Cureus
Part of SPRINGER NATURE

Open Access Original Article

Socioeconomic Inequality in Ever Tobacco Use Among Women in Selected Field-Practice Areas of Lucknow District of North India: A Decomposition Analysis

Review began 09/26/2026
Review ended 10/13/2026
Published 10/16/2026

© Copyright 2026
Sengar et al. This is an open access article distributed under the terms of the Creative Commons Attribution License CC-BY 4.0., which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

DOI: 10.7759/cureus.118041

Mili Sengar [1], Shikhar Singh [1], Anamika Chandra [1], Amit Kaushik [1], SD Kandpal [1], Rashmi Kumari [1], Vinita Shukla [1], Arshi Ansari [1], Beena Sachan [1]

1. Community Medicine, Dr. Ram Manohar Lohia Institute of Medical Sciences, Lucknow, IND

Corresponding author: Mili Sengar, drmili85@gmail.com

Abstract

Background: Socioeconomic comparisons of tobacco use can reveal differences that are hidden by an overall prevalence figure. We studied women aged 30 years and above to describe ever use of tobacco across socioeconomic groups and to determine which measured characteristics contributed most to the observed inequality.

Materials and methods: The study was conducted in the rural and urban field-practice areas attached to Dr. Ram Manohar Lohia Institute of Medical Sciences, Lucknow, India. A total of 496 women were included, 248 from each area. Participants were selected by simple random sampling and interviewed using a pre-tested schedule. Income quartiles were used to rank socioeconomic position. Inequality was assessed with the Erreygers-corrected concentration index (ECI), followed by a generalized linear model and decomposition of the ECI.

Results: Overall, 16% of women reported ever use of tobacco. The percentages across Q1 to Q4 were 16.9%, 8.9%, 21%, and 16.1%, respectively. Thus, the largest crude proportion occurred in Q3 rather than at either end of the income distribution. The ECI was +0.048. In the decomposition, education contributed 45.3% and income quartile 35.9%; age, marital status, family type, and occupation contributed considerably less.

Conclusion: The socioeconomic pattern of ever use of tobacco was irregular across the four income quartiles, although the summary inequality measure was slightly positive. Education and income explained most of the measured inequality. Programme planning for women should therefore not be restricted to the poorest group and should take differences in education and economic position into account.

Categories: Family/General Practice, Environmental Health, Epidemiology/Public Health
Keywords: decomposition analysis, income quartile, north india, socioeconomic, tobacco and women

Introduction

Tobacco-related illness remains an important component of the preventable disease burden. Tobacco exposure has been linked with major chronic conditions, including cancers and cardiovascular and respiratory diseases [1-5]. In India, this burden is occurring in a population in which non-communicable diseases are already a major health concern [6].

The circumstances surrounding tobacco use in women are not necessarily the same as those in men. Education, household resources, social roles, and the local availability of tobacco products can influence patterns of use [7-11]. For this reason, an overall prevalence estimate may give an incomplete picture when women from different socioeconomic backgrounds are considered together.

Information on women in middle and later adulthood is particularly relevant because tobacco exposure at these ages coexists with an increasing burden of chronic disease and functional limitations [12,13]. Examining the socioeconomic distribution of use may therefore add information that is not obtained from prevalence alone.

In the present analysis, socioeconomic inequality was examined in addition to conventional descriptive estimates. The concentration index was used to summarize how tobacco use was distributed over the socioeconomic ranking, and decomposition was used to estimate the share attributable to the measured socio-demographic characteristics [14,15].

The study was undertaken among women aged 30 years and above residing in the rural and urban field-practice areas of the institute. We aimed to measure ever use of tobacco prevalence, examine its socio-

demographic pattern, estimate socioeconomic inequality, and identify the relative contribution of the variables included in the decomposition model.

Materials And Methods

Study design and setting

This community-based cross-sectional study covered the service areas of the Urban Health and Training Centre, Ujjariaon, and the Rural Health and Training Centre, Juggaur, both affiliated with Dr. Ram Manohar Lohia Institute of Medical Sciences, Lucknow, India.

Study population and eligibility criteria

Women were considered for enrolment if they were 30 years of age or older, were permanent residents of the selected area, and consented in writing. Pregnant or lactating women were excluded, as were women who were severely ill or bedridden at the time of contact and those who did not agree to participate.

