# Behavioural interventions for tobacco cessation in India: A systematic review and meta-analysis

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## Abstract

Tobacco consumption is an area of public health concern in India. One of the unmet needs of many low-resource countries is to provide cost-effective tobacco cessation interventions for reducing tobacco-related mortality. This article reviews studies on non-pharmacological interventions for tobacco cessation in India. A systematic review by PICO (population, intervention, comparison, outcome) of behavioural intervention-based tobacco cessation studies that met the inclusion criteria, with a minimum 1-month follow-up, reporting outcomes in terms of frequencies or percentages published between 2010 and 2020 was performed. Following the review stages, 16 studies comprising 9,613 participants were included in the review. A pooled estimate was derived using both fixed-effects and random-effects models. The intervention showed good overall efficacy for any tobacco user (relative risk [RR] = 1.73 [95% confidence interval [CI]: 1.58–1.90) (fixed-effect model)] and (RR = 2.02 [95% CI: 1.64–2.48] [random-effects model]). Behavioural intervention studies targeted towards only smokers (RR of 1.81 [95% CI: 1.55–2.11] and 1.96 [95% CI: 1.52–2.53]) and combined smoking and smokeless tobacco users (RR of 1.69 [95% CI: 1.50–1.90] and 2.12 [95% CI: 1.49–3.01]) were equally efficacious. The review provides the effectiveness of behavioural interventions in quitting tobacco among users of both smoking and smokeless forms of tobacco. The review findings are of particular significance to inform health policy decisions on the integration of cost-effective brief behavioural intervention into existing health care services in resource-constrained countries.

**Keywords:** Cessation, counselling, intervention, quit rate, tobacco

## Introduction

An estimated 8 million deaths a year are caused due to tobacco.[1] Tobacco predisposes to multiple diseases including tuberculosis (TB) and results in poor treatment outcomes in both TB and HIV patients.[2-5]

To control this epidemic of tobacco, the World Health Organization (WHO) formed the Framework Convention on

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Tobacco Control (FCTC) and MPOWER initiatives at the global level.[6-8] Sustainable Development Goal 3 targets to strengthen the implementation of the WHO FCTC on tobacco control in all countries by 2030.[9] At the national level, India has the National Tobacco Control Program and the Cigarettes and Other Tobacco Products Act of 2003, which restrict the advertisement of tobacco products, ban smoking in public places and put regulations on the trade of tobacco products.[10,11]

Apart from the efforts at the global and national levels, tobacco cessation services need to be strengthened at the local level. Tobacco is exceptionally addictive, and thus individuals who want to quit tobacco are unable to do it.[12] This calls for tobacco cessation programs to provide the support required for tobacco users to quit.[13] Currently, however, only 23 countries provide comprehensive cessation services to assist tobacco users to quit. This covers just 32% of the world's population.[14]

Globally, a declining trend in tobacco consumption was observed from 2000 (33.3%) to 2015 (24.9%). However, it still falls short of the target to cut tobacco use by 30% by 2025.[15] In India, although the prevalence of tobacco use has decreased from 34.6% (2009–2010) to 28.6% (2016–2017), the burden is high when observed in absolute numbers.[6,16] Contrary to the rest of the world, in India, smokeless form of tobacco (21.4%) is more common than smoked tobacco (10.7%).[6] It has been found that switching to smokeless tobacco is the most common cessation method for smoking.[17] There, thus is a need for guidance and a need for developing cost-effective community tobacco-cessation models. There have been many studies conducted in India to look at the effect of tobacco-cessation intervention services on quit rates for tobacco. The study aims to systematically review and meta-analyse the quit rates achieved in these studies.

This study is especially relevant to primary healthcare physicians as they are amongst the first point of contact of tobacco users with the healthcare system. Quitting tobacco requires sustained, repeated reinforcements and reminders, which are provided by the platform of primary healthcare. The findings from this review will provide evidence for physicians to integrate tobacco-cessation counselling into their clinical practice.

