

Original Research Article

RELATIONSHIP BETWEEN TOBACCO USE PATTERNS, NICOTINE DEPENDENCE, AND FOLLOW-UP RESPONSE IN INDIVIDUALS ATTENDING A TOBACCO CESSATION CLINIC

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ABSTRACT

Background: Tobacco use remains a major preventable cause of morbidity and mortality worldwide. Understanding the relationship between tobacco use patterns, nicotine dependence, and follow-up response in individuals attending tobacco cessation clinics is essential for optimizing cessation strategies and improving long-term abstinence outcomes. **Aims and objectives:** This study aimed to evaluate the association between different tobacco use patterns, the level of nicotine dependence, and follow-up response among individuals attending a tobacco cessation clinic.

Materials and Methods: A prospective, observational, hospital-based study was conducted at Burdwan Dental College and Hospital, Tobacco Control Unit, from February 2024 to August 2025 over 18 months. A total of 200 patients were enrolled, and relevant demographic, behavioral, and clinical data were collected and analyzed.

Results: Among 200 subjects, most were males aged 20–50 years. Bidi smoking was predominant (53.5%). High FTND (Fagerström Test for Nicotine Dependence) was seen in 54%. According to Transtheoretical Model of Change, Contemplation stage was common (42%). On follow-up, 48% reduced use, 26% quit, 21.5% were not reachable, and education below graduation was most frequent (67.5%).

Conclusion: Tobacco use patterns and nicotine dependence evaluated by FTND scale are strong predictors of follow-up adherence and cessation outcomes in tobacco cessation clinic attendees. Tailoring cessation interventions based on dependence severity and use patterns may improve long-term quitting success and patient engagement.

Keywords: Tobacco Addiction, FTND score, Stage of behavior change (Transtheoretical Model of Change), response on follow up.

INTRODUCTION

The tobacco epidemic remains one of the most significant global public health challenges, responsible for more than 8 million deaths annually. Of these, over 7 million deaths result from direct tobacco use, while approximately 1.3 million are attributable to exposure to second-hand smoke. All forms of tobacco consumption are harmful, and no level of exposure can be considered safe.^[1] Tobacco use is a well-established risk factor for a wide range of systemic diseases. In the respiratory system, it contributes to chronic conditions such as bronchial asthma, chronic obstructive pulmonary disease (COPD), emphysema, interstitial lung disease, pulmonary fibrosis, and lung cancer. It is also a major modifiable risk factor for cardiovascular diseases and plays a significant role in the development of multiple chronic non-communicable diseases, thereby adversely affecting overall quality of life. In addition, tobacco use has profound deleterious effects on oral health, increasing the risk of oral potentially malignant disorders, oral cancer, periodontal diseases, and other mucosal lesions.^[2,3] Globally, tobacco use is recognized as a leading preventable cause of cancer incidence and cancer-related mortality. India, being the second-largest producer and consumer of tobacco worldwide, bears a substantial burden, with more than 1.35 million tobacco-related deaths annually. The country faces a dual challenge of both smoked and smokeless forms of tobacco consumption, with smokeless tobacco use being particularly prevalent in many regions.^[2] To combat this epidemic, the World Health Organization (WHO) introduced the Framework Convention on Tobacco Control (FCTC) along with the MPOWER strategy, aiming to strengthen global tobacco control measures. At the national level, India has implemented the National Tobacco Control Programme (NTCP) and the Cigarettes and Other Tobacco Products Act (COTPA), 2003, which regulate tobacco advertising, restrict smoking in public places, and control the sale and distribution of tobacco products.^[1] Despite these efforts, effective tobacco cessation at the community level remains a challenge. Tobacco is highly addictive, and many individuals find it difficult to quit without structured support. Hence, the establishment and strengthening of tobacco cessation clinics by medical and dental institutions, along with non-governmental organizations, is essential to support individuals in overcoming tobacco dependence. Assessment of nicotine dependence is a critical component in tobacco cessation interventions, as it helps tailor counselling and pharmacological strategies. Although several tools exist, the Fagerström Test for Nicotine Dependence (FTND) remains one of the most widely used standardized instruments for evaluating the intensity of nicotine addiction.^[4] In West Bengal, there is limited data regarding tobacco use patterns, dependence levels, and cessation

