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ORIGINAL ARTICLE

DETERMINANTS OF RETENTION, REDUCED USE, AND RELAPSE IN TOBACCO CESSATION CENTRES IN VILLUPURAM, TAMIL NADU, 2023-24

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ABSTRACT

INTRODUCTION : Tobacco use remains a major preventable cause of morbidity and mortality globally and in India. Retention in tobacco cessation programmes is critical for sustained abstinence, yet follow-up and relapse remain major challenges. This study assessed determinants of retention, reduced tobacco use, and relapse among tobacco users enrolled in Tobacco Cessation Centres (TCCs) in Villupuram district, Tamil Nadu, during 2023–24.

METHODS : A prospective cohort study was conducted between December 2023 and April 2024 among tobacco users attending non-communicable disease clinics across 65 primary health centres and the TCC at Villupuram Medical College. Tobacco dependence was assessed using the Fagerström Test for Nicotine Dependence. Participants with low dependence received behavioural counselling at PHCs, while moderate and high dependence users were referred to TCCs for behavioural counselling with nicotine replacement therapy (NRT) or medications. Participants were followed at 2 weeks, 4 weeks, 6 weeks, and 3 months. Incidence rate ratios (IRR) for reduced use and relapse were estimated.

RESULTS: Among 438 enrolled tobacco users, 74.2% demonstrated reduced tobacco use and 39.5% experienced relapse during follow-up. Overall retention declined from 77% at 2 weeks to 35% at 3 months. Male participants had higher reduced use (aIRR 1.7; 95% CI: 1.1–2.8) and higher relapse risk (aIRR 2.3; 95% CI: 1.2–4.4). Participants receiving counselling with NRT showed significantly lower relapse risk (aIRR 0.2; 95% CI: 0.1–0.3). Median time to reduced use was 2 weeks, while median time to relapse was 10 weeks. Shorter distance to TCCs and later age of tobacco initiation were associated with better retention.

CONCLUSION: Retention in tobacco cessation programmes declines substantially over time despite early reduction in tobacco use. Strengthening follow-up systems, improving accessibility to cessation services, integrating pharmacotherapy, and targeted interventions for high-risk groups may improve long-term cessation outcomes.

INTRODUCTION

Smoking tobacco is responsible for approximately 7.69 million (7.16–8.20 million) deaths and 200 million (185–214 million) disability-adjusted life years (DALYs) globally each year. An estimated 1.14 billion smokers consume about 7.41 trillion cigarette equivalents annually. It is a leading risk factor for death among males, accounting for 20.2 percent (19.3–21.1 percent) of male deaths.[1] Of the 7.69 million deaths, 6.68 million are attributed directly due to smoking due to tobacco.[1] In India, the economic burden of tobacco use is substantial, amounting to approximately 1.04 percent of the nation's gross domestic product (GDP). For every INR 100 received as excise taxes from tobacco products, INR 816 is imposed on society through its consumption.[2] In 2017–2018, the total economic costs attributable to tobacco use for individuals aged 35 years or older amounted to INR 1773.4 billion (US $27.5 billion), with direct costs accounting for 22 percent and indirect costs 78 percent. Men bear 91 percent of the total costs, with smoking contributing 74 percent and smokeless tobacco (SLT) use contributing 26 percent(3). Tobacco use is a major modifiable and preventable factor in many premature deaths due to non-communicable diseases (NCDs).[4] The World Health Organisation (WHO) advocates the Framework Convention on Tobacco Control (FCTC) and MPOWER policy to combat the tobacco epidemic. These policies focus on monitoring tobacco control laws and prevention policies, protecting people from second-hand smoke, offering assistance to quit tobacco, and warning

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people about the dangers of tobacco. As a signatory to the FCTC, India has developed guidelines for the National Tobacco Control Programme, which aims to advocate for the FCTC. Sustainable Development Goal (SDG) 3, which aims to promote good health and well-being by preventing preventable diseases and premature deaths.[5] Currently, 55 percent of smokers and 50 percent of smokeless tobacco users are planning or considering quitting tobacco.[6] India, being a signatory to the WHO FCTC, has implemented a national tobacco control programme since 2007. One of the main thrust areas was the setting up and strengthening of cessation facilities, including the provision of pharmacological treatment. Health situation analysis in Villupuram district identified high tobacco prevalence as a key health priority, with a prevalence of 25.1 percent in men and 8.8 percent in women over 16 years old.[7] A tobacco cessation clinic was established in Villupuram district in 2007. We analyzed the profile and outcomes of tobacco users enrolled in the tobacco cessation centre from 2018 to 2022. We found only 5.5 percent of the 1,394 individuals enrolled in Tobacco Cessation Centers (TCC) had six months of abstinence from tobacco use. Hence, we conducted this study to estimate the retention rate of tobacco users at 2 weeks, 4 weeks, 6 weeks, and 3 months in Villupuram, Tamil Nadu, India, in 2023–24 by engaging primary health care staff involved in non-communicable disease management.

