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Geographical Variation on Smokeless Tobacco Consumption among Male and Female in Northeast States, India

Kh Jitenkumar Singh [1], Neeru Singh [2]
[1,2](*National Institute of Medical Statistics ICMR, India*)

ABSTRACT: *Objective of the study is to identify sub-state regions with significantly high and low prevalence of smoking tobacco We also explored whether smoking was spatially correlated with the different background variables like education, occupation etc in order to find its present condition so that control intervention can be done. Methods: We used data from the cross-sectional survey DLHS-4 (2012-2013) of northeast state, India. The spatial autocorrelation between the smokeless tobacco and various socio-demographic variables were calculated and spatial maps were generated using QGIS and GeoDa. Conclusion: Results along with earlier evidence on the prevalence of smokeless tobacco suggest that local public health action on tobacco consumption might help to reduce its consumption. Surveys that properly represent tobacco and alcohol consumptions at the district level are recommended.*

Keywords: *Smokeless tobacco , LISA, QGIS, male, female*

I. Introduction

Tobacco use either smoking or smokeless both are hazards for life WHO [1,2,3]. India is the second most populous country and one of the world's largest producers and consumers of tobacco. Tobacco is available in a variety of different types and brands e.g. bidi, gutka, khaini, pan masala, hookah, cigarettes etc includes[4]. The prevalence of tobacco consumption in India, either smoked or smokeless tobacco, in the population aged 15 years and above was 47 percent among male and 14 percent among female, while overall prevalence was 37 percent [5,6,7]. At least, one person dies every six seconds due to the consumption of tobacco [5,8]. Studies revealed that the smokeless tobacco is found high among the women in Northeast States, India [1,5]. Consumption of smokeless tobacco is risk also for non communicable diseases like cancer. Aizwal district in Mizoram recorded the highest number of cancer cases among males while Papumpare district in Arunachal Pradesh reported the highest rate of the disease among women [9]. In northeast states of the India, smokeless tobacco is treated as a part of the socio-cultural [10]. They have different customs, food habits, lifestyle, diverse ethnic groups, type and pattern of tobacco consumption as compared to the rest of the country. Research have shown that in northeast states, betel quid (55.4%), is the most popular smokeless tobacco followed by tuibur (13.1%), gul (12.0%) and khaini (9.1%), Gul and tubur are primarily used by women and recent study shows that the prevalence of smokeless tobacco in northern, eastern and northeast states is 8.4%, 31.8% and 23.8% [10-12]. Betel quid is a combination of betel leaf, areca products, betel quid and gutka are known to cause Esophageal cancer, Lip cancer, Mouth cancer, Pharynx cancer, Tongue cancer. The most harmful cancer-causing substances in smokeless tobacco are tobacco of specific nitrosamines (TSNAs). TSNA levels vary by product, but the higher the level the greater the cancer risk. nut, and slaked lime. Like other smokeless tobacco which is created a noxious effect on both male and female. As smokeless tobacco is quite famous among women, the most common negative effects that can be seen are their oral morbidity and perinatal health, including premature delivery, low birth weight, and shortened length [5,13,14] .

As government policies majorly depend only on the current situation of any hazard habits and implementation of smokeless tobacco consumption control policies is the responsibility of them [15,16], thus studying the distributions of smokeless tobacco as well as their spatial association at the sub-state level with the various socio-economic variables is essential. Advances in geographic information system (GIS) technology enable analysis of public health phenomena by taking ''space'' into account [1,17]. GIS is a tool that allows the visual presentation of areal data [1,17,18]. We used QGIS for visualizing presentations of the prevalence of smokeless tobacco among male and female, the spatial analysis also adopted to measures the spatial association with itself to space. Our objective was to identify sub-state regions with significantly high and low prevalence of smoking tobacco. We also explored whether smoking was spatially correlated with the different background variables like education, occupation etc in order to find its present condition so that control intervention can be done.

II. Data and Methods

Data used the fourth round of the District Level Household Survey (DLHS-4) conducted during 2012-13. The study used the pooled data of the states namely, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Tripura, and Sikkim. The outcome variable included in the analysis is "personal habit of age 15 and above

smokeless tobacco", "smoke tobacco" and "alcohol". Where the response was further divided into two categories like "Current Consumption" and "No Consumption" the household members was considered current consumers if they had responded that they were consuming (substance) and coded as 1, while the never consumers, ex-consumers and don't know are coded as 0. BPL card users, availability of piped water facility, no drainage facility, literacy, lower wealth quintile, christian population, schedule caste and tribe population, chronic illness and urban population were taken as the covariate variables in the analysis.