outcomes, particularly in relation to follow-up response and behavioural change stages among clinic attendees. Moreover, there is a paucity of studies exploring the association between FTND scores and the stage of behavior change (Transtheoretical Model of Change) among tobacco users in this region.^[5] Therefore, the present study was undertaken to evaluate the relationship between tobacco use patterns, nicotine dependence, and follow-up response among individuals attending a tobacco cessation clinic. This study aimed to evaluate the association between different tobacco use patterns, the level of nicotine dependence, and follow-up response among individuals attending a tobacco cessation clinic.

MATERIALS AND METHODS

Study design: Observational and prospective hospital-based study.

Place of study: Burdwan Dental College and Hospital. Tobacco Control Unit

Period of study: 18 months (February 2024 to August 2025)

Sample size: 200 Patients.

Inclusion Criteria

- Current users of any form of tobacco (smoked or smokeless), including:
 - Cigarette smokers
 - Bidi smokers
 - Smokeless tobacco users
 - Dual/combination tobacco users
- Individuals attending the Tobacco Cessation Clinic during the study period.
- Individuals who have been using tobacco regularly for at least six months.
- Individuals willing to participate and who provide written informed consent.
- Individuals who complete the baseline assessment, including:
 - Tobacco use history
 - Fagerström Test for Nicotine Dependence assessment
 - Stage of behavior change assessment. (Transtheoretical Model of Change)
- Participants who are available for at least one scheduled follow-up.

Exclusion Criteria

- Former tobacco users who had already quit before enrollment.
- Individuals who refuse or are unable to provide informed consent.
- Individuals with severe psychiatric illness or cognitive impairment that prevents reliable interview.
- Patients with severe medical illness requiring emergency treatment at the time of recruitment.
- Individuals who do not complete the baseline questionnaire.

- Individuals with incomplete records or missing key variables (FTND score, stage of change, or follow-up outcome).
- Participants who are transferred to another cessation center immediately after enrollment.
- Patients diagnosed with oral squamous cell carcinoma

Study Variable:

- Age
- Gender
- INCOME/MONTH
- HABIT
- FTND SCORE
- STAGE, RESPONSE ON FOLLOW UP
- Education

Statistical Analysis: For statistical analysis, data were initially entered into a Microsoft Excel spreadsheet and then analysed using SPSS (version 27.0; SPSS Inc., Chicago, IL, USA) and GraphPad Prism (version 5). Numerical variables were summarized using means and standard deviations, while Data were entered into Excel and analyzed using SPSS and GraphPad Prism. Numerical variables were summarized using means and standard deviations, while categorical variables were described with counts and percentages. Two-sample t-tests were used to compare independent groups, while paired t-tests accounted for correlations in paired data. Chi-square tests (including Fisher's exact test for small sample sizes) were used for categorical data comparisons. P-values ≤ 0.05 were considered statistically significant.

RESULTS

Table 1: Frequency Percentage distribution of the variables according to study subject (n=200)

		Frequency	percentage
Age	<20	6	3.00%
	20-50	136	68.00%
	>50	58	29.00%
Gender	Male	194	97.00%
	Female	6	3.00%
INCOME/MONTH	<5000	49	24.50%
	5000-10000	88	44.00%
	>10000	63	31.50%
HABIT	SMOKELESS	40	20.00%
	CIGARETTE	23	11.50%
	BIDI	107	53.50%
	COMBINATION	30	15.00%
FTND SCORE	LOW	27	13.50%
	MODERATE	65	32.50%
	HIGH	108	54.00%
	MEAN	2.4	1.20%
	SD	0.71	0.36%
STAGE	PRECONTEMPLATION	47	23.50%
	CONTEMPLATION	84	42.00%
	PREPARATION	44	22.00%
	ACTION	25	12.50%
RESPONSE ON FOLLOW UP	INDIFFERENT	9	4.50%
	REDUCED	96	48.00%
	LEFT	52	26.00%
	NOT REACHABLE	43	21.50%
Education	ILLETERATE	39	19.50%
	BELOW GRADUATION	135	67.50%
	GRADUATE	19	9.50%
	POST GRADUATE	7	3.50%

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In the study involving 200 subjects, the distribution of age, gender, income, habits, FTND scores, stages of behavior change, response on follow-up, and education levels was analyzed.

