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This week's issue was organized by Guest Editor Lin Xiao.

Preplanned Studies

Utilization of Smoking Cessation Support Among Adults — 18 PLADs, China, 2020

Yongfu Yan¹; Bingliang Lin¹; Qingqing Xu¹; Huiyu Xie¹; Xinying Zeng¹;
Xinbo Di¹; Zida Meng¹; Lin Xiao¹; Shiwei Liu^{1,†}

Summary

What is already known about this topic?

In 2018, unassisted smoking cessation (USC) was the predominant method for quitting smoking among Chinese adult smokers, accounting for 90.1% of cases. The utilization of professional smoking cessation support was comparatively low in this population.

What is added by this report?

In 2020, the prevalence of USC methods increased to 93.1%. Concurrently, there was a slight increase in the utilization of pharmaceuticals (from 4.6% in 2018 to 5.5% in 2020) and counseling and quit line services (from 3.2% in 2018 to 7.5% in 2020). On the other hand, the use of e-cigarettes as a cessation aid decreased from 14.9% in 2018 to 9.8% in 2020. Smokers aged 15–24 years old were more likely to rely on pharmaceutical interventions (7.9%), and less likely to choose USC methods (79.0%).

What are the implications for public health practice?

The promotion of professional cessation support is essential for enhancing smoking cessation rates.

Smoking cessation is a crucial strategy in achieving the goal of a smoking prevalence rate below 20% as outlined in the Healthy China initiative (2019–2030)(1–2). However, in 2018, the proportion of current smokers in China who attempted to quit within the past 12 months was only 19.8%, significantly lower than the global average of 40% (3–4). Various smoking cessation support methods have been developed in China, such as smoking cessation medications, nicotine replacement therapy (NRT), smoking cessation clinics, traditional Chinese medicine therapies, and the quit smoking hotline (quit line) (3). Yet, limited studies have focused on the utilization of smoking cessation support in China. This study is the first to provide a comprehensive overview of smoking cessation and the utilization of smoking cessation support in China using the most recent data

from the 2020 National Adult Tobacco Survey (NATS). The results indicate that while utilization of professional cessation support has increased, unassisted smoking cessation (USC) remains the primary method. Thus, there remains a pressing need to implement more effective policies to promote professional cessation support.

The 2020 NATS is a cross-sectional survey that is provincially representative of adults aged 15 years and older in all 31 provincial-level administrative divisions (PLADs). A five-stage stratified cluster random sampling method was employed for each PLAD. In the first stage, five surveillance points (consisting of five districts for urban areas and five counties for rural areas) were selected from each PLAD using the probability proportional to size (PPS) sampling method. During the second stage, three subdistricts (referred to as “Jiedao” in Chinese) or townships were chosen from each surveillance point utilizing the PPS method. In the third stage, two communities or villages were selected from each subdistrict or township using the PPS method. In the fourth stage, 120 households were randomly chosen from each community or village. Finally, in the fifth stage, one person was randomly selected from each household to potentially complete the investigation as a participant.

In the 2020 NATS, a customized electronic survey system was employed. Strict data collection and quality control procedures were implemented throughout the research process. China CDC provided training for all investigators and quality control reviewers before initiating the study. A three-tiered quality control structure was established, consisting of county-level reviewers, provincial-level supervisors, and national-level staff. Informed consent was obtained from each participant before they were instructed to complete the questionnaire.

In this study, 18 PLADs across 7 regions in China were proportionally selected based on population size, including Tianjin and Shanxi from northern China; Heilongjiang and Liaoning from northeastern China;

Shanghai, Zhejiang, Anhui, and Fujian from eastern China; Henan and Hunan from central China; Guangdong and Guangxi from southern China; Guizhou, Yunnan, and Xizang (Tibet) from southwestern China; and Gansu, Ningxia, and Xinjiang from northwestern China. A total of 140,400 respondents participated in the survey.

Survey quality was assessed for each investigator, with issues identified in the corresponding questionnaires through several indicators. These indicators included household size (the proportion of one- and two-person families in a surveillance point being double or more than that of the PLAD), time taken by each respondent (with over 50% of smokers, ex-smokers, and never-smokers taking less than 8, 7, and 6 minutes, respectively), and the number of surveys conducted per day (the mean number of respondents exceeded 20 daily). All responses demonstrating poor survey quality were excluded from analysis. Ultimately, a dataset of 99,092 respondents was used for the final nationwide estimation.

In the study, smokers were identified using the following questions to determine their smoking status: “Do you currently smoke every day, occasionally, or not at all?” and “In the past, have you smoked every day, occasionally, or not at all?”. Respondents who currently smoke were categorized as current smokers, while those who previously smoked but no longer use tobacco were classified as ex-smokers. The study inquired about the utilization of smoking cessation support among current smokers who attempted to quit within the past 12 months and ex-smokers who quit within the same timeframe. The types of smoking cessation support examined included professional smoking cessation support (pharmaceuticals, such as smoking cessation medications or NRT, counseling, and quit lines, such as smoking cessation clinics or quit lines), e-cigarettes, USC, and other support methods (traditional Chinese medicine therapies, such as acupuncture or Chinese herbs, smokeless tobacco, etc.).

The overall smoking cessation rate was calculated, and participants were categorized based on gender, age, ethnicity, education level, occupation, annual household income, residential region, and e-cigarette use. All statistical analyses and figures were conducted using SAS (version 9.4; SAS Institute, Inc. Cary, NC, USA) and R (version 4.2.1; R Core Team, Vienna, Austria). Estimates were weighted by multiplying the base weight according to the complex design, non-response weight, and post-stratification weight. The

Rao-Scott chi-square test was utilized for bivariate analysis, and a two-sided P -value of <0.05 was considered statistically significant. Missing data were imputed using the random forest algorithm. Additionally, the use of smoking cessation support reported in the 2020 NATS was compared to that in the 2018 Global Adult Tobacco Survey (GATS)-China, adhering to the same definitions of relevant concepts (3).

In 2020, the smoking cessation rate in China was 19.1% (18.8% for males and 25.9% for females), with higher rates observed among smokers aged 65 and older (37.1%), of Han ethnicity (19.8%), in the retired population (40.2%), those with an annual household income of $\geq 100,000$ CNY (30.2%), eastern China residents (30.3%), and non-e-cigarette users (20.2%). Moreover, significant differences in smoking cessation rates among males were found across ethnicity ($P=0.006$), household income level ($P=0.009$), and e-cigarette use ($P<0.001$); however, no significant differences were observed in females (Supplementary Table S1, available in <https://weekly.chinacdc.cn/>).

In 2020, 20.2% of former smokers (20.7% for males and 10.6% for females) reported quitting smoking within the previous 12 months. A high proportion of this population consisted of occupational managers and professionals (56.7%), individuals with an annual household income of 50,000–99,999 CNY (25.9%), residents of eastern China (26.2%), and e-cigarette users (38.2%). Moreover, 34.7% of current smokers attempted to cease smoking within the prior 12 months. This was particularly true for smokers aged 15–24 years (60.2%) and those residing in northern China (44.5%) (Supplementary Table S2, available in <https://weekly.chinacdc.cn/>).

In 2020, 93.1% of smokers who reported smoking cessation in the past 12 months utilized USC. Among these individuals, USC was used by 96.7% of ex-smokers and 91.7% of current smokers. USC was notably more prevalent compared to other smoking cessation aids. From 2018 to 2020, usage of counseling and quit lines for smoking cessation increased from 3.2% to 7.5%, while e-cigarette use decreased from 14.9% to 9.8%. Among current smokers, the proportion that utilized counseling and quit lines rose from 3.2% in 2018 to 9.1% in 2020, while the proportion that employed e-cigarettes declined from 16.2% in 2018 to 12.0% in 2020 (Figure 1A).

For both males and females, the utilization of smoking cessation support increased from 2018 to 2020 in terms of pharmaceuticals, counseling, and quit

