhua Lan	Nanping
12	The Second Affiliated Hospital of Chongqing Medical University	Jin Tong	Chongqing
13	Shaanxi Hospital of Traditional Chinese Medicine	Tongsheng Su	Xi’an
14	The Affiliated Hospital of Qingdao University	Qiang Wang	Qingdao
15	The First Affiliated Hospital of Guangzhou Medical University	Xinyan Yang	Guangzhou
16	The People's Hospital of Inner Mongolia Autonomous Region	Dejun Sun	Hohhot
17	Hunan Provincial People’s Hospital	Liming Zhu	Changsha
18	The Second Affiliated Hospital of Fujian Medical University	Xiaoyang Chen	Quanzhou
19	The First Affiliated Hospital of Chongqing Medical University	Hong Chen	Chongqing
20	The First Affiliated Hospital of Wenzhou Medical University	Yupeng Xie	Wenzhou
21	The Third People’s Hospital of Datong City	Zhihua Xiao	Datong
22	The First Affiliated Hospital of Soochow University	Yanbin Chen	Suzhou
23	Shengjing Hospital Affiliated to China Medical University	Bo Zhao	Shenyang
24	The First Affiliated Hospital of Zhengzhou University	Qiuge Wu	Zhengzhou
25	The Affiliated Hospital of Chengde Medical College	Wenli Chen	Chengde
26	The First Hospital of Shanxi Medical University	Dongyan Li	Taiyuan
27	The Second Affiliated Hospital of China Medical University	Hongbo Liu	Shenyang

SUPPLEMENTARY TABLE S2. Baseline characteristics of study participants in 27 centers, China, 2017–2022.

Characteristics	Adherent group, *N* (%)	Non-adherent group, *N* (%)	Total, *N* (%)
Gender			
Men	401 (93.7)	657 (94.9)	1,058 (94.5)
Women	27 (6.3)	35 (5.1)	62 (5.5)
Age, years			
<40	89 (20.8)	159 (23.0)	248 (22.1)
40–49	74 (17.3)	122 (17.6)	196 (17.5)
50–59	119 (27.8)	170 (24.6)	289 (25.8)
60 and above	146 (34.1)	241 (34.8)	387 (34.6)
Mean (SD)	52.9 (13.8)	52.5 (13.7)	52.9 (13.6)
Ethnicity			
Han	411 (96.0)	648 (93.6)	1,059 (94.6)
Others	17 (4.0)	44 (6.4)	61 (5.4)
Marriage			
Single	32 (7.5)	51 (7.4)	83 (7.4)
Married	391 (91.4)	623 (90.0)	1,014 (90.5)
Separated/divorced/widowed	5 (1.2)	18 (2.6)	23 (2.1)
Education			
Primary school or less	19 (4.4)	76 (11.0)	95 (8.5)
Middle and high school	202 (47.2)	320 (46.2)	522 (46.6)
College and higher	207 (48.4)	296 (42.8)	503 (44.9)
Monthly income, CNY			
<1,000	17 (4.0)	33 (4.8)	50 (4.5)
1,000–2,999	84 (19.6)	131 (18.9)	215 (19.2)
3,000–5,999	211 (49.3)	274 (39.6)	485 (43.3)
6,000–9,999	69 (16.1)	175 (25.3)	244 (21.8)
>10,000	47 (11.0)	79 (11.4)	126 (11.3)
Self-reported health status			
Poor	83 (19.4)	137 (19.8)	220 (19.6)
Average	196 (45.8)	333 (48.1)	529 (47.2)
Good	149 (34.8)	222 (32.1)	371 (33.1)
Diseases at baseline			
Respiratory diseases	133 (31.1)	218 (31.5)	351 (31.5)
Cardiovascular diseases	43 (10.0)	78 (11.3)	121 (10.8)
Cancer	19 (4.4)	34 (4.9)	53 (4.7)
Other chronic diseases	79 (18.5)	131 (18.9)	210 (18.8)
Depression	12 (2.8)	29 (4.2)	41 (3.7)
Anxiety	13 (3.0)	27 (3.9)	40 (3.6)
Alcohol use			
Yes	180 (42.1)	280 (40.5)	460 (41.1)
No	248 (57.9)	412 (59.5)	660 (58.9)

Continued

Characteristics	Adherent group, *N* (%)	Non-adherent group, *N* (%)	Total, *N* (%)
Cigarettes smoked per day			
1–9	18 (4.2)	33 (4.8)	51 (4.6)
10–19	160 (37.4)	232 (33.5)	392 (35.0)
20–29	193 (45.1)	309 (44.7)	502 (44.8)
30 and above	57 (13.3)	118 (17.1)	175 (15.6)
Smoking duration, years			
1–9	13 (3.0)	23 (3.3)	36 (3.2)
10–19	82 (19.2)	159 (23.0)	241 (21.5)
20–29	101 (23.6)	174 (25.1)	275 (24.6)
30 and above	232 (54.2)	336 (48.6)	568 (50.7)
FTND			
0−3	140 (32.7)	229 (33.1)	369 (32.9)
4–6	174 (40.7)	390 (41.9)	464 (41.4)
7 and above	114 (26.6)	173 (25.0)	287 (25.6)
Self-awareness of the importance of quitting			
Week	57 (13.4)	89 (12.9)	146 (13.1)
Medium	112 (26.4)	213 (30.8)	325 (29.1)
Strong	256 (60.2)	389 (56.3)	645 (57.8)
Self-confidence in quitting			
Week	60 (14.1)	94 (13.6)	154 (13.8)
Medium	138 (32.5)	269 (38.9)	407 (36.5)
Strong	227 (53.4)	328 (47.5)	555 (49.7)
Self-readiness in quitting			
Week	66 (15.5)	97 (14.0)	163 (14.6)
Medium	115 (27.1)	220 (31.8)	335 (30.0)
Strong	244 (57.4)	374 (54.1)	618 (55.4)
Allocated medication			
Varenicline	152 (35.5)	300 (43.4)	452 (40.4)
Bupropion	260 (60.7)	317 (45.8)	577 (51.5)
NRT	16 (3.7)	75 (10.8)	91 (8.1)

Abbreviation: FTND=Fagerstrom Test for Nicotine Dependence; NRT=nicotine replacement therapy; SD=standard deviation; CNY=Chinese Yuan.