## Data selection, extraction, and synthesis

We used the international PICOS format for the meta-analysis; P–population consists of participants who are tobacco consumers, I–intervention is behavioural intervention for tobacco cessation, C–the comparative group consists of tobacco users who did not receive any intervention, O–the outcome is the quit rates achieved in these studies, and S-studies included are randomized controlled trials (RCTs).

The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) framework was used for reporting this review.[18] An online search strategy was performed to systematically review the literature for various tobacco cessation intervention studies in India. The resultant data evaluated are shown in Figure 1.

An extensive literature search on PubMed, Scopus, Web of Science, and Embase, was performed using a combination of keywords such as 'tobacco cessation' OR 'tobacco intervention' OR 'tobacco quit rates' OR 'quit line', OR 'brief advice' AND 'India.' Study authors were contacted to identify additional studies. The date were last searched on 1 December 2022.

The criteria for data selection, obtained from the search above, were as follows:

## Inclusion criteria

(1) Research methods included RCT studies. (2) Studies with behavioural intervention to quit tobacco. (3) Studies assessing quit rate as primary or as a secondary objective. (4) Studies providing complete data on quit rates. (5) Studies within the time frame from 2010–2020. (6) Studies performed on the Indian population. (7) Studies published in English language literature.

## Exclusion criteria

(1) Literature reviews, systematic reviews, and study protocols. (2) Studies with differing objectives. (3) Studies without full texts. (4) Studies with more than one comparator group. (5) Studies with no comparator group (follow-up interventional studies). (6) Studies with data of before 2010. (7) Studies with pharmacological interventions.

## Outcome measures

Our primary outcome of interest was abstinence from tobacco at a follow-up period of at least 1 month. The abstinence rates were as defined by the authors. Both biochemical verification and self-reported abstinence were included.

Data such as title of the study, first author, publication year, study design, target population, type of intervention, the sample size for the study, follow-up periods, quit rates (percentages or frequencies) were extracted from the studies and put in the Excel sheet.

## Statistical analysis

RRs obtained from each study were merged. The pooled estimate of RR was calculated. The sample size of each study was considered to provide weightage of the study. The forest plots were presented to show study-wise variations with RR. Data included (1) behavioural interventions and tobacco cessation, (2) heterogeneity test and subgroup analysis, and (3) bias analysis.

# Results

A total of 2,037 titles were found after the exclusion of duplicates [Figure 1]. A search in the grey literature revealed
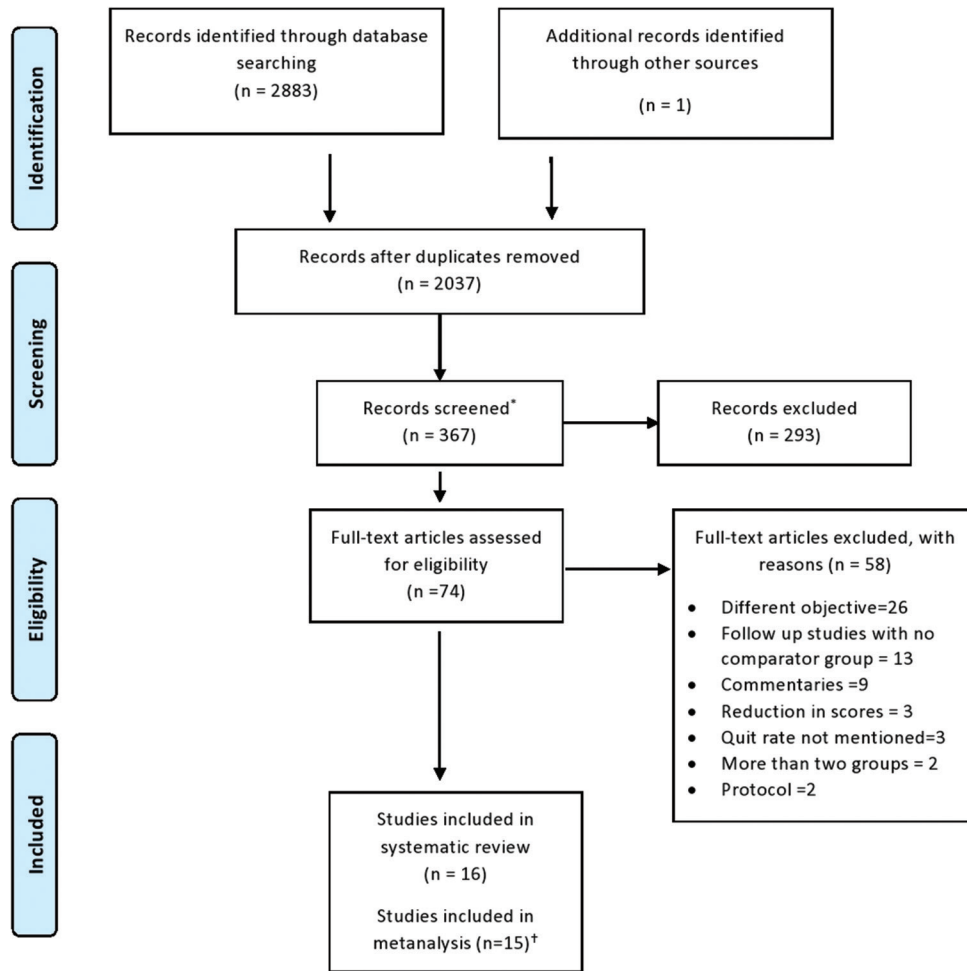
**Figure 1:** Flow diagram showing study selection process based on PRISMA 2009 guidelines