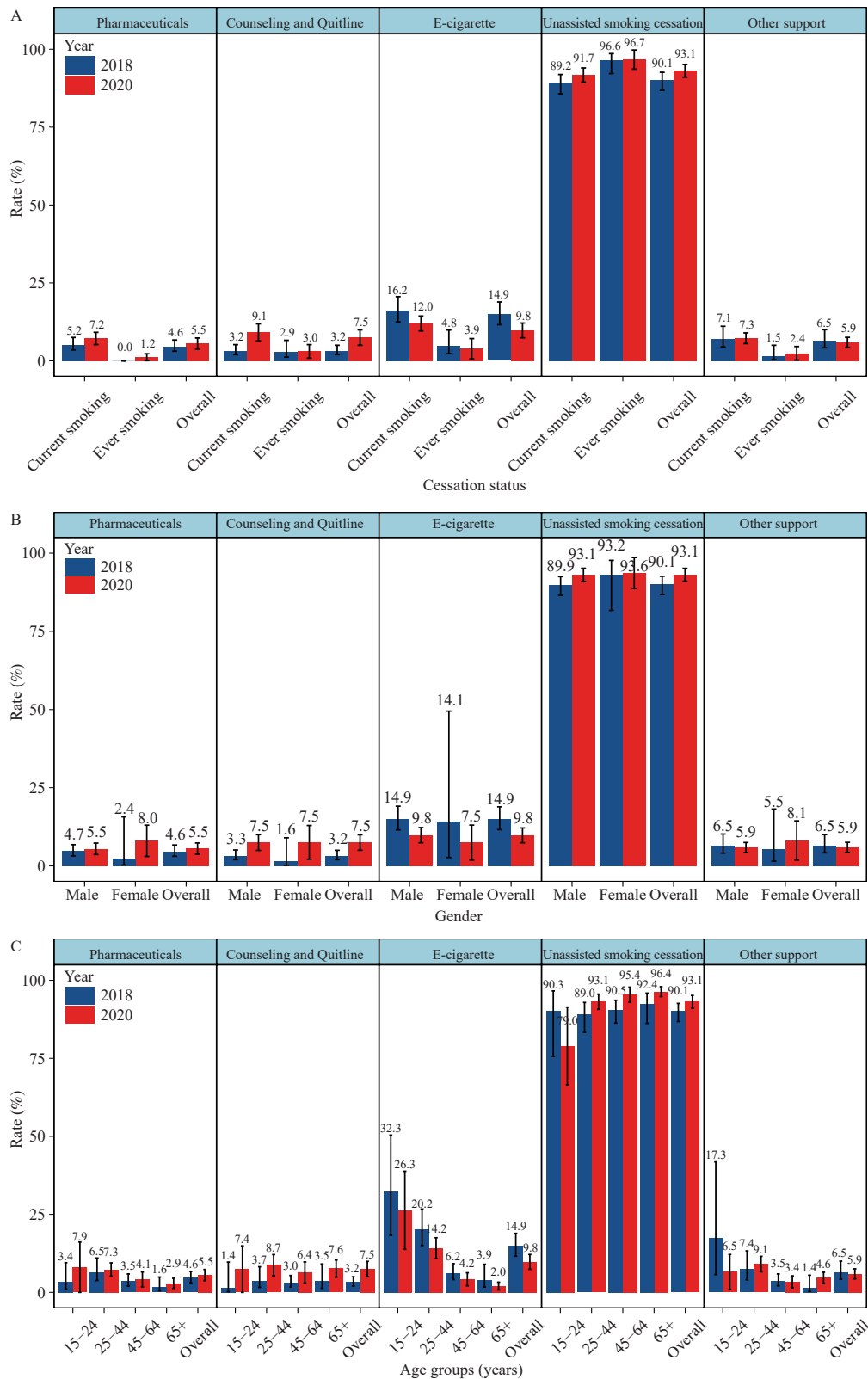


FIGURE 1. Cessation support utilization among current smokers who attempted to quit and recent ex-smokers, stratified by smoking status, gender and age group, in the past 12 months across 18 provincial-level administrative divisions of China, 2018–2020. (A) Cessation support utilization by smoking status. (B) Cessation support utilization by gender. (C) Cessation support utilization by age group.

lines. However, e-cigarette use decreased during the same period. Moreover, men increased their use of USC, while females exhibited a more substantial increase in quitting through other aids (Figure 1B). Additionally, e-cigarette use decreased across all age groups from 2018 to 2020, while pharmaceuticals, counseling, and quit line usage increased. Furthermore, younger individuals were more inclined to use e-cigarettes for smoking cessation. USC usage only decreased in the 15–24-year-old age group, while it increased in other age categories (Figure 1C).

Discussion

The findings of this study demonstrated that the smoking cessation rates for males and females were 18.8% and 25.9%, respectively. The various methods utilized for smoking cessation, such as the use of USC, pharmaceutical interventions, counseling and quit line services, and e-cigarettes, contributed to cessation rates of 93.1%, 5.5%, 7.5%, and 9.8%, respectively. It was observed that a majority of smokers did not pursue external professional support for cessation, and younger smokers exhibited a higher likelihood of quitting through the use of e-cigarettes.

The smoking cessation rate among male smokers employed as managers and professionals (23.9%) was substantially greater than that of their female counterparts (3.9%). This discrepancy may be attributable to the limited sample size of the female subpopulation. Additionally, female smokers in a predominantly male-oriented society may experience increased work pressure and exhibit a reduced inclination to stop smoking compared to male smokers.

The smoking cessation rates among smokers aged 15 years and older were found to be comparable between 2018 and 2020 (3). Female and older smokers demonstrated a higher likelihood of quitting smoking. These findings are in alignment with the results from a study conducted in 1998 and 2003 (5); however, they do not concur with the International Tobacco Control (ITC) China Survey conducted between 2006 and 2009 (6). As such, additional research is warranted to further investigate smoking cessation efforts in China.

The primary method for smoking cessation is USC (3,7), which may be attributed to several factors. First, smokers in China have limited access to cessation clinics. Due to the high cost of smoking cessation pharmaceuticals and their exclusion from the social security system (8), smokers are less likely to seek help

from healthcare professionals. Second, there may be a lack of awareness regarding available smoking cessation support in China, resulting in many smokers being unaware of how to access professional assistance. Third, the severe coronavirus disease 2019 epidemic in 2020 may have further restricted access to smoking cessation support and contributed to an increase in smokers (9).

In comparison to 2018, a greater number of smokers who encountered difficulties in quitting smoking sought assistance from smoking cessation clinics and hotlines in 2020, while the usage of e-cigarettes for cessation decreased. This trend may suggest an increased concern for professional support in smoking cessation and a preference for avoiding less effective cessation strategies (10). Additionally, changes in the use of smoking cessation support appeared to be similar between males and females; however, differences were observed across various age groups. Younger individuals demonstrated the highest usage of e-cigarettes and were more likely to utilize these devices as a cessation aid (10).

The study was subject to at least two limitations. First, the smoking cessation status was solely based on self-reported data from participants, which could introduce information bias and potential changes in smoking cessation status over time. Second, due to the repeated attempts by numerous smokers to access smoking cessation support, the definitive impact of such support on cessation outcomes could not be determined.

In conclusion, although progress has been made in smoking cessation efforts in China, there is a need for more effective policies to encourage smokers to quit and increase access to professional cessation support. Furthermore, the high prevalence of e-cigarette use as a smoking cessation aid among young adults warrants increased attention.

Conflicts of interest: No conflicts of interest.

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SUPPLEMENTARY TABLE S1. Sociodemographic characteristics of former and current smokers in the 18 provincial-level administrative divisions of China, 2020.