Sample size and sampling technique

The calculation used an expected prevalence of 17.7% [14], 95% confidence, and 5% absolute precision. After allowing 10% for non-response, the minimum sample was 492. Rural and urban areas were assigned equal numbers. The household lists maintained at the two field centres were used for selection. Simple random sampling was applied, and only one eligible woman was taken from a selected household.

Data collection

Field investigators collected information during face-to-face interviews with a structured proforma that had been pre-tested. Recorded variables included age, education, marital status, occupation, income, family type, and ever use of tobacco. Tobacco use in the present analysis meant self-reported ever use of either smoked or smokeless tobacco.

Ethical considerations

The Institutional Ethics Committee of Dr. Ram Manohar Lohia Institute of Medical Sciences approved the study (approval number: RC-1833/RMLIMS/2025). Verbal informed consent preceded data collection. Interviews and records were handled in a manner intended to maintain participant privacy and confidentiality.

Statistical analysis

Analysis was carried out using IBM SPSS Statistics for Windows, V. 22.0 (IBM Corp., Armonk, NY, USA). Frequencies and percentages were used to describe the study population and ever use of tobacco.

Income was calculated using total monthly household income. Women were ranked by income. After ranking women by income quartiles, the distribution was divided at the 25th, 50th, and 75th percentiles into four groups: Q1 represented the lowest socioeconomic position and Q4 the highest.

For the binary tobacco-use outcome, inequality was expressed using the Erreygers-corrected concentration index (ECI) [15]. The ECI was calculated as $\mathrm{E} = 4\mu\mathrm{C}$, where μ is the prevalence of ever tobacco use and C is the standard concentration index, $\mathrm{C} = (2/\mu)\mathrm{cov}(\mathrm{y}\ ,\ \mathrm{R}\ )$, with R_i the fractional income rank of woman i. The ECI was decomposed as $\mathrm{E} = \Sigma\ \ 4\beta\ \bar{\mathrm{x}}\ \mathrm{C}\ \ + 4\mathrm{GC}_\varepsilon$. Here, β_k is the marginal effect of determinant k from the logit model, $\bar{x_k}$ its mean, C_k its concentration index, and GC_ε the generalized concentration index of the residual. The contribution of each determinant was $4\beta_k\bar{x_k}C_k$, and its relative contribution was expressed as a percentage of the total ECI. The sign of the ECI was used to indicate the direction of the socioeconomic concentration. Positive values place relatively more of the outcome toward the higher end of the socioeconomic ranking; negative values indicate the opposite pattern.

The concentration curve plotted the cumulative proportion of tobacco ever users against the cumulative population after ordering participants by socioeconomic position. The equality line provided the reference against which the observed curve was viewed.

A generalized linear model with a binomial family and logit link was fitted for ever use of tobacco. Age group, education, marital status, occupation, family type, and income quartile were entered in the model. The ECI was then decomposed to estimate how much each included variable contributed to the measured inequality. Contributions were calculated from the model terms and the socioeconomic distribution of the determinants and were finally expressed as percentages for comparison.

Results

Data from 496 women were analyzed, with 248 participants from the rural area and 248 from the urban area. The distributions of the measured characteristics were similar in the two settings. Married women accounted for 89.1% (221 women) of the rural sample and 85.9% (213 women) of the urban sample. In each area, 30.6% (76 women) were illiterate. Primary schooling was reported by roughly 35% (87 women), secondary schooling by about 30% (75 women), and graduate-level education or above by only 4-4.4%. Homemakers constituted more than 94% of both groups. Most women lived in either nuclear or joint families (Table *1*).

Variable		Rural (n = 248)		Urban (n = 248)	
		n	%	n	%
Marital status	Married	221	89.1	213	85.9
	Divorced/separated	1	0.40	1	0.40
	Unmarried	11	4.44	15	6.05
	Widowed	15	6.05	19	7.66
Educational status	Illiterate	76	30.65	76	30.65
	Primary	87	35.08	88	35.48
	Secondary	75	30.24	73	29.44
	Graduate and above	10	4.03	11	4.44
Employment status	Employed	14	5.65	12	4.84
	Homemaker	234	94.35	236	95.16
Type of family	Nuclear	113	45.56	117	47.18
	Joint	124	50	121	48.79
	Extended	11	4.44	10	4.03

TABLE 1: Socio-demographic profile of the study participants

Seventy-eight of the 496 women, approximately 16%, reported ever use of tobacco. The percentages did not change in a graded fashion across the income groups. Ever use of tobacco was 16.9% in Q1 (i.e., 21 women out of 124), 8.9% in Q2 (i.e., 11 women out of 124), 21% in Q3 (26 women out of 124), and 16.1% in Q4 (20 women out of 124). Q3 therefore had the largest crude proportion and Q2 the smallest (Table *2*). The overall difference across quartiles was not statistically significant ($\chi^2 = 7.12$; df = 3; $p \approx 0.07$).