METHODS

A prospective cohort study was conducted in Villupuram, a northern district in Tamil Nadu, between December 2023 and April 2024 covering all the 65 primary health centres and the TCC at Villupuram Medical College. The implementation of the study started with the training workshops during the month of December 2023, which included a detailed plan to train primary health care staff on how to screen, treat, and refer tobacco dependence and give patient-focused, culturally sensitive advice based on the tobacco dependence treatment guidelines.[8] The workshops were conducted for NCD staff from Primary Health centres (PHCs) and psychologists and psychiatrists from Tobacco Cessation Centres (TCCs). Key materials used in the training were paper based data collection sheet, motivation assessment, the Fagerstrom test for nicotine dependence, and referral slips. The training was headed by the District Health Officer (DHO) and conducted by a District Training Team Medical Officer (DTTMO) and psychiatrist from the National Mental Health Programme (NMHP). The workshops were 1-day events held at the district level, organised in four different groups to ensure everyone received proper training. Feedback was collected afterward to evaluate the training's effectiveness and identify areas for improvement. (Table 1) This approach aimed to improve the skills of healthcare professionals in supporting tobacco cessation. Taking into consideration the programme evaluation data (unpublished), which reported an average outpatient for non-communicable diseases of 3000–4000 per month, 30–40 patients were referred from PHC to TCC per year in total. The study population were patients attending the NCD clinics in the primary health centres. During the month of January 2024, patients attending this clinic were screened for tobacco use, and those with low dependence were given behavioural counselling in all 65 primary health centres (PHCs) in Villupuram district. Those with moderate and high dependence were referred to the Tobacco Cessation Centre (TCC).

Table 1: Contents and brief about the training curriculum

Contents of the implementation package	**Brief about the training workshops**
Curriculum Tobacco dependence treatment guidelines, delivery of patient-centric and culturally sensitive advice	**Participants** NCD staff of PHC Psychologist of TCC Psychiatrist of TCC
Resource material Tobacco cessation clinic-Intake form Motivation assessment form-readiness to quit Fagerstrom score for nicotine dependence Referral slip	**Trainers** District training team medical officer Psychiatrist- NMHP
	Layout 1-day workshop in the district with District Tobacco control cell, organised by District training team medical officer in 4 different batches
	Feedback following the training

These individuals were followed up on for a period of three months until April 2024. We included tobacco users residing in Villupuram who were willing to participate and provided informed consent. We excluded tobacco users who were in follow-up prior to the initiation of this study.

Study Procedure: A primary health centre staff nurse specialising in non-communicable disease screening, referral, and treatment of non-communicable diseases would inquire of the patients visiting the NCD clinic about tobacco use and assess their readiness to quit using the contemplation ladder. Based on the contemplation level of the tobacco user, dependence on tobacco was measured using the Fagerstrom test for nicotine dependence[9], which includes various questions with scores ranging from 1 to 10 and is categorised

as low (1-3), moderate (4-6), and high (7–10) dependence. Low dependence scores received treatment at PHC and moderate and high dependence scores are referred to TCC with the referral slip to TCC. Tobacco users referred to TCC at Government Villupuram Medical College with the referral slip were communicated to the psychologist in TCC by the NCD staff nurse to ensure appropriate treatment and follow-up. At the TCC, referred tobacco users were guided by a psychologist and a social worker to ensure appropriate treatment from the psychiatrist at the TCC and follow-up.A comprehensive list of enrolled tobacco users and their follow-up dates were maintained and communicated to the respective PHC staff nurses about their follow-up dates and assessments. The NCD staff of the PHC reminded the patient about their scheduled visit one day prior through a phone call.

Sampling procedure: A consecutive sampling method was employed, wherein all eligible individuals screened for tobacco use and willing to quit, attending NCD clinics of all 65 PHCs in Villupuram district during January 2024, were enrolled into the cohort and followed up.

