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DEMOGRAPHIC CHANGE HEALTH INEQUALITY AND HUMAN DEVELOPMENT IN INDIA

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Dedicated to
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in West Bengal. Orissa has done better in fertility reduction than many other states, but it is one of the poorest states in India and mortality, particularly infant and child mortality is substantially high there.

In terms of SLI, inequality is quite low in West Bengal. In fact, it occupies the ninth rank among the 11 states considered. Inequality is not that low in West Bengal when we consider the other variables in the socio-economic development. The extent of inequality is highest in this state in terms of availability of health facility within the locality. The proportion of 'other' women staying in a locality with no health facility is only 27 per cent as against 70 per cent among ST women. Orissa shows very high inequality in socio-economic variables, whereas Assam shows the least inequality.

The situation in Assam is particularly noticeable. For similar socio-economic characteristics, as compared to other groups of women, in Assam (i) SC women are less likely to be without ANC. (ii) OBC women in Assam are less likely to have unsafe delivery, less likely to have low BMI, and less likely to be anaemic. (iii) ST women in Assam are less likely to have low BMI and are less likely to be anaemic. One wonders whether this is due to the work done by Christian missionaries in the Northeastern part of India. A similar pattern is observed also for SC women in Orissa and West Bengal who are less likely to go without ANC than 'other' women. In West Bengal, SC women are also less likely to have unsafe delivery as compared to 'other' women, after adjusting for the effect of socio-economic factors. One needs to investigate further why SCs and STs in this region tend to behave differently. For similar socio-economic characteristics, SCs and STs are likely to have better nutrition and are more likely to utilize the programme services, compared to women of other groups.

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10

Multilevel Analysis of Health Behaviours

S. V. Subramanian, Shailen Nandy, Michelle Kelly, Dave Gordon and George Davey Smith

INTRODUCTION

Very little is known about health behaviours of the Indian population and attention has not been paid to understanding health behaviours within the context in which they happen. In this paper we examine health behaviours associated with smoking, drinking and tobacco chewing in India by asking which population groups are more likely to smoke, drink and chew. We also examine whether the micro-environments of households and the macro-environments of local areas, districts and states in which people live make a difference to these individual behaviours.

As part of its ongoing health projects and assistance in formulation of government health strategies, DFID commissioned an analysis of socioeconomic and cultural differences in health and health-related practices across the four states of Andhra Pradesh Orissa, Madhya Pradesh and West Bengal. The study used data from the 1998-99 Indian National Family Health Survey. This paper represents part of the work undertaken within this commission.

AIMS

In this paper, we examine three health behaviours smoking, drinking and tobacco chewing (henceforth "chewing"), all of which are well-known risk factors for cancer and cardiovascular diseases. Importantly, our goal is to describe the socioeconomic disparities in these behaviours and to evaluate the independent role of local areas and macro-environments (such as districts and states) on these behaviours. While local area variation in health behaviours may be largely due to socio-cultural influences, district or state variations may largely be induced by public policies on smoking, drinking and chewing. Specifically, using a multilevel conceptual and methodological framework (Subramanian, Jones, Duncan 2003), this study raises and addresses the following questions for each of three health behaviours, smoking, drinking and chewing:

- What are the average state and urban-rural differences in health behaviours, and to what extent do the three health behaviours vary between-households, between-local areas, and between-districts?
- To what extent are the health behaviours systematically patterned across different individual and household socio-demographic (age, sex, marital status, caste, religion) and economic characteristics (educational attainment and household standard of living)?
- Over and above the influence of individual/household sociodemographic and economic characteristics, are there significant differences between the four states?
- Do individual and household sociodemographic and economic characteristics explain the variation in health behaviours between local areas and districts?
- Are there significant effects of a local area's socioeconomic deprivation on health behaviours, over and above individual/household socioeconomic well-being?

METHODS

Sources of data

The analysis was based on the 1998-99 Indian National Family Health Survey (NFHS) for the states of Andhra Pradesh, Madhya Pradesh, Orissa and West Bengal. For details on the characteristics and history of this survey see (IIPS 2000). In brief, this survey is the second systematic attempt (after the initial 1992-93 Indian NFHS) to collect information on the health of the population, with a special focus on women and children. For this study, we utilized the household data file (www.measuredhs.com) which provides information on smoking, drinking and tobacco chewing habits for each member of the household. We are not aware of any other population-based surveys in India, which provide similar information.

Outcome measures

This study had three dichotomous outcomes; whether an individual smokes or not, drinks or not; and chews or not, with a score of 1 assigned if the individual reported practicing the health behaviour, 0 if they did not. Stated differently, we modeled the probability of smoking, drinking and chewing. Individuals over the age of 18 were considered in the analysis.

Exposure measures

Exposure variables, measured at different levels, were considered simultaneously. At the ***individual level***, we considered age, sex, marital status and educational attainment (i.e. number of years of schooling). While age and educational attainment were considered as continuous measures, sex and marital status were specified as a dichotomous and categorical variable, respectively. At the ***household level***, caste, religion and a standard of living index based on material possessions were considered. Caste status was based on the following classification: Scheduled Caste (SC), Scheduled Tribe (ST), Other Backward Caste (OBC); Other Caste (OC); and No Caste (NOC). The category OC is largely a residual category, that is, those who are *not* SC, ST or OBC; while NOC represents a grouping that is comprised of population groups for whom caste is not applicable and/or those who did not report any caste affiliation in the survey (e.g. Muslims, Christians or Buddhists). Religious affiliation was considered as a four categorical variable: Hindu, Muslim, Christian and Other. We also considered a household standard of living index (HSLI), measured on a continuous scale. The HSLI was constructed from data on material goods owned, with a proportionate possessions weight applied reflecting the differences in ownership specific to the population in question. Box 1 shows the different components (along with their individual weight) which were used to develop state-specific standard of living indices.

Box 1: Methodology for constructing household standard of living indices

Standard of living indices were created using the consumption-based and asset-based material possessions. The standard of living indices were weighted for state-specificity. The weights were calculated as: $100 - x$, where x represents the percent proportion of each item within the state taken from NFHS-2 state reports. This standard of living index uses the relative proportion of each possession as scores reflecting the significant differences specific to the population in question. The following table describes the weights for different material possessions across the four states.