| Characteristic | Total | | | | | | Male | | | | | | Female | | | | | |
|-----------------------------|----------------------------------|------------------|------------------|----------------------------------|-------|------------------|----------------------------------|------------------|------------------|----------------------------------|-----|------------------|----------------------------------|-------------------|--|----------------------------------|--|-------|
| | Ex-smoker | | | Current smoker | | | Ex-smoker | | | Current smoker | | | Ex-smoker | | | Current smoker | | |
| | Unweighted, Weighted, % (95% CI) | | | Unweighted, Weighted, % (95% CI) | | | Unweighted, Weighted, % (95% CI) | | | Unweighted, Weighted, % (95% CI) | | | Unweighted, Weighted, % (95% CI) | | | Unweighted, Weighted, % (95% CI) | | |
| | n | | | n | | | n | | | n | | | n | | | n | | |
| Total | 5,903 | 19.1 (15.1–23.0) | 80.9 (77.0–84.9) | 22,675 | 543 | 95.0 (92.6–97.4) | 5,498 | 18.8 (14.7–22.9) | 81.2 (77.1–85.3) | 21,615 | 405 | 25.9 (20.5–31.3) | 1,060 | 74.1 (68.7–79.5) | | | | |
| Age group (years) | | | | | | | | | | | | | | | | | | |
| 15–24 | 43 | 5.0 (2.6–7.4) | 95.0 (92.6–97.4) | 543 | 33 | 4.2 (2.1–6.3) | 518 | 95.8 (93.7–97.9) | 115.89 | 518 | 10 | 19.6 (0.0–40.7) | 25 | 80.4 (59.3–100.0) | | | | 0.026 |
| 25–44 | 610 | 10.7 (6.6–14.8) | 89.3 (85.2–93.4) | 6,155 | 566 | 10.5 (6.3–14.7) | 5,978 | 89.5 (85.3–93.7) | | 5,978 | 44 | 17.9 (5.4–30.5) | 177 | 82.1 (69.5–94.6) | | | | |
| 45–64 | 2,389 | 21.6 (15.9–27.4) | 78.4 (72.6–84.1) | 11,050 | 2,265 | 21.6 (15.6–27.5) | 10,558 | 78.4 (72.5–84.4) | | 10,558 | 124 | 22.8 (17.8–27.8) | 492 | 77.2 (72.2–82.2) | | | | |
| 65+ | 2,861 | 37.1 (34.0–40.3) | 62.9 (59.7–66.0) | 4,927 | 2,634 | 36.9 (33.7–40.2) | 4,561 | 63.1 (59.8–66.3) | | 4,561 | 227 | 40.1 (32.8–47.5) | 366 | 59.9 (52.5–67.2) | | | | |
| Ethnicity | | | | | | | | | | | | | | | | | | |
| Han | 5,271 | 19.8 (15.5–24.2) | 80.2 (75.8–84.5) | 19,558 | 4,901 | 19.6 (15.1–24.1) | 18,607 | 80.4 (75.9–84.9) | 7.43 | 18,607 | 370 | 26.2 (20.0–32.4) | 951 | 73.8 (67.6–80.0) | | | | 0.679 |
| Minority | 632 | 13.8 (10.9–16.6) | 86.2 (83.4–89.1) | 3,117 | 597 | 13.4 (10.5–16.3) | 3,008 | 86.6 (83.7–89.5) | | 3,008 | 35 | 24.1 (16.7–31.6) | 109 | 75.9 (68.4–83.3) | | | | |
| Education | | | | | | | | | | | | | | | | | | |
| Junior high school or below | 4,393 | 18.3 (16.2–20.4) | 81.7 (79.6–83.8) | 16,323 | 4,057 | 18.0 (15.8–20.1) | 15,455 | 82.0 (79.9–84.2) | 1.54 | 15,455 | 336 | 26.1 (20.1–32.1) | 868 | 73.9 (67.9–79.9) | | | | 0.298 |
| High school | 903 | 18.5 (14.1–22.8) | 81.5 (77.2–85.9) | 3,745 | 852 | 18.1 (13.6–22.7) | 3,617 | 81.9 (77.3–86.4) | | 3,617 | 51 | 30.4 (19.8–40.9) | 128 | 69.6 (59.1–80.2) | | | | |
| Junior college or above | 607 | 23.3 (8.5–38.2) | 76.7 (61.8–91.5) | 2,607 | 589 | 23.5 (8.3–38.6) | 2,543 | 76.5 (61.4–91.7) | | 2,543 | 18 | 18.0 (6.7–29.2) | 64 | 82.0 (70.8–93.3) | | | | |
| Occupation | | | | | | | | | | | | | | | | | | |
| Managers and professionals | 233 | 23.2 (8.5–38.0) | 76.8 (62.0–91.5) | 1,129 | 230 | 23.9 (8.9–39.0) | 1,103 | 76.1 (61.0–91.1) | 68.74 | 1,103 | 3 | 3.9 (0.0–10.7) | 26 | 96.1 (89.3–100.0) | | | | 0.015 |
| Commerce and service | 2,844 | 17.2 (14.0–20.4) | 82.8 (79.6–86.0) | 13,066 | 2,703 | 17.0 (13.8–20.3) | 12,560 | 83.0 (79.7–86.2) | | 12,560 | 141 | 23.7 (19.1–28.2) | 506 | 76.3 (71.8–80.9) | | | | |
| Unemployment | 618 | 20.9 (17.8–24.1) | 79.1 (75.9–82.2) | 1,750 | 527 | 19.3 (16.1–22.5) | 1,593 | 80.7 (77.5–83.9) | | 1,593 | 91 | 34.2 (20.5–48.0) | 157 | 65.8 (52.0–79.5) | | | | |
| Retired | 1367 | 40.2 (29.9–50.5) | 59.8 (49.5–70.1) | 2,317 | 1,258 | 40.3 (29.4–51.3) | 2,130 | 59.7 (48.7–70.6) | | 2,130 | 109 | 38.1 (29.3–46.9) | 187 | 61.9 (53.1–70.7) | | | | |
| Other | 841 | 14.5 (11.8–17.2) | 85.5 (82.8–88.2) | 4,413 | 780 | 14.3 (11.6–17.0) | 4,229 | 85.7 (83.0–88.4) | | 4,229 | 61 | 19.6 (4.7–34.6) | 184 | 80.4 (65.4–95.3) | | | | |

TABLE S1. (Continued)

| Characteristic | Total | | | | | Male | | | | | Female | | | | |
|--------------------------------|--------------------|-------------------------|--------------------|-------------------------|------------------------|-----------|--------------------|-------------------------|--------------------|-------------------------|--------------------|-------------------------|--------------------|-------------------------|-------|
| | Ex-smoker | | Current smoker | | | Ex-smoker | | Current smoker | | | Ex-smoker | | Current smoker | | |
| | Unweighted, % n | Weighted, % (95% CI) | Unweighted, % n | Weighted, % (95% CI) | Rao-Scott, χ^2 | P | Unweighted, % n | Weighted, % (95% CI) | Unweighted, % n | Weighted, % (95% CI) | Unweighted, % n | Weighted, % (95% CI) | Unweighted, % n | Weighted, % (95% CI) | P |
| Annual household income in CNY | | | | | | | | | | | | | | | |
| <50,000 | 4,036 | 16.3 (14.3–18.3) | 15,878 | 83.7 (81.7–85.7) | 8.84 | 0.012 | 3,728 | 15.9 (13.9–17.9) | 15,062 | 84.1 (82.1–86.1) | 308 | 26.0 (21.0–31.0) | 816 | 74.0 (69.0–79.0) | 0.931 |
| 50,000–99,999 | 1,257 | 18.7 (16.4–21.0) | 4,570 | 81.3 (79.0–83.6) | | | 1,183 | 18.4 (16.1–20.8) | 4,397 | 81.6 (79.2–83.9) | 74 | 24.9 (12.4–37.3) | 173 | 75.1 (62.7–87.6) | |
| ≥100,000 | 610 | 30.2 (13.4–47.0) | 2,227 | 69.8 (53.0–86.6) | | | 587 | 30.3 (13.1–47.4) | 2,156 | 69.7 (52.6–86.9) | 23 | 28.1 (16.7–39.5) | 71 | 71.9 (60.5–83.3) | |
| Region | | | | | | | | | | | | | | | |
| Northern China | 966 | 13.5 (9.6–17.4) | 3,018 | 86.5 (82.6–90.4) | 106.39 | <0.001 | 833 | 13.0 (9.3–16.8) | 2,739 | 87.0 (83.2–90.7) | 133 | 25.3 (18.1–32.5) | 279 | 74.7 (67.5–81.9) | 0.001 |
| Northeastern China | 436 | 13.6 (10.7–16.6) | 2,824 | 86.4 (83.4–89.3) | | | 359 | 13.1 (9.8–16.3) | 2,505 | 86.9 (83.7–90.2) | 77 | 17.4 (11.6–23.2) | 319 | 82.6 (76.8–88.4) | |
| Eastern China | 1,836 | 30.3 (21.6–39.0) | 4,242 | 69.7 (61.0–78.4) | | | 1,778 | 30.2 (21.4–39.0) | 4,139 | 69.8 (61.0–78.6) | 58 | 34.9 (21.7–48.1) | 103 | 65.1 (51.9–78.3) | |
| Central China | 629 | 16.2 (11.8–20.7) | 2,432 | 83.8 (79.3–88.2) | | | 618 | 16.2 (11.7–20.6) | 2,370 | 83.8 (79.4–88.3) | 11 | 19.5 (8.4–30.5) | 62 | 80.5 (69.5–91.6) | |
| Southern China | 559 | 14.6 (11.6–17.7) | 2,522 | 85.4 (82.3–88.4) | | | 515 | 13.8 (11.0–16.6) | 2,467 | 86.2 (83.4–89.0) | 44 | 45.8 (27.7–63.9) | 55 | 54.2 (36.1–72.3) | |
| Southwestern China | 783 | 14.2 (11.4–17.1) | 3,962 | 85.8 (82.9–88.6) | | | 731 | 13.7 (10.8–16.6) | 3,802 | 86.3 (83.4–89.2) | 52 | 24.8 (17.8–31.9) | 160 | 75.2 (68.1–82.2) | |
| Northwestern China | 694 | 13.8 (9.9–17.8) | 3,675 | 86.2 (82.2–90.1) | | | 664 | 13.5 (9.6–17.3) | 3,593 | 86.5 (82.7–90.4) | 30 | 29.8 (16.2–43.3) | 82 | 70.2 (56.7–83.8) | |
| E-cigarette use | | | | | | | | | | | | | | | |
| Yes | 225 | 8.4 (6.2–10.5) | 2,044 | 91.6 (89.5–93.8) | 28.69 | <0.001 | 201 | 7.9 (5.8–10.0) | 1,960 | 92.1 (90.0–94.2) | 24 | 27.5 (14.5–40.4) | 84 | 72.5 (59.6–85.5) | 0.835 |
| No | 5,678 | 20.2 (15.9–24.5) | 20,631 | 79.8 (75.5–84.1) | | | 5,297 | 19.9 (15.5–24.4) | 19,655 | 80.1 (75.6–84.5) | 381 | 25.8 (19.9–31.7) | 976 | 74.2 (68.3–80.1) | |

Abbreviations: CNY=Chinese Yuan; CI=confidence interval.