A local measure of spatial association provide a measure of association for each unit and help identify the spatial correlation and it was implemented using LISA and local Moran's I used as an indicator of local spatial correlation. After computing the appropriate statistics from the smoothed rates, a Monte Carlo Randomization (MCR) procedure was used to recalculate the statistics from the randomized data observations to generate a reference distribution using 999 permutations. The p-values were computed by comparing the observed statistics to the distribution generated by the MCR process and the significance level was set as .001 [5, 20 ,21,22]

III. Results

Table1 shows the sample count of respondents and population estimates classified by selected socio-demographic and occupational background. In this study we are dealing with the 143,744 individuals were the unit of analysis in which 67,930 individual are males and 75,814 individual females.

Table 1 Sample counts and population estimates according to the selected background characteristics DLHS-4(2012-2013) Northeast states , India

Background Characteristics	Male		Female		Total (N)
	Percent	Sample size	Percent	Sample size	
Age					
15-19	47.6	7,512	52.4	8,263	15,775
20-34	42.9	21,552	57.1	28,628	50,180
35-59	48.1	28,578	51.9	30,860	59,438
60+	56.1	10,288	43.9	8,048	18,336
Level of education					
Illiterate	35.0	11,196	65.0	20,753	31,949
Below Middle	46.8	16,066	53.2	18,229	34,295
Middle	50.2	16,636	49.8	16,473	33,109
Secondary	54.2	24,049	45.8	20,359	44,408
Religion					
Christian	47.1	39667	52.9	44520	84,187
Non Christian	47.5	28280	52.5	31294	59,574
Caste					
Scheduled tribe	49.35	76,484	50.65	78506	154,990
Scheduled caste	50.33	5772	49.67	5697	11,469
Others	49.58	17078	50.41	17363	34441
Occupation					
Working	69.5	41,633	30.5	18,302	59,935
Not working	31.4	26,314	68.6	57,512	83,826
Marital status					
Unmarried	51.4	18,634	48.6	17,653	36,287
Married	45.9	49,311	54.1	58,159	107,470
Place of residence					
Urban	46.4	16,832	53.6	19,442	36,274
Rural	47.6	51,115	52.4	56,372	107,487
Socio-Economic Variables					
BPL Card	-	-	-	-	57669(28.7)
No Drainage Facility	-	-	-	-	10862(5.4)
Piped Water Facility	-	-	-	-	111332(55.5)
Chronic Illness	-	-	-	-	13286(6.6)
Kaccha House	-	-	-	-	96469(48.1)
Source: Based on the authors computations					

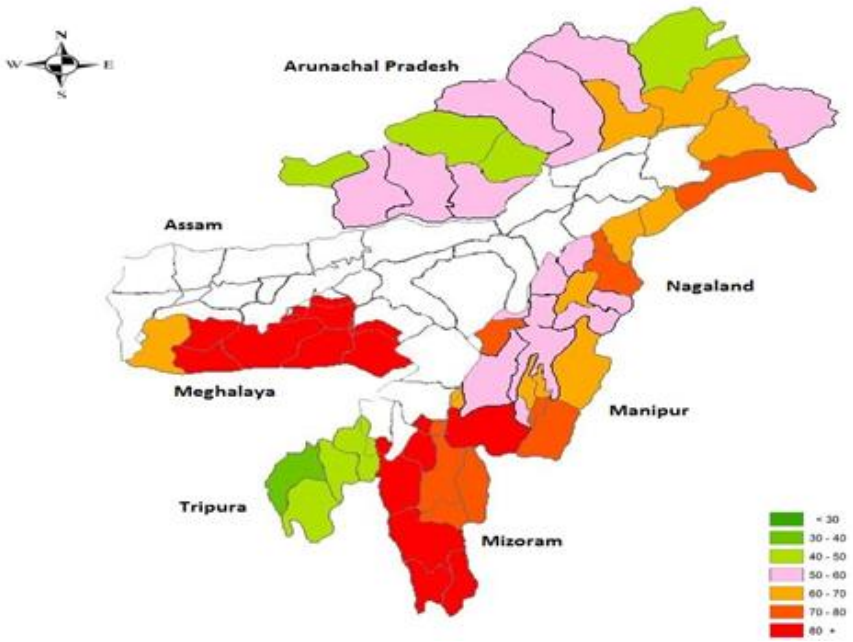

Figure 1.1 Districts-wise prevalence of smokeless tobacco consumption among male in northeast states, DLHS-4 (2012-13)