Item	Andhra Pradesh	Madhya Pradesh	Orissa	West Bengal
Mattress	67.1	52.6	86.9	62.7
Pressure cooker	85.2	76.5	87.0	76.8
Chair	45.5	71.2	68.3	66.3
Cot/Bed	14.6	12.7	28.6	38.0
Table	59.5	75.3	72.6	62.8
Clock/Watch	37.6	44.7	52.8	38.3
Electric fan	46.1	60.0	72.4	66.3
Bike	61.3	49.2	43.8	46.7
Radio	64.9	73.7	69.3	61.4
Sewing machine	90.3	83.2	94.6	91.2
Telephone	95.1	95.5	97.4	94.2
Refrigerator	93.6	93.6	96.3	91.8
TV (B/W)	74.1	75.0	85.4	78.1
TV (colour)	92.6	93.9	97.0	93.5
Moped	90.8	88.5	92.9	95.4
Car	99.2	99.1	99.4	98.9
Water pump	87.4	88.5	96.3	93.9
Bullock cart	92.0	83.6	91.0	94.9
Thresher	99.7	94.0	95.4	96.6
Tractor	99.4	97.6	99.8	99.6
	11.4	10.7	3.6	11.0
	54.8	43.0	42.5	61.7
	64.3	41.2	48.0	58.2

Were removed based on reliability analysis

At the *local area level*, we considered an Area-based Standard of Living Index (ASLI) which was derived by aggregating and averaging the HSLI for each local area. The term 'local areas' essentially relates to the Primary Sampling Units (PSUs) that were considered in the Indian NFHS 1998-99. PSUs, in the 1998-99 NFHS, were identified as villages or groups of villages (for rural areas) and wards or municipal localities (for urban areas). Consequently, besides ASLI, local areas were also characterized by their urban/rural status using the following Demographic and Health Survey (DHS) classification of PSUs: Large Cities (a population of 1 million or more), Small Cities (population of more than 100,000 but less than 1 million), Towns (population of less than 100,000) and Rural Areas. While the first three represent grades of urban setting, villages represent rural local areas.

Analytical framework

As one of the key aims of this paper is to investigate the degree to which people's health behaviours are influenced by the contexts within which they live, the use of a conventional regression analysis framework has two critical limitations. First, the analytical framework assumes that the individual observations are independent of one another. This assumption is conceptually and technically problematic. From a conceptual standpoint, it negates the real dependency that is often created by the spatial contexts on individual health behaviours and outcomes. The cluster sampling used in many surveys may accentuate this dependency in a particular data set. Conventional regression frameworks require that observations are independent of one another and violating this assumption may lead to standard errors for the regression coefficients to be under-estimated, thereby increasing the risk of false positive findings. Second, standard regression modeling assumes a single of *source* of variation, that it is either individual *or* contextual. Since in our analysis we anticipate the causal pathways to lie at both the levels *simultaneously*, it is essential to ascertain the contribution of the different sources or levels to the variation in the outcomes. Not differentiating the level-contingent nature of different exposure measures can also lead to under- or over-estimation of the regression coefficients as well as the standard errors. Consequently, the statistical modeling framework in this paper anticipates that individual health behaviours are dependent upon the households and spatial contexts (e.g., local areas; districts) to which they belong. This dependency in the response was modeled by partitioning the individual, household, local area and district sources of variation.

Multilevel statistical techniques provide a technically robust framework, to analyze the dependent nature of the outcome variable (Goldstein 1995; Raudenbush, Bryk 2002). Specifically, multilevel models are pertinent:

a) when data are clustered;

b) when the causal process affecting the outcome is seen to operate at more than one level simultaneously; and

c) when there is an intrinsic interest in the variation and heterogeneity underlying average relationships.

Each of these factors are central to this paper.

The principles underlying multilevel modeling procedures have been extensively discussed elsewhere (Subramanian, Jones, Duncan 2003). Briefly, all statistical models, including conventional regression models, can be seen to have two parts: the *fixed part* and the *random part*. The fixed part estimates, also known as regression or "slope" coefficients in conventional models, show how each exposure, conditional on others included in the model, is related to the outcome variable, *on average*. The "unexplained" part of the statistical model constitutes the random component – what are typically referred to as "errors" in conventional regression models. In contrast, in multilevel models, while the fixed part is comparable (though not identical) to the regression slope coefficients from a single level regression model, it is the expansion of the random part that provides key methodological and substantive advantages. First, since the source of variation in the outcome is seen to come from multiple sources, these are specified as levels, the variance attributable to each level is ascertained. Consequently, instead of one variance term, a multilevel model estimates random variance parameters for each of the defined levels. Second, by explicitly recognizing the distinct levels appropriate for each of the exposures, the regression coefficients and the standard errors are robust.

In the context of the analysis presented here, the multilevel techniques allow estimation of:

a) the average differences between individual/household factors and health behaviours across all local areas and districts, adjusting for average state and urban-rural differences ("fixed/average parameters");

b) variation between local areas and districts in health behaviours that cannot be accounted for by these factors ("random/ variance parameters"); and

c) the effect of local area-level predictors on individual health behaviours ("fixed/average parameters") and the extent to which they explain local area variations in health behaviours ("random/ variance parameters").

As is evident from the preceding discussion, there is a good deal of interest in ascertaining and estimating the relative importance of spatial contexts for individual/population health behaviours. Stated differently, there is an intrinsic interest in describing the underlying contextof different health behaviours. To ascertain contextual variation between places, two potential modelling strategies can be employed. In the first, spatial contexts (such as local areas) are treated as a level in the analytical framework, with the local areas being considered as a *random sample* of the population of local areas, with a defined mean and variance. In the second, spatial contexts can be treated as fixed exposures, rather than as a level. The latter would be appropriate when the interest is in making inferences about specific places and/or if we do not have a large number of places that are necessary to estimate the mean and variance of the sample of places. The first strategy is appropriate when there are a sufficient number of local areas, and the interest is in making inferences about the *population* of local areas, rather than one or more specific areas.

In the analysis presented in this paper, we combine the two modeling strategies, within a multilevel framework, to ascertain the geographic variations in health behaviours at multiple spatial levels. While we consider local areas and districts as distinct levels in our multilevel analysis, and thus provide estimates about how local areas and districts vary in the population, we model state-effects as an exposure with a fixed regression coefficient. The reason for not considering the state as a distinct level is mainly because our interest is in making specific inferences about the four states (conditional on individual exposures, as well as after taking account of the intra-state variations due to districts and local areas). Moreover, since in our study we consider only four states, it may not be appropriate to model them as a random sample from all states of India.