Operational definitions:

Follow-up: Tobacco users followed up every 2 weeks until 6 weeks and after 3 months from date of registration

Missed Visits: Tobacco users initiated treatment and not attending one scheduled visit.

No Change: Tobacco users who had no change in the Fagerstrom score in the follow up compared to baseline.

Reduced Use: reduction in Fagerstrom score compared to baseline among the tobacco users

Lost to Follow-up: Beneficiaries missing two or more consecutive visits

Relapse: increase in Fagerstrom score from baseline or after reduced use.

Retention Rate: Beneficiaries followed up in April 2024 without missing any visits to beneficiaries enrolled in January 2024.

Data Collection: NCD staff of all the 65 PHC in the district, oriented towards a one-day training workshop, have been involved in collecting the details of the tobacco user in the process of screening, referral, and follow-up. Primary data collection for the quantitative phase was done in a paper-based form through a semi-structured questionnaire on sociodemographic profile, alcohol drinking, type of tobacco, age at initiation of tobacco, Fagerstrom test for nicotine dependence, and type of treatment (Annexure-1) given to them. Referral cards were provided to the patients referred to the TCC. Once the patient visits the TCC, primary data is obtained from the patient in the TCC, assessed for Fagestrom test for Nicotine Dependence score, and appropriate treatment is initiated by the psychiatrist of the TCC. The compiled patient roster was communicated to PHC staff for follow-up reminders. The data collected from the tobacco users in Tobacco Cessation form was entered in Epi Info V7.2.5.0, and the data was imported into an Excel file and cleaned up for analysis.

Data Analysis: Data Analysis was done using Epi Info V.7.2.5.0 software to report the proportion of the characteristics, mean, and standard deviation, Deviation of age at initiation, age at registration in cessation, and distance of the TCC from the place of residence and STATA version 17 for calculating the incidence rate ratio (IRR)of retention among enrolled in subsequent follow-up, median time to reduced use and relapse of tobacco, and incidence of reduced use and relapse in person weeks. We used STROBE checklist for reporting the study findings.

Human Participant protection: No vulnerable population was included in the study. Tobacco users who initiated treatment and had withdrawal symptoms were managed. A unique identity number was given to the participants to protect their anonymity from being disclosed. Written informed consent was obtained from all the participants. Ethical approval was sought from the Institutional Human Ethics Committee (Academics), Indian Council of Medical Research, National Institute of Epidemiology.

RESULTS

We assessed the eligible 438 participants using Fagerstrom test for nicotine dependence and categorised them as low dependence (n=210), moderate dependence (n=162) and high dependence (n=66). All the 210 low dependence users were given behavioral counselling at PHC and moderate and high dependence in total (n=228) were referred to TCC for behavioural counselling with nicotine replacement therapy and medications.

Of the 210 low dependence users identified, all were provided behavioral counselling. During follow up, 180 attended the first visit in two weeks, 160 attended the second visit at four weeks, 147 attended the third visit at six weeks, 173 attended the fourth visit at three months. Of the 162 moderate dependence tobacco users, 101 attended the first visit, 52 attended the 2nd visit, 50 attended the 3rd visit, 33 attended the 4th visit. Of the 66 high dependence tobacco users, 50 attended the first visit, 17 attended the 2nd visit, 22 attended the 3rd visit, and 47 attended the 4th visit (Figure 2).