SUPPLEMENTARY TABLE S2. Proportion of smoking cessation within the past 12 months among ex-smokers and proportion of attempted smoking cessation within the past 12 months among current smokers across 18 provincial-level administrative divisions in China, 2020.

| Characteristic | Ex-smokers | | Rao-Scott, χ^2 | P | Current smokers | | Rao-Scott, χ^2 | P |
|--------------------------------|---------------|----------------------|---------------------|--------|-----------------|----------------------|---------------------|--------|
| | Unweighted, n | Weighted, % (95% CI) | | | Unweighted, n | Weighted, % (95% CI) | | |
| Total | 843 | 20.2 (13.7–26.7) | | | 2,951 | 34.7 (30.8–38.7) | | |
| Gender | | | | | | | | |
| Male | 792 | 20.7 (14.0–27.4) | 11.02 | 0.001 | 2,811 | 34.8 (30.7–38.8) | 0.02 | 0.900 |
| Female | 51 | 10.6 (5.4–15.8) | | | 140 | 34.1 (24.7–43.5) | | |
| Age group (years) | | | | | | | | |
| 15–24 | 16 | 39.7 (15.4–64.0) | 6.87 | 0.076 | 100 | 60.2 (50.2–70.1) | 48.65 | <0.001 |
| 25–44 | 153 | 21.8 (10.2–33.4) | | | 930 | 37.1 (30.5–43.6) | | |
| 45–64 | 375 | 25.3 (10.1–40.5) | | | 1,371 | 29.6 (26.3–33.0) | | |
| 65+ | 299 | 10.1 (8.5–11.8) | | | 550 | 30.4 (27.0–33.8) | | |
| Ethnicity | | | | | | | | |
| Han | 750 | 20.6 (13.6–27.6) | 1.83 | 0.176 | 2,488 | 34.4 (30.1–38.7) | 0.49 | 0.485 |
| Minority | 93 | 16.1 (11.6–20.7) | | | 463 | 36.8 (30.6–43.1) | | |
| Education | | | | | | | | |
| Junior high school or below | 605 | 19.0 (10.4–27.5) | 3.41 | 0.182 | 1,975 | 33.7 (29.4–38.1) | 1.28 | 0.527 |
| High school | 139 | 33.9 (12.7–55.1) | | | 538 | 37.4 (33.5–41.3) | | |
| Junior college or above | 99 | 12.0 (0.1–23.9) | | | 438 | 36.5 (26.6–46.4) | | |
| Occupation | | | | | | | | |
| Managers and professionals | 34 | 56.7 (14.5–98.8) | 21.02 | <0.001 | 208 | 32.7 (20.0–45.5) | 6.13 | 0.189 |
| Commerce and service | 455 | 16.4 (12.2–20.6) | | | 1,621 | 34.7 (30.1–39.2) | | |
| Unemployment | 87 | 14.6 (10.9–18.3) | | | 285 | 42.1 (34.6–49.7) | | |
| Retired | 117 | 7.6 (3.9–11.4) | | | 258 | 26.1 (20.8–31.5) | | |
| Other | 150 | 31.7 (10.6–52.8) | | | 579 | 35.3 (28.8–41.8) | | |
| Annual household income in CNY | | | | | | | | |
| <50,000 | 574 | 15.1 (13.1–17.1) | 9.48 | 0.009 | 2,094 | 37.4 (33.2–41.6) | 5.78 | 0.055 |
| 50,000–99,999 | 169 | 25.9 (8.8–43.0) | | | 568 | 30.4 (23.2–37.5) | | |
| ≥100,000 | 100 | 25.5 (20.2–30.8) | | | 289 | 30.0 (22.7–37.4) | | |
| Region | | | | | | | | |
| Northern China | 109 | 15.0 (9.6–20.4) | 68.15 | <0.001 | 364 | 44.5 (28.5–60.5) | 25.89 | <0.001 |
| Northeastern China | 55 | 8.5 (2.9–14.0) | | | 255 | 29.8 (18.5–41.1) | | |
| Eastern China | 266 | 26.2 (16.0–36.3) | | | 452 | 23.7 (17.0–30.4) | | |
| Central China | 104 | 18.9 (14.9–23.0) | | | 333 | 41.5 (35.5–47.5) | | |
| Southern China | 94 | 17.5 (13.5–21.5) | | | 444 | 40.8 (35.4–46.2) | | |
| Southwestern China | 114 | 14.0 (10.0–18.0) | | | 581 | 34.5 (28.3–40.8) | | |
| Northwestern China | 101 | 12.5 (8.7–16.4) | | | 522 | 41.1 (35.1–47.2) | | |
| E-cigarettes use | | | | | | | | |
| Yes | 66 | 38.2 (24.6–51.7) | 5.18 | 0.023 | 473 | 37.2 (31.3–43.2) | 1.21 | 0.272 |
| No | 777 | 19.4 (12.5–26.4) | | | 2,478 | 34.2 (30.2–38.3) | | |

Abbreviation: CNY=Chinese Yuan; CI=confidence interval.

Preplanned Studies

Effectiveness and Acceptability of a Comprehensive Mobile Health-Based Modality for Smoking Cessation — Beijing Municipality, China, 2022

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Summary

What is already known on this topic?

Mobile health interventions have been demonstrated to be effective in aiding smoking cessation among smokers. Nevertheless, research on this topic remains limited in China.

What is added by this report?

Following two months of utilizing the services of a comprehensive mobile health (mHealth)-based modality (“Way to Quit” modality) which integrated three online interventions through the WeChat application, 29.1% of participating smokers successfully quit smoking. Participants who used a greater number of online services were more likely to cease smoking. All services were scored highly for satisfaction among smokers.

What are the implications for public health practice?

This study presents a practical and feasible method to assist Chinese smokers in quitting smoking. The results of this research suggest a promising direction for enhancing the accessibility and utilization of smoking cessation services. Additionally, these findings serve as a critical reference for addressing the obstacles faced by smoking cessation services in China.

China has a high prevalence of tobacco use, yet smoking cessation services are insufficient. However, mobile health (mHealth) can provide smoking cessation assistance. We developed and refined a comprehensive mHealth-based smoking cessation modality called the “Way to Quit” modality (WQ modality), comprising three interventions and using the WeChat app based on multiple behavior change theories. To assess the effectiveness and acceptability of the optimized WQ modality, we conducted a prospective cohort study from May to September 2022 in Beijing Municipality, China, as part of a large public

welfare program. Eligible smokers were recruited using online advertisements and received WQ modality-based interventions for two months, followed by phone or online follow-up at 1-month, 2-month, and 3-month. Usage data was downloaded from the WeChat platform for each service. We included 392 eligible participants who completed at least one follow-up in the final analysis. The self-reported 7-day point prevalence of abstinence (PPA) at 1-month, 2-month, and 3-month was 27.0%, 29.1%, and 22.7%, respectively. Participants who used more online services were more likely to quit smoking [using all services: adjusted odds ratio (OR)=9.08, 95% confidence interval (CI): 4.36–18.94, *P*-trend<0.001]. The satisfaction score for each service was on average 9 out of 10 points [interquartile range (IQR): 8–9]. This study provided an effective and accessible smoking cessation approach for Chinese smokers.

An initial study in western China discovered that the WQ modality was efficacious in encouraging smoking cessation (1). To augment the effectiveness of this modality, we further refined it by integrating various theories of behavior change, such as developing interventions that are matched to the stage of development and customized in the WeChat group, organizing guidance on utilizing the WeChat mini-program, and fortifying referrals between various services. In 2022, we implemented the optimized WQ modality in a public welfare program, namely the Online Quit Program — an online smoking cessation public welfare program designed for citizens of Beijing Municipality, China. The program aimed to provide cessation assistance to more than 500 smokers.

A prospective cohort study was carried out in Beijing Municipality from May to September 2022. Individuals who were current smokers, 18 years or older, planned to quit within a month, and possessed a WeChat account were eligible to participate. Recruitment took place from May 31 to June 6, 2022 through an online advertisement on the WeChat

official account. Individuals with mental and psychological illnesses were excluded.

Those who were interested in participating underwent a screening process by scanning a Quick Response code on the advertisement to determine eligibility. Online consent forms were provided for eligible individuals. Out of the 729 participants who underwent screening, 604 were found eligible. Among those eligible individuals, 112 did not complete the baseline survey, and 100 lost all three follow-ups; they were excluded. Ultimately, 392 eligible participants who completed the baseline survey and at least one follow-up were included in the final analysis. Approval for this study was granted by the Institutional Review Board of Beijing Chao-Yang Hospital, Capital Medical University (IRB# 2022-ke-394).

We provided two months of comprehensive cessation services to participants, based on the WQ modality. Participants who used any of the WQ modality services during the program were included in the exposed group, while those who did not use any WQ modality services were included in the non-exposed group. The WQ modality was developed based on three behavior change theories: the capability, opportunity, motivation, and behavior (COM-B) model (2), Transtheoretical Model (TTM) (3), Ecological Systems Theory (EST) (4), and clinical practice guideline (5). To integrate the WQ modality, we developed a WeChat mini program (QUIT WMP), a WeChat group (QUIT WG), and a WeChat official account (QUIT WOA). The QUIT WMP was designed to help smokers build their capacity to quit smoking and was based on behavior change techniques (BCTs) (6) and clinical guideline for smoking cessation

treatment (5). Detailed functions have been published elsewhere (7). Participants were encouraged to use the QUIT WMP at least five days per week. The QUIT WG provided real-time online counseling, stage-matched group interventions, and interactive activities to foster long-lasting and supportive relationships to promote smoking cessation. Weekly topics and examples of group interventions and interactive activities are provided in Table 1. Participants were divided into ten subgroups (30–40 per subgroup) to facilitate discussion. To promote interaction among smokers, ten participants were selected as team leaders. The QUIT WOA provided smoking cessation materials electronically and offered information about group interventions and interactive activities for smokers to download at their convenience. Additionally, smoking cessation physicians provided online professional counseling for at least one hour through WeChat group or Tencent video conferences every weekday during the program. Furthermore, a series of popular science lectures were conducted by eight smoking cessation experts once a week for two months. While the program did not provide any cessation medications to participants, they were free to use cessation medications or other smoking cessation methods in combination with the WQ modality-based interventions on their own.