Regarding age, the majority of participants were between 20 and 50 years old, comprising 68.00% (n=136) of the sample. Those over 50 years old made up 29.00% (n=58), while participants under 20 years old constituted only 3.00% (n=6).

In terms of gender, the sample was predominantly male, with 97.00% (n=194) male participants, and only 3.00% (n=6) female participants.

When looking at income per month, 24.50% (n=49) of participants earned less than 5000 units, 44.00% (n=88) earned between 5000 and 10000 units, and 31.50% (n=63) earned more than 10000 units.

Analyzing habits, it was found that 20.00% (n=40) of participants used smokeless tobacco, 11.50% (n=23) smoked cigarettes, 53.50% (n=107) smoked bidis, and 15.00% (n=30) used a combination of these products.

The FTND score distribution showed that 13.50% (n=27) of participants had a low score, 32.50% (n=65) had a moderate score, and 54.00% (n=108) had a high score, with a mean score of 2.4 (SD = 0.71).

The stages of behavior change indicated that 23.50% (n=47) of participants were in the precontemplation stage, 42.00% (n=84) in the contemplation stage, 22.00% (n=44) in the preparation stage, and 12.50% (n=25) in the action stage.

Finally, the education levels of the participants were as follows: 19.50% (n=39) were illiterate, 67.50% (n=135) had education below graduation, 9.50% (n=19) were graduates, and 3.50% (n=7) were postgraduates.

Table 2: Correlation in between the selected variables and RESPONSE ON FOLLOW UP according to study subject (n=200)

Variables	Correlation (R value)	P value	Remarks
Age and RESPONSE ON FOLLOW UP	0.234	0.851	Weak positive Correlation
Habits and RESPONSE ON FOLLOW UP	0.31	0.611	Weak positive Correlation
FTND score and RESPONSE ON FOLLOW UP	0.741	<0.001	Strongly positive Correlation
Stage and RESPONSE ON FOLLOW UP	0.619	0.0029	Moderate positive Correlation

Findings

In the study conducted with 200 subjects, the correlation between selected variables and the RESPONSE ON FOLLOW UP was analyzed. The correlation between age and RESPONSE ON FOLLOW UP showed a weak positive correlation with an R value of 0.234 and a P value of 0.851, indicating no statistically significant relationship. Similarly, habits and RESPONSE ON FOLLOW UP exhibited a weak positive correlation, with an R value of 0.31 and a P value of 0.611, also not reaching statistical significance.

In contrast, the FTND score and RESPONSE ON FOLLOW UP demonstrated a strongly positive correlation, with an R value of 0.741 and a highly significant P value of less than 0.001. This suggests a robust and statistically significant positive relationship between the FTND score and the follow-up response. Furthermore, the Stage of behavior change (Transtheoretical Model of Change) showed a moderate positive correlation with RESPONSE ON FOLLOW UP, with an R value of 0.619 and a significant P value of 0.0029. These results indicate that both the FTND score and the stage of the condition are important predictors of RESPONSE ON FOLLOW UP in the study population.