Income quartile	Ever tobacco users (n)	Prevalence (%)	95% CI
Q1 (lowest)	21	16.9	11.4-24.5
Q2	11	8.9	5.0-15.2
Q3	26	21	14.7-28.9
Q4 (highest)	20	16.1	10.7-23.6

TABLE 2: Income quartile and tobacco consumption among the study participants

$\chi^2 = 7.12$; df = 3; $p \approx 0.07$

CI: confidence interval

The ECI for ever use of tobacco was +0.048. Its positive direction indicates that, when the entire socioeconomic ranking was considered, ever use of tobacco was slightly concentrated toward the better-off end. The ECI of +0.048 is the overall socioeconomic inequality in ever tobacco use.

For a binary outcome, ECI is calculated as $E = 4\mu C$, where μ is the prevalence of ever tobacco use and C is the standard concentration index: $C = (2/\mu)\mathrm{cov}(y, R)$. Here, y_i is the tobacco-use status of woman i (1 = ever user; 0 = never user), and R_i is her fractional rank in the income distribution.

Following Erreygers [15], the ECI was decomposed into the contributions of the variables in the regression model plus an unexplained residual, $E = \Sigma\ 4\beta\ \bar{x}\ C\ + 4GC_\varepsilon$, where β_k is the marginal effect of determinant k from the binomial logit model, $\bar{x}_k$ is the mean of determinant k, C_k is the concentration index of determinant k with respect to income rank, and GC_ε is the generalized concentration index of the error term, i.e., the residual. Each term $4 \times \beta_k \times \bar{x}_k \times C_k$ is the contribution of determinant k, as shown in Table 3.

Determinant	Coefficient	Concentration index (C_k)	Contribution	% of explained	% of ECI
Age group	0.03	−0.012	0.0006	9.4	1.3
Marital status	0.02	−0.015	0.0003	4.7	0.6
Education level	0.06	+0.048	0.0029	45.3	6
Occupation	0.01	−0.005	0.0001	1.6	0.2
Family type	0.02	−0.006	0.0002	3.1	0.4
Income quartile	0.04	+0.048	0.0023	35.9	4.8
Explained (sum of determinants)	-	-	0.0064	100	13.3
Residual (unexplained)	-	-	0.0416	-	86.7
Total ECI	-	-	0.048	-	100

TABLE 3: Erreygers decomposition analysis of tobacco consumption among women

ECI: Erreygers corrected concentration index

The value 0.0064 is therefore the sum of these contributions: the part of the ECI explained by the six variables in the model. The ECI equals this explained part plus the residual: 0.048 = 0.0064 (explained) + 0.0416 (residual).

The model thus explained 13.3% of the measured inequality. The remaining 86.7% was due to factors not included in the model.

Education made the largest contribution in the decomposition (45.3%), followed by income quartile (35.9%). The percentages were calculated by dividing each variable's absolute contribution by the sum of the listed contributions (0.0064). Age group accounted for 9.4%, marital status 4.7%, family type 3.1%, and occupation 1.6%. The concentration indices for age, marital status, occupation, and family type were negative, while those for education and income quartile were positive.

Figure 1 presents the four quartile-specific prevalence estimates and makes the non-linear pattern visible.

