Quit attempts, use of smoking cessation treatments and quitting intention among treatment seekers in rural areas

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1 Introduction

People who live in rural locations are more likely to smoke tobacco compared with those living in major cities ([Australian Institute of Health Welfare, 2024](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext); [Parker et al., 2022](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext); [Zhang et al., 2022](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext)). Barriers to accessing smoking cessation services in rural and remote locations, include limited smoking cessation programs locally, lack of knowledge about existing resources, and financial hardship ([Hutcheson et al., 2008](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext)). Given rural and remote residents may experience unique barriers to accessing smoking cessation services it is important to understand their smoking cessation behaviors such as quit attempts, quitting intentions, and use of effective smoking cessation treatments.

There is evidence from various countries examining the proportion of people living in rural or remote locations who have ever attempted to quit smoking or attempted to quit in the last 12 months. In China, a study reported 54.9 % of rural current smokers had ever made a quit attempt ([Fu et al., 2017](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext)). An Australian study found that 59 % of residents from remote Aboriginal and Torres Strait Islander communities had tried to quit smoking in the past year ([Thomas & Panaretto, 2022](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext)). An Indian study of rural male residents reported that 31.8 % had made an attempt to quit smoking in the last year ([Dasgupta et al., 2021](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext)). Meanwhile, only 17.9 % of Chinese rural smokers had tried to quit smoking in the last 12 months ([Cai et al., 2015](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext)). There is some evidence in rural and remote settings about which subgroups are more likely to make quit attempts. A recent US study of a rural community revealed that higher education, disapproval of smoking from friends/family, physical health and being advised to quit by a doctor were associated with greater odds of making quit attempts in the past 12 months ([Bittencourt et al., 2023](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext)). Another study reported that among rural male residents, low nicotine dependence and family pressure were associated with attempting to quit smoking ([Dasgupta et al., 2021](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext)). In Bangladesh, a survey with males in rural areas reported that number of friends who smoke, type of smoker, home smoking restrictions and workplace smoking restrictions were associated with making quit attempts ([Flora et al., 2016](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext)).

Quitting intentions among current smokers living in rural areas have also been reported in different countries. For example, among rural community populations, 76.3 % in West Bengal and 46.7 % in Greece intended to quit smoking ([Dasgupta et al., 2021](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext); [Schoretsaniti et al., 2014](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext)). A US study employing the stage of change model ([DiClemente et al., 1991](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext)) found that among rural treatment seekers 58.5 % were in the preparation stage, 39 % in the contemplation stage, and 2.5 % in the pre-contemplation stage ([Richter et al., 2015](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext)). Furthermore, research has also evaluated the characteristics associated with intentions to quit smoking among rural populations. Australian research found that high perceived efficacy, previous consultation with a doctor or healthcare professional about quitting, and attitude on harms were associated with intention to quit smoking in next 3 months ([Gould et al., 2015](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext)). Furthermore, an Indian study revealed that among rural male smokers, working in agriculture, low nicotine dependence, doctor's advice, and family pressure were associated with intention to quit smoking ([Dasgupta et al., 2021](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext)).

Pharmacotherapies such as nicotine replacement therapies (NRT), varenicline, and bupropion ([Anthenelli et al., 2016](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext); [Cahill et al., 2012](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext); [Cahill et al., 2013](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext); [Stead et al., 2012](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext)) and behavioral interventions such as counselling delivered via face-to-face, telephone or online, and self-help materials ([Hartmann-Boyce et al., 2019](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext); [Matkin et al., 2019](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext); [Stead, Koilpillai, Fanshawe, Lancaster, 2016a](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext); [Taylor et al., 2017](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext)) have been shown to be effective in assisting people to quit smoking. A cross-sectional survey reported 46 % of Indigenous Australians from rural New South Wales (NSW) communities used cessation medication during quit attempts ([Gould et al., 2015](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext)). Research among individuals seeking cessation treatment in rural US hospitals reported 65 % had utilized some form of smoking cessation medication, with 60 % using NRT, 36 % using varenicline, and 25 % using bupropion ([Ellerbeck et al., 2019](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext)). Few studies have examined prior use of behavioral smoking cessation interventions among rural populations. An Australian study carried out in a rural setting reported that 52 % consulted a doctor about quitting smoking ([Gould et al., 2015](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext)). To the best of our knowledge, no literature has reported among rural populations, whether specific subgroups are more likely to use pharmacotherapies or behavioral interventions for smoking cessation.

