

Postprint: Utilization of Behavior Change Techniques by Healthcare Professionals in Chinese Smoking Cessation Clinics and Their Association with Quit Success Rates

Authors: Hong Qiumian, Liao Yanhui, Jing Xiaojuan, Zhang Ning, Zhang Ning

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Abstract

Background Behavior Change Techniques (BCTs) for smoking cessation refer to explicit descriptions of intervention content that can change participants' smoking behavior. Currently, research exploring the usage status of BCTs among medical staff in smoking cessation clinics in China is lacking.

Objective To investigate the usage of smoking cessation-related BCTs among medical staff in smoking cessation clinics in China, and to examine the relationships between medical staff's BCTs usage, perceived effectiveness, and their clinic's smoking cessation success rate.

Methods From February 2022 to March 2023, an online questionnaire was distributed via "Wenjuanxing" to medical staff in smoking cessation clinics across China, surveying their usage of 44 smoking cessation-related BCTs, perceived effectiveness, their clinic's smoking cessation success rate, and demographic characteristics including age and gender. Hierarchical linear regression models were employed to analyze the effects of the number of BCTs used and perceived effectiveness on clinic smoking cessation success rates, as well as the interaction between these two factors. Simple slope analysis was further used to examine the interaction between the number of BCTs used and perceived effectiveness.

Results A total of 285 valid questionnaires were collected. The 285 medical staff in smoking cessation clinics used an average of (29 ± 13) BCTs, with an average perceived effectiveness rating of 3.5. Statistically significant differences were found in the number of BCTs used and perceived effectiveness among medical staff with different highest education levels and clinic tracking of smokers' cessation outcomes ($P < 0.05$). Statistically significant differences were found in clinic smoking cessation

success rates among medical staff with different years of experience in smoking cessation clinics, hospital positions, and clinic tracking of smokers' cessation outcomes ($P < 0.05$). Hierarchical linear regression analysis revealed that after controlling for three variables—years of experience in smoking cessation clinics, hospital position, and whether the clinic tracked smokers' cessation outcomes—medical staff's perceived effectiveness of BCTs positively predicted the clinic's smoking cessation success rate [$b(95\%CI) = 10.070(7.066 \sim 13.075)$, $P < 0.05$], whereas the number of BCTs used was not a significant predictor ($P > 0.05$). After further including the interaction term of number of BCTs used \times perceived effectiveness, the model's explanatory power for clinic smoking cessation success rate increased by 2.2%, with both BCTs perceived effectiveness [$b(95\%CI) = 11.711(8.548 \sim 14.874)$, $P < 0.05$] and the interaction term [$b(95\%CI) = 2.921(0.958 \sim 4.884)$, $P < 0.05$] showing positive predictive effects on smoking cessation success rate.

Conclusion Medical staff's usage of smoking cessation-related BCTs significantly impacts their clinic's smoking cessation success rate, with a significant interaction effect between the number of BCTs used and perceived effectiveness on success rate. Future efforts should improve training programs for smoking cessation clinic intervention techniques, facilitating the translation and implementation of intervention techniques from theory to practice, to help more smokers successfully quit.

Full Text

Abstract

Background: Smoking cessation related behavior change techniques (BCTs) are defined as explicit descriptions of intervention content that can change participants' smoking behavior. Currently, there is a lack of research exploring the usage status of BCTs among medical staff in smoking cessation clinics in China. **Objective:** To understand the usage of smoking cessation related BCTs by medical staff in China and examine the relationship between BCTs usage, perceived effectiveness, and the smoking cessation success rate in their clinics. **Methods:** From February 2022 to March 2023, an online questionnaire was distributed via “Wenjuanxing” to medical staff in smoking cessation clinics across China, investigating their usage of 44 smoking cessation related BCTs, perceived effectiveness, self-reported clinic cessation success rates, and demographic characteristics such as age and gender. Hierarchical linear regression models were used to analyze the effects of the number of BCTs used and perceived effectiveness on clinic cessation success rates and their interaction. Simple slope analysis was further conducted to examine the interaction between the number of BCTs used and perceived effectiveness. **Results:** A total of 285 valid questionnaires were collected. On average, medical staff used (29 ± 13) BCTs, with a mean perceived effectiveness score of (3.15 ± 0.96) , and an average clinic cessation success rate of $(12.5 \pm 3.5\%)$. Statistically significant differences were found in the number of BCTs used