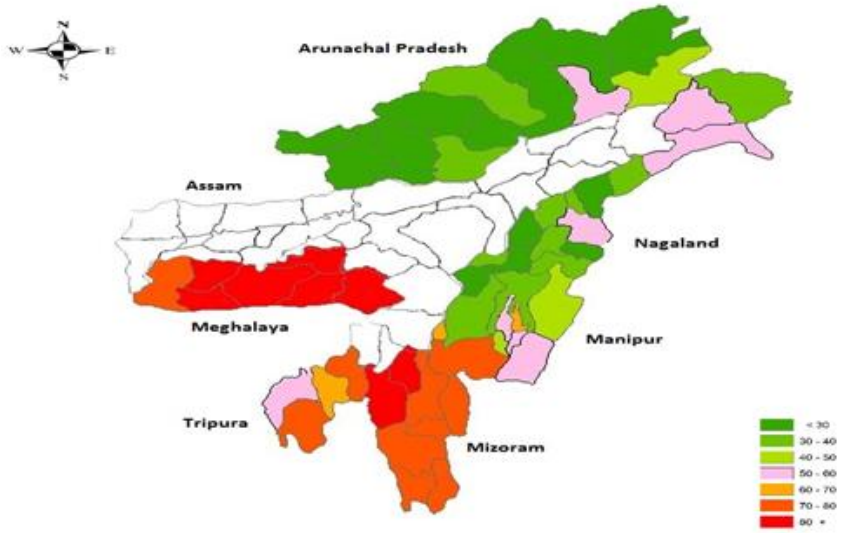

Figure1.2 Districts-wise prevalence of smokeless tobacco consumption among female in northeast states, DLHS-4 (2012-13)

Figure 1.1 represents the district wise prevalence of smokeless tobacco consumption among male in northeast states, India. Where red color shows the high consumption (80>) in Meghalaya followed by Mizoram with (80 above and between 70-80). Some part of Manipur consumes the high comparatively to other parts. Arunachal Pradesh is the least smokeless tobacco consumer in the northeast states with prevalence (30<) followed by Nagaland and some part of Manipur. Figure 1.2 represents the district wise consumption of smokeless tobacco among females in northeast states, India. Females in Meghalaya were found consumed high smokeless tobacco which is shown in the red color prevalence (80>) followed by the Mizoram which falls under the area of prevalence (80> and 70-80) while Meghalaya is the state where least number of females consumes smokeless tobacco.

LISA Cluster Map

Figure 1.3 and 1.4 result shows a special choropleth map showing those locations with a significant Local Moran statistic classified by type of spatial correlation: bright red for the high-high association, bright blue for low-low, light blue for low-high, and light red for high-low. The high-high and low-low locations suggest

clustering of similar values, whereas the high-low and low-high locations indicate spatial outliers.The high-high type indicates that a district with high prevalence is surrounded by neighbouring districts also with high prevalence; while low-high type indicates that a district with low prevalence is surrounded by neighbouring districts with high prevalence. Figure 1.3 and 1.4 districts of Meghalaya has high-high prevalence and Arunachal Pradesh has the low-low prevalence

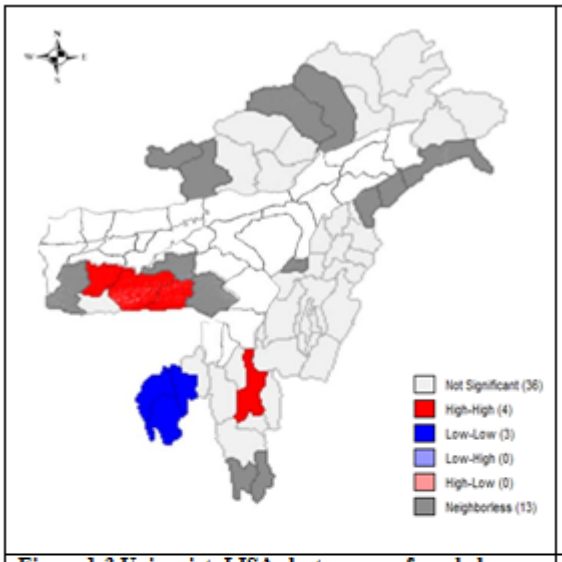

Figure 1.3 UnivariateLISA cluster map of smokeless tobacco use among male in Northeast states