one extra study. Three hundred sixty-seven records were screened, 74 full texts were evaluated and based on the exclusion and inclusion criteria, 16 studies were included. The review included 9,613 persons: case group (*n* = 4,857) and control group (*n* = 4,756). The details of the included studies are given in Table 1.

Three studies were conducted only among males, and a single study was exclusively conducted among females.[23,25,27,34] All other studies had both males and female participants. Six studies only included smokers, whereas 10 studies included both smoked and smokeless tobacco users.

In our review, there were nine cluster RCTs.[19-21,25-27,30,32,33] The number of clusters varied from 11 to 60.[25,33] Among these, four RCTs used geographical units such as low-income administrative blocks, community development blocks, villages and polling areas as clusters.[19,25,27,33] Three studies used schools as clusters.[20,26,30] Other study settings were manufacturing worksite units and designated microscopy centres.[21,32]

The populations addressed in the studies can broadly be divided into three categories: community-based, school-based (focusing on adolescents), and those targeting special populations. Among the special populations, two studies were conducted among tuberculosis or HIV patients.[21,22] Other studies were carried out among convicted male prisoners,[23] male diabetic patients,[24] school teachers,[26] patients discharged after an acute coronary syndrome,[31] and among workers at manufacturing sites.[32]

Varied types of interventions were used in the studies to facilitate tobacco cessation. Broadly we have classified the interventions into individual sessions and group-based sessions. Seven studies gave counselling individually on a one-to-one basis[21,22,24,29,31,32,34] and eight gave group-based interventions.[19,20,23,26-28,30,33] One study included both individual- and group-based sessions.[25]

The number of intervention sessions ranged from one single session to a maximum of 15 sessions.[19,33,34] Most studies delivered six sessions of intervention.[20,29,31,32] The duration of each intervention ranged from 2 min to 50 min.[20,21] Maximum studies, however, reported a contact time of 30 min.[24,27,29,34]

Some studies used a more pragmatic approach and physicians carried out the interventions.[21,22,27] In the study by Goel *et al.*,[21] ABC intervention (Ask, Brief advice, and Cessation support)