and perceived effectiveness among staff with different education levels and those whose clinics tracked smokers' cessation outcomes ($P < 0.05$). Significant differences in clinic cessation success rates were observed among staff with different years of experience in smoking cessation clinics, hospital positions, and tracking status ($P < 0.05$). Hierarchical linear regression analysis showed that after controlling for years of experience, hospital position, and tracking status, perceived effectiveness of BCTs positively predicted clinic cessation success rates [$b(95\%CI) = 10.070(7.066 \sim 13.075)$, $P < 0.05$], while the number of BCTs used was not a significant predictor ($P > 0.05$). When the interaction term (number of BCTs used \times perceived effectiveness) was included, the model's explanatory power increased by 2.2%. Both perceived effectiveness [$b(95\%CI) = 11.711(8.548 \sim 14.874)$, $P < 0.05$] and the interaction term [$b(95\%CI) = 2.921(0.958 \sim 4.884)$, $P < 0.05$] positively predicted cessation success rates. **Conclusion:** The usage of smoking cessation related BCTs by medical staff significantly impacts clinic cessation success rates, with a significant interactive effect between the number of BCTs used and perceived effectiveness on success rates. Future efforts should improve training programs for smoking cessation interventions, facilitate the translation and implementation of intervention techniques from theory to practice, and help more smokers quit successfully.

Keywords: smoking cessation clinics; behavior change techniques; usage frequency; perceived effectiveness; smoking cessation success rate; hierarchical linear regression; interaction effects

Introduction

The 2018 China Adult Tobacco Survey reported a smoking prevalence of 26.6% among individuals aged 15 years and older in China [1]. The "Healthy China 2030" Planning Outline explicitly states that "by 2030, the smoking rate among people over 15 years old should be reduced to 20%" [2]. Previously, the Framework Convention on Tobacco Control proposed the "MPOWER" strategy, with establishing smoking cessation clinics being one of the effective means to improve cessation success rates [3]. China's "Smoking Cessation Clinic Operation Guidelines" primarily adopts the "5A+5R" combined intervention method, which has demonstrated good effectiveness in smoking cessation practice [4-6]. However, compared to foreign countries, China's smoking cessation clinics started relatively late [7], medical staff have poor mastery of smoking cessation skills [8], and lack motivation [9], resulting in a gap between the cessation success rates of smoking cessation clinics and the expected tobacco control targets.

Previous researchers have assessed the skill mastery level of medical staff in smoking cessation clinics in China [8,10-12], but most used single-dimension measurements such as "whether smoking cessation services are provided" [12], which cannot specifically understand medical staff's mastery and usage of different intervention strategies. In 2011, Michie et al. [13] developed a smoking cessation related BCTs taxonomy containing 43 items that can be divided into four

categories. Smoking cessation related BCTs are defined as “explicit descriptions of intervention content that can change participants’ smoking behavior.” This taxonomy helps researchers better communicate smoking cessation intervention information, build consensus, and provide clearer recommendations for subsequent research. With the popularization of smoking cessation interventions, the significance of the smoking cessation BCTs taxonomy has become more prominent [13]. A study conducted in the United Kingdom showed that the number and types of smoking cessation BCTs used could predict the cessation success rates of medical institutions [14]. Therefore, exploring the current usage status of smoking cessation BCTs in China’s smoking cessation clinics can help deepen understanding of medical staff’s intervention skill usage, identify focal points for optimizing smoking cessation operations, and further improve the cessation success rates of clinic visitors. However, no studies have yet evaluated the usage of BCTs by medical staff in smoking cessation clinics in China when providing services to smokers. This study aims to describe the frequency and perceived effectiveness of smoking cessation BCTs used by medical staff in China’s smoking cessation clinics, explore the relationship between BCTs usage and clinic cessation success rates, and provide references for future improvements in clinic technical training, promotion of BCTs application, and development of personalized smoking cessation intervention programs.

Methods

Study Participants

From February 2022 to March 2023, an online questionnaire was distributed through the “Wenjuanxing” platform (<https://www.wjx.cn/>) to medical staff in smoking cessation clinics nationwide. Inclusion criteria were: (1) working in a smoking cessation clinic for ≥ 1 year; (2) age ≥ 21 years; (3) directly involved in patient consultation/treatment. A total of 312 questionnaires were collected. After excluding questionnaires from unqualified respondents and those with unqualified responses, 285 valid questionnaires were obtained, with an effective response rate of 91.3%.