Model specification and strategy

Since each of our outcomes is binary, a multilevel binary logistic model based on a logit-link function was used (Goldstein, Rasbash 1996). Models were fitted using the *MLwiN* program Version 1.10.0006 with Predictive/Penalized Quasi Likelihood (PQL) approximation and a second order Taylor linearization procedure (Rasbash et. al. 2000). All models were estimated using the logit (logarithm of the odds) function. For presentation and interpretation we have used proportion and/or Odds Ratio (OR). Box 2 presents a brief description about the relevance of using OR to understanding the social patterning in health outcomes.

Box 2: Odds Ratios and Relative Risk: a description
(Egger, Davey Smith, Phillips 1997)

Odds and odds ratio

The odds is the number of patients who fulfill the criteria for a given endpoint divided by the number of patients who do not. For example, the odds of diarrhoea during treatment with an antibiotic in a group of 10 patients may be 4 to 6 (4 with diarrhea divided by 6 without, 0.66); in a control group the odds may be 1 to 9 (0.11) (a bookmaker would refer to this as 9 to 1). The odds ratio of treatment to control group would be 6 (0.66 ÷ 0.11).

Risk and relative risk

The risk is the number of patients who fulfill the criteria for a given end point divided by the total number of patients. In the example above the risks would be 4 in 10 in the treatment group and 1 in 10 in the control group, giving a risk ratio, or relative risk, of 4 (0.4 ÷ 0.1).

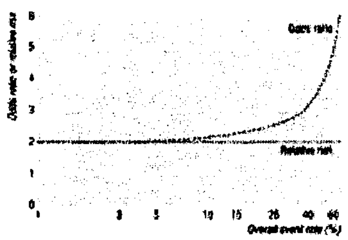
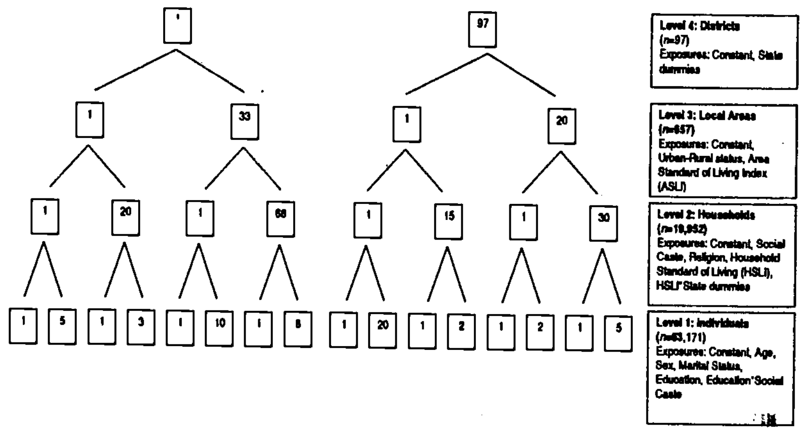


Figure 1 presents the multilevel structure that was developed to calibrate different model specifications with 63,171 individuals at level-1 nested within 19,952 households at level-2 within 657 local areas at level-3 within 97 districts at level-4. Thus, in the hierarchic structure illustrated in Figure 1, five individuals are shown to belong to household 1 in local area 1 in district 1, and so on. The different exposures that were related to the three behaviors at different levels are also listed.

Figure 1: Structure and specification for multilevel modeling



Using the above structure, five multilevel models were sequentially developed for each of the three health behaviours:

Model 1: A four-level model of individuals at level-1 nested within households at level-2 nested within local areas at level-3 nested within districts at level-4, with state-specific and urban/rural indicator variables in the fixed part of the model. This model provides a baseline for comparing the size of contextual variations at the different levels in health behaviours in subsequent models and is useful for discussing the "compositional" and "contextual" aspects of place variations in health behaviours.

Model 2: As Model 1 but includes individual age, sex, marital status and household social caste and religion in the fixed part of the model. The contextual variation in health behaviours at the household, local area and district level is evaluated after taking into account the compositional effect of the individual/household socio-demographic variables. In addition, the model also assesses whether the state and urban-rural differences are attenuated or exaggerated once we take into account the individual and household socio-demographic effects.

Model 3: As Model 2 but considers the fixed average effect of HSLI and individual educational attainment on individual health behaviours and the extent to which individual and household socioeconomic position (SEP) accounts for household, local area and district differences and attenuates the average state and urban-rural differences.

Model 4: As Model 3 but considers the effect of the local area exposure, ASLI (a contextual deprivation measure) in the fixed part of the model. This model allows us to evaluate the relative importance of household versus local area level socioeconomic deprivation on individual health behaviours. In addition, it also measures the extent to which mortality differences at the local area level can be explained by place-based deprivation measure.

Model 5: As Model 4 but explores two interactions, one at a time, in the fixed part of the model. The first interaction examines the extent to which the HSLI is different across the four states; and the second interaction investigates how the effect of educational attainment is different for different social caste groups.

Table 1 provides a summary of the final data considered for the analysis. Except for age, education, and standard of living (all specified as continuous measures), the remaining exposure variables were specified as categorical variables, with a base line category and a set of contrasted dummies (see Table 1). After excluding the missing data on the outcomes, smoking, drinking and chewing, and on the exposure variables, we conducted a multilevel regression analysis on 63,171 adult individuals aged 18 and over (at level-1) nested within 19,952 households (at level-2) nested within 657 local areas (at level-3) nested within 97 districts (at level-4). Madhya Pradesh accounted for about 35 percent of the total individual sample, followed by Orissa (24 percent), West Bengal (23 percent) and Andhra Pradesh (18 percent). In the final sample, the reported prevalence on the three health behaviours, pooled across all the four states, were different with chewing having the highest reported prevalence (about 27 percent), followed by smoking (about 18 percent) and drinking (about 12 percent).