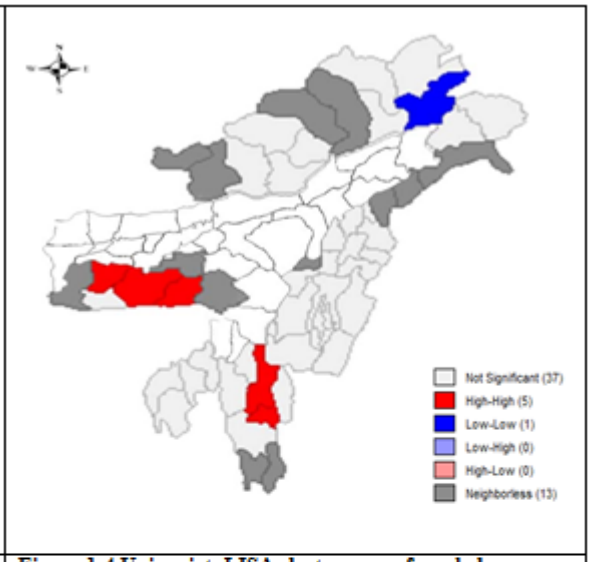

Figure 1.4 UnivariateLISA cluster map of smokeless tobacco use among female in Northeast states

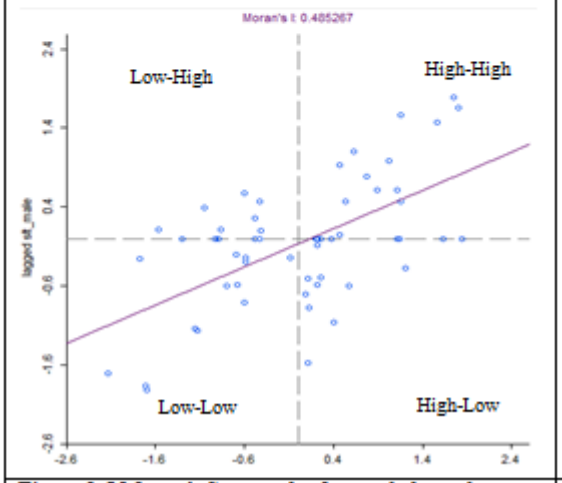

Figure 1.5 Moran's Scatterplot for smokeless tobacco use among male in Northeast states, 2012-13.

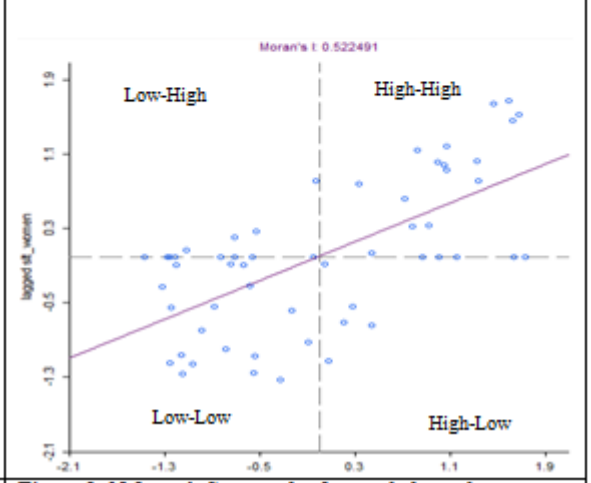

Figure 1.6 Moran's Scatterplot for smokeless tobacco use among female in Northeast states, 2012-13.