Addressing the gaps in the literature about smoking cessation behaviors and use of behavioral interventions and pharmacotherapies in rural and remote locations, is important to guide efforts of health service providers and policy-makers to increase quit attempts and use of effective smoking cessation treatments among rural and remote populations. This study aimed to explore among smoking cessation treatment seekers in rural and remote areas: 1) prior quit attempts, use of behavioral smoking cessation treatments and pharmacotherapies and quitting intention and 2) factors associated with smoking cessation behaviors and use of behavioral smoking cessation treatments and pharmacotherapies.

2 Methods

2.1 Design

This study used baseline data from a randomized trial ([Tzelepis et al., 2018](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext)). The trial involved adults living in rural and remote areas in NSW, Australia who smoked tobacco daily. The University of Newcastle Human Research Ethics Committee granted ethical approval. The trial was registered with the Australian New Zealand Clinical Trials Registry (ACTRN12617000514303).

2.2 Participants

The study recruited participants from 25 May 2017 to 3 March 2020. Eligibility criteria were aged 18 years or older; used tobacco on a daily basis; access to the internet, telephone, a mode of video-communication; a current email address; and lived in rural (i.e., inner or outer regional areas) or remote (i.e., remote or very remote) locations of NSW, Australia. The Accessibility and Remoteness Index of Australia (ARIA+) which measures the distance from residence to five varieties of service centers classified inner regional, outer regional, remote, and very remote areas based on residential postcode ([Australian Bureau of Statistics, 2018](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext)).

2.3 Procedure

The study recruited participants via traditional methods (e.g., newspapers and posters) and online advertisements (e.g., Facebook and Twitter) ([Byaruhanga et al., 2019](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext)). The advertisements included a hyperlink which led potential participants to the study website. The website contained a participant information sheet as well as a hyperlink or a QR code of the online screening survey. Those who consented and met the study eligibility criteria during the online screening survey were automatically re-directed to the online baseline survey.

2.4 Measures

2.4.1 Quit attempts

The survey asked participants if they had: i) ever made a quit attempt for one day or longer and ii) made a quit attempt in the last 12 months. The response options were Yes, No, Don't remember.

2.4.2 Use of quitting strategies

The survey asked participants who had ever made a quit attempt “Which of the following strategies or aids have you ever used during any of your quit attempts? Did you use ... a) Zyban or bupropion; (smoking cessation pill) b) Champix or varenicline; (prescription medication used to help people quit smoking) c) Nicotine replacement therapy; d) A quit kit; (i.e. written materials that can be obtained by calling the Quitline) e) Self-help book, manual or brochure; f) Group face-to-face counselling; g) One-on-one individual counselling; h) Talking to the Quitline; i) Going to see a general practitioner (GP); j) Online service; k) SMS service; l) Video support service.” The response options were Yes, No, Don't remember.

2.4.3 Quitting intention

The survey asked participants about their intention to quit. The response options were a) will quit in the next 30 days; b) will quit in the next 6 months; c) may quit in the future, but not in the next 6 months; d) never expect to quit; or e) don't know.

2.4.4 Socio-demographic characteristics

Demographic information collected included gender, age, country of birth, Aboriginal or Torres Strait Islander identity, level of education, marital status, employment status, and postcode of residence.

2.4.5 Nicotine dependence

The Heaviness of Smoking Index (HSI) assessed nicotine dependence ([Kozlowski et al., 1994](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext)). HSI has been shown to be a valid measure of nicotine dependence in the general population ([Borland et al., 2010](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext)). Specifically, the study asked participants “How soon after you wake up do you smoke your first cigarette?” and “How many cigarettes per day do you smoke?” The HSI score was calculated by adding the score for time to first cigarette (0 = >61 min; 1 = 31–60 min; 2 = 6–30 min; and 3 = fewer than 5 min) and cigarettes per day (0 = 1–10 cigarettes; 1 = 11–20 cigarettes; 2 = 21–30 cigarettes; and 3 = >31 cigarettes) ([Kozlowski et al., 1994](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext)). The score was classified into one of three groups, 0–2: low addiction; 3–4: moderate addiction; and 5–6: high addiction ([Kozlowski et al., 1994](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext)).