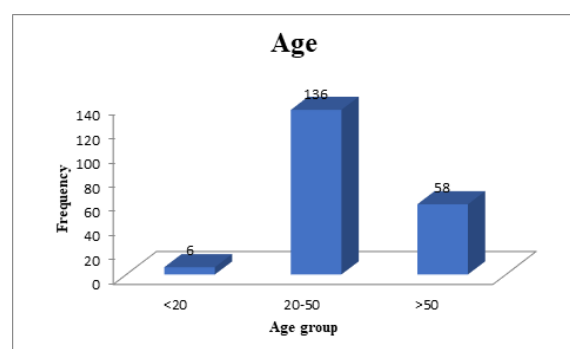


Figure 1: Age-wise distribution of study population

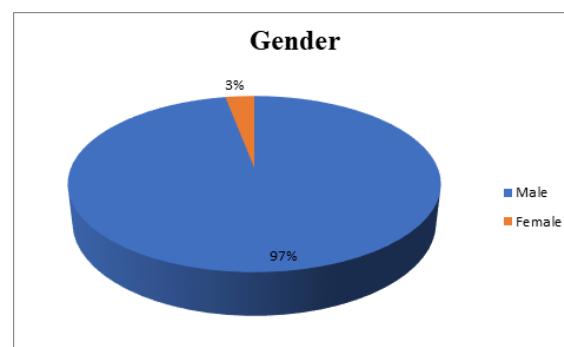


Figure 2: Gender-wise distribution of study population

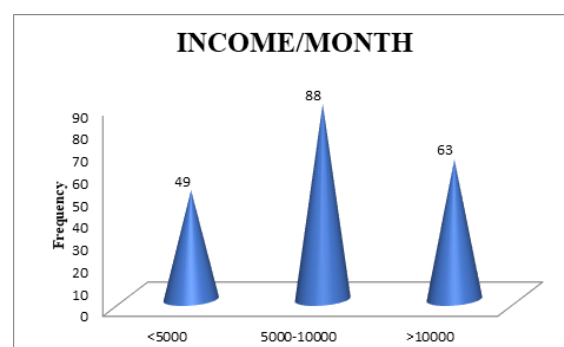


Figure 3: Monthly income-wise distribution of study population

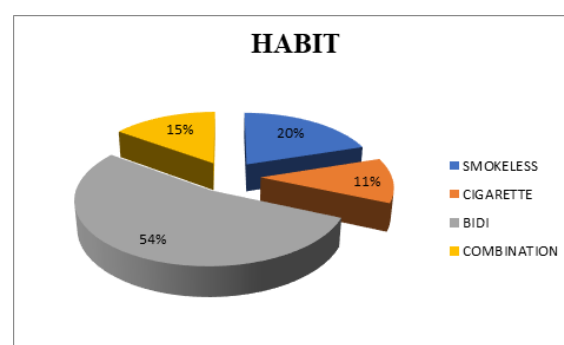


Figure 4: Distribution of study population according to habit pattern

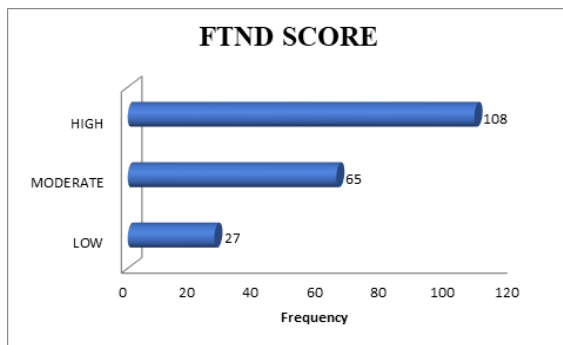


Figure 5: FTND score distribution among study population

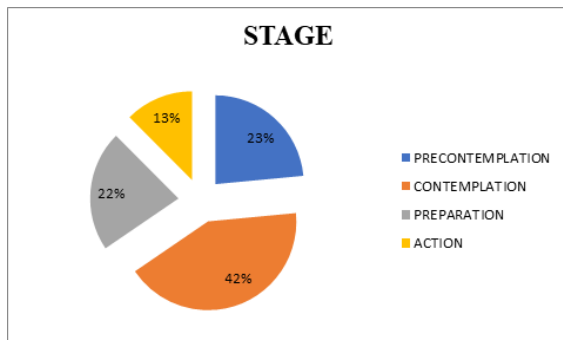


Figure 6: Distribution of study population according to stages of behavior change