## Table 1: Description of studies that met our eligibility criteria

| Ref. no. | Author *et al.* | Year | Target population | Study area | Intervention | Results |
|---|---|---|---|---|---|---|
| 19 | Sarkar *et al.* | 2016 | Adult tobacco users (*n*=1213) | Delhi | The intervention consisted of a single session of advice on quitting tobacco, for around 15 min along with training in yogic breathing exercises. | The smoking cessation rate was higher in the intervention group (2.6%) than in the control group (0.5%). |
| 20 | Chatterjee *et al.* | 2019 | Students of low-income families in grades 7, 8, and 9. (*n*=222) | Mumbai | An intervention titled "Life First" was delivered. It consisted of a psychosocial approach and focused on smaller groups. | For tobacco-only users, there was a non-significant increase of 1.7% in intervention schools and a significant 26.2% increase in the comparison group. Tobacco plus supari use declined in both groups. |
| 21 | Goel *et al.* | 2017 | Smokers (15+ years) registered as smear-positive pulmonary TB for DOTS (*n*=156) | Chandigarh | The intervention by the International Union against TB and Lung Disease (The Union) "Smoking Cessation and Smoke-free Environments for TB Patients 2010" was used in the study. | Smoking cessation was higher in the intervention arm (80.2%) than in the comparison arm (57.5%) |
| 22 | Kumar *et al.* | 2017 | HIV/TB male patients referred to the National Institute for Research in Tuberculosis (*n*=160) | Madurai | The intervention group received counselling from a physician and self-help material in addition to the standard advice for smoking cessation. | Quit rates were 41% in the physician group and 35% in the standard counselling arm. |
| 23 | Naik *et al.* | 2014 | Male adults, tobacco-convicted prisoners of Central Jail (*n*=600) | Bangalore | Motivational intervention was given to male prisoners in Central Jail, Bengaluru city. | After the intervention, 16% stopped smoking as compared to 2% in the control arm. |
| 24 | Thankappan *et al.* | 2013 | Adult diabetic smokers (*n*=224) | Thiruvananthapuram | A counselling session specific to diabetes and tobacco was delivered by health personnel. It was based on 5As (ask, advise, assess, assist and arrange), and 5 Rs (relevance, risks, rewards, roadblocks and repetition). | The quit rate was 51.8% in the intervention arm as compared to 12.5% in the control arm. |
| 25 | Jayakrishnan *et al.* | 2013 | Male smokers in the age group 18–60 years (*n*=928) | Thiruvananthapuram | The intervention group received multiple approaches such as face-to-face interviews, telephone counselling and distribution of educational materials on tobacco hazards. | The quit rates were found to be 14.7% in the intervention arm and 6.8% in the control arm. |
| 26 | Sorensen *et al.* | 2013 | School teachers (*n*=268) | Patna | The intervention comprised educating the people, developing policies to control tobacco, and providing quitting support that was designed according to the needs of the people. | The adjusted 6-month abstinence rates were 20% and 5%, respectively, for the intervention and control groups. |
| 27 | Kumar *et al.* | 2012 | Male tobacco users in the age group 20-40 years (*n*=400) | Tiruchirappalli | A physician delivered two health education sessions to the intervention group over a period of 5 weeks. Intervention participants were also provided with self-help materials. | Abstinence from tobacco was 12.5% in the intervention group, and more than 6.0% in the control group. |