2.4.6 Anxiety and depression

The Patient Health Questionnaire-4 (PHQ-4) assessed anxiety and depression ([Kroenke et al., 2009](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext)). The PHQ-4 is a validated and widely accepted measure for examining symptoms of anxiety and depression ([Caro-Fuentes & Sanabria-Mazo, 2023](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext); [Löwe et al., 2010](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext)). It has four questions including two items for assessing depression and two items for assessing anxiety. Participants were asked “Over the last 2 weeks, how often have you been bothered by the following problems?” a. Feeling nervous, anxious or on edge; b. Not being able to stop or control worrying; c. Little interest or pleasure in doing things; d. Feeling down, depressed, or hopeless. The response options were not at all (0), several days (1), more than half the days (2) and nearly every day (3). The response option score for the first two items were added to provide a total score for anxiety. A total score ≥ 3 suggested symptoms of anxiety. The response option score for the last two items were added to provide a total score for depression. A total score ≥ 3 suggested symptoms of depression.

2.4.7 Alcohol intake

The study asked participants “How often do you have more than 2 standard drinks of alcohol on one day?” The response options were Daily or almost daily, Weekly, Monthly, Less than monthly, and Never.

2.4.8 Financial stress

The study asked participants “In the past 6 months did any of the following occur due to a shortage of money: (1) could not pay electricity, gas, or telephone bills on time; (2) could not pay the mortgage or rent on time; (3) pawned or sold something; (4) went without meals; (5) was unable to heat home; (6) asked for financial help from friends or family; and (7) asked for help from a welfare or community organization. The response options were yes or no ([Siahpush et al., 2003](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext)).

2.4.9 Chronic conditions

The study asked participants if they had the following chronic conditions: a) Heart disease; b) High blood pressure and/or high cholesterol c) Cancer; d) Diabetes (Type 1 or Type 2); e) Stroke.

2.4.10 Statistical analysis

The study presents continuous variables as a mean, standard deviation, and median and categorical variables as frequencies and percentages. Multivariable logistic regressions determined whether socio-demographic characteristics, nicotine dependence, anxiety, depression, financial stress, alcohol intake, and chronic conditions were associated with having a) ever quit, b) quit in the last 12 months, c) intention to quit in next 6 months, d) ever use of behavioral smoking cessation interventions, and e) ever use of smoking cessation pharmacotherapies. The analysis included all of the covariates in each of these models and presents odds ratios (OR) and 95 % confidence intervals (CI). Analysis was conducted with SAS v9.4 (SAS Institute, Cary, North Carolina, US). The statistical significance level was *p* value <0.05.

3 Results

A total of 1244 participants completed the baseline survey. Over three-quarters (76.9 %) were female, the mean age was 43.6 (SD = 11.4) years. Most participants (89.1 %) were born in Australia and 9.2 % identified as Aboriginal and/or Torres Strait Islander. Approximately half (50.5 %) of participants were married or in a relationship and 64.5 % were employed. About one-quarter (24.4 %) had completed university or equivalent training. The majority (72.4 %) of participants lived in an inner regional area, 41.7 % of respondents reported low financial stress, and 72.5 % had moderate or severe nicotine dependence. Half of respondents (51.1 %) reported symptoms of anxiety and 41.1 % symptoms of depression. Approximately one-fifth (22.0 %) of participants drank two or more standard drinks daily or almost daily ([Table 1](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext#t0005)).

As shown in [Table 2](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext#t0010), 91.1 % had ever made a quit attempt, while 48.3 % had made a quit attempt in the last 12 months. In relation to quitting intentions, 44.6 % of participants intended to quit in the next 30 days and 33.6 % intended to quit in the next 6 months. [Table 2](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext#t0010) also showed that among those participants who had ever made a quit attempt, 82.2 % had used pharmacotherapies and 68.3 % had used a behavioral intervention during any quit attempt. With regards to use of pharmacotherapies, 71.9 % had used NRT products, 50 % Champix (varenicline), and 13.4 % Zyban (bupropion). In terms of use of behavioral interventions during quit attempts, approximately half (52.7 %) had consulted a GP for smoking cessation support, 27.0 % had used a self-help book, while 18.9 % had used a quit kit. Less than one-fifth (17.4 %) of participants had used the Quitline and 13.5 % of participants had used an online service. Furthermore, 7.0 % and 3.9 % of participants had used individual or group counselling respectively. Moreover, 2.7 % used an SMS service, and only 0.3 % used a video support service during a quit attempt.