The study collected baseline data through an online questionnaire, which included demographic characteristics, smoking and quitting history, and comorbidities. The Fagerström test for nicotine dependence (FTND) was used to measure nicotine dependence. Follow-up data were collected at 1-month, 2-month, and 3-month intervals after baseline,

TABLE 1. The weekly topics and examples of group interventions and interactive activities in the QUIT WeChat Group used in the Online Quit Program in Beijing Municipality, China, 2022.

| Week | Stage | Topic | Group intervention | Interactive activity |
|--------|-------------|--------------------------------------|--|--|
| Week 1 | Preparation | Motivating to quit | Health hazards of smoking and benefits of quitting smoking | Discussion: Why do I quit smoking? |
| Week 2 | Action | Setting a quit day | Facilitating a quit plan | Establishing a target date to quit smoking and publicly declaring the intention to quit within the online support community. |
| Week 3 | Action | Coping with craving | Skills to cope with smoking craving | Experience sharing: How did I cope with smoking craving? |
| Week 4 | Action | Developing the capacity for quitting | Effective methods for smoking cessation | Discussion: What are the barriers to quitting smoking for me? |
| Week 5 | Maintenance | Preventing relapse | How to prevent relapse | Experience sharing: My experience of relapse. |
| Week 6 | Maintenance | Establishing new habits. | How to establish a new habit | Experience sharing: My new habit to replace smoking. |
| Week 7 | Maintenance | Refusing the temptation of tobacco | Refuse the first cigarette | Discussion: How do I refuse cigarettes from others. |
| Week 8 | Maintenance | Benefits of quitting | Benefits of quitting | Sharing quitting achievement pictures in the online group. |

including changes in smoking behaviors, cessation service usage, and satisfaction with each service. Login information for QUIT WMP and messages sent to QUIT WG were downloaded from the WeChat app platform. The primary effectiveness outcome was self-reported 7-day PPA at the 2-month follow-up. This was defined as the proportion of smokers who reported abstaining from smoking for the past 7 days at the 2-month follow-up (8). Secondary effectiveness outcomes included self-reported 7-day PPA at the 1-month and 3-month follow-up, as well as self-reported quit attempt rates at 1-month, 2-month, and 3-month intervals. Participants' willingness to recommend online services to other smokers and their satisfaction scores of each service were used to assess the acceptability of the online service. All statistical analyses were performed using SPSS software (version 22.0; SPSS, Inc., Chicago, IL, USA). Descriptive statistics were presented as means (standard deviation, SD), medians (IQR), and proportions for continuous variables with normal distribution, variables without normal distribution, and categorical variables, respectively. Logistic regression was used to calculate *OR* and 95% *CI* for the relationship between cessation service use and self-reported 7-day PPA at the 2-month follow-up. Participants' smoking status at the last follow-up was determined to be continuous smoking. A significance level of 0.05 (two-tailed) was used to define statistical significance.

The study included 392 participants, the majority of whom were men (97.2%; $n=381$) with a median age of 41.3 ± 10.0 years. Most participants had a college degree or higher (81.6%; $n=320$) and 44.1% ($n=173$) had comorbid conditions. More than half of the participants had smoked for at least 20 years (57.9%; $n=227$), with 54.1% ($n=212$) smoking more than 20 cigarettes per day. Additionally, 63.0% ($n=247$) were moderately or severely dependent on nicotine (FTND score ≥ 4) and 61.22% ($n=240$) had attempted to quit smoking in the past. Willpower was the most commonly used cessation method (57.9%; $n=139$) among those who had attempted to quit in the past. The follow-up rates for the 1-month, 2-month, and 3-month follow-up were 53.8% ($n=211$), 77.8% ($n=305$), and 60.7% ($n=238$), respectively.

Based on usage data downloaded from the WeChat app platform, all participants adhered to the QUIT WOA and subsequently joined the QUIT WG, 60.7% (238/392) of participants registered for the QUIT WMP. Among these individuals, only 32.4% (77/238) used the QUIT WMP for more than 20 days while

25.5% (100/392) sent more than 30 messages in the QUIT WG. During the first month of the program, the median daily number of messages sent in the QUIT WG was 1,123 (IQR: 972, 1,451); however, this figure gradually decreased in the second and third months (2-month: Median, IQR=608, 485–651; 3-month: Median, IQR=357, 320–398).

The study assessed self-reported 7-day PPA at 1-month, 2-month, and 3-month post-baseline, as well as self-reported quit attempts. The results showed that 27.0%, 29.1%, and 22.7% reported 7-day PPA at 1-month, 2-month, and 3-month respectively, with an additional 25.0%, 28.8%, and 18.4% reporting quit attempts at those same time points. After controlling for covariates such as age, sex, education, occupation, and use of other cessation services, logistic regression analysis revealed that participants who used any services of the WQ modality were more likely to quit smoking after the intervention (*OR*=1.99, 95% *CI*: 1.15–3.44) compared to those who did not use online cessation services at 2-month follow-up. Furthermore, participants who used more online services were even more likely to quit smoking (using all three services: *OR*=9.08, 95% *CI*: 4.36–18.94, *P*-trend<0.001) (Table 2). The majority of smokers found the WQ modality-based services attractive (198/238, 83.2%) and would recommend it to other smokers (203/238, 85.3%). Participants also rated satisfaction with each service at 9 out of 10 (IQR: 8–9).

DISCUSSION

Following two months of utilizing WQ modality-based services, 29.1% of participants successfully quit smoking. Participants who used a greater number of online services were more likely to cease smoking. All services were scored highly for satisfaction among smokers. The optimized WQ modality was demonstrated to be an efficient, favorable, and convenient means of aiding smokers in quitting smoking. These results may offer promising resolutions to the struggle of delivering smoking cessation services in China.

The rate of abstinence in our study is similar to that found in real-world studies on quitlines and smoking cessation clinics in China. The abstinence rate on quitline was approximately 25% (9), and that of the smoking cessation clinic was about 30% (10). This finding indicates that mHealth-based cessation services can be used alongside traditional cessation services, especially in areas where cessation resources are limited.

TABLE 2. Association between using the WQ-based services and participants' self-reported 7-day quitting at 2-month follow-up in the Online Quit Program in Beijing Municipality, China, 2022.

| Interventions | <i>n</i> | % | 7-day PPA <i>n</i> (%) | adjusted <i>OR</i> * (95% <i>CI</i>) | <i>P</i> |
|---|----------|-------|------------------------|---------------------------------------|----------|
| Used services | | | | | |
| No (Ref.) | 109 | 27.81 | 21 (19.27) | 1.00 | |
| Yes | 283 | 72.19 | 93 (32.86) | 1.99 (1.15–3.44) | 0.014 |
| Number of services | | | | | |
| None (Ref.) | 109 | 27.81 | 21 (19.27) | 1.00 | |
| Used any 1 | 175 | 44.64 | 29 (16.57) | 0.81 (0.43–1.52) | 0.508 |
| Used any 2 | 45 | 11.48 | 21 (46.67) | 3.68 (1.70–7.94) | 0.001 |
| Used all 3 | 63 | 16.07 | 43 (68.25) | 9.08 (4.36–18.94) | <0.001 |
| <i>P</i> -trend | | | | | <0.001 |
| Different combinations of two or more services [†] | | | | | |
| None (Ref.) | 109 | 27.81 | 21 (19.27) | 1.00 | |
| WOA [§] +WMP [¶] | 13 | 3.32 | 7 (53.85) | 5.60 (1.65–19.07) | 0.006 |
| WOA+WG ^{**} | 31 | 7.91 | 13 (41.94) | 2.77 (1.14–6.70) | 0.024 |
| WOA+WMP+WG | 63 | 16.07 | 43 (68.25) | 8.68 (4.15–18.17) | <0.001 |
| <i>P</i> -trend | | | | | <0.001 |

Abbreviation: 7-day PPA=7-day point prevalence of abstinence; *OR*=odds ratio; *CI*=confidence interval; WOA=WeChat official account; WMP=WeChat mini program; WG=WeChat Group.

* Adjusted for age, sex, education level, and occupation, as well as incorporating additional interventions such as counseling in smoking cessation clinics and using cessation medications or electronic cigarettes.

[†] Only one participant used WMP+WG, and he was not included in this analysis section.

[§] Self-reported use of QUIT WOA during the program at the 2-month follow-up;

[¶] Used the QUIT WMP for more than 20 days from baseline to the 2-month follow-up according to the usage data obtained from the WeChat app platform.

^{**} Sent more than 30 messages to the QUIT WG from baseline to the 2-month follow-up according to the usage data obtained from the WeChat app platform.

Several reasons could account for the positive impact of the WQ modality. First, the WQ modality was developed using behavior change theories (2–4) and clinical practice guideline (5), which ensured that the smoking cessation interventions offered were evidence-based, stage-matched, and personalized. Second, the WQ modality integrated three mHealth-based smoking cessation interventions into one platform, which could lead to increased intervention intensity and improved access to multiple cessation services. Furthermore, the Online Quit Program was part of the 2022 World No Tobacco Day, and the media conducted extensive campaigns on smoking hazards and quitting smoking during this period, which likely boosted participants' motivation and confidence to quit smoking.