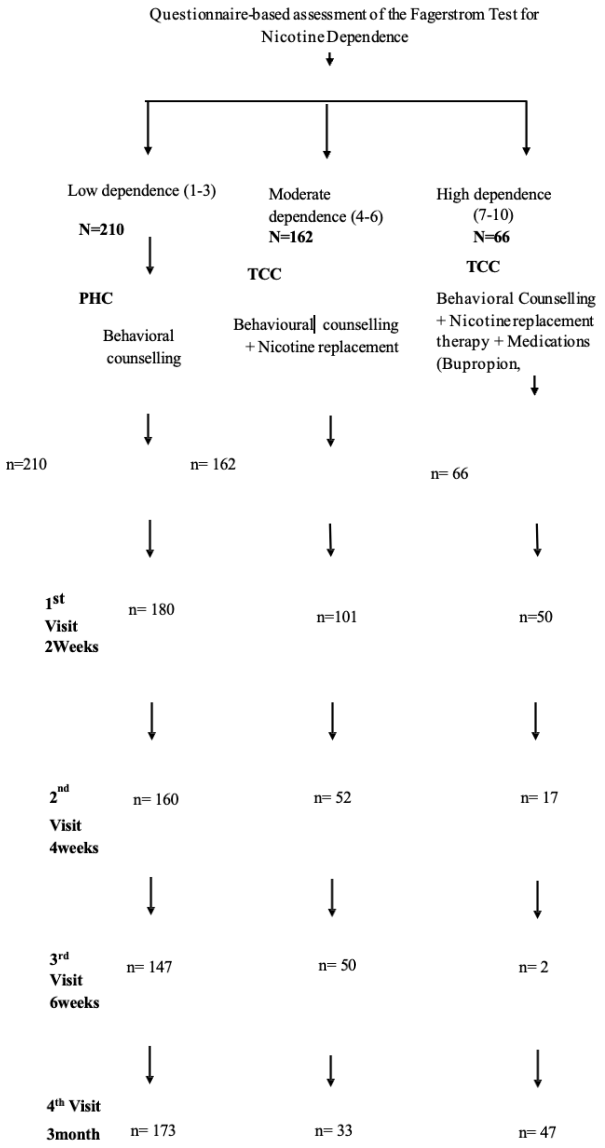

Figure 1: Tobacco users enrolled in study (N= 438)

Of the 438 participants enrolled, 423(97 percent) were rural residents, 198(45 percent) were in 46-60 age group of the 438 participants age ranging from age 21-90, 345 (79 percent) were male, 423 (97 percent) were married, 254 (58 percent) were smokers, 240(53 percent) were alcoholic, 424(97 per cent) were using bus as the mode of transport to reach the treatment centre (Table 2).

Low dependence beneficiaries who are receiving treatment in PHC showed 52 percent retention by three months follow up, whereas moderate dependence beneficiaries showed a significant drop of retention rate to 18 percent in three months follow up from 62 percent in the 1st visit(2weeks) follow up and high dependence beneficiaries showed 19 percent retention during the 4th visit (3months) follow 75 percent in 1st visit (2 weeks) (Table 3).

Table 2: Characteristic profile of the tobacco users initiated treatment cascade during January 2024

Sociodemographic profile		Number	Proportion (%)
Residence	Rural	423	97
	Urban	15	3
Age	21-30	14	3
	31-45	121	28
	46-60	198	45
	>60	105	24
Sex	Male	345	79
	Female	93	21
Education status	Secondary	148	34
	Illiterate	138	32
	Primary	110	25
	Higher Secondary	40	9
	Undergraduate	1	0
	Postgraduate	1	0
Marital status	Married	423	97
	Unmarried	12	3
	Widowed	2	0
Type of tobacco	Smoking	254	58
	Smokeless	154	35
	Both	30	7
Medical conditions	Ischaemic heart disease	4	1
	Stroke	4	1
	Asthma	15	3
	oral cavity	3	1
	others	6	1
Alcohol drinking	Yes	230	53
	No	208	47
Means of transport	Bus	424	97
	Own transport	13	3
	Auto	1	0

Of the 438 tobacco users enrolled males have a higher chance of reduced use compared to females with IRR 1.6(95 percent CI 1.2-2.2) and urban residents had higher relapse rate than rural residents with IRR of 2.1((95 percent CI 1.2-3.8). Beneficiaries receiving combined behavioral counselling and nicotine replacement therapy had 80 percent lesser chance of relapse compared to those who received only behavioral counselling.

Among retained beneficiaries mean age at initiation of tobacco use was found to be (mean=19, SD=9) in high dependence compared to moderate (mean =27, SD=8) and low dependence (Mean=28, SD=12) (Table 4).

Table 3 Proportion of retained among treatment-initiated tobacco users(N=438) with type of dependence in subsequent visit

Follow- up Visits	Low		Moderate		High		Total	
	n1 (210)	%	n2 (162)	%	n3 (66)	%	N (438)	%
1st visit	187	89	101	62	50	75	338	77
2nd visit	141	67	43	26	17	25	201	46
3rd Visit	118	56	37	23	13	19	165	38
4th visit	110	52	29	18	13	19	152	35

Mean distance of TCC from the place of residence in retained patients (attended all 4 visits) receiving care in TCC (mean= 28, SD=10), is lesser than those during the initiation of treatment (mean= 36, SD=12) (Table 5).