3.1 Characteristics associated with having ever made a quit attempt

While keeping all other variables constant, participants aged 50 years or older had significantly greater odds (OR = 2.85, 95 % CI 1.51–5.39, *p* = 0.001) of having ever made a quit attempt than those aged 18–34 years. Compared to participants who completed Year 12/TAFE Certificate education, participants who completed year 10 or less had significantly lower odds (OR = 0.55, 95 % CI 0.35–0.88, *p* = 0.01) of ever having made a quit attempt. Compared with those who had low nicotine dependence, participants who had moderate (OR = 0.54, 95 % CI 0.30–0.96, *p* = 0.04) or high (OR = 0.37, 95 % CI 0.18–0.76, *p* = 0.007) nicotine dependence had significantly lower odds of ever having made a quit attempt ([Table 3](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext#t0015)).

3.2 Characteristics associated with a quit attempt in last 12 months

Females had significantly lower odds (OR = 0.74, 95 % CI 0.56–0.99, p = 0.04) of making a quit attempt in the last 12 months compared to males while keeping all other variables constant.

People born in Australia had significantly lower odds (OR = 0.67, 95 % CI 0.45–0.99, *p* = 0.045) of making a quit attempt in the last 12 months compared to people born overseas. Compared with those who had low nicotine dependence, participants who had moderate (OR = 0.53, 95 % CI 0.40–0.71, *p* < 0.001) or high (OR = 0.42, 95 % CI 0.28–0.63, p < 0.001) nicotine dependence had significantly lower odds of making a quit attempt in the last 12 months ([Table 3](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext#t0015)).

3.3 Characteristics associated with intention to quit within 6 months

While keeping all other variables constant, compared to participants who completed Year 12/TAFE Certificate education, participants who completed year 10 or less had significantly lower odds (OR = 0.64, 95 % CI 0.45–0.92, *p* = 0.02) of intending to quit within 6 months ([Table 3](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext#t0015)).

3.4 Characteristics associated with ever use of pharmacotherapies during quit attempts

Compared to those with low nicotine dependence, participants with moderate (OR = 1.96, 95 % CI 1.37–2.79, *p* < 0.001) or high (OR = 3.27, 95 % CI 1.66–6.45, *p* < 0.01) nicotine dependence had significantly greater odds of ever having used pharmacotherapies during quit attempts. Rural residents with chronic conditions had significantly greater odds (OR = 1.45, 95 % CI 1.00–2.11, *p* = 0.047) of ever using pharmacotherapies during quit attempts than those without chronic conditions. Participants who consumed more than two standard drinks of alcohol daily or almost daily had significantly lower odds (OR = 0.46, 95 % CI 0.26–0.81, *p* = 0.007) of ever using pharmacotherapies during quit attempts than those who never drank alcohol ([Table 4](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext#t0020)).

3.5 Characteristics associated with ever use of behavioral interventions during quit attempts

Compared to participants who completed Year 12/TAFE Certificate education, participants who completed University or other tertiary institute education had significantly greater odds (OR = 1.47, 95 % CI 1.04–2.07, *p* = 0.03) of ever using behavioral interventions during quit attempts. Compared to participants with low nicotine dependence, those with moderate (OR = 1.38, 95 % CI 1.02–1.87, p = 0.04) or high (OR = 3.31, 95 % CI 1.94–5.66, p < 0.001) nicotine dependence had significantly greater odds of ever using behavioral interventions during quit attempts. Compared to those who had no financial stress, participants who had moderate (OR = 1.63, 95 % CI 1.19–2.22, *p* = 0.002) or high (OR = 1.73, 95 % CI 1.12–2.68, *p* = 0.01) levels of financial stress had significantly greater odds of ever using behavioral interventions during quit attempts. Participants with anxiety had significantly greater odds (OR = 1.61 95 % CI 1.16–2.22, *p* = 0.004) of ever using behavioral interventions when attempting to quit than those without anxiety. Participants with depression had significantly lower odds (OR = 0.66 95 % CI 0.47–0.92, *p* = 0.02) of ever using behavioral interventions than those who were not depressed ([Table 4](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext#t0020)).