The study found the optimized WQ modality to be acceptable. Within just one week of recruitment, over 700 smokers registered through online advertisements on the WeChat app. Participants expressed satisfaction with the services, finding the WQ modality attractive and indicating a willingness to recommend it to other

smokers. This may be attributed to the fact that the WQ modality is based on the WeChat app, which is the most popular app in China and more user-friendly. Moreover, the WQ modality enabled participants to access real-time online professional smoking cessation assistance without being limited by time or location, removing barriers to accessing cessation services. Additionally, the WQ modality enabled the professional smoking cessation team to treat hundreds of smokers simultaneously, thereby improving treatment efficiency and expanding services to reach more smokers.

The present study has some limitations. First, our evaluation of the optimized WQ modality was conducted in a prospective cohort study rather than a randomized controlled trial (RCT). Therefore, our conclusions are not definitive. Second, the cessation status information relied on self-reporting, which was not biochemically validated, leading to potential measurement bias. Finally, the study provided a relatively brief two-month intervention for smoking cessation, so the effectiveness of the comprehensive

online interventions for the long-term needs to be further determined by RCT design over at least a one-year follow-up period.

The study findings suggest that utilizing the optimized WQ modality can assist with short-term smoking cessation and is acceptable to the general population. Moreover, it has the potential to attain comprehensive coverage. To further promote the success of this modality and achieve the smoking cessation goal set by Healthy China 2030, there is a need to develop a standardized online smoking cessation intervention toolkit in the near future. This toolkit would enable nationwide dissemination of the WQ modality.

Conflicts of interest: No conflicts of interest.

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Preplanned Studies

Evaluation of Smoking Cessation Intervention Effectiveness in Smoking Cessation Clinics — China, 2019–2021

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Summary

What is already known about this topic?

Since 2014, the Chinese government has advocated for the development of smoking cessation clinics (SCCs) within each provincial-level administrative division (PLAD).

What is added by this report?

In the 2019–2021 period, the self-reported 7-day point prevalence of abstinence rates (PPARs) at 1-month and 3-month follow-up were 26.2% and 23.5%, respectively.

What are the implications for public health practice?

The interventions implemented by SCCs in this investigation proved to be successful. It is imperative to employ extensive tobacco control strategies in order to enhance the motivation of smokers to seek assistance for cessation from SCCs.

In 2018, more than 308 million adults were current smokers in China (1). Quitting smoking has been associated with reduced risks of tobacco-related diseases, premature death, and improved quality of life (2). However, due to its nature as a chronic disease, tobacco dependence is often considered difficult to overcome solely through personal willpower (3). Substantial evidence suggests that interventions from healthcare providers can significantly increase the chances of abstinence from smoking (4). In 2018, a data management platform for smoking cessation clinics (SCCs) was developed. This study examined data from 448 SCCs obtained from the platform between 2019 and 2021 to evaluate the effectiveness of smoking cessation interventions. The China CDC Institutional Review Board approved the study. The findings showed that the patient self-reported 7-day point prevalence of abstinence rates (PPARs) at 1-month and 3-month follow-ups were 26.2% and 23.5%, respectively. It indicates that interventions provided by SCCs in this study were effective. Comprehensive tobacco control measures should be

implemented to increase the willingness of smokers to seek support for quitting in SCCs.

The data collected from patients who visited the clinics for the first time and received follow-up care at 1 month and 3 months after the initial visit encompassed demographic characteristics, smoking status, and other factors. Eligibility criteria for patient participation included: 1) a current smoker at the time of the first clinic visit, and 2) at least 18 years old. Interventions for smoking cessation, provided by trained practitioners in the SCCs, consisted of counseling, counseling combined with first-line medications [including varenicline, bupropion, and nicotine replacement therapy (NRT)] (5), or counseling combined with traditional Chinese medicine (TCM, including acupuncture, ear acupuncture, and Chinese herbal). Generally, physicians recommended medication options to all smokers, particularly those with severe nicotine dependence (except for pregnant women), however, the final decision regarding the use of cessation medications was left to the patients.

Counseling services were delivered in adherence to the established clinical practice guidelines of smoking cessation (3,5), incorporating the use of the 5A's model (Ask, Advise, Assess, Assist, and Arrange follow-up) in clinical interviews, and encouraging behavior modifications for cessation utilizing the 5R's model (Relevance, Risks, Rewards, Roadblocks, and Repetition) techniques. The recommended duration for each counseling session was ≥ 10 minutes (6).

Smoking status was assessed through self-report measures. At the 1-month and 3-month follow-up assessments, patients were asked to report their smoking status by answering the question, "Have you smoked within the past 7 days?" Those who responded "no" were categorized as abstinent. Individuals lost to follow-up were presumed to be smokers. Inactive occupational status included patients who were students, retired, unemployed, and so on. The Fagerstrom Test for Nicotine Dependence (FTND) was utilized to measure nicotine dependence. Data were cleaned using Python (version 3.7.11, Python

Software Foundation, Fredericksburg, VA, US) and analyzed with SPSS (version 22, IBM Corporation, Armonk, US). The chi-squared test was employed to examine differences in categorical variables, and a logistic regression model was applied to investigate factors associated with abstinence at the 3-month follow-up. A *P*-value of less than 0.05 was deemed statistically significant in the analyses.

Between 2019 and 2021, a total of 59,239 patients visited 448 SCCs located across 29 provincial-level administrative divisions (PLADs). The average number of clinical visits at each SCC was 45, 71, and 73 for each of the 3 years, respectively. Follow-up rates at 1-month and 3-month intervals were 69.1% and 50.6%, respectively. The sociodemographic characteristics of the patients are presented in Table 1. The average age of patients was 50.5±14.9 years. Among the participants, 96.5% were male, 28.6% held a college degree, and 68.5% were not currently employed. Furthermore, 46.0% of the patients reported a monthly family income of 5,000 Chinese Yuan (CNY) or higher as shown in Table 1.

In terms of smoking behaviors, the average number of cigarettes smoked per day was 18.5±11.3, 79.2% of the patients smoked fewer than 20 cigarettes per day, 62.4% had moderate or high nicotine dependence (with FTND scores of 4 or higher). The average duration of smoking was 24.3±13.8 years. 70.2% of SCCs were equipped with exhaled carbon monoxide (ECO) detectors. Only 36.2% of the patients underwent ECO testing, and a mere 12.5% received a

combination of first-line smoking cessation medications alongside behavioral counseling (Table 1).

The self-reported 7-day PPARs at 1-month and 3-month follow-up were 26.2% and 23.5%, respectively. PPARs significantly varied by intervention methods (*P*<0.001). Patients with higher PPARs were identified among those who were: 60 years old or above, female, holding a college degree, not actively working, having a higher family income, exhibiting low nicotine dependence, possessing a stronger willingness to quit, having undergone ECO testing, and receiving intervention with first-line medications (*P*<0.05) (Table 1).

The logistic regression analysis indicated that factors predicting abstinence at the 3-month follow-up included being 40–59 years old (*OR*=1.066; 95% *CI*: 1.014–1.122), being 60 years old or older (*OR*=1.306; 95% *CI*: 1.230–1.387), female gender (*OR*=1.184; 95% *CI*: 1.069–1.312), having a high school education (*OR*=1.062; 95% *CI*: 1.008–1.119), having a college degree or higher (*OR*=1.083; 95% *CI*: 1.015–1.155), a monthly family income of at least 5,000 CNY (*OR*=1.089; 95% *CI*: 1.042–1.138), a higher ECO test score (*OR*=1.397; 95% *CI*: 1.342–1.455), and receiving a combination intervention of first-line medication and counseling (*OR*=1.119; 95% *CI*: 1.056–1.187). Patients with an active occupation (*OR*=0.924; 95% *CI*: 0.885–0.966), moderate nicotine dependence (*OR*=0.824; 95% *CI*: 0.788–0.861), high nicotine dependence (*OR*=0.732; 95% *CI*: 0.694–0.772), planning to quit within 30 days

TABLE 1. Baseline characteristics and abstinence rates at 1- and 3-month follow-ups of patients visiting SCCs — China, 2019–2021.

| Characteristic | Sample | PPAR at 1-month | | | PPAR at 3-month | | |
|-----------------------------|----------------|-----------------|----------|----------------|-----------------|----------|----------------|
| | <i>n</i> (%) | % | χ^2 | <i>P</i> value | % | χ^2 | <i>P</i> value |
| Overall abstinence rate | 59,239 (100) | 26.2 | | | 23.5 | | |
| Demographic characteristics | | | | | | | |
| Age group (years) | | | | | | | |
| <40 | 15,639 (26.4) | 25.6 | 56.144 | <0.001* | 22.9 | 28.631 | <0.001* |
| 40–59 | 26,233 (44.3) | 25.2 | | | 23.0 | | |
| ≥60 | 17,357 (29.3) | 28.3 | | | 25.0 | | |
| Gender | | | | | | | |
| Male | 57,155 (96.5) | 26.2 | 4.102 | 0.043* | 23.4 | 10.022 | 0.002* |
| Female | 2,073 (3.5) | 28.2 | | | 26.4 | | |
| Education status | | | | | | | |
| Primary school or below | 147,898 (25.0) | 26.2 | 39.484 | <0.001* | 22.5 | 19.695 | <0.001* |
| High school | 27,527 (46.4) | 25.2 | | | 23.5 | | |
| College degree or above | 16,914 (28.6) | 27.9 | | | 24.6 | | |