Table 4: Mean and standard deviation of age at registration,

Follow- up Visits	Low		Moderate		High		Total	
	n1 (210)	%	n2 (162)	%	n3 (66)	%	N (438)	%
1st visit	187	89	101	62	50	75	338	77
2nd visit	141	67	43	26	17	25	201	46
3rd Visit	118	56	37	23	13	19	165	38
4th visit	110	52	29	18	13	19	152	35

Table 5: Mean and standard deviation of age at registration, age at initiation of tobacco, distance to Tobacco Cessation Centre from residence at baseline(N=438)

Initiated treatment N=438	Age at registration		Age at initiation		Distance of TCC from the residence	
	Mean	SD	Mean	SD	Mean	SD
Low	51	13	28	10	36	17
Moderate	54	10	28	10	38	16
High	52	11	26	11	33	8

The incidence rate of reduced use and relapsed use of tobacco, were reported in person weeks, with 24.48 per 100 person-weeks (95 percent CI: 21.96-27.30) for reduced use, indicating that approximately 24 participants per 100 reduced their tobacco use within a week of treatment initiation. Conversely, the incidence rate of relapse was 6.9 per 100 person-weeks (95 percent CI: 5.91-7.96), indicating that about 7 participants per 100 relapsed within a week who are followed up, persons attending the visit with missing visits are also taken up for study to calculate the time taken by them for relapse or reduced use (Table 8)

Table 6: Probability of reduced use in follow up visits

Time interval (weeks)	No. at risk	Reduced use	Censored	Probability of Reduced use	95 percent CI	
0	438	0	59	1	-	-
2	379	299	10	0.20	0.16	0.24
4	70	11	2	0.17	0.13	0.21
6	57	4	7	0.16	0.12	0.20
12	46	11	35	0.10	0.06	0.14

Kaplan Meyer graph which is plotted with attaining reduced use as event and person with no change or lost to follow up or increased score are censored with the median time to reduced use as 2 weeks, (Figure 3).

The probability of reduced use over 2 weeks follow up period is 80 percent, with probability increasing to 90 percent in 3 months retention of the tobacco user to the programme (Table 6)

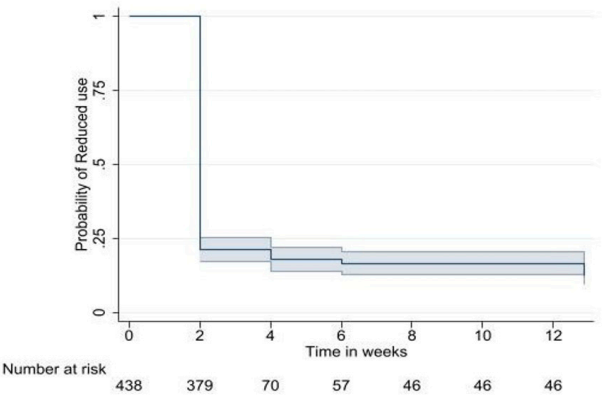

Figure 3: Overall distribution of the cohort for Reduced use

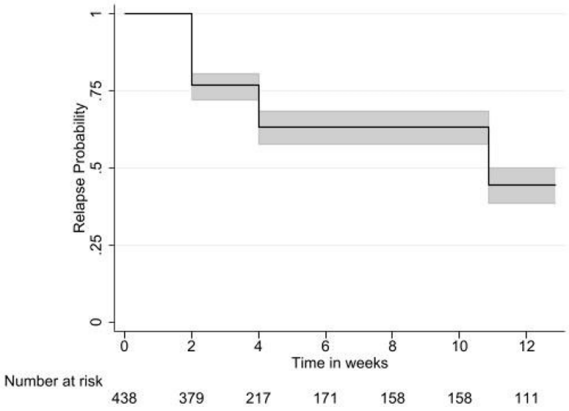

Figure 4 : Overall distribution of the cohort for Relapse

Table 7: Probability of relapse in follow up visits

Time interval (weeks)	No. at risk	Relapse	Censored	Probability of Relapse	95 percent CI	
0	438	0	59	1	-	-
2	379	88	74	0.74	0.69	0.79
4	217	38	8	0.61	0.55	0.66
6	171	0	13	0.61	0.55	0.66
10	158	47	0	0.43	0.37	0.49
12	111	0	111	0.43	0.37	0.49

Kaplan Meyer graph which is constructed with persons attaining relapse as event and no change in score from baseline, reduced score and lost to follow-up as censored, median time taken to relapse in follow up tobacco users as 10 weeks (Figure 4), with probability of getting relapse as 25 percent over 2 weeks follow up period and 57 percent over a follow up of 3 months' duration (Table 7).