Table 1: Data description for the final sample

Response		
Smoking	Yes (*n*=11633, 18.4%)	No (*n*=51538, 81.6%)
Drinking	Yes (*n*=7344, 11.6%)	No (*n*=55827, 88.4%)
Chewing	Yes (*n*=17127, 27.1%)	No (*n*=46044, 72.9%)
Level-1: Individuals, *n*=63171		
Age (in years)	Mean = 38 years	Range = 18 - 99 years
Sex	Base: Male (*n*=32022, 50.7%)	Contrast: Female (*n*=31149, 49.3%)
Education (in years)	Mean = 5 years	Range = 0 – 22
Marital Status	Base: Married (*n*=47387, 75.0%)	Contrast: Single (*n*=9771, 15.5%) Widowed (*n*=5326, 8.4%) Separated/Divorced (*n*=687, 1.1%)
Level-2: Households, *n*=19952		
Caste	Base: Other Caste (*n*=22548, 35.7%)	Contrast: Scheduled Caste (*n*=11161, 17.7%) Scheduled Tribe (*n*=8021, 12.7%) Other Backward Caste (*n*=19342,30.6%) No Caste (*n*=2099, 3.3%)
Religion	Base: Hindu (*n*=56388, 89.3%)	Contrast: Muslim (*n*=5065, 8.0%) Christ (*n*=1118, 1.8%) Other (*n*=600, 0.9%)
Household Standard of Living (HSLI)	Mean: 4.75	Range = 0.046 – 16.364
Level-3: Local areas, *n*=657		
Area Standard of Living (ASLI)	Mean: 4.75	Range = 1.40 – 11.33
Place of residence	Base: Village (*n*=43252, 68.5%)	Contrast: Large City (*n*=5938, 9.4%) Small City (*n*=5094, 8.1%) Town (*n*=8887, 14.1 %)
Level-4: District, *n*=97		
State	Base: Andhra Pradesh (*n*=11647, 18.4%)	Contrast: Madhya Pradesh (*n*=21809, 34.5%) Orissa (*n*=15010, 23.8%) West Bengal (*n*=14705, 23.3%)

Table 2 provides the self reported prevalence rates for the three health behaviours across different individual and area-level exposures. The prevalence rates presented in this table are considered for each exposure separately. This initial exploration of the patterns also helps us appreciate the additional gains we make by adopting a more sophisticated multilevel modeling strategy. The general pattern observed from Table 2 across the three health behaviours is as follows:

a) There seem to be important inter-state and urban-rural differences in the prevalence of smoking, drinking and chewing;

b) Gender differences are also observed across the three health behaviours, with the difference being largest for smoking and least for chewing;

c) While there are no substantial religious differences in the self-reported prevalence of health behaviours (except for drinking), there are marked caste-based differences.

d) Marital status seems to also influence self-reported smoking, drinking and chewing prevalence patterns;;

e) The mean rates of self reported smoking, drinking and prevalence were lower for individuals with a higher SEP, but the area-level socioeconomic measure was not a marked predictor, except for drinking.

While providing general population patterns to health behaviours, such averages have their limits. First, it is not clear whether some of the observed state, or urban-rural differences in prevalence rates are true, or simply due to not taking account of SEP and caste. Second, while we obtain average prevalences there is no description about how these rates vary across households, villages and districts. While, a multiple regression would address the first concern, using a multilevel regression model allows us to address both the concerns simultaneously, and also provides robust regression coefficients for the different exposures, along with their appropriate standard errors. We first consider the average socioeconomic differentials in smoking, drinking and chewing based on multilevel models, along with a discussion of the two interaction effects, i.e., a) on whether the effects of HSLI are different in different states; and b) whether the effect of educational attainment on health behaviours is different across

Table 2: Smoking, drinking and chewing prevalence by individual and area exposures

Exposures	Total	Smoke	Drink	Chew
Andhra Pradesh	11647 (18.4%)	2487 (21.4%)	2076 (17.8%)	1288 (11.1%)
Madhya Pradesh	21809 (34.5%)	3847 (17.6%)	2402 (11.0%)	6396 (29.3%)
Orissa	15010 (23.8%)	2102 (14.0%)	1964 (13.1%)	6627 (44.2%)
West Bengal	14705 (23.3%)	3197 (21.7%)	902 (6.1%)	2816 (19.1%)
Village	43252 (68.5%)	8659 (20.0%)	6065 (14.0%)	12953 (29.9%)
Town	8887 (14.1%)	1252 (14.1%)	677 (7.6%)	2246 (25.3%)
Small City	5094 (8.1%)	748 (14.7%)	303 (5.9%)	887 (17.4%)
Large City	5938 (9.4%)	974 (16.4%)	299 (5.0%)	1041 (17.5%)
Male	32022 (50.7%)	11057 (34.5%)	6054 (18.9%)	11171 (34.9%)
Female	31149 (49.3%)	576 (1.8%)	1290 (4.1%)	5956 (19.1%)
No Caste	2099 (3.3%)	435 (20.7%)	90 (4.3%)	400 (19.1%)
Scheduled Tribe	8021 (12.7%)	1664 (20.7%)	2598 (32.4%)	3076 (38.3%)
Scheduled Caste	11161 (17.7%)	2416 (21.6%)	1585 (14.2%)	3415 (30.6%)
Other Backward Caste	19342 (30.6%)	3376 (17.5%)	2038 (10.5%)	5369 (27.8%)
Other Caste	22548 (35.7%)	3742 (16.6%)	1033 (4.6%)	4867 (21.6%)
Other Religion	600 (0.9%)	78 (13.0%)	90 (15.0%)	131 (21.8%)
Christian	1118 (1.8%)	224 (20.0%)	223 (19.9%)	219 (19.6%)
Muslim	5065 (8.0%)	920 (18.2%)	136 (2.7%)	1102 (21.8%)
Hindu	56388 (89.3%)	10411 (18.5%)	6895 (12.2%)	15675 (27.8%)
Single	9771 (15.5%)	783 (8.0%)	383 (3.9%)	1466 (15.0%)
Widowed	5326 (8.4%)	650 (12.2%)	523 (9.8%)	1782 (33.5%)
Separated/Divorced	687 (1.1%)	99 (14.4%)	71 (10.3%)	202 (29.4%)
Married	47387 (75.0%)	10101 (21.3%)	6367 (13.4%)	13677 (28.9%)
Age	37.9 (15.8)	42.9 (14.7)	41.8 (14.5)	42.6 (16.0)
Education (years)	4.6 (5.0)	4.0 (4.4)	2.6 (3.8)	3.5 (4.3)
Household Standard of Living Score (HSLI)	4.7 (2.8)	3.96 (2.51)	3.3 (2.1)	4.2 (2.6)
Area Standard of Living Score (ASLI)	4.7 (1.7)	4.4 (1.5)	3.3 (2.1)	4.5 (1.6)

Note: Column 'Total' presents the number of observations across each exposure, along with the percent proportion in each category; for Age, Education, HSLI and ASLI, the table provides the mean and their standard deviation in brackets.

different caste groups. Following this we discuss the contextual variations that underlie these average socioeconomic patterns.