TABLE 1. (Continued)

| Characteristic | Sample | PPAR at 1-month | | | PPAR at 3-month | | |
|--|---------------|-----------------|----------|---------|-----------------|----------|---------|
| | n (%) | % | χ^2 | P value | % | χ^2 | P value |
| Occupational status | | | | | | | |
| Inactive | 40,571 (68.5) | 27.1 | 48.802 | <0.001* | 24.1 | 23.572 | <0.001* |
| Active | 18,658 (31.5) | 24.4 | | | 22.3 | | |
| Family income/month (CNY) | | | | | | | |
| <5,000 | 25,882 (43.7) | 26.7 | 120.995 | <0.001* | 23.1 | 173.424 | <0.001* |
| ≥5,000 | 27,256 (46.0) | 27.1 | | | 25.3 | | |
| Don't know or won't say | 6,091 (10.3) | 20.4 | | | 17.5 | | |
| Smoking status | | | | | | | |
| Number of cigarettes smoked/day group | | | | | | | |
| ≤10 | 18,829 (31.8) | 31.0 | 365.596 | <0.001* | 26.7 | 183.210 | <0.001* |
| 11–20 | 28,068 (47.4) | 24.9 | | | 22.8 | | |
| 21–30 | 6,763 (11.4) | 22.2 | | | 21.2 | | |
| ≥31 | 5,569 (9.4) | 21.7 | | | 19.5 | | |
| Duration of smoking group (years) | | | | | | | |
| <20 | 38,734 (65.4) | 26.0 | 3.709 | 0.054 | 23.3 | 3.199 | 0.075 |
| ≥20 | 20,495 (34.6) | 26.7 | | | 24.0 | | |
| Nicotine dependence group (score) | | | | | | | |
| 0–3 (low) | 22,293 (37.6) | 28.6 | 150.393 | <0.001* | 25.5 | 96.315 | <0.001* |
| 4–6 (moderate) | 22,954 (38.8) | 26.0 | | | 23.1 | | |
| ≥7 (high) | 13,982 (23.6) | 22.8 | | | 21.1 | | |
| Past-year quit attempts | | | | | | | |
| None | 34,651 (58.5) | 26.4 | 1.222 | 0.543 | 23.5 | 0.497 | 0.780 |
| 1–5 times | 21,712 (36.7) | 26.2 | | | 23.5 | | |
| >5 times | 2,865 (4.8) | 25.5 | | | 24.1 | | |
| Willingness to quit | | | | | | | |
| Within 7 days | 35,809 (60.5) | 32.8 | 2227.820 | <0.001* | 28.5 | 1492.844 | <0.001* |
| Within 30 days | 9,928 (16.7) | 21.3 | | | 21.1 | | |
| 30 days later | 13,491 (22.8) | 12.5 | | | 12.2 | | |
| Intervention | | | | | | | |
| Exhaled carbon monoxide test | | | | | | | |
| No | 37,757 (63.8) | 23.7 | 336.174 | <0.001* | 20.8 | 419.059 | <0.001* |
| Yes | 21,472 (36.2) | 30.6 | | | 28.3 | | |
| Intervention methods | | | | | | | |
| Counseling | 49,537 (83.6) | 25.5 | 80.043 | <0.001* | 22.9 | 98.222 | <0.001* |
| Combination of TCM and counseling | 2,303 (3.9) | 30.1 | | | 23 | | |
| Combination of first-line medications and counseling | 7,388 (12.5) | 29.8 | | | 28.1 | | |
| Year of intervention (Number of SCCs) | | | | | | | |
| 2019 (220) | 10,013 (16.9) | 28.0 | 177.35 | <0.001* | 25.8 | 848.895 | <0.001* |
| 2020 (306) | 21,836 (36.9) | 28.7 | | | 29.2 | | |
| 2021 (371) | 27,380 (46.2) | 23.7 | | | 18.2 | | |

Abbreviation: SCCs=smoking cessation clinics; TCM=traditional Chinese medicine; PPAR=point prevalence of abstinence rate; CNY=Chinese Yuan.

*P<0.05.

($OR=0.652$; 95% CI : 0.618–0.688), and planning to quit after 30 days ($OR=0.373$; 95% CI : 0.352–0.395) were less likely to exhibit abstinence at the 3-month follow-up (Table 2).

DISCUSSION

In the present study, self-reported 7-day PPARs at 1-

month and 3-month follow-up were found to be 26.2% and 23.5%, respectively. When compared to very brief interventions (7), this study's interventions provided by SCCs exhibited greater effectiveness. Nevertheless, these rates are lower than those reported in previous studies involving interventions provided by SCCs (8–10). These studies demonstrated that self-reported 7-day PPAR at 1-month follow-up ranged

TABLE 2. Predictors of abstinence at 3-month follow-up of patients visiting SCCs — China, 2019–2021.

| Predictors | P value | OR (95% CI) |
|--|---------|---------------------|
| Age group (years) | | |
| <40 | | 1 |
| 40–59 | 0.013* | 1.066 (1.014–1.122) |
| ≥60 | <0.001* | 1.306 (1.230–1.387) |
| Gender | | |
| Male | | 1 |
| Female | 0.001* | 1.184 (1.069–1.312) |
| Education status | | |
| Primary school or below | | 1 |
| High school | 0.036* | 1.062 (1.008–1.119) |
| College degree or above | 0.025* | 1.083 (1.015–1.155) |
| Occupational status | | |
| Inactive | | 1 |
| Active | 0.015* | 0.924 (0.885–0.966) |
| Family income/month (CNY) | | |
| <5,000 | | 1 |
| ≥5,000 | <0.001* | 1.089 (1.042–1.138) |
| Don't know or won't say | <0.001* | 0.733 (0.681–0.789) |
| Nicotine dependence group (score) | | |
| 0–3 (low) | | 1 |
| 4–6 (moderate) | <0.001* | 0.824 (0.788–0.861) |
| ≥7 (high) | <0.001* | 0.732 (0.694–0.772) |
| Willingness to quit | | |
| Within 7 days | | 1 |
| Within 30 days | <0.001* | 0.652 (0.618–0.688) |
| 30 days later | <0.001* | 0.373 (0.352–0.395) |
| Exhaled carbon monoxide test | | |
| No | | 1 |
| Yes | <0.001* | 1.397 (1.342–1.455) |
| Intervention methods | | |
| Counseling | | 1 |
| Combination of TCM and counseling | 0.126 | 1.083 (0.978–1.201) |
| Combination of first-line medications and counseling | <0.001* | 1.119 (1.056–1.187) |

Abbreviation: SCCs=smoking cessation clinics; TCM=traditional Chinese medicine; PPAR=point prevalence of abstinence rate; CNY=Chinese Yuan.

* $P<0.05$.

from 34.1% to 38.6% and at the 3-month follow-up, it ranged from 28.4% to 36.4%. Potential reasons for these comparatively lower rates may include the low proportion of patients receiving smoking cessation medications and relative low follow-up rate.

Based on substantial scientific evidence, a combination of counseling and pharmacotherapy is the optimal treatment for smoking cessation, demonstrating greater efficacy compared to either intervention alone (2). This study supports this conclusion. However, due to the lack of reimbursement for pharmacotherapy costs in China and the relatively high expense, first-line medications for smoking cessation were underutilized. Previous research indicates that insurance coverage for smoking cessation treatment can increase the utilization of these services, resulting in higher rates of successful quitting (2). We suggest that first-line medication needs to be included in the medical insurance directory in China to enhance the use of effective interventions.

Research suggests that TCM is a well-received and secure treatment when properly administered, however, its efficacy may be inferior to evidence-based interventions when utilized independently (11). In the present study, integrating TCM with counseling resulted in enhanced smoking cessation outcomes at 1-month compared to counseling in isolation. Nonetheless, this distinction failed to reach statistical significance at the 3-month interval. Consequently, these findings imply that TCM may furnish temporary advantages for smoking cessation, yet its enduring effectiveness warrants additional exploration.

Previous research (12) has shown that the ECO test is effective in increasing patients' willingness to quit smoking. The current study also found that the ECO test can improve abstinence rates. However, only 70.2% of SCCs were equipped with ECO detectors, and only 36.2% of outpatients underwent testing. It is essential to provide and encourage the use of ECO detectors within SCCs to enhance testing rates and potentially improve patient outcomes.

A recent study (13) has shown that discontinuing smoking before the age of 40 can substantially reduce the risk of tobacco-related diseases by up to 90%. In the current study, only 26.4% of patients who sought professional help from SCCs were under the age of 40. Consequently, enhancing public awareness campaigns is necessary to encourage younger smokers to seek assistance for cessation at SCCs. More evidence-based research and study on mobile smoking cessation tools for young people can be developed in the future.

Willingness to quit reflects an individual's motivation to stop smoking. The present study found that patients with a stronger willingness to quit demonstrated higher abstinence rates. Effective tobacco control measures, such as increasing cigarette prices and implementing smoke-free legislation, can enhance smokers' willingness to quit. Therefore, reinforcement of these measures may lead to greater awareness among smokers, encouraging them to seek support for quitting at SCCs and ultimately reducing the risk of tobacco-related illnesses. Moreover, the current study's findings reveal that patients with lower nicotine dependence, higher education levels, and higher family income reported higher abstinence rates, which aligns with previous research (14–15).

A potential limitation of the current study is the assessment of smoking status at only the 1- and 3-month follow-up time points. Future research would benefit from incorporating longer follow-up intervals to evaluate the long-term effects of smoking cessation interventions. Moreover, the cessation outcomes in this study relied on patient self-report, without corroborative biochemical confirmation. As such, discrepancies between reported and actual outcomes may exist. At last, the data used in this study were from the SCCs that used the platform, the data from some parts of SCCs that did not use the platform were not included.

In conclusion, the interventions provided by SCCs in this study proved effective. However, clinic visits to SCCs in China remain low. Greater publicity should be given to SCCs, and comprehensive tobacco control measures must be implemented to increase smokers' willingness to seek support for quitting at SCCs. Furthermore, the underutilization of first-line medications for smoking cessation was observed; we recommend including these medications in the medical insurance directory in China to enhance the use of effective interventions.

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Commentary

The Progress of the Global Tobacco Cessation Strategies

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The tobacco epidemic is one of the biggest public health threats the world has ever faced, killing more than 8 million people a year, mainly through noncommunicable diseases (NCDs) (1). World Health Organization (WHO) set nine voluntary global targets for NCDs to be attained by 2025, including a 30% relative reduction in prevalence of current tobacco use by 2025 (2), which requires a strong commitment by governments to strengthen the national health system responses and to take action against the leading risk factors for NCDs including tobacco use, the single most preventable cause of death. Commitment to strengthening full implementation of the WHO Framework Convention on Tobacco Control (WHO FCTC) is a crucial component of action by governments.

Although global smoking prevalence among people aged over 15 years has fallen from 22.7% to 17.5%, tobacco control still faces major challenges (3). First, smoking prevalence needs to be further reduced to achieve the global target for tobacco reduction. There remain over 1.3 billion tobacco users in the world and over 80% of them live in low- and middle-income countries (LMICs) (4), including 308 million smokers in China (5). Second, tobacco industry interference plays a big role in slowing progress in tobacco control. Tobacco industry has been aggressively promoting new and emerging products such as e-cigarettes and heated tobacco products as “safer” or “smoke-free” alternatives to conventional cigarettes to undermine the implementation of the WHO FCTC globally (3). Finally, lack of government investment and technical resources is common in most countries. To address these challenges, it is critical to improve support for tobacco cessation, advocate for the prioritization of tobacco control on political agendas, implement sustained investment in tobacco control, and address tobacco industry interference.

TOBACCO CESSATION STRATEGIES RECOMMENDED BY WHO FCTC ARTICLE 14 GUIDELINES

The emphasis on tobacco cessation and treatment

for tobacco dependence as part of a comprehensive tobacco control is enshrined in Article 14 of the WHO FCTC, which requires signatories to “take effective measures to promote cessation of tobacco use and adequate treatment for tobacco dependence” (6). To further elaborate on these measures, the Guidelines for Implementation of Article 14 of the WHO FCTC call for the development of a comprehensive tobacco cessation and treatment system. This system should offer tobacco users a range of cessation interventions, including brief advice, a national toll-free quitline, specialized tobacco dependence treatment, and evidence-based medications (7). Despite strong demand, implementation of these tobacco cessation measures in LMICs has been inadequate. While approximately 60% of the 1.3 billion tobacco users worldwide have expressed an intention to quit, only 30% have access to comprehensive tobacco cessation services (8).

Therefore, the most urgent task of the global tobacco cessation work is to improve the reach of existing proven tobacco cessation services. To achieve this aim, countries must change their tobacco cessation strategies, reorient, and refocus their efforts to accelerate the impact of their national tobacco cessation services.

STRATEGIC CHANGES NEEDED IN PROMOTING TOBACCO CESSATION

To address the aforementioned challenges and improve the impact of national tobacco cessation services, the WHO recommends that countries prioritize integration, sustainability, innovation, and a systematic approach. Countries should leverage the unique opportunities presented by health systems and digital technology to establish an inclusive, resilient, and sustainable ecosystem for delivering tobacco cessation services. To create such an integrated and dynamic system, four strategic changes are recommended. These changes will allow tobacco users to access the interventions of their preference at a time that suits them best (8). The specifics of these strategic

changes are discussed in detail below.

Implementing Tobacco Cessation Measures Synergistically with Other Tobacco Control Policies

The optimal effectiveness of tobacco cessation support is achieved when it is implemented in conjunction with other demand-reduction tobacco control policies. These policies include raising tobacco taxes, establishing smoke-free environments, banning tobacco advertising, promotion, and sponsorship, printing pictorial health warnings on tobacco product packs, and developing anti-tobacco mass media campaigns. These measures promote tobacco cessation by encouraging quitting and creating a supportive environment. A compelling example of synergistic efforts is including the quitline number on cigarette packs and mass media anti-tobacco campaigns, resulting in a significant increase in demand for tobacco cessation services (9). This approach is especially important for China, as only 16.2% of smokers in China expressed a desire to quit, according to a 2018 survey of Chinese adults (5).

Using Existing Infrastructure to Develop Cessation Support

Integrating brief advice into primary health care systems is a crucial measure for countries seeking to provide comprehensive cessation support. Given that en masse infrastructure, like primary health care, is available in almost all countries, this implementation is both practical and economical. The systematic distribution of brief advice across health care systems has the potential to touch base with over 80% of all tobacco users annually in a country if it is consistently delivered (10). Where feasible, cessation interventions should be incorporated into existing health programs like primary care, as well as those aimed towards specific populations and diseases like national tuberculosis programs, non-communicable disease programs, oral health programs, HIV/AIDS programs, mental health programs, and programs addressing the health requirements of women, children, and teenagers.

Countries should consider utilizing their pre-existing infrastructure to implement national toll-free quitline services. Several countries have well-established call centers, existing coronavirus disease 2019 (COVID-19), or other health-related hotlines with the potential to expand and offer tobacco quitline services.

Prioritizing Population-Level Tobacco Cessation Approaches

Prioritizing population-based tobacco cessation interventions can help reach as many tobacco users as possible at the lowest possible cost and have the most impact on reducing the prevalence of tobacco use at the population level. Government should consider implementing the three “best-buy” interventions as recommended by WHO Global NCD Action Plan 2023–2030: integrating brief advice into primary care, national toll-free quitline services and cessation interventions delivered via mobile text messaging (mCessation) (11). The maximum impact of the three population-level tobacco cessation interventions occurs if they are part of a dynamic integrated tobacco cessation ecosystem.

In 2021, WHO developed the global investment case to explain why countries should invest in tobacco cessation from health and economic perspectives. A return-on-investment analysis of 124 LMICs shows that these population-level interventions cost little but have significant returns (12). On average, countries only need to spend 0.21 USD per person per year on these interventions to witness an estimated 88 million individuals quitting smoking by 2030, leading to 1.4 million lives saved. Over time, a total of 9.3 million lives can potentially be saved among those who quit smoking by the age of 65. It is evident that these three population-level interventions are exceedingly cost-effective.

Embracing More Innovative Approaches to Improve the reach of Tobacco Cessation Interventions

Effective interventions to aid in tobacco cessation have been identified; however, not enough tobacco users are currently benefitting from them. To increase accessibility and outreach of these interventions, it is imperative to leverage emerging technologies. The popular digital platforms, in conjunction with mobile technology, can be effectively employed to deliver tobacco cessation services. For instance, WeChat, the most widely-used social media platform in China, has demonstrated to be a viable and efficient tool to administer cease-smoking interventions to a wide range of smokers through extensive research (13–14).

Research and development into other innovations such as artificial intelligence (AI) should also be encouraged. During the COVID-19 pandemic, WHO developed an AI-based digital health worker (Florence) to provide brief tobacco cessation advice (15). Florence

is now available 24/7 in multi-languages. The next step is to get more people to use this tool.

IMPLICATION FOR CHINA

China has the largest smoking population and is suffering the highest burden of tobacco-related diseases in the world. Tobacco cessation and treatment for tobacco dependence are key measures to reduce smoking rate and relevant hazards. China has made some efforts on cessation services, such as setting up quitlines, training medical professionals to persuade smokers to quit by brief advice, and establishing hundreds of cessation clinics. Some studies on mCessation were conducted and offering tobacco users cessation support in some primary care facilities was piloted. In 2021, “CHINA QUIT PLATFORM” was developed by Chinese Center for Disease Control and Prevention, which refers to available cessation services by each province including hotline, cessation clinics and mCessation tools. It is time for China to consider developing a national tobacco cessation strategy to provide direction and scope for Chinese tobacco cessation program based on WHO FCTC Article 14 Guidelines. It is also imperative to ensure that government provides sustained investment to strengthen comprehensive tobacco cessation services in China, such as a national toll-free quitline and government endorsed and validated mCessation services, integrating brief advice into existing health care systems, and providing cessation services in communities. For example, due to the shortage of financial support, tobacco users in China have low awareness and utilization of the current existing quitlines. Besides tobacco cessation services, other tobacco control strategies should also be put in place to increase smokers’ willingness to quit, such as increasing the price of cigarettes, placing pictorial warning labels on cigarette packages, implementing smoke-free policies, and implementing media campaigns aimed at persuading smokers to quit.

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