a) Local Moran's I and Univariate, Bivariate Analysis

Table2 shows Pearson's correlation coefficients under the assumption of stationary. A result indicates a little or no correlation across the variables except kaccha house, married, schedule tribe and schedule caste with SLT males and correlation of variables like kaccha house, BPL, piped water facility, chronic illness with SLT females but this correlation can be likely due to the large sample. The univariate Moran's I values were computed for each independent variable, which provides the measure of how well a variable cluster with itself. Local Moran's I is an indicator of the aggregate spatial cluster (or dispersion).Value range between -1(perfect dispersion) and +1(perfect correlation), while value "0" indicates no spatial correlation at all. Males, there is a considerable degree of spatial lag in most of the variables except the literacy and Scheduled caste here shows perfect autocorrelation [22]. The bivariate spatial analysis is based on the first law of Geographic which assumes that all things in space are related, but those things which are closure in space aIre more strongly related [22,23]. Among male there is a positive association of smokeless tobacco with the scheduled tribe (index score 0.32) and negatively association with the scheduled caste and kaccha house (index score -0.39 and -0.38) while among females there is a strong positive association among smokeless tobacco and the variables kaccha house, BPL, piped water facility, chronic illness and no drainage facility (index score 0.31, 0.34 , 0.40 , 0.33 and 0.35) and

literacy is highly associated with the consumption of smokeless tobacco by region (index score 0.42). Table2 shows that the smokeless tobacco is more high among females.

Table2. Correlation, Univariate and Bivariate local Moran's I with smokeless tobacco use among male and female according to selected background characteristics, DLHS-4 (2012-13) Northeast states, India

		Male		Female	
Background variable	Univariate Moran's I	Correlation (r)	Bivariate Moran's I	Correlation (r)	Bivariate Moran's I
Proportion of Christian	0.59	0.17	0.10	-0.17	0.15
Proportion of Married	0.65	-0.40	-0.27	-0.29	0.16
Proportion of HH living in Kaccha house	0.46	-0.51	-0.38*	-0.53	0.31*
Proportion of HH have BPL card	0.53	-0.05	-0.09	0.51	0.34*
Proportion of HH has piped water facility	0.43	-0.06	0.03	0.45	0.40*
Proportion of Chronic illness in HH	0.45	-0.06	-0.02	0.49	0.33*
Proportion of population with no drainage facility	0.54	-0.14	-0.07	0.40	0.35*
Proportion of Literacy	0.80	0.17	0.04	0.61	0.42*
Proportion of Urbanization	0.40	0.05	0.10	0.10	0.09
Proportion of Lower wealth	0.35	-0.09	-0.06	-0.07	0.004
Proportion of Scheduled tribe	0.53	0.32	0.32*	-0.04	0.05
Proportion of Scheduled caste	0.18	-0.50	-0.39*	0.83	0.17
Average household size	0.32	-0.06	-0.05	0.12	0.25
Population density	0.20	-0.10	-0.01	0.11	0.13
Proportion of female Work	-0.41	0.15	0.13	0.30	0.22
Source: Based on the authors computations					

b) Spatial Regression Analysis

We estimate OLS as well as spatial lag and error models (Table 3). The first column shows OLS estimates, columns 2 show estimates obtained using spatial error model and columns 3 show estimates of the spatial lag modelIn Table 3,. If we look at the value of Adjusted R^2 is minimum in OLS (R^2- 0.67) while same in both spatial Lag and Error model (R^2- 76) which give no information that which model is more adaptive. Spatial error model with the lowest AIC(409.271) is appropriate for the study. Which shows that error term is spatial in nature and it is hard to say that which affects the dependent variable more.

In Table 4 Similarly like table3 OLS over estimated the model parameters. A crude look at the table indicates that OLS tend to overestimate the model parameter in the presence of spatial effects with minimum Adjusted R^2. Adjusted R^2 (0.82) is same in both Lag and Error model which give no information on which model will be more adaptive. spatial error model has the lowest AIC(444.052).

Table 3. Results of Ordinary Least Squares Estimation, Spatial Lag and Spatial Error for consumption of smokeless tobacco among male , DLHS-4 (2012-13) Northeast states, India