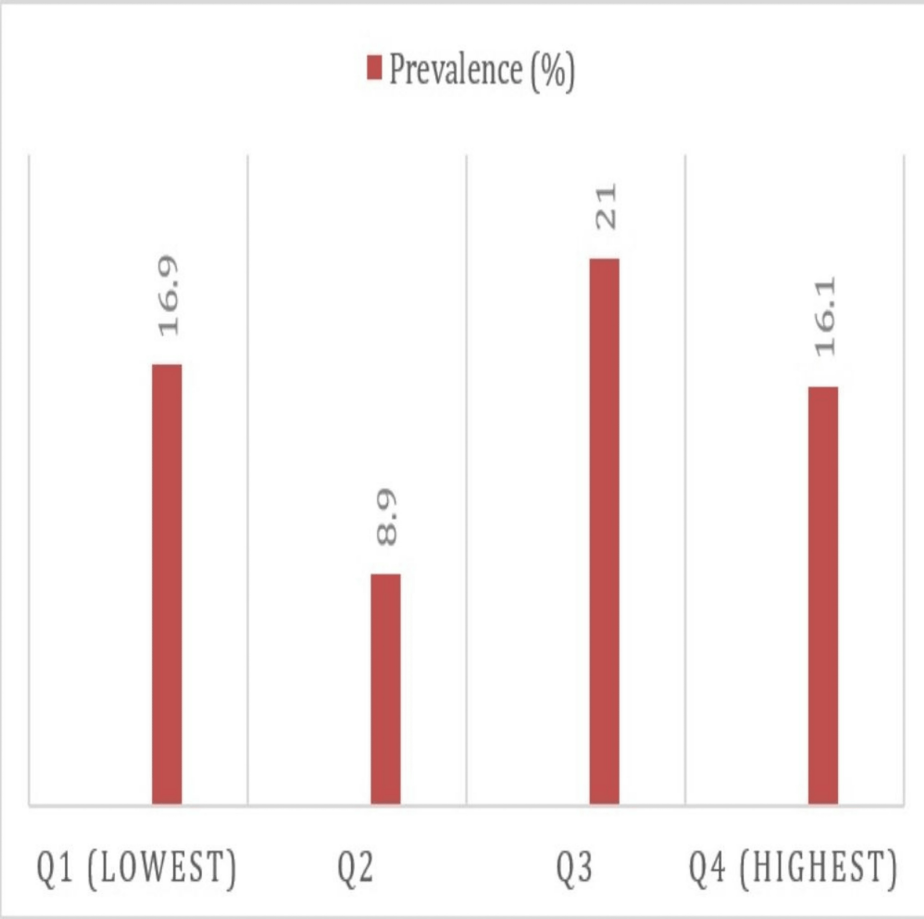


FIGURE 1: Prevalence of use by income quartile

Figure *2* shows the concentration curve close to the equality line, which is compatible with the small ECI. The graphical and numerical results therefore point to limited overall inequality but appreciable variation between individual socioeconomic groups.

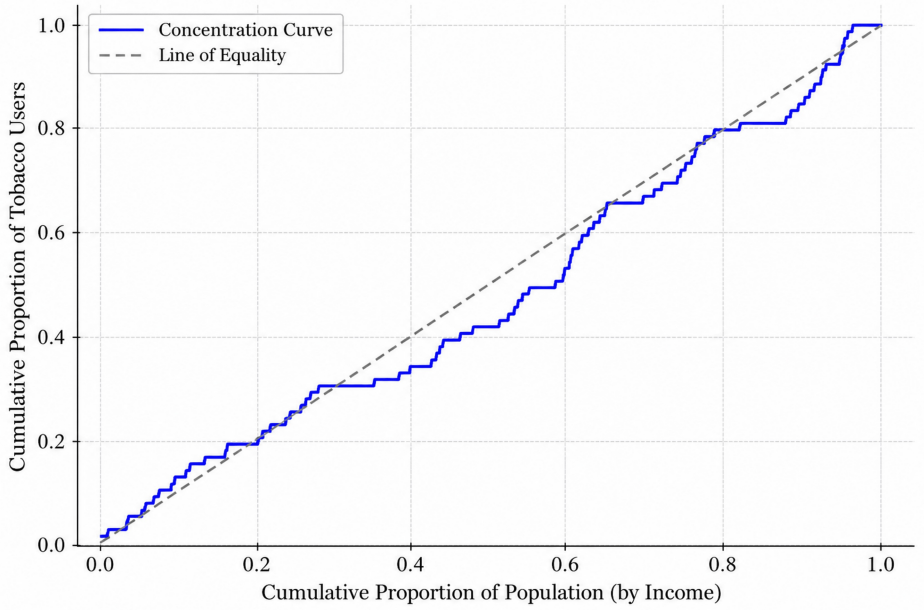


FIGURE 2: Concentration curve for use among women

Discussion

The study found ever use of tobacco in 16% of women aged 30 years and above. More importantly for the present analysis, tobacco use was not arranged in a simple socioeconomic sequence. Q3 recorded the highest prevalence (21%) and Q2 the lowest (8.9%), and Q1 and Q4 had fairly similar values. The positive ECI of +0.048 therefore needs to be read as a summary of the complete socioeconomic ranking rather than as evidence that prevalence rose steadily with income.