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| | | | | **Table 1: Contd...** | | |
| Ref. no. | Author *et al.* | Year | Target population | Study area | Intervention | Results |
| 28 | Reddy *et al.* | 2015 | Students from the Degree colleges (*n*=115) | Bangalore | Interventions were administered in a total of four sessions. The topics included a general introduction to tobacco, assessment of high-risk situations, providing participants with educational material on tobacco, taking feedback and reinforcing tobacco cessation. | In the intervention group, 29.1% of students stopped using tobacco completely as compared to 15% in the control group. |
| 29 | Joshi *et al.* | 2019 | Individuals at intermediate to high cardiovascular disease risk (*n*=2,125) | 28 villages across India. | In the intervention group, trained community health workers delivered risk-reduction advice and monitored risk factors. | The proportion of individuals who used smokeless tobacco declined by 16.4% in the intervention arm, and by 6.8% in the control arm, the proportion of individuals who smoked declined by 4.1% in the intervention arm and by 2.6% in the control arm. |
| 30 | Mall *et al.* | 2017 | Adolescent students (*n*=367) | Gandhinagar | Intervention consisted of training influential students to act as peer supporters during informal interaction outside the classroom to encourage their peers not to consume tobacco in any form. | A significant reduction in tobacco consumption was observed in the intervention group (48%–36%) during the follow-up. |
| 31 | Xavier *et al.* | 2016 | Patients with acute coronary syndrome (*n*=284) | 14 cities in India | In the intervention group, four in-hospital and two home visits were made by community health workers. They used unstructured discussions, visual methods, and patient diaries to educate patients on healthy lifestyles and drugs, and measures to enhance adherence. | A significantly greater proportion in the intervention group reported being abstinent at 1 year (85%) compared with the control group (52%). |
| 32 | Sorensen *et al.* | 2017 | Workers in manufacturing industries (*n*=1,469) | Mumbai | Organizational-level and individual-level interventions were implemented at the worksite. | In the intervention group, 17.3% of students stopped using tobacco completely as compared to 11.1% in the control group. |
| 33 | Thankappan *et al.* | 2018 | Individuals with the Indian Diabetes Risk Score (IDRS) ≥60 and aged 30–60 years (*n*=1007) | Trivandrum | The intervention was a peer support program delivered at the community level with 15 group sessions. It included a variety of activities to help make lifestyle modifications. | In all, 5.5% of participants had quit in the intervention group as compared to 1.6% of the participants in the control group. |
| 34 | Jhanjee *et al.* | 2017 | Women tobacco users (*n*=100) | Delhi | Behavioural intervention (BI) was delivered by two trained social workers. It was a single session of 30 min duration using the FRAMES model (details in the text). | In all, 40% of participants had quit in the intervention group as compared to 26% of the participants in the control group. |

*n indicates the number of tobacco users in the study

was delivered by the physician within the existing program activities for around 5 min. These services were delivered at the time of registration of the patients and during their sputum re-examination visits (2 months, 5 months end). In the other study conducted among HIV and TB patients, the individuals in the intervention group received counselling from a physician using a modified version of the 5As (ask, advise, assess, assist and arrange) strategy. It was a modified 5As approach, as the

physician counselled both the subject and the family members.[22] In a study performed in Tamil Nadu, two sessions of health education were delivered by a physician along with providing the participants with self-help material.[27] In a similar way, community health workers were trained to give counselling sessions along with regular screening for cardiovascular diseases.[29]

Intervention approaches in the community included the FRAMES (Feedback, Responsibility for their choices, Advice, Menu of alternative strategies, Empathy and Self-efficacy to inspire optimism) approach in the study on women residing in low socio-economic areas.[34] Some other interventions were the practice of yogic breathing exercises,[19] and the setting up of medical camps and mobile phone counselling.[25]

The follow-up periods varied among studies. Most community-based studies and a study among school teachers in Bihar had a follow-up period of 1 year or more.[25,29-31,33] The maximum follow-up period of 24 months was observed in a cluster- RCT of the Kerala Diabetes Prevention Program.[33] In contrast, follow-up of less than 6 months was reported in three studies.[22,27,34] Out of these, two were community-based studies, and one was conducted among TB and HIV patients. Participants in the studies conducted among diabetic patients, male prisoners, and students of degree colleges were followed up for 6 months.[23,24,28] For participants recruited from low-community clusters, designated microscopy centres (DMC), worksite manufacturers, and adolescents in schools the follow-up period varied from 7 to 9 months.[19-21,26,32]

The period of abstinence from tobacco that was considered as quit tobacco was variable among studies. It varied from 7 days to 6 months in the included studies.[19,24,26,32] The abstinence was verified by carbon monoxide levels in two studies and salivary cotinine levels in one study.[19,22,23]

## Meta-analysis of tobacco cessation quit rates

Risk ratios (RR) were used to measure the effect quantity. One study was not included in the meta-analysis as the number of tobacco users increased in the control group.[20] Results were calculated using both random effects and fixed effects models. The fixed-effect model assumed that the actual effect size for all studies was identical. The sampling error was the reason for having effect size difference. Fixed-effect and random-effects weights were different. The random effect model was assumed to estimate the mean of a distribution of effects. Studies were allotted weights according to their sample sizes.