Table 8: Incidence of reduced use and relapse per 100 person weeks

Cohort	Person-time	Reduced use	Incidence rate (per 100 person weeks)	95 percent CI	
Total	1327.43	325	24.48	21.96	27.30

Cohort	Person-time	Relapse	Incidence rate (per 100 person weeks)	95 percent CI	
Total	2523.43	173	6.86	5.91	7.96

A total of 74.2% (325/438) participants reported a reduction in Fagerström score. After adjustment, male gender was significantly associated with reduced tobacco use (aIRR 1.7; 95% CI: 1.1–2.8), while age, education, marital status, residence, type of tobacco use, comorbidities, alcohol use, and mode of transport showed no significant association.

Table 10: Multivariable Analysis of Factors Associated with Relapse among Study Participants (n=438)

Baseline characteristics	No relapse (%)	n Relapse (%)	n Total N	IRR (95% CI)	aIRR (95% CI)
Age group					
20–29	5 (55.6)	4 (44.4)	9	Ref	Ref
30–44	49 (51.6)	46 (48.4)	95	1.1 (0.4–3.0)	1.2 (0.3–4.6)
45–60	152 (66.4)	77 (33.6)	229	0.8 (0.3–2.1)	1.3 (0.3–5.2)
>60	59 (56.2)	46 (43.8)	105	1.0 (0.4–2.7)	1.4 (0.4–5.9)
Gender					
Female	65 (69.9)	28 (30.1)	93	Ref	Ref
Male	200 (58.0)	145 (42.0)	345	1.4 (0.9–2.1)	**2.3 (1.2–4.4)**
Education					
Illiterate	82 (59.4)	56 (40.6)	138	Ref	Ref
Primary	75 (68.2)	35 (31.8)	110	0.8 (0.5–1.2)	1.0 (0.6–1.7)
Middle secondary	87 (58.8)	61 (41.2)	148	1.0 (0.7–1.5)	1.2 (0.7–1.8)
Higher secondary	19 (47.5)	21 (52.5)	40	1.3 (0.8–2.1)	1.6 (0.8–3.2)
Graduate	2 (100)	0 (0)	2	–	–
Marital status					
Married	257 (60.8)	166 (39.2)	423	Ref	Ref
Unmarried	7 (58.3)	5 (41.7)	12	1.1 (0.4–2.6)	1.2 (0.4–3.7)
Widowed	1 (33.3)	2 (66.7)	3	1.7 (0.4–6.8)	1.7 (0.2–13.8)
Residence					
Rural	262 (62.1)	160 (37.9)	422	Ref	Ref
Urban	3 (18.8)	13 (81.3)	16	2.1 (1.2–3.8)	1.8 (0.9–3.7)
Type of tobacco use					
Smokeless	95 (61.7)	59 (38.3)	154	Ref	Ref
Smoking	152 (59.8)	102 (40.2)	254	1.0 (0.8–1.4)	0.8 (0.5–1.2)
Both	18 (60.0)	12 (40.0)	30	1.0 (0.6–1.9)	0.9 (0.4–1.9)
Comorbidities					
Hypertension	95 (57.6)	70 (42.4)	165	Ref	Ref
Diabetes	37 (57.8)	27 (42.2)	64	1.0 (0.6–1.6)	0.9 (0.6–1.4)
Others	40 (57.1)	30 (42.9)	70	1.0 (0.7–1.5)	1.0 (0.6–1.5)
Alcohol use					
No	116 (55.8)	92 (44.2)	208	Ref	Ref
Yes	149 (64.8)	81 (35.2)	230	0.8 (0.6–1.1)	0.8 (0.5–1.2)
Mode of transport					
Bus/Auto	252 (59.3)	173 (40.7)	425	Ref	Ref
Own vehicle	13 (100)	0 (0)	13	–	–
Treatment					
Counselling alone	74 (35.2)	136 (64.8)	210	Ref	Ref
Counselling + NRT	146 (90.1)	16 (9.9)	162	**0.2 (0.1–0.3)**	**0.2 (0.1–0.3)**
Counselling + medication	45 (68.2)	21 (31.8)	66	**0.5 (0.3–0.8)**	**0.5 (0.3–0.9)**

Participants receiving counselling plus nicotine replacement therapy demonstrated significantly better reduction compared to counselling alone (aIRR 0.6; 95% CI: 0.4–0.8). Counselling combined with other medications did not show a statistically significant advantage over counselling alone.