Previous work from India and neighbouring South Asian settings has often described a heavier burden of tobacco, especially smokeless tobacco, among socioeconomically disadvantaged women [8,9]. Our data did not reproduce a straightforward version of that gradient. This does not contradict the earlier studies; the populations, age composition, setting, and measures of socioeconomic position differ. It does, however, show why local data should be examined before assuming that the same gradient applies in every population. Similar to the present study, according to the Global Adult Tobacco Survey (GATS) 2016-2017, 14.2% of Indian women used tobacco in some form. Across all adults, tobacco use was higher in rural areas (32.5%) than in urban areas (21.2%) [16].

Education accounted for 45.3% of the decomposed inequality, the largest share among the variables studied. Earlier literature has also linked educational differences with tobacco-use patterns among women [8,9]. In the present study, this result means that education explained a substantial part of the measured socioeconomic inequality after considering its regression relationship and its distribution across socioeconomic rank. It should not be interpreted as proof of a causal effect because exposure and outcome were measured at the same point in time.

Income quartile contributed another 35.9%. The crude results are useful here: the greatest ever use of tobacco was seen in Q3, not in the poorest quartile and not in Q4. These findings suggest that the need for tobacco education and cessation support may extend beyond women in the lowest socioeconomic group, although this needs to be tested in further studies. Education and cessation messages may need to be available across the income distribution.

Age, marital status, and family type together explained a much smaller share than education and income. Occupation contributed only 1.6%. This result also reflects the composition of the sample: more than 94% of women were homemakers, leaving relatively little occupational variation from which an inequality contribution could arise. Haustein [17] described a higher burden of smoking among lower-income groups and the poverty-related pressures, including stress, social norms, and limited access to cessation support, that may encourage tobacco use among low-income women.

From a programme perspective, the findings support broad access to tobacco prevention and cessation services for women rather than restriction to a single income group. Communication can be adapted for different educational levels, and existing community and primary-care platforms may be used to reach women in different socioeconomic circumstances. These implications follow from the observed distribution, but their effectiveness would require evaluation in intervention studies.

This study has some limitations. Tobacco use was self-reported, and since tobacco use by women is socially disapproved of in many communities, some women may not have disclosed it. The actual prevalence may therefore be higher than 16%. If under-reporting was more common in some education or income groups, this could also have affected the ECI and the decomposition results, though in which direction is not clear. Household income was also self-reported. As most of the women were homemakers, some may not have known the exact family income, and incorrect placement of women in income quartiles would tend to reduce the observed income-related differences. The study was carried out in the field-practice areas of one institute, where women are in regular contact with health workers and outreach programmes, so their awareness and tobacco-use behavior may not be the same as in other areas of North India. Only 26 women (5.2%) were employed; the small contribution of occupation is mainly due to this, and it does not mean that occupation has no role in tobacco use. The variables in our model explained only a small part of the inequality, and the estimates for individual quartiles had wide confidence intervals. Being cross-sectional, the study cannot establish cause and effect, and ever use does not separate current users from those who have quit. Larger studies covering more areas, with follow-up over time and more detailed measures of tobacco use, are needed to see whether a similar pattern is found elsewhere.

Conclusions

Ever use of tobacco was reported by 16% of the women studied. Across the four income quartiles, the pattern was non-linear, with the highest prevalence in Q3. The ECI (+0.048) nevertheless indicated a small overall concentration toward the better-off side of the socioeconomic ranking. Education (45.3%) and income quartile (35.9%) accounted for most of the decomposed inequality. It is suggested that tobacco-control activities for women should therefore remain available across socioeconomic groups, with communication and cessation support adapted to educational and economic circumstances.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Mili Sengar, Shikhar Singh, SD Kandpal, Rashmi Kumari, Beena Sachan

Acquisition, analysis, or interpretation of data: Mili Sengar, Anamika Chandra, Amit Kaushik, Vinita Shukla, Arshi Ansari

Drafting of the manuscript: Mili Sengar, Shikhar Singh, Anamika Chandra, SD Kandpal, Rashmi Kumari, Arshi Ansari