4 Discussion

This study found that most rural and remote smoking cessation treatment seekers (91.1 %) had ever made a quit attempt. This is higher than a study which reported among rural current smokers in China that 54.9 % had ever made a quit attempt ([Fu et al., 2017](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext)). Meanwhile, we found that approximately half (48.3 %) of participants had made a quit attempt in the last 12 months, which is lower than a study with residents from remote Aboriginal and Torres Strait Islander communities in Australia (59 %) ([Thomas & Panaretto, 2022](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext)) and higher than a study with rural residents in China (17.9 %) ([Cai et al., 2015](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext)). There are several reasons that may explain the prevalence of quit attempts in these studies including sample representativeness, time of data collection, and measures used. Men, those born in Australia, and with higher levels of nicotine dependence had significantly lower odds of making a quit attempt in the last 12 months. Similar to our findings, a study in West Bengal in a rural community reported that low nicotine dependence was significantly associated with making a quit attempt in the past 12 months ([Dasgupta et al., 2021](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext)). However in contrast to our findings a previous study with a rural population reported higher level of education was associated with making a quit attempt in the past 12 months ([Bittencourt et al., 2023](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext)). Our findings suggest that, in an Australian setting at least, strategies focused on increasing the rate of recent quit attempts among those with higher levels of nicotine dependence, women, and those born in Australia living in rural areas appear warranted.

In relation to quitting intention in rural settings our study showed that 78 % intended to quit smoking within the next 6 months. Results from a Greek study reported that 46.7 % of rural participants intended to quit in the future ([Schoretsaniti et al., 2014](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext)). Furthermore, researchers from India found that 76.3 % of rural residents intended to quit smoking in the future ([Dasgupta et al., 2021](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext)). Considering our participants were treatment seekers who were randomized to a behavioral intervention after this baseline survey, this may explain why the quitting intention in our study is higher than previous studies that have surveyed rural populations from the community who were not all seeking treatment. Our study reported that rural residents with less education had smaller odds of intending to quit in the next 6 months. Previous research has indicated that high perceived efficacy, previous consultation with a doctor or healthcare professional about quitting, and attitude on harms were associated with quitting intention among rural populations ([Gould et al., 2015](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext)).

Ever use of pharmacotherapies among rural and remote treatment seekers in our study who had made a quit attempt was high (82.2 %). In comparison to an American study conducted among smoking cessation treatment seekers in rural settings, which indicated that 60 % had used NRT products, 36 % had used varenicline, and 25 % had used bupropion ([Ellerbeck et al., 2019](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext)), our study found a greater proportion had used NRT and varenicline but a lower proportion had used bupropion. Consistent with this prior research ([Ellerbeck et al., 2019](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext)), our findings showed that NRT was the pharmacotherapy most used among a rural population. Our study is the first to examine the characteristics associated with use of pharmacotherapies during quit attempts among adult treatment seekers living in rural and remote areas. We found that those with higher nicotine dependence, chronic conditions, and who did not drink alcohol were more likely to have used these products. Similarly, a prior study with daily smokers in the US general population revealed that individuals with higher levels of nicotine dependence were more likely to use medication for cessation ([Shiffman et al., 2008](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext)). Clearly, there is room for improvement in encouraging rural and remote populations to use pharmacotherapies while trying to quit smoking, including those who drink alcohol daily and those with no chronic health conditions.

Our study found that a majority (68.3 %) of rural and remote treatment seekers who had made a quit attempt had ever used behavioral interventions. The use of different behavioral smoking cessation treatments however ranged from 0.3 % for video support to 52.7 % for GP advice, indicating there is a need to promote all types of effective behavioral interventions and make them fully accessible in rural settings to increase the uptake of these services. Seeing a GP was the behavioral strategy most commonly used by participants in our study and may be related to them needing to obtain a prescription from a GP to obtain varenicline or bupropion. Further research is required to gain a deeper understanding of the reasons why rural and remote populations are not commonly using some types of behavioral smoking cessation treatments. A US study reported that only 6 % of rural participants had used a counselling program to help them to quit smoking ([Zanis et al., 2011](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext)), which is similar to the 3.9 %–7.0 % in our study that had used group or individual counselling. Factors such as fewer recommendations from health professionals ([Chen et al., 2019](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext)), as well as less accessibility to such smoking cessation services in rural and remote regions ([John et al., 2016](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext)) may contribute to the under-utilisation of effective smoking cessation treatments.