Sociodemographic and economic differentials in smoking

Table 3 presents the fixed part results that allow us to ascertain the population groups that are more likely to smoke. Results in Model 1 (Table 3) essentially lays out the average differences in smoking rates across the four states, along with the urban-rural differentials. The constant in Model 1 represents individuals living in rural Andhra Pradesh, and the probability of smoking was about 23 percent. Madhya Pradesh and Orissa have lower probabilities of smoking with 19 and 14 percent, respectively. The differential for West Bengal, however, was not significantly different from that of Andhra Pradesh. While smoking prevalence is strongly divided across urban-rural lines, there is some evidence of a gradient, with prevalence highest in rural areas (23 percent) followed by towns (16 percent), small cities (15 percent) and large cities (14 percent).

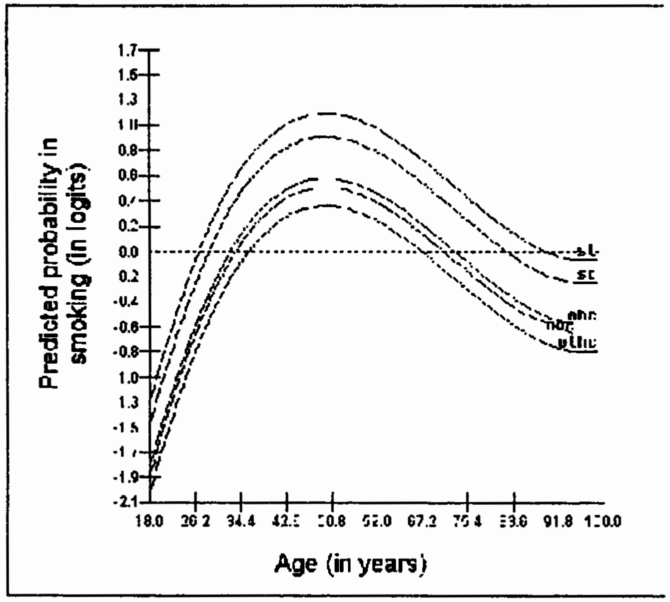
Model 2 (Table 3) considers the individual and household socio-demographic influences as main effects on individual smoking. Significant differentials in smoking were observed for age, sex, marital status, caste and religion. The base category, represented by constant, is a 40-year old married Hindu OC male living in rural Andhra Pradesh with a 55 percent individual probability of smoking. Age was related to smoking in a curvilinear manner, with older people, on average, being more likely to smoke. Smoking tends to be highest for the age groups 35-55 and then reduces marginally, as shown in Figure 1. As expected, women are less likely to smoke (2 percent) compared to men (55 percent). Smoking is also systematically related to caste, with the prevalence being highest for ST (OR = 2.15), followed by SC (OR = 1.77) and OBC (OR = 1.25). The coefficient for NOC was not significantly different from that of OC, the base line category. Figure 2 plots the non-linear effects of age and the main effect of caste on smoking. Religion-based differentials were also observed, with Christians and the Other religion having significantly lower rates of smoking when compared to Hindu. No significant differences in smoking prevalence were found between Hindu and Muslims. Marital status also seems to be a strong predictor of smoking, with the prevalence being greatest for separated/divorced (OR = 1.48), followed by widowed (OR = 1.22), as compared to the married group, the baseline category.

Table 3: Fixed part results for the multilevel analytical models for smoking (presented in terms of Odds Ratios and 95% Confidence Intervals)

Parameters	Model 1	Model 2	Model 3	Model 4
Constant	1.00	1.00	1.00	1.00
Madhya Pradesh	0.78 (0.66 - 0.93)	0.60(0.44 - 0.80)	0.69(0.52 - 0.90)	0.68(0.51 -0.89)
Orissa	0.53(0.43 - 0.67)	0.32(0.22 - 0.46)	0.35(0.25 - 0.50)	0.35(0.24 -0.50)
West Bengal	1.12(0.91 - 1.38)	1.24(0.87 - 1.77)	1.26(0.90 - 1.76)	1.26(0.90 - 1.77)
Large City	0.54(0.41 -0.71)	0.43(0.28 - 0.67)	0.73(0.48 - 1.11)	0.69(0.45 - 1.06)
Small City	0.59(0.51 - 0.68)	0.48(0.39 - 0.60)	0.76(0.61 - 0.94)	0.72(0.57 - 0.91)
Town	0.63(0.56 - 0.70)	0.55(0.47 - 0.66)	0.84(0.71 - 0.99)	0.80(0.67 - 0.97)
Age		1.04(1.04 - 1.04)	1.04(1.03 -1.04)	1.04(1.03 - 1.04)
Age Squared		1.00(1.00 - 1.00)	1.00(1.00 -1.00)	1.00(1.00 - 1.00)
Age Cubed		1.00(1.00 - 1.00)	1.00(1.00 - 1.00)	1.00(1.00 - 1.00)
Female		0.02(0.01 - 0.02)	0.01(0.01 - 0.01)	0.01(0.01 - 0.01)
Scheduled Caste		1.78(1.61 - 1.96)	1.13(1.01 - 1.25)	1.13(1.01 - 1.25)
Scheduled Tribe		2.15(1.89 - 2.45)	1.26(1.11 - 1.45)	1.27(1.11 - 1.45)
Other Backward Caste		1.25(1.14 - 1.38)	0.97(0.89 - 1.07)	0.97(0.89 - 1.07)
No Caste		1.16(0.95 - 1.42)	1.05(0.86 - 1.29)	1.06(0.87 - 1.29)
Muslim		1.12(0.96 - 1.31)	0.84(0.72 - 0.98)	0.84(0.72 - 0.98)
Christian		0.73(0.56 - 0.94)	0.77(0.60 - 1.00)	0.77(0.60 - 1.00)
Other Religion		0.48(0.32 - 0.72)	0.59(0.39 - 0.88)	0.59(0.39 - 0.88)
Single		0.41(0.37 - 0.46)	0.45(0.40 - 0.51)	0.45(0.40 - 0.51)
Widowed		1.22(1.07 - 1.40)	1.14(1.00 - 1.30)	1.14(1.00 - 1.30)
Separated/Divorced		1.49(1.08 - 2.04)	1.31(0.95 - 1.80)	1.31(0.95 - 1.80)
Education			0.93(0.92 -0.94)	0.93(0.92 - 0.94)
Household Standard of Living Score (HSLI)			0.89(0.88 - 0.90)	0.89(0.87 - 0.90)
Area Standard of Living Score (ASLI)				1.02(0.98 - 1.07)

Interestingly, unmarried/single people have a significantly lower probability of smoking compared to the other groups, including married people with an OR of 0.41.