Survey Instruments

BCTs Usage Questionnaire. Based on the smoking cessation related BCTs taxonomy developed by Michie et al. [13], a questionnaire containing 44 items was developed. The 44 BCTs can be divided into four categories: Direct Motivation Enhancement (M), Self-Management Capacity Building (S), Facilitating Auxiliary Activities (A), and General Support (G). For each technique, participants completed two items: (1) “During the process of providing smoking cessation clinic services to smokers, have you used the following technique?” with three response options: “used,” “not used,” and “not aware.” If “used” was selected for item 1, they then answered (2) “How effective do you think this technique is in helping smokers quit?” rated on a 5-point Likert scale from “com-

pletely ineffective” to “very effective” (scored 1-5). In this study, the internal consistency was 0.969 for item 1 and 0.974 for item 2.

Smoking Cessation Success Rate Item. The item asked: “Based on your experience, what percentage of smokers who seek help at your smoking cessation clinic ultimately quit successfully?” Responses were recorded on a scale from 0-100%.

Survey and Quality Control Procedures

Medical staff from smoking cessation clinics nationwide were contacted through the Tobacco Control Committee of the Zhejiang Health Education and Promotion Association to participate in the online survey. Participants first reviewed an informed consent form before formally responding to ensure they understood and voluntarily completed the questionnaire. After submission, investigators checked the completeness and logical consistency of questionnaires. Exclusion criteria were: (1) questionnaires with missing data; (2) questionnaires where the item “When did you start working in the smoking cessation clinic” indicated less than 1 year; (3) questionnaires containing IP addresses—only one was retained for duplicate submissions; (4) questionnaires with response times too long (>1,800s) or too short (<120s) (average response time was 468s); (5) questionnaires from respondents aged <21 years; (6) questionnaires where respondents indicated they were aware of all techniques and rated every technique’s perceived effectiveness identically.

Statistical Analysis

SPSS 23.0 and MPLUS 8.3 software were used for statistical analysis. Count data were expressed as frequencies and percentages, while measurement data were expressed as ($\bar{x}\pm s$). Two-group comparisons used t-tests, and multi-group comparisons used one-way ANOVA. Hierarchical linear regression models were constructed to examine the predictive effects of the number of smoking cessation related BCTs used and perceived effectiveness on clinic cessation success rates, with simple slope analysis used to test their interaction effects. After excluding public health personnel and pharmacist samples, sensitivity analysis was conducted to verify result stability. The significance level was set at $\alpha=0.05$ (two-tailed).

Results

Basic Characteristics of Medical Staff and Outcome Variables

The 285 medical staff came from 24 provinces, with the majority from Ningxia Hui Autonomous Region (115, 40.4%) and Zhejiang Province (45, 15.8%). Most were female (182, 63.9%), aged 21-66 years with a mean age of (41.7 ± 9.4) years. The majority held bachelor’s degrees (185, 64.9%) and were married (251,

88.1%). Years of experience in smoking cessation clinics were: 1-3 years for 126 (44.2%), 4-10 years for 122 (42.8%), and $\$11yearsfor37(13.0\pm24.3)\pm\23.4% .

BCTs Usage and Perceived Effectiveness

BCTs Usage. The number of BCTs used by the 285 medical staff ranged from 0 to 44, with an average of (29 ± 13) items. Among the 44 BCTs, 39 had usage rates $>50.0\%$. The most frequently used BCTs were: “G-Listen to smokers’ views on how to quit” [253 (88.8%)], “S-Provide targeted advice for smokers to change their habitual smoking behavior” [244 (85.6%)], “G-Inform quitters about withdrawal symptoms” [240 (84.2%)], “G-Provide support to help smokers quit” [233 (81.8%)], and “S-Provide targeted advice to enhance smokers’ psychological capacity to participate in quitting” [231 (81.1%)], all with usage rates $>80.0\%$. The least used BCTs ($<50.0\%$) were: “G-Inform smokers about the purpose of carbon monoxide (CO) monitoring” [135 (47.4%)], “M-Provide CO measurement services for smokers” [122 (42.8%)], “M-Provide rewards based on quitters’ effort or progress” [116 (40.7%)], “M-Reward smokers who successfully quit” [94 (33.0%)], and “A-Assist smokers in obtaining free smoking cessation medication” [78 (27.4%)]. Among the top 10 most frequently used BCTs, 6 belonged to General Support (G), 3 to Self-Management Capacity Building (S), and 1 to Direct Motivation Enhancement (M). The three BCTs with the highest rates of being “not aware” ($>5\%$) were “A-Assist smokers in obtaining free smoking cessation medication” [19 (6.7%)], “M-Strengthen their identification as a quitter” [18 (6.3%)], and “S-Provide advice to help quitters avoid social cues that may trigger smoking” [16 (5.6%)]. See Table 1 .