A pooled analysis of all studies was undertaken to study the effect of tobacco cessation interventions on quit rates. As shown in Figure 2, the combined effect quantity for tobacco cessation intervention had an RR value of 1.73 (95% CI: 1.58–1.90) (fixed-effect model) and 2.02 (95% CI: 1.64–2.48) (random-effects model). Further categorisation of studies into those only targeting smokers and studies targeting both

smoked and smokeless tobacco users was performed. A RR of 1.81 (95% CI: 1.55–2.11) and 1.96 (95% CI: 1.52–2.53) was observed among smokers. And an RR of 1.69 (95% CI: 1.50–1.90) and 2.12 (95% CI: 1.49–3.01) was observed in studies with both smokers and smokeless tobacco users. This suggests that non-pharmacological cessation intervention helps in quitting tobacco.

## Heterogeneity test and subgroup analysis

A heterogeneity check for the study type, sample group, and type of tobacco users was carried out using the "metafor" package available in the R3.5.1 software; the study population was checked for homogeneity. A statistically significant heterogeneity showing $P < 0.01$ and $I^2 = 72\%$ was found. The data are indeed representative of the entire population as shown by the considerable heterogeneity.

## Discussion

Tobacco use is one of the most important modifiable risk factors for non-communicable diseases.[35] In all, 9.5% of all deaths in India are caused by tobacco, mainly through cardiovascular diseases.[36,37] Our review has found that behavioural intervention is successful in making tobacco users quit. Similar results were observed in other systematic reviews where community-based behavioural interventions helped tobacco users quit.[38,39] Behavioral interventions are also one of the most cost-effective primary prevention methods in developing countries.[40-42] Studies have proved the effectiveness of individual-level behavioural interventions for smoking abstinence.[43] A systematic review published in Cochrane has found that such interventions delivered by community workers such as pharmacists could help in smoking cessation.[44] However, in contrast, a systematic review conducted among the Arab population, which included four RCTs, did not show any evidence of intervention effectiveness. The reason provided by the authors is the low importance given to research on tobacco in Arab countries.[45]