Figure 2: Predicted relationship between age and smoking for different social caste groups



Model 3 (Table 3) additionally considers the main effects of individual and household SEP on smoking. SEP is captured at the individual level by educational attainment (measured through number of years of education) and at the household level by HSLI. As expected, both the SEP measures are significantly and linearly associated with smoking, such that increased education and improved standard of living decreases the probability of smoking. SEP also attenuates the earlier observed urban-rural, state, caste, religion and marital status based differences, as can be seen by comparing ORs across Model 2 and 3 in Table 3. The caste-differentials reduce substantially once we control for SEP. Indeed, the differential observed for OBC is no longer significant. While there is a strong influence of SEP on smoking, we did not find evidence for an effect of local area based socioeconomic deprivation index (ASLI). While this was true, as we will

Table 4: Fixed part results for the multilevel analytical models for drinking (presented in terms of Odds Ratios and 95% Confidence Intervals)

Parameters	Model 1	Model 2	Model 4	Model 4
Constant	1.00	1.00	1.00	1.00
Madhya Pradesh	0.59(0.40 - 0.85)	0.27(0.16 -0.46)	0.33(0.19 -0.56)	0.33(0.19 -0.56)
Orissa	0.83(0.51 - 1.36)	0.40(0.20 -0.80)	0.45(0.23 -0.92)	0.47(0.24 -0.95)
West Bengal	0.34(0.22 -0.55)	0.19(0.10 - 0.38)	0.19(0.10 -0.38)	0.20(0.10 -0.40)
Large City	0.54(0.32 -0.91)	1.03(0.47 -2.26)	2.03(0.93 -4.43)	2.63(1.17 -5.88)
Small City	0.48(0.37 -0.63)	0.66(0.44 -0.98)	1.24(0.84 -1.84)	1.61(1.03 -2.51)
Town	0.53(0.43 -0.65)	0.64(0.47 -0.88)	1.12(0.83 -1.52)	1.40(0.99 -1.97)
Age		1.03(1.02 -1.03)	1.02(1.02 -1.02)	1.02(1.02 -1.03)
Age Squared		1.00(1.00 -1.00)	1.00(1.00 -1.00)	1.00(1.00 -1.00)
Age Cubed		1.00(1.00 -1.00)	1.00(1.00 -1.00)	1.00(1.00 -1.00)
Female		0.06(0.05 -0.06)	0.04(0.04 -0.05)	0.04(0.04 -0.05)
Scheduled Caste		4.47(3.78 -5.28)	2.51(2.13 -2.97)	2.48(2.09 -2.93)
Scheduled Tribe		11.39(9.42 -13.78)	6.07(5.02 -7.34)	5.96(4.92 -7.22)
Other Backward Caste		1.89(1.61 -2.21)	1.33(1.14 -1.56)	1.31(1.12 -1.54)
No Caste		2.04(1.36 -3.05)	1.71(1.15 -2.53)	1.69(1.13 -2.52)
Muslim		0.30(0.21 -0.42)	0.21(0.15 -0.29)	0.20(0.14 -0.29)
Christian		0.50(0.36 -0.70)	0.55(0.40 -0.77)	0.55(0.40 -0.77)
Other Religion		1.23(0.72 -2.10)	1.63(0.96 -2.76)	1.66(0.97 -2.83)
Single		0.32(0.27 -0.39)	0.37(0.30 -0.44)	0.37(0.30 -0.44)
Widowed		1.12(0.94 -1.32)	1.06(0.90 -1.25)	1.06(0.89 -1.25)
Separated/Divorced		0.88(0.60 -1.30)	0.77 (0.52 -1.12)	0.77 (0.52 -1.13)
Education			0.91(0.90 -0.92)	0.91(0.90 -0.92)
Household Standard of Living Score (HSLI)			0.84(0.82 -0.86)	0.84(0.82 -0.86)
Area Standard of Living Score (ASLI)				0.93(0.88 -0.99)

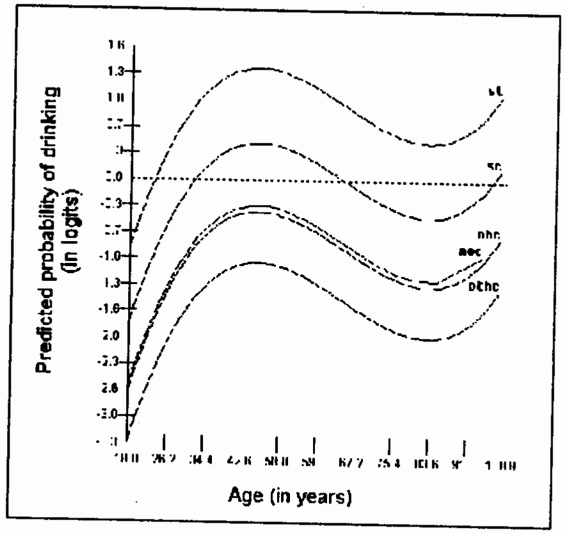
show below, it cannot be said that local areas do not make a difference to individual smoking behaviour. We now turn to presenting and discussing the socioeconomic and demographic gradients in drinking.

Sociodemographic and economic differentials in drinking

Table 4 presents the fixed part results for drinking. As shown in Model 1 (Table 4), as with smoking, strong urban-rural differentials are observed with drinking being significantly lower in large cities (OR = 0.53), small cities (OR = 0.48) and towns (OR = 0.52) when compared to villages. Madhya Pradesh (OR = 0.58) and West Bengal (0.34) have significantly lower prevalence, while drinking prevalence in Orissa was not significantly different from the reference category, Andhra Pradesh.