Table 9: Multivariable Analysis of Factors Associated with Reduction in Fagerström Nicotine Dependence Score among Study Participants (n=438)

Baseline characteristics	No reduction N = 113 n (%)	Reduced use N = 325 n (%)	Total N = 438	IRR 95 % CI	aIRR 95 % CI
Age group					
20-29	1 (11.1)	8 (88.9)	9	Ref	Ref
30-44	16 (16.8)	79 (83.2)	95	0.9 (0.5, 1.9)	0.8 (0.3, 2.4)
45-60	64 (28.0)	165 (72.1)	229	0.8 (0.4, 1.6)	0.9 (0.3, 2.5)
Above 60	32 (30.5)	73 (69.5)	105	0.8 (0.4, 1.6)	0.8 (0.3, 2.5)
Gender					
Female	47 (50.5)	46 (49.5)	93	**Ref**	**Ref**
Male	66 (19.1)	279 (80.9)	345	**1.6 (1.2, 2.2)**	**1.7 (1.1, 2.8)**
Education					
Illiterate	43 (31.2)	95 (68.8)	138	Ref	Ref
Primary	34 (30.9)	76 (69.1)	110	1.0 (0.7, 1.4)	1.0 (0.7, 1.5)
Middle Secondary	30 (20.3)	118 (79.7)	148	1.2 (0.9, 1.5)	1.1 (0.8, 1.5)
Higher Secondary	6 (15.0)	34 (85.0)	40	1.2 (0.8, 1.8)	1.2 (0.7, 2.1)
Graduate	0 (0)	2 (100)	2	1.5 (0.4, 5.9)	1.9 (0.4, 8.1)
Marital status					
Married	109 (25.8)	314 (74.2)	423	Ref	Ref
Unmarried	3 (25.0)	9 (75.0)	12	1.0 (0.5, 2.0)	0.8 (0.3, 2)
Widowed	1 (33.3)	2 (66.7)	3	0.9 (0.2, 3.6)	1 (0.1, 7.2)
Residence					
Rural	112 (26.5)	310 (73.5)	422	Ref	Ref
Urban	1 (6.3)	15 (93.8)	16	1.3 (0.8, 2.1)	1.4 (0.7, 2.6)
Tobacco use					
Smokeless	51 (33.1)	103 (66.9)	154	Ref	Ref
Smoke	51 (20.1)	203 (79.9)	254	1.2 (0.9, 1.5)	0.9 (0.7, 1.3)
Both	11 (36.7)	19 (63.3)	30	0.9 (0.6, 1.5)	0.8 (0.4, 1.4)
Comorbidities					
Hypertension	44 (26.7)	121 (73.3)	165	Ref	Ref
Diabetes	14 (21.9)	50 (78.1)	64	1.1 (0.8, 1.5)	1 (0.7, 1.4)
Others	16 (22.9)	54 (77.1)	70	1.1 (0.8, 1.4)	1 (0.7, 1.5)
Alcohol use					
No	61 (29.3)	147 (70.7)	208	Ref	Ref
Yes	52 (22.6)	178 (77.4)	230	1.1 (0.9, 1.4)	0.9 (0.7, 1.3)
Mode of transport					
Bus/Auto	109 (25.7)	316 (74.4)	425	Ref	Ref
Own vehicle	4 (30.8)	9 (69.2)	13	0.9 (0.5, 1.8)	0.9 (0.5, 1.9)
Treatment					
Counselling	27 (12.9)	183 (87.1)	210	**Ref**	**Ref**
Counselling +NRT	70 (43.2)	92 (56.8)	162	**0.7 (0.5, 0.8)**	**0.6 (0.4, 0.8)**
Counselling +Medication	16 (24.2)	50 (75.8)	66	0.9 (0.6, 1.2)	0.8 (0.5, 1.2)

Overall, 39.5% (173/438) of participants experienced relapse during follow-up. After adjustment, male gender was independently associated with a significantly higher risk of relapse (aIRR 2.3; 95% CI: 1.2–4.4), while age, education, marital status, residence, tobacco use pattern, comorbidities, alcohol use, and mode of transport were not significantly associated. Participants receiving counselling combined with nicotine replacement therapy had a substantially lower risk of relapse compared to counselling alone (aIRR 0.2; 95% CI: 0.1–0.3). Counselling combined with pharmacotherapy also demonstrated a significant protective effect against relapse (aIRR 0.5; 95% CI: 0.3–0.9).