The paper is important in primary care practice as it provides strong evidence that behavioural interventions can lead to tobacco cessation. Most studies included in our review that were delivered by health professionals or trained workers resulted in increased cessation rates.[21,22,24,25,27,29,31,33] This is similar to the literature available, where it has been found that counselling conducted by a health professional may increase abstinence rates.[46] Primary healthcare is the most appropriate setting for guiding and counselling on tobacco cessation as it provides multiple key opportunities to find tobacco habits, offer advice and aid individuals in quitting tobacco. Primary healthcare providers must incorporate tobacco-cessation counselling in their day-to-day clinical practice and interaction with patients. A review in Australia strongly recommends cessation advice by healthcare personnel in increasing the number of quit attempts made by the user.[47] This short brief counselling can go a long way in impacting the quit rates. Hence, the topic must attain high priority for comprehensive management of the
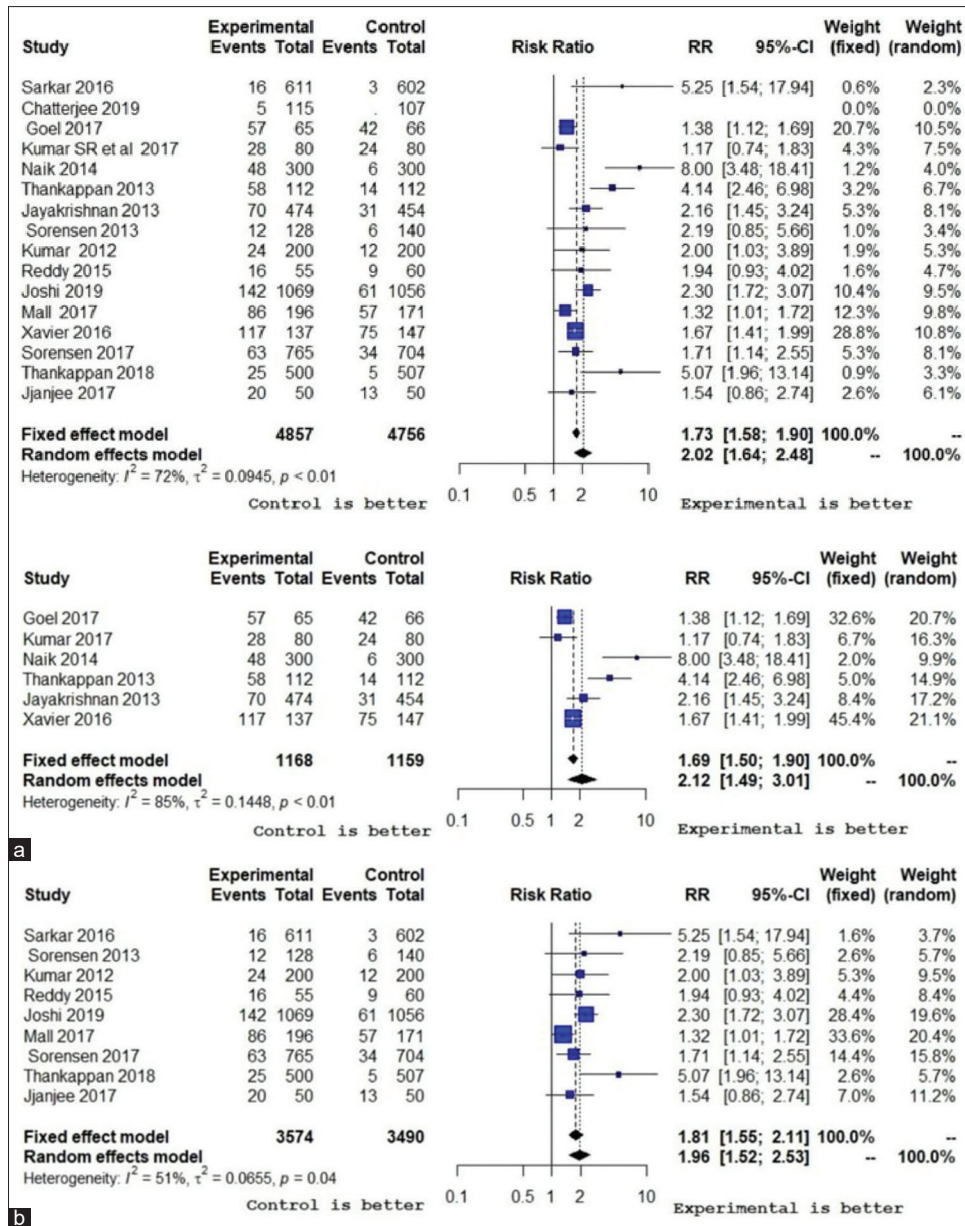
**Figure 2:** Forest plot showing pooled tobacco cessation risk ratios among intervention and control groups in the included tobacco cessation intervention studies. (a) Subgroup analysis in studies targeting only Smoke form of tobacco (b) Subgroup analysis in studies targeting both Smoke and smokeless form of tobacco

complaints of a patient. However, there are numerous barriers faced by healthcare workers for counseling regarding tobacco cessation. The primary care providers are often not able to provide tobacco cessation counselling to their patients because of lack of time, excess work and lack of training in cessation services.[48] These barriers must be addressed and effective measures must be implemented. One such way could be to have brief counseling during the OPD services and proper links of the health center to tobacco-cessation centers.[49,50] Studies have indicated that currently, the knowledge among healthcare providers is more theoretical than what is being practiced.[51]