Perceived Effectiveness of BCTs. Medical staff’s perceived effectiveness scores for BCTs ranged from 3.14 to 3.55 points, with an average of (3.15 ± 0.96) . *The top 5 BCTs in perceived effectiveness were : "G – Build a harmonious and trusting relationship with smokers" [(3.55±0.97)], "A – Assist smokers in obtaining free smoking cessation medication" [(3.50±0.98)], "A – Help smokers better obtain or utilize social support to help them quit" [(3.49±0.94)], "M – Reward smokers who successfully quit" [(3.48±0.97)], and "A – Understand whether smokers are using medication 3.30 : "G – Listen to smokers’ views on how to quit" [(3.27±0.91)], "G – Emphasizes smokers’ autonomy to decide whether to strengthen their identification as a quitter" [(3.22±0.93)], "M – Motivates smokers to make timely quitting commitment. Understand and assess smokers’ past quit attempts" [(3.14±0.92)].* See Table 1 .

Comparisons by Staff Characteristics

Significant differences were found in the number of BCTs used and perceived effectiveness among medical staff with different highest education levels and tracking status of smokers’ cessation outcomes ($P<0.05$). Significant differences in clinic cessation success rates were observed among staff with different years of experience in smoking cessation clinics, hospital positions, and tracking status ($P<0.05$). See Table 2 .

Hierarchical Linear Regression Analysis

Using clinic cessation success rate as the dependent variable, number of smoking cessation related BCTs used and perceived effectiveness as independent variables, and years of experience, hospital position, and tracking status as control variables, a hierarchical linear regression model was constructed. In Model 1, control variables were entered. In Model 2, independent variables and control variables were entered. In Model 3, independent variables, control variables, and the interaction term (number of BCTs used \times perceived effectiveness) were entered.

Results showed that after controlling for years of experience, hospital position, and tracking status, perceived effectiveness of BCTs positively predicted clinic cessation success rates [b(95%CI)=10.070(7.066~13.075), $P<0.05$], while the number of BCTs used was not a significant predictor ($P>0.05$). When the interaction term was included, the model's explanatory power increased by 2.2% ($\Delta F=8.580$, $P<0.05$). Both perceived effectiveness [b(95%CI)=11.711(8.548~14.874), $P<0.05$] and the interaction term [b(95%CI)=2.921(0.958~4.884), $P<0.05$] positively predicted cessation success rates, indicating an interactive effect between the number of BCTs used and perceived effectiveness on success rates. See Table 3 .

Simple slope analysis further examined the interaction effect. Results showed that perceived effectiveness predicted clinic cessation success rates for both staff using fewer and more BCTs, but the predictive effect was stronger for those using more BCTs ($b=18.188$, $P<0.05$) compared to those using fewer ($b=10.090$, $P<0.05$). That is, when perceived effectiveness was higher, using more BCTs led to higher cessation success rates. See Figure 1 [Figure 1: see original paper].

Discussion

This study surveyed medical staff in smoking cessation clinics nationwide to describe the current usage of smoking cessation related BCTs in China and analyze its relationship with self-reported clinic cessation success rates. Results showed considerable variation in the number of BCTs used by different medical staff, with higher-educated staff using more BCTs and perceiving better effectiveness. Overall, the most frequently reported BCTs were those with lower perceived effectiveness, while those with better perceived effectiveness were used less frequently, leading to insufficient and inadequate interventions. The study also demonstrated that the interaction between the number of BCTs used and perceived effectiveness positively predicted self-reported clinic cessation success rates, highlighting the importance of BCTs usage for improving intervention effectiveness.