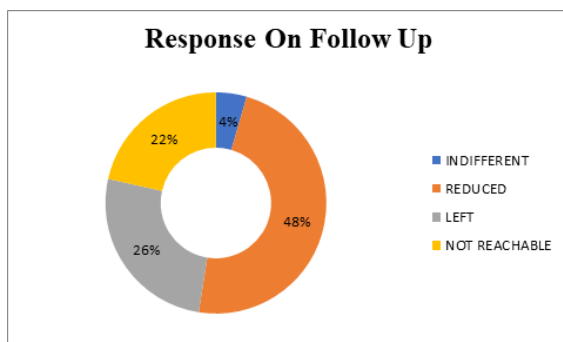


Figure 7: Follow-up response pattern among study population

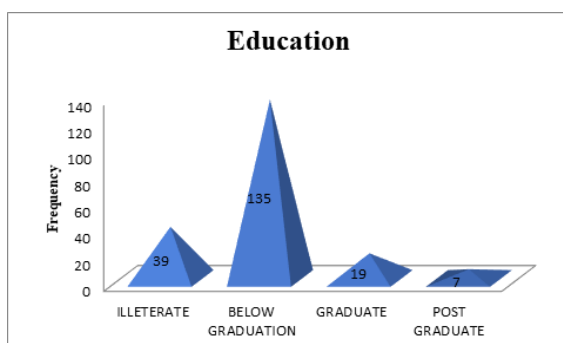


Figure 8: Distribution of study population according to educational status

DISCUSSION

In the present study involving 200 subjects, a comprehensive analysis of sociodemographic, behavioral, and clinical variables was performed

along with correlation assessment against follow-up response. The majority of participants were in the 20–50 years age group (68.00%), followed by those above 50 years (29.00%) and below 20 years (3.00%), indicating a predominance of middle-aged individuals, which is consistent with global tobacco use distribution patterns [6,7]. The study population was overwhelmingly male (97.00%), reflecting the higher burden of tobacco consumption among men in South Asian populations as documented in large epidemiological surveys.^[6,8] Socioeconomic analysis showed that a substantial proportion of participants belonged to lower-income groups, with 24.50% earning <5000 units monthly, 44.00% between 5000–10000 units, and 31.50% above 10000 units, highlighting the well-established inverse relationship between socioeconomic status and tobacco use prevalence.^[7,9] Habit pattern analysis revealed that bidi smoking was the most common form of tobacco consumption (53.50%), followed by smokeless tobacco use (20.00%), cigarette smoking (11.50%), and combined use (15.00%), consistent with regional consumption trends where bidis remain widely used due to affordability and accessibility.^[8,9] The FTND score distribution indicated a predominance of high nicotine dependence (54.00%), followed by moderate (32.50%) and low dependence (13.50%), with a mean score of 2.4 ± 0.71 , reflecting a significant burden of nicotine addiction in the study population.^[10,14] The stages of change model demonstrated that most participants were in the contemplation stage (42.00%), followed by precontemplation (23.50%), preparation (22.00%), and action (12.50%), reflecting behavioral readiness patterns consistent with the Transtheoretical Model of behavior change.^[11] Follow-up response analysis showed that 48.00% of participants reduced tobacco use, 26.00% quit, 21.50% were not reachable, and 4.50% remained indifferent, indicating partial but meaningful behavioral modification following intervention.^[12] Educational status revealed that 67.50% had education below graduation, 19.50% were illiterate, 9.50% were graduates, and 3.50% were postgraduates, reinforcing the association between lower educational attainment and higher tobacco dependence.^[13] Correlation analysis demonstrated that age and habit pattern had weak and non-significant associations with follow-up response ($R = 0.234$, $P = 0.851$; $R = 0.31$, $P = 0.611$ respectively), suggesting limited predictive value of demographic and behavioral variables. In contrast, FTND score showed a strong and statistically significant positive correlation with follow-up response ($R = 0.741$, $P < 0.001$), indicating that nicotine dependence is a major determinant of cessation outcome.^[10,14] Similarly, stage of change demonstrated a moderate and significant correlation with follow-up response ($R = 0.619$, $P = 0.0029$), supporting the predictive validity of the Transtheoretical Model in smoking cessation behaviour.^[11,15] These findings highlight that psychological readiness and dependence severity are

stronger predictors of cessation outcomes than basic demographic factors.