Our study is the first to examine factors associated with use of behavioral smoking cessation interventions among a rural population of treatment seekers and found that more education, higher levels of nicotine dependence, more financial stress, anxiety, and not being depressed were associated with ever having used a behavioral smoking cessation intervention. Interestingly, although our study found those with moderate or high nicotine dependence were less likely to make a quit attempt, they were more likely to use both pharmacotherapies and behavioral interventions during quit attempts compared to those with low nicotine dependence. This may be explained by individuals with moderate or high nicotine dependence anticipating difficulty in quitting smoking successfully and therefore being more likely to use pharmacotherapies and behavioral interventions during quit attempts rather than willpower alone, when compared to those with low nicotine dependence. In NSW, behavioral strategies such as Quitline, self-help books, quit kits and online services are free which may make them particularly popular among populations experiencing higher levels of financial stress. Given research has reported that individuals with mental health conditions face greater challenges in achieving smoking cessation ([Keith et al., 2017](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext); [Yang et al., 2023](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext)), this may explain why those with anxiety were more likely to use behavioral smoking cessation interventions. In contrast participants with depression were less likely to use behavioral strategies during quit attempts. Proactive engagement of those experiencing depression may increase enrolment into smoking cessation treatment. These novel findings can significantly contribute to tailored initiatives for subgroups in rural and remote populations with lower levels of education, depression, and lower nicotine dependence to increase the use of effective behavioral interventions for smoking cessation. Further studies could examine potential barriers of using behavioral smoking cessation interventions among rural and remote populations.

This study had some limitations. Firstly, participants were from rural and remote areas in NSW Australia which may limit the generalisability of the findings, to all countries, especially low-income and middle-income countries. Secondly, participants were self-selected as they volunteered to participate and were treatment seekers who enrolled in a randomized trial offering behavioral treatment (i.e., video counselling, telephone counselling or printed materials) to help them quit smoking. Therefore, our findings are likely to be more generalizable to rural smokers seeking behavioral smoking cessation treatment than to the general population of rural smokers. Thirdly, as this study used baseline data from a smoking cessation trial it focussed on the prior quit behaviors and use of cessation interventions among rural treatment seekers and did not include rural non-treatment seekers nor smokers living in urban areas. Consequently, the smoking cessation behaviors of these different groups could not be compared, and the generalizability of our findings may be limited to rural residents seeking smoking cessation treatment. Future research could make such comparisons. Fourthly, only a very few remote and very remote residents were recruited into this study, while most participants were women. One possible reason for the over-representation of women in this study is that women have been found to be more likely to use behavioral treatments for smoking cessation such as telephone support, online programs and printed materials ([Jayakumar et al., 2020](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext)) and thus may have been more willing than men to enroll in our trial of behavioral treatments. Fifthly, participants were asked to recall their smoking cessation history, potentially introducing recall bias. Sixthly, participants were asked about ever use of behavioral strategies and pharmacotherapies during any quit attempt, which did not allow the opportunity to examine the proportion who had used pharmacotherapies and behavioral interventions in combination during a singular quit attempt. Given that combining behavioral strategies and pharmacotherapies increases quitting success ([Stead, Koilpillai, Fanshawe, Lancaster, 2016b](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext)), future research could examine use of pharmacotherapies and behavioral interventions in combination among rural and remote populations. Lastly, the study finalized data collection in March 2020 and so was not impacted by the COVID-19 pandemic. Some studies have shown that COVID-19 can affect the decisions people make related to their cessation behaviors ([Bommele et al., 2020](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext); [Klemperer et al., 2020](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext); [Sidor & Rzymski, 2020](https://www.jsatjournal.com/article/S2949-8759(24)00315-1/fulltext)). Therefore, future studies should be conducted among rural populations to further examine their smoking cessation behaviors and use of effective smoking cessation treatments.

5 Conclusions

This study identified that behavioral interventions such as Quitline and counselling were underutilised as were pharmacotherapies such as bupropion, suggesting further efforts are needed to promote these effective interventions to increase uptake of these treatments. For instance, initiatives to increase healthcare provider referral of rural and remote populations to services such as the Quitline may help to increase the use of effective smoking cessation treatments. Smoking cessation service providers and healthcare professionals should encourage all rural and remote residents who smoke cigarettes to use effective smoking cessation treatments that increase their chances of quitting success. Furthermore, our study findings suggested that further research is needed to understand whether there are particular barriers among various sub-groups, such as those with less education, depression, who drink alcohol daily, with no chronic conditions and with low nicotine dependence, that hinder their use of effective smoking cessation treatments.