Background variable	**OLS**	**Spatial Lag**	**Spatial Error**
Proportion of Christian	-0.007(0.87)	-0.010(0.79)	0.905(0.91)
Proportion of Married	-0.630(0.00)	-0.492(0.00)	-0.453(0.00)
Proportion of HH living in Kaccha house	-0.466(0.43)	0.080(0.30)	-0.069(0.38)
Proportion of HH have BPL card	0.074(0.42)	0.268(0.38)	0.254(0.40)
Proportion of HH have piped water facility	0.296(0.71)	-0.079(0.76)	-0.109(0.67)
Proportion of Chronic illness in HH	-0.115(0.24)	0.369(0.17)	0.356(0.19)
Proportion of population with no drainage facility	0.377(0.04)	-0.680(0.00)	-0.594(0.01)
Proportion of Female literacy	-0.646(0.00)	0.391(0.00)	0.380(0.00)
Proportion of Urbanization	0.376(0.06)	-0.205(0.04)	-0.252(0.02)
Proportion of Lower wealth	-0.232(0.16)	-0.152(0.13)	-0.179(0.08)
Proportion of Scheduled tribe	-0.169(0.32)	-0.069(0.25)	-0.087(0.16)
Proportion of Scheduled caste	-2.568(0.00)	-2.513(0.00)	-2.605(0.00)
Average household size	0.214(0.30)	0.181(0.29)	0.224(0.18)
Population density	-0.007(0.32)	-0.007(0.23)	-0.005(0.34)
Proportion of female Work	0.32(0.46)	0.388(0.29)	0.342(0.35)
Adjusted R-squared	0.67	0.76	0.76
Log likelihood	-188.703	-188.197	-188.636
Akaike info criterion(AIC)	409.406	410.826	409.271
Source: Based on the authors computations Note: Values inside the parenthesis are p-value			

Table 4. Results of Ordinary Least Squares Estimation, Spatial Lag and Spatial Error for consumption of smokeless tobacco among female, DLHS-4 (2012-13) Northeast states, India

Background variable	OLS	Spatial Lag	Spatial Error
Proportion of Christian	0.020(0.75)	0.029(0.22)	0.068(0.21)
Proportion of Married	-0.630(0.00*)	-0.5887(0.00")	-0.574(0.00*)
Proportion of HH living in Kaccha house	-0.019(0.88)	-0.030(0.77)	-0.044(0.68)
Proportion of HH have BPL card	0.594(0.24)	0.636(0.13)	0.448(0.27)
Proportion of HH have piped water facility	-0.121(0.78)	-0.185(0.61)	-0.096(0.78)
Proportion of Chronic illness in HH	0.619(0.17)	0.629(0.09)	0.730(0.4)
Proportion of population with no drainage facility	-0.588(0.17)	-0.560(0.10)	-0.429(0.20)
Proportion of Female literacy	0.645(0.00*)	0.630(0.00*)	0.657(0.00*)
Proportion of Urbanization	-0.437(0.01*)	-0.474(0.00*)	-0.536(0.00*)
Proportion of Lower wealth	-0.234(0.16)	-0.251(0.07)	-0.256(0.06)
Proportion of Scheduled tribe	-0.047(0.64)	-0.067(0.43)	-0.117(0.18)
Proportion of Scheduled caste	-1.22(0.16)	-1.402(0.05*)	-1.478(0.06)
Average household size	0.219(0.44)	0.255(0.27)	0.258(0.26)
Population density	-0.006(0.51)	-0.006(0.41)	-0.001(0.90)
Proportion of female Work	-0.773(0.20)	-0.896(0.08)	-0.549(0.27)
Adjusted R-squared	0.74	0.82	0.82
Log likelihood	-206.747	-206.022	-206.025
Akaike info criterion(AIC)	445.495	446.045	444.052
Sigma (Maximum Likelihood root MSE)	94.25	91.59	89.23
No. of observations	56	56	56
Source: Based on the authors computations Note: Values inside the parenthesis are p-value			

IV. Conclusion

There is an urgent need for research to determine the current level of smokeless tobacco in the Northeast states. This study examines the spatial patterns of smokeless tobacco consumption among males and smokeless tobacco consumption among female's rates across the Northeast states and districts of it. We found evidence for significant local spatial correlation of SLT males and SLT females with independent variables namely Kaccha house, Piped water, Chronic illness, literacy, BPL card users. The local spatial autocorrelation helped us in identifying 'geographic traps' in some areas of Northeast states. Therefore, it is quite possible that various risks to health tend to cluster in some of the areas. Meghalaya as one such state which requires further exploration. The presence of significant local spatial autocorrelation means both immediate and wider social environment influence consumption of smokeless tobacco.

The study further examines the dependent variable smokeless tobacco consumption among male and females in the Northeast states, Indi. We found that the people leaving in kaccha house, using BPL card, suffering from chronic illness, have no drainage facility, belongs to lower wealth quintile are not significantly affected but married women, Urbanization, and literacy were significant. This mean ensuring accessibility and availability of the facilities will affect the consumption. Significant association of literacy with smokeless tobacco consumption among females indicates that integrating health awareness with health policy might be helpful in improving health outcomes.

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