As can be seen from the results presented in Model 2 (Table 4) there is a strong socio-demographic patterning for the prevalence of drinking in the four Indian states. Age was again curvilinearly associated with drinking, as shown in Figure 3. However, we must note that the curvilinear pattern should not be over-interpreted since predictions for indivuals over the age of eighty are based on very small numbers. Women are significantly less likely to drink (OR = 0.055) with an absolute prevalence of about 2 percent compared to men (about 25 percent). Strong caste gradients were observed in drinking, with the prevalence being higher for ST (OR = 11.4), SC (OR = 1.5), and OBC (OR = 1.9). Unlike smoking, a significant differential was also observed for NOC (OR = 2.0). Figure 3 plots the main effects of caste along with the non-linear age/drinking relationship across the four states. In terms of religion-based differences, as one would expect, the reported prevalence of drinking was significantly lower for Muslims (OR = 0.30) when compared to the baseline category (Hindu). However, interestingly, the prevalence was also lower among Christians (OR = 0.5) compared to Hindus. No significant differentials were observed for the residual religious category. No gradient was observed regarding the relationship between drinking and martial status. The drinking prevalence differences were largely dichotomous unmarried/single and the rest, with the unmarried/single individuals having a significantly lower prevalence of drinking (OR = 0.32). No statistically significant differences were found between married, widowed and separated/divorced categories.

Figure 3: Predicted relationship between age and drinking for different social caste groups



Note: The curve at the older ages (80 and above) is subject to small numbers and hence should not be over-interpreted.

Even after controlling for socio-demographic variables, the state differences do not simply remain, but they become more pronounced, as can be seen by comparing the ORs between the columns Model 1 and Model 2 in Table 4. Indeed, Orissa is now significantly different from the base category, Andhra Pradesh, with a lower prevalence of drinking.

As can be seen in the results column titled Model 3 (Table 4), the ORs associated with individual SEP (measured through educational attainment and HSLI) were both highly significantly, and the relationship between drinking and SEP was linear. As with smoking, SEP attenuates some of the state-differences and a substantial part of the urban-rural differences. Indeed, no significant urban-rural differences in drinking remain once we consider the individual and household SEP.

While the socioeconomic index of a local area did not make any difference in the case of smoking, there is a significant linear association between local area ASLI and drinking behaviour, so that better-off local areas have a lower prevalence compared to worse off areas. While local area effects are significant, they do not diminish the average state-differences in drinking, and also do not fully account for the caste gradients in drinking behaviour.

Sociodemographic and economic differentials in chewing

Table 5 presents the fixed part results for chewing. As shown in column Model 1 (Table 5), there are significant differences between states in the prevalence of chewing, with the highest prevalence being observed for Orissa (43 percent) followed by Madhya Pradesh (27 percent), West Bengal (18 percent) and Andhra Pradesh (8 percent). In terms of urban-rural differences, while chewing prevalence is lower in small cities (OR = 0.72) and towns (OR = 0.78), compared to villages, interestingly, no significant differences were observed between large cities and villages.

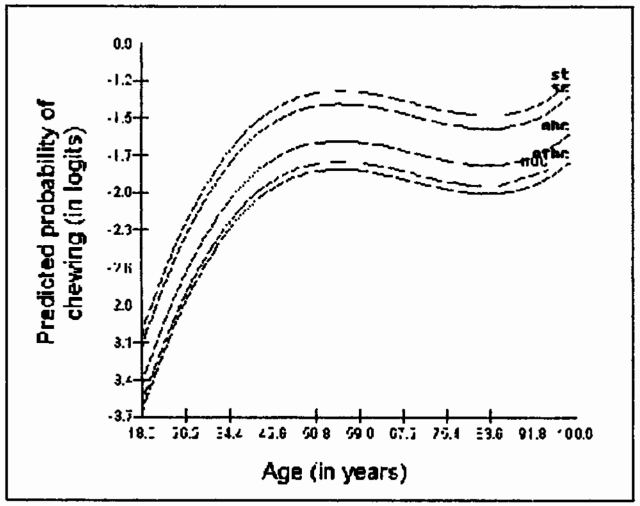
As with smoking and drinking, significant socio-demographic inequalities are observed in chewing across the four states. As before, a curvilinear association between age and chewing is observed, as shown in Figure 4. Women are less likely to chew tobacco (OR = 0.29). As with smoking and drinking, a strong caste gradient is found for chewing with the prevalence lowest for the base category (OC) followed by OBC (OR = 1.2), SC (OR = 1.6) and being highest for ST (OR = 1.8). Figure 3 plots the main effects of social caste along with the non-linear association between age and chewing. In terms of religion based differences, while Muslims tend to have a higher prevalence of chewing (OR = 1.456), compared to Hindus, Christians and the residual religious category are less likely to chew tobacco (OR of 0.76 and 0.62, respectively). The patterns of chewing according to marital status are also significant with widowed and separated/divorced groups having a greater propensity to chew (OR of 1.4 and 1.3, respectively) while unmarried and single people have a lower probability (OR = 0.57), compared to the baseline category, married. While the socio-demographic factors attenuate the earlier observed urban-rural differences in the baseline model (Model 1), they intensify the state differences for chewing.

As before individual and household SEP are strongly related to chewing with higher SEP leading to lower probabilities of tobacco chewing (Model 3, Table 5). While SEP substantially attenuates the caste differences (with OBC no longer being significantly different to OC) the state differences become even more pronounced. We did not find the local area level

Table 5: Fixed part results for the multilevel analytical models for chewing (presented in terms of Odds Ratios and 95% Confidence Intervals)