In some studies included in our systematic review, counselling was conducted by specialized trained personnel and as a separate

stand-alone component. As suggested in the review performed in sub-Saharan Africa, better approaches for developing countries would be to identify tobacco users in the already running national programs for TB, HIV, and maternal and child health programs and incorporate the component of tobacco cessation counseling in it.[52] There is a need to individualize counselling according to the requirement of each person.[53]

Our review had three studies conducted among students and adolescents in India.[20,28,30] These studies showed a significant drop in tobacco usage among the students in the intervention group. These findings are similar to the review by Stanton *et al.*,[54] where behavioral interventions among young people may lead to increased abstinence rates in the long term. Studies have shown that even

short periods of abstinence or those initiated in the hospital and continued in the post-hospital stay have been found to be effective, the world over and may prove beneficial for the patients.[55,56]

Among the included studies, only three had validated the findings of self-reported abstinence of tobacco with biochemical tests.[19,22,23] The literature shows variable results with studies showing both, a high and a low agreement between self-reported abstinence and biochemically confirmed abstinence.[57,58]

## Limitations

Our review suffers from a few limitations, one of them being the quality of the included studies. Some studies did not give complete information on particulars such as the number of sessions held, and the frequency and time duration of the sessions. Most tobacco use information is self-reported. Thus, there is a probability of under-reporting of tobacco use. Studies have used self-declaration data on tobacco abstinence, which may show inflated quit rates. The review may suffer from publication bias. Also, the studies were performed in an ideal situation with a trained workforce and meticulous follow-up. We may not be able to extrapolate the findings of these interventions to real-world situations when implementing programs at population levels. We have not included data from abstracts and conferences. Despite making all the efforts, there is likely the possibility of missing the data from grey literature. Significant heterogeneity was detected across studies on smokers. Therefore, despite the use of random-effects models to account for heterogeneity, our pooled estimates should be interpreted with caution.

## Conclusion and Future Implications

The above systematic review proves the effectiveness of behavioural interventions in quitting tobacco in both smoking and smokeless forms of tobacco users. Pharmacotherapy is not a feasible option for most developing country settings due to the formidable cost and requirement of a trained health workforce to administer and monitor the drug therapies. Behavioural interventions are easy to administer at all levels of care and by all categories of caregivers with appropriate training.

Delivery of tobacco-cessation interventions, however, faces multiple challenges at various levels in low-middle-income country (LMIC) settings ranging from organization of services, and program implementation to availability and access to cessation services, including trained healthcare providers to deliver the program. The findings of the review have significant implications for tobacco-cessation program delivery policy and practice in LMIC settings. Establishment of formal tobacco-cessation services, though recommended under the tobacco control program, are fewer and tend to be established only at tertiary and secondary healthcare facilities. Thus, access and utilization of these services are limited to the tobacco users identified in opportunistic healthcare settings. Different programs and healthcare settings adopting or preferring to refer tobacco users to specialized cessation services for cessation counselling are likely to increase the dropout and lost to follow-up rate for seeking the counselling services. Instead, integrating tobacco cessation counselling in the existing healthcare services is more likely to be utilized and availed by tobacco users and will help in addressing the issue of tobacco deaddiction as observed in the studies.[59]

Population-level penetration of behavioural interventions for tobacco cessation in primary care programs can be achieved by optimal training and sensitization of healthcare workers including frontline health workers as part of the community-based assessment checklist (CBAC) recommended in the non-communicable diseases program of the Government of India. Further potential use and effectiveness of-m-Health approaches, using mobile phones in LMICs, need to be explored that provide broad penetration to aid tobacco cessation. A recent study has also found a mobile-based cessation approach to be effective.[60]

## Key messages

Non-pharmacological interventions for tobacco cessation are feasible, cost-effective, and a suitable strategy with the potential to overcome the public health system challenges of low-middle-income countries (LMIC) of program delivery to its diverse population by integration through a wide range of healthcare programs and personnel.

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## Conflicts of interest

There are no conflicts of interest.

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