In this study, medical staff reported generally high usage rates of BCTs, but the most frequently used techniques differed from previous research. Studies by West et al. [14] and Lorencatto et al. [15] showed that the most frequently used techniques in UK Stop Smoking Services were “A-Provide targeted ad-

vice on cessation medications” with usage rates of 98% and 94%, respectively, while Chinese smoking cessation clinics used this technique only 62.5% of the time, ranking it lower among all BCTs. Meanwhile, this study found that medication-related interventions had better perceived effectiveness. Although China’s “Smoking Cessation Clinic Operation Guidelines” clearly specify the classification, usage methods, and recommendations for cessation medications, the “5A” intervention method only states that “except for special circumstances, the use of cessation medications is encouraged. Meanwhile, it should be emphasized that cessation medications are not ‘magic bullets’ and willpower is essential during the quitting process,” without explicitly requiring specific medication types to be introduced and recommended, which may weaken the importance of medication advice. Additionally, many smoking cessation clinics are located in hospitals that do not provide cessation medications, which may also lead to lower usage frequency of this technique. Therefore, training for smoking cessation clinic staff should emphasize the importance of cessation medications and require staff to provide targeted medication recommendations and access channels based on smokers’ nicotine dependence levels.

This study also found that medical staff had high awareness rates of BCTs. The technique with the lowest awareness rate, “A-Assist smokers in obtaining free smoking cessation medication,” also had the lowest usage frequency but relatively good perceived effectiveness. The possible reason is that unlike countries such as the UK (which provides free cessation medications to some smokers based on income level [16]), China does not have a policy of providing free medications to quitters, with only a few regions conducting short-term free medical smoking cessation service activities [17-18]. Previous studies have also shown that free (or low-cost) cessation medications can increase quit attempts [19] and improve short-term cessation rates [20]. Currently, cessation medications in China are not included in the medical insurance reimbursement catalog, and the high cost of medications limits medication accessibility and the effectiveness of smoking cessation interventions to some extent [21]. In addition, for the other two techniques with the lowest awareness rates, “M-Strengthen their identification as a quitter” and “S-Provide advice to help quitters avoid social cues that may trigger smoking,” previous studies have shown that strengthening quitter identity helps promote quitting action [22] and improve cessation success rates [14], while also emphasizing the negative impact of social pressure on successful quitting and the importance of learning to refuse “social smoking” to reduce smoking rates [23]. Therefore, increasing the popularity and usage of these two techniques can help improve clinic intervention effectiveness.

Regarding perceived effectiveness, this study found that Facilitating Auxiliary Activities (A) and Direct Motivation Enhancement (M) BCTs had better overall perceived effectiveness, consistent with West et al. [14]. These techniques can provide substantive help from physiological and psychological perspectives, such as medication advice and rewards for successful quitting. Previous randomized controlled trials have also shown that teaching skills [24] or providing rewards [25] helps improve cessation success rates, but these two categories of

techniques were used less frequently in Chinese smoking cessation clinics. In contrast, this study found that most frequently used techniques belonged to General Support (G), but their perceived effectiveness was not prominent. General Support (G) techniques have the advantage of being easy to integrate into the intervention process, but some are relatively basic (such as assessing objective conditions) while others are more difficult to provide with substantive and sustainable intervention support. For example, “G-Listen to smokers’ views on how to quit” depends on whether medical staff can guide quitters to express their true thoughts and provide influential feedback. Therefore, some General Support (G) techniques place higher demands on medical staff. However, it is undeniable that “G-Build a harmonious and trusting relationship with smokers” plays an important role in the smoking cessation clinic intervention process [26], which was also reflected in this study’s results.

Self-Management Capacity Building (S) techniques showed mixed effectiveness evaluations. On one hand, the effectiveness of these techniques (e.g., “S-Help quitters prevent and cope with relapse”) largely depends on smokers’ individual characteristics such as age [27], addiction level [28], self-rated health status [29], and self-efficacy [30]. For example, quitters with higher self-efficacy are better able to prevent relapse [30], thus making advice more effective. On the other hand, since these techniques are self-implemented and supervised by quitters, medical staff find it difficult to objectively evaluate their effectiveness, especially in clinics that do not conduct follow-up, making the role of these techniques even harder to assess. Overall, Chinese smoking cessation clinics should strengthen training and usage of Direct Motivation Enhancement (M) and Facilitating Auxiliary Activities (A) BCTs, increase multi-dimensional substantive support for quitters’ physiological, psychological, and social needs, improve individual self-quitting skills, and organically combine all four categories of intervention techniques to develop and implement personalized smoking cessation intervention programs.