DISCUSSION

Our study findings provide valuable insights into the demographic and behavioural factors with gender, place of residence, type of treatment, distance to the tobacco cessation centre, mode of transport used to reach the TCC influencing treatment retention with reduced use, relapse, as well as the effectiveness of different treatment modalities over time. Tobacco users who were male are said to be retained and reduced use, residing in urban are said to relapse. Tobacco users receiving behavioural counselling are said to reduce use within 2 weeks and said to relapse within next 6-8 weeks of recovery. Those who receive combined therapy have less chances of relapse. The comparative analysis over the two time points reveals important insights into patient retention in tobacco cessation programs. Telephonic calls for the patient as a reminder for the follow-up dates are said to improve the retention rate.[10] Younger age at the initiation of tobacco use is associated with high dependence on tobacco.[11] Additionally, closer proximity to the TCC appears to enhance retention. These findings suggest that targeting younger tobacco users and improving accessibility to cessation services could improve programme retention and overall success rates. The high incidence rate of reduced use indicates that the intervention is effective at reducing tobacco use with regular follow-up.[8] Previous studies done for patients with 3 month follow up had only 21 percent improvement from the baseline status[12], the high rate of reduced use is promising, reflecting the immediate impact of the treatment program.

The lower incidence rate of relapse suggests that while some participants relapse, it is less frequent compared to the reduction in use. But participants who are not receiving combined pharmacotherapy and behavioural counselling are said to relapse. The overall retention rate among the cohort was 35 percent at the fourth visit (three- month follow-up), follow up demonstrating a significant decline from 77 percent at the first visit, Previous studies have reported that women, younger age, and low dependence have decreased lost to follow-up.[6]

The type of treatment significantly influenced retention rates, reduced use and relapse use of tobacco. Participants receiving only behavioural counselling had a higher retention rate (52 percent) compared to those receiving a combination of behavioural counselling and nicotine replacement therapy (NRT) (18 percent) and those receiving behavioural counselling, NRT, and medications (20 percent). Previous findings suggest that while combined treatments might be more intensive in smoking cessation[13], this study showed that behavioural counselling is associated with reduced use and relapsed use compared to combined therapy, they may also be more challenging for participants to adhere to, potentially due to increased complexity or side effects.

Conversely, the Kaplan-Meier analysis revealed that the median time to relapse was 10 weeks, with a 25 percent probability of relapse at two weeks and 57 percent at three months. This highlights the critical need for sustained support and interventions beyond the initial treatment phase to maintain long-term tobacco abstinence.

The mean distance from the residence to the Tobacco Cessation Centre (TCC) for retained tobacco users was lower compared to those at the initiation of treatment, suggesting that closer proximity to treatment centres enhances retention rates, possibly by reducing travel barriers. Furthermore, the mean age at initiation of tobacco use was lower among high dependence participants (mean = 19; SD = 9) compared to moderate (mean = 27; SD = 8) and low dependence (mean = 28; SD = 12) participants. This indicates that earlier initiation of tobacco use is associated with higher dependence, necessitating more tailored and intensive interventions for this subgroup.

CONCLUSION

The study highlights the importance of addressing demographic, behavioural, and health-system factors to improve retention in tobacco cessation programmes. Urban residence was associated with relapse, while males were more likely to show reduced tobacco use. Behavioural counselling alone demonstrated better retention and reduced use compared to combined treatment modalities. Proximity to treatment centres and early initiation of tobacco use also emerged as key determinants influencing treatment outcomes.

Sustained programme effectiveness requires strengthening service delivery and system support. Distance to facilities, social stigma, and heavy PHC staff workload

negatively affect follow-up and continuity of care. Improving availability of essential medications, resolving technical challenges with the MTM portal, simplifying documentation, and integrating tobacco cessation services through CHCs and mobile medical units can enhance accessibility and efficiency. Localised interventions, capacity building, and effective use of technology, supported by coordinated resource allocation, are critical to improving retention and long-term tobacco cessation outcomes.