Parameters	Model 1	Model 2	Model 3	Model
Constant	1.00	1.00	1.00	1.00
Madhya Pradesh	4.28(3.09 -5.92)	5.13(3.57 -7.39)	5.68(3.94 -8.19)	5.78(4.00 -8.34)
Orissa	8.83(5.79 -13.46)	12.05(7.51 -19.32)	13.33(8.28 -21.46)	13.46(8.36 -21.68)
West Bengal	2.56(1.72 -3.80)	2.97(1.90 -4.63)	3.06(1.95 -4.79)	3.05(1.95 -4.77)
Large City	0.79(0.54 -1.16)	0.85(0.55 -1.32)	1.25(0.82 -1.91)	1.31(0.85 -2.03)
Small City	0.72(0.60 -0.88)	0.78(0.63 -0.97)	1.12(0.91 -1.38)	1.18(0.94 -1.48)
Town	0.78(0.68 -0.90)	0.85(0.72 -0.99)	1.15(0.99 -1.34)	1.20(1.01 -1.42)
Age		1.03(1.03 -1.03)	1.03(1.03 -1.03)	1.03(1.03 -1.03)
Age Squared		1.00(1.00 -1.00)	1.00(1.00 -1.00)	1.00(1.00 -1.00)
Age Cubed		1.00(1.00 -1.00)	1.00(1.00 -1.00)	1.00(1.00 -1.00)
Female		0.29(0.27 -0.30)	0.24(0.23 -0.25)	0.24(0.23 -0.25)
Scheduled Caste		1.63(1.49 -1.78)	1.16(1.06 -1.28)	1.16(1.06 -1.27)
Scheduled Tribe		1.80(1.61 -2.01)	1.23(1.09 -1.37)	1.22(1.09 -1.37)
Other Backward Caste		1.24(1.14 -1.34)	1.02(0.94 -1.1	1.02(0.94 -1.11)
No Caste		1.06(0.87 -1.29)	0.98(0.81 -1.19)	0.98(0.81 -1.19)
Muslim		1.46(1.26 -1.68)	1.18(1.02 -1.36)	1.17(1.02 -1.35)
Christian		0.76(0.58 -1.00)	0.84(0.64 -1.10)	0.84(0.64 -1.10)
Other Religion		0.62(0.45 -0.87)	0.73(0.53 -1.02)	0.74(0.53 -1.02)
Single		0.57(0.52 -0.62)	0.62(0.56 -0.68)	0.62(0.56 -0.68)
Widowed		1.38(1.26 -1.51)	1.31(1.20 -1.44)	1.31(1.20 -1.44)
Separated/Divorced		1.33(1.07 -1.66)	1.23(0.99 -1.52)	1.23(0.99 -1.53)
Education			0.94(0.93 -0.94)	0.94(0.93 -0.94)
Household Standard of Living Score (HSLI)			0.93(0.92 -0.94)	0.93(0.92 -0.94)
Area Standard of Living Score (ASLI)				0.98(0.94 -1.02)

Figure 4: Predicted relationship between age and chewing for different social caste groups



indicator ASLI to be significantly associated with the prevalence of chewing (Model 4, Table 5).

Interaction effects across health behaviours

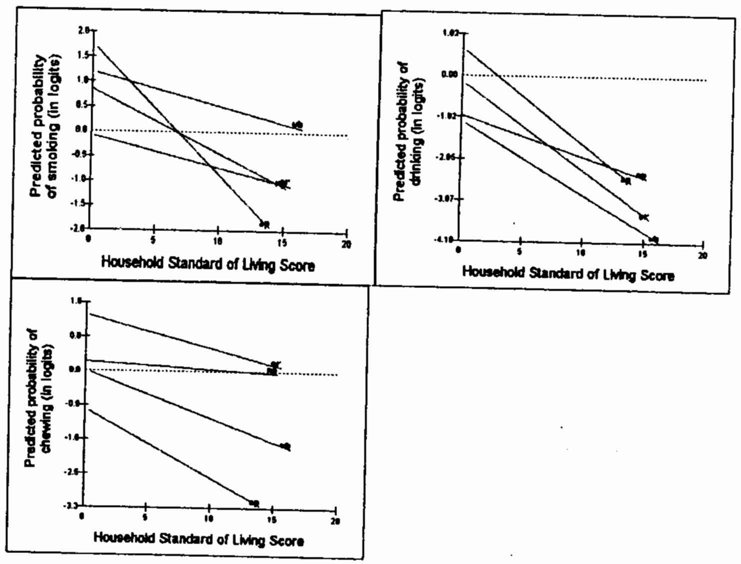
Having analyzed the main effects of key socio-demographic and economic predictors on the three different health behaviours, this section discusses two interaction effects that were considered. First, we consider the interaction effects between HSLI and the fixed state-effects. Since the health behaviours showed strong patterning along HSLI lines we explored whether the effect of HSLI was different across the four states. Only the results of the relevant main and interaction effects are presented in Table 6, as no significant changes for other predictors were observed. The interactions were additionally included to Model 4 of each of the health behaviours. In order to facilitate interpretation and discussion the results are presented in the predicted plot in Figure 5 for smoking, drinking and chewing.

Table 6: Fixed interaction effects (in logits) between household standard of living and states (additionally included to Model 4)

Parameters	Smoking	Drinking	Chewing
Main effects			
Constant	1.761	0.674	-0.914
Madhya Pradesh	-0.909 (0.168)	-1.654 (0.304)	1.146 (0.212)
Orissa	-1.842 (0.203)	-0.824 (0.378)	2.274 (0.263)
West Bengal	-0.562 (0.194)	-1.797 (0.368)	0.924 (0.252)
Household Standard of Living Score	-0.265 (0.019)	-0.236 (0.027)	-0.166 (0.023)
State and SLI Interaction			
Madhya Pradesh.SLI	0.134 (0.022)	0.135 (0.034)	0.148 (0.024)
Orissa.SLI	0.199 (0.023)	*0.018 (0.037)	0.086 (0.025)
West Bengal.SLI	0.195 (0.022)	*0.055 (0.040)	0.052 (0.026)

Notes: Figures in the brackets represent the standard errors. Coefficients marked with * are not significant at the 0.05 probability level.

Figure 5: Fixed interaction effects between States and House hold Standard of Living Index for smoking, drinking and chewing



As can be seen from the graphs, while HSLI works in the same direction in all the four states the gradients differ. In the case of smoking, the HSLI has a significantly stronger relationship in Andhra Pradesh, as compared to the remaining three states, with a relatively shallow gradient for Madhya Pradesh and West Bengal. On the other hand, West Bengal has a strong HSLI gradient for drinking, as do Andhra Pradesh and Orissa, but not Madhya Pradesh. With regards to chewing, the gradient is again stronger for Andhra Pradesh, as compared to Orissa and West Bengal, with almost no relationship being observed for chewing and HSLI in Madhya Pradesh.