Regarding factors influencing clinic cessation success rates, this study found an interactive effect between the number of BCTs used and perceived effectiveness on success rates: more BCTs used and better perceived effectiveness led to higher success rates. However, when more BCTs were used, the effect of perceived effectiveness on success rates was greater, demonstrating the importance of BCTs effectiveness. Since this study’s technique effectiveness data came from self-reports, medical staff may rate a technique as more effective when they receive positive feedback from quitters, which increases their usage frequency and proficiency, allowing the technique’s true effectiveness to be realized. This correspondingly helps improve quitters’ experiences, enhances their quitting self-efficacy, and thus increases cessation success rates. Therefore, smoking cessation clinics should not simply pursue the superposition and combination of intervention techniques but should focus more on the effectiveness and appropriateness of the strategies used, while considering how to maximize the intervention effects of both the quantity and quality of cessation methods.

This study also found that follow-up tracking of quitters significantly improved cessation success rates, possibly because follow-up increases intervention intensity, reinforces quitting effects [31], and reduces relapse rates [32]. Compared to foreign countries, China's smoking cessation clinics are relatively underdeveloped [7], with unbalanced development across regions [21], and medical staff's service capacity and intervention enthusiasm need improvement [9]. Therefore, based on existing smoking cessation clinic operation guidelines and management standards, this study proposes the following recommendations:

First, smoking cessation behavior change strategies [33] should be integrated before intervention implementation to enhance standardized technical training, with both theoretical and practical feedback after training, focusing on the translation from theory to practice. Second, smoking cessation clinics can regularly hold experience-sharing sessions, inviting staff with longer experience or successful quitting cases to share insights, allowing medical staff to jointly study difficult intervention techniques, analyze difficult-to-treat populations, and develop smoking cessation intervention guidelines suitable for local populations. Third, before formal intervention, in addition to collecting demographic information and smoking levels, personality characteristics [34] and language preferences can be measured to facilitate better personalized interviews and interventions. Fourth, during intervention implementation, while ensuring technique effectiveness, multiple BCTs can be combined to create a warm and comfortable intervention environment, increase the proportion of substantive intervention support, enhance quitters' motivation, and mobilize their self-management capacity.

This study has several limitations. First, the sample size was relatively small, and stratified sampling of medical staff from different regions was not conducted, resulting in selection bias. Future studies should investigate the actual usage of smoking cessation related BCTs in broader populations. Second, this study targeted medical staff in smoking cessation clinics rather than medical institutions, which is more focused than previous research. However, BCTs usage and clinic success rates were self-reported by medical staff, introducing recall bias and social desirability effects. Future studies could use hospital cessation records or CO measurements to obtain objective cessation data. Third, this study only examined the usage frequency and effectiveness of individual BCTs, while in reality, medical staff typically use comprehensive intervention techniques. Future research could examine the effectiveness of commonly used comprehensive intervention techniques in smoking cessation clinics to obtain more practically relevant evidence.

In summary, this study analyzed the usage of BCTs by medical staff in China's smoking cessation clinics and its relationship with clinic cessation success rates, finding considerable variation in the number of BCTs used, with commonly used BCTs not achieving their potential effects while those with better effectiveness were underutilized. This study also demonstrated the predictive role of BCTs usage quantity and effectiveness on clinic cessation success rates. Therefore, future researchers should examine BCTs usage among broader medical staff

populations and its relationship with objectively reported clinic success rates. Smoking cessation clinics can use these findings to optimize training strategies, and medical staff can deepen their learning of intervention techniques, focus on BCTs effectiveness, and provide more substantive help to quitters.

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Author Contributions

Hong Qiumian: responsible for data organization and analysis according to research design, chart preparation, results reporting, drafting the initial manuscript, and revising the paper. Liao Yanhui and Jing Xiaojuan: participated in manuscript revision. Zhang Ning: proposed the research question, responsible for research design and data collection, guided data analysis, manuscript writing, and revision.

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References

- [1] Chinese Center for Disease Control and Prevention. 2018 China Adult Tobacco Survey Report [EB/OL]. (2019-05-30) [2023-03-31]. https://www.chinacdc.cn/yw_{9324}/201905/t2019
- [2] Central Committee of the Communist Party of China and State Council. “Healthy China 2030” Planning Outline [EB/OL]. (2016-10-25) [2023-03-24]. http://www.gov.cn/zhengce/2016-10/25/content_{5124174}.htm.
- [3] WHO. WHO Framework Convention on Tobacco Control [EB/OL]. (2003-05-25) [2023-03-24]. <https://fctc.who.int/publications/i/item/9241591013>.
- [4] Zhu Xiaoqiu, Gu Yueying. Application of the 5A method in smoking cessation intervention in outpatient clinics [J]. *Nursing and Rehabilitation*, 2013, 12(10): 993-994. DOI: 10.3969/j.issn.1671-9875.