Supervision: Mili Sengar

Critical review of the manuscript for important intellectual content: Anamika Chandra, Amit Kaushik, Rashmi Kumari, Vinita Shukla, Beena Sachan

Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all participants in this study. Institutional Ethics Committee of Dr. Ram Manohar Lohia Institute of Medical Sciences issued approval RC-1833/RMLIMS/2025. **Animal subjects:** All authors have confirmed that this study did not involve animal subjects or tissue. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

References

1. Peres MA, Macpherson LM, Weyant RJ, et al.: Oral diseases: a global public health challenge. Lancet. 2019, 394:249-60. 10.1016/S0140-6736(19)31146-8
2. Tobacco and nicotine. (2026). Accessed: January 05, 2023: https://www.who.int/news-room/fact-sheets/detail/tobacco.
3. Duong M, Islam S, Rangarajan S, et al.: Mortality and cardiovascular and respiratory morbidity in individuals with impaired FEV1 (PURE): an international, community-based cohort study. Lancet Glob Health. 2019, 7:e613-23. 10.1016/S2214-109X(19)30070-1
4. Zhou M, Wang H, Zeng X, et al.: Mortality, morbidity, and risk factors in China and its provinces, 1990-2017: a systematic analysis for the Global Burden of Disease Study 2017. Lancet. 2019, 394:1145-58. 10.1016/S0140-6736(19)30427-1
5. Kurmi OP, Li L, Davis KJ, et al.: Excess risk of major vascular diseases associated with airflow obstruction: a 9-year prospective study of 0.5 million Chinese adults. Int J Chron Obstruct Pulmon Dis. 2018, 13:855-65. 10.2147/COPD.S153641
6. Nethan S, Sinha D, Mehrotra R: Non communicable disease risk factors and their trends in India . Asian Pac J Cancer Prev. 2017, 18:2005-10. 10.22034/APJCP.2017.18.7.2005
7. Welding K, Iacobelli M, Saraf S, Smith KC, Puntambekar N, Gupta PC, Cohen JE: The market for bidis, smokeless tobacco, and cigarettes in India: evidence from semi-urban and rural areas in five states. Int J Public Health. 2021, 66:1604005. 10.3389/ijph.2021.1604005
8. Thakur JS, Paika R: Determinants of smokeless tobacco use in India . Indian J Med Res. 2018, 148:41-5. 10.4103/ijmr.IJMR_27_18
9. Bandyopadhyay A, Irfan M: Educational and wealth inequalities in smokeless tobacco use: an analysis of rural-urban areas of Bangladesh and India. Subst Abuse. 2019, 13:1178221818825074. 10.1177/1178221818825074
10. Yadav A, Ling P, Glantz S: Smokeless tobacco industry's brand stretching in India . Tob Control. 2020, 29:e147-9. 10.1136/tobaccocontrol-2019-055382
11. Widyaningrum N, Yu J: Tobacco use among the adult Muslim population in Indonesia: a preliminary study on religion, cultural, and socioeconomic factors. J Drug Issues. 2018, 48:676-88. 10.1177/0022042618789491
12. Halder M, Saha J, Roy A, Roy D, Chouhan P: Functional disability and its associated factors among the elderly in rural India using LASI Wave 1 data. J Public Health. 2024, 32:1-13. 10.1007/s10389-023-01890-9
13. LASI Wave-I. (2021). Accessed: March 31, 2023: https://iipsindia.ac.in/content/lasi-wave-i.
14. Global Adult Tobacco Survey Fact Sheet/Uttar Pradesh 2016-17 . (2026). Accessed: December 09, 2024: https://cdn.who.int/media/docs/default-source/searo/india/tobacoo/uttar-pradesh-gats2-2016-17.pdf?sfvrsn=4bce2316_2&u....
15. Erreygers G: Correcting the concentration index. J Health Econ. 2009, 28:504-15. 10.1016/j.jhealeco.2008.02.003
16. Global Adult Tobacco Survey. (2016). Accessed: September 07, 2024: https://ntcp.mohfw.gov.in/assets/document/surveys-reports-publications/Global-Adult-Tobacco-Survey-

Second-Round-India....
17. Haustein KO: Smoking and poverty. Eur J Cardiovasc Prev Rehabil. 2006, 13:312-8. 10.1097/01.hjr.0000199495.23838.58