CONCLUSION

The study demonstrated that tobacco use was predominantly observed among middle-aged males from lower socioeconomic and educational backgrounds, with bidi smoking being the most common form of consumption. Most participants exhibited moderate to high nicotine dependence and were in the contemplation stage of behavioral change. Follow-up findings indicated that a considerable proportion of participants either reduced or quit tobacco use after the intervention, suggesting a positive impact of tobacco cessation counseling. Correlation analysis further showed that nicotine dependence and stage of behavioral change were significant predictors of cessation outcomes, whereas demographic characteristics and habit pattern had limited influence. These findings emphasize the importance of incorporating behavioral assessment and dependence evaluation into tobacco cessation programs to improve treatment outcomes.

REFERENCES

1. Heatherton TF, Kozlowski LT, Frecker RC, FAGERSTROM KO. The Fagerström test for nicotine dependence: a revision of the Fagerstrom Tolerance Questionnaire. *British journal of addiction*. 1991 Sep;86(9):1119-27.
2. World Health Organization. WHO report on the global tobacco epidemic 2021: addressing new and emerging products.
3. World Health Organization. WHO global report on trends in prevalence of tobacco use 2000–2030. World Health Organization; 2024 Jan 15.
4. Adams JM. Smoking cessation—progress, barriers, and new opportunities: the Surgeon General's report on smoking cessation. *Jama*. 2020 Jun 23;323(24):2470-1.
5. Sharma MK, Suman LN, Srivastava K, Suma N, Vishwakarma A. Psychometric properties of Fagerstrom Test of Nicotine Dependence: A systematic review. *Industrial psychiatry journal*. 2021 Jul 1;30(2):207-16.
6. World Health Organization. WHO global report on trends in prevalence of tobacco use 2000–2024 and projections 2025–2030.
7. GBD 2019 Tobacco Collaborators. Spatial, temporal, and demographic patterns in prevalence of smoking tobacco use and attributable disease burden in 204 countries and territories, 1990–2019: a systematic analysis from the Global Burden of Disease Study 2019. *Lancet (London, England)*. 2021 Jun 19;397(10292):2337.
8. Mehta V, Pardeshi A, Rahman R, Noor T, Mathur A. Early initiation of tobacco use and its socio-demographic correlates in India: evidence from the Global Adult Tobacco Survey (GATS-2). *Tobacco Use Insights*. 2026 Feb 12;19:1179173X251372804.
9. Mishra S, Joseph RA, Gupta PC, Pezzack B, Ram F, Sinha DN, Dikshit R, Patra J, Jha P. Trends in bidi and cigarette smoking in India from 1998 to 2015, by age, gender and education. *BMJ global health*. 2016 Apr 6;1(1).
10. Fagerström K. Determinants of tobacco use and renaming the FTND to the Fagerström Test for Cigarette Dependence. *Nicotine & tobacco research*. 2011 Oct 24;14(1):75-8.
11. Van Leer E, Hapner ER, Connor NP. Transtheoretical model of health behavior change applied to voice therapy. *Journal of Voice*. 2008 Nov 1;22(6):688-98.
12. Lee EH, Yu HJ. Effectiveness of nurse-initiated smoking cessation intervention: a systematic review and meta-analysis. *Substance Abuse Treatment, Prevention, and Policy*. 2025 Apr 7;20(1):18.
13. Nkomo NY, Adanlawo EF. The effects of education on tobacco consumption: A panel data analysis. *Journal of Ecohumanism*. 2024;3(3):308-16.
14. Hughes JR, Dash M, Callas PW. Is impulsivity a symptom of initial tobacco withdrawal? A meta-analysis and qualitative systematic review. *Nicotine & Tobacco Research*. 2014 Oct 21;17(5):503-9.
15. Carpenter MJ, Hughes JR, Gray KM, Wahlquist AE, Saladin ME, Alberg AJ. Nicotine therapy sampling to induce quit attempts among smokers unmotivated to quit: a randomized clinical trial. *Archives of internal medicine*. 2011 Nov 28;171(21):1901-7.