- [5] Zhou Enting, Gao Yang, Wang Xiufeng, et al. Evaluation of community smoking cessation intervention using 5A method combined with telephone hotline [J]. *Shanxi Medical Journal*, 2020, 49(2): 215-217. DOI: 10.3969/j.issn.0253-9926.2020.02.038.
- [6] Xue Wen, Huang Fang, Li Xiaoyan, et al. Effect of smoking cessation intervention among smokers in Shiwan Community, Zhudong Town, Pudong New Area, Shanghai [J]. *Occupation and Health*, 2017, 33(14): 1939-1941, 1944. DOI: 10.13329/j.cnki.zyyjk.2017.0584.
- [7] Li Hui, Meng He, Wei Na, et al. Practice and development of smoking cessation clinics at home and abroad [J]. *Chinese Journal of Public Health Management*, 2020, 2(36): 201-203. DOI: 10.19568/j.cnki.23-1318.2020.02.014.
- [8] Sun Ai, Chen Jianwei, Luo Minhong, et al. Assessment of smoking cessation service status and capacity in Guangzhou medical institutions [J]. *Chinese Journal of Public Health Management*, 2014, 30(3): 431-432. DOI: 10.19568/j.cnki.23-1318.2014.03.052.
- [9] Xu Pusheng, Li Meiyi, Xiao Kun, et al. Review of the current status of smoking cessation clinics in China [J]. *Modern Hospitals*, 2022, 3(22): 432-435. DOI: 10.3969/issn.1671-332X.2022.03.029.
- [10] Luo Minhong, Sun Ai, Chen Jianwei. Analysis of smoking cessation service status in Guangzhou medical institutions [J]. *Chinese Journal of Public Health Management*, 2020, 36(6): 830-833. DOI: 10.19568/j.cnki.23-1318.2020.06.020.
- [11] Yang Xiaoli, Liu Hongling, Shen Chengfeng, et al. Survey on smoking cessation services in urban medical institutions in China [J]. *Chinese Journal of Public Health*, 2004, 20(10): 110-111. DOI: 10.11847/zgggws2004-20-10-62.
- [12] Zu Wei, Xiao Qin, Kong Haonan, et al. Survey of smoking cessation clinics in Chaoyang District, Beijing in 2017 [J]. *Journal of Chronic Diseases*, 2019, 20(5): 675-678. DOI: 10.16440/j.cnki.1674-8166.2019.05.014.
- [13] Michie S, Hyder N, Walia A, et al. Development of a taxonomy of behaviour change techniques used in individual behavioural support for smoking cessation [J]. *Addictive Behaviors*, 2011, 36(4): 315-319. DOI: 10.1016/j.addbeh.2010.11.016.
- [14] West R, Walia A, Hyder N, et al. Behavior change techniques used by the English Stop Smoking Services and their associations with short-term quit outcomes [J]. *Nicotine & Tobacco Research*, 2010, 12(7): 742-747. DOI: 10.1093/ntr/ntq074.
- [15] Lorencatto F, West R, Christopherson C, et al. Assessing fidelity of delivery of smoking cessation behavioural support in practice [J]. *Implementation Science*, 2013, 8: 40. DOI: 10.1186/1748-5908-8-40.
- [16] Bauld L, Bell K, McCullough L, et al. The effectiveness of NHS smoking cessation services: a systematic review [J]. *Journal of Public Health*, 2010, 32(1):

71-82. DOI: 10.1093/pubmed/fdp074.

[17] Youth Net. 2022 Beijing Citizen Science Smoking Cessation Public Welfare Activity Launched, Plans to Recruit 500 Smokers to Help Them Quit [EB/OL]. (2022-08-30) [2023-03-30]. <https://t.yynet.cn/baijia/33282885.html>.

[18] Youth Net. Beijing Mobile Medical Smoking Cessation Service Activity Launched Again, 300 Free Smoking Cessation Spots Available for Registration [EB/OL]. (2023-02-09) [2023-03-30]. <https://baijiahao.baidu.com/s?id=1757325863398074672&wfr=spider&for>

[19] Van den Brand FA, Nagelhout GE, Hummel K, et al. Does free or lower cost smoking cessation medication stimulate quitting? Findings from the International Tobacco Control (ITC) Netherlands and UK Surveys [J]. *Tobacco Control*, 2019, 28(s1): s61-67. DOI: 10.1136/tobaccocontrol-2017-054023.

[20] Aksel O, Kucuktepe N, Yaslika Z, et al. Providing free access to smoking cessation medications: does it have an impact on the treatment adherence and success of smoking cessation? [J]. *Turkish Thoracic Journal*, 2021, 22(3): 224-230. DOI: 10.5152/TurkThoracJ.2021.20124.

[21] Chu Shuilian, Wang Shujun, Shi Ju, et al. Current status and policy recommendations for China's smoking cessation service system construction [J]. *Preventive Medicine*, 2022, 34(12): 1235-1239. DOI: 10.19485/j.cnki.issn2096-5087.2022.12.009.

[22] Van den Putte B, Yzer M, Willemsen MC, et al. The effects of smoking self-identity and quitting self-identity on attempts to quit smoking [J]. *Health Psychology*, 2009, 28(5): 535-544. DOI: 10.1037/a0015199.

[23] Waring JJC, Hebert ET, Alexander AC, et al. Evaluating the influences of social support and smoking cues on daily smoking abstinence among socioeconomically disadvantaged adults [J]. *Addictive Behaviors*, 2020, 100: 106107. DOI: 10.1016/j.addbeh.2019.106107.

[24] Litt MD, Kadden RM, Kabela-Cormier E, et al. Coping skills training and contingency management treatments for marijuana dependence: exploring mechanisms of behavior change [J]. *Addiction*, 2008, 103(4): 638-648. DOI: 10.1111/j.1360-0443.2008.02137.x.

[25] Halpern SD, French B, Small DS, et al. Randomized trial of four financial-incentive programs for smoking cessation [J]. *New England Journal of Medicine*, 2015, 372(22): 2108-2117. DOI: 10.1056/NEJMoa1414293.

[26] Chen Li, Gong Yan. Practical experience of setting up "dedicated personnel and rooms" in smoking cessation clinics to support smoking cessation services [J]. *Chinese Journal of Health Education*, 2020, 36(9): 870-871. DOI: 10.16168/j.cnki.issn.1002-9982.2020.09.023.

[27] Cui Y, Wen WQ, Moriarty CJ, et al. Risk factors and their effects on the dynamic process of smoking relapse among veteran smokers [J]. *Behaviour Research and Therapy*, 2006, 44(7): 967-981. DOI: 10.1016/j.brat.2005.07.006.

- [28] Qian Juncheng, Rao Keqin, Gao Jun, et al. Analysis of factors influencing smoking cessation and relapse and health status of quitters [J]. Chinese Journal of Health Statistics, 2009, 26(2): 150-153. DOI: CNKI:SUN:ZGWT.0.2009-02-010.
- [29] Yang TZ, Fisher KJ, Li FZ, et al. Attitudes to smoking cessation and triggers to relapse among Chinese male smokers [J]. BMC Public Health, 2006, 6: 65. DOI: 10.1186/1471-2458-6-65.
- [30] Elfeddali I, Bolman C, Candel MJJM, et al. The role of self-efficacy, recovery self-efficacy, and preparatory planning in predicting short-term smoking relapse [J]. British Journal of Health Psychology, 2012, 17: 185-201. DOI: 10.1111/j.2044-8287.2011.02032.x.
- [31] Papadakis S, McDonald PW, Pipe AL, et al. Effectiveness of telephone-based follow-up support delivered in combination with a multi-component smoking cessation intervention in family practice: a cluster-randomized trial [J]. Preventive Medicine, 2013, 56(6): 390-397. DOI: 10.1016/j.ypmed.2013.02.018.
- [32] Wu L, He Y, Jiang B, et al. Additional follow-up telephone counselling and initial smoking relapse: a longitudinal, controlled study [J]. BMJ Open, 2016, 6(4): e010795. DOI: 10.1136/bmjopen-2015-010795.
- [33] Zhang Ning, Wang Anran. Behavioral intervention strategies to nudge smoking cessation [J]. Advances in Psychological Science, 2023, 31(4): 684-696. DOI: 10.3724/SP.J.1042.2023.00684.
- [34] Hampson SE, Andrews JA, Barckley M. Personality traits, perceived risk, and risk-reduction behaviors: a further study of smoking and radon [J]. Health Psychology, 2006, 25(4): 530-536. DOI: 10.1037/0278-6133.25.4.530.

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ORCID IDs: Hong Qiumian: <https://orcid.org/0000-0002-2495-6571>; Zhang Ning: <https://orcid.org/0000-0002-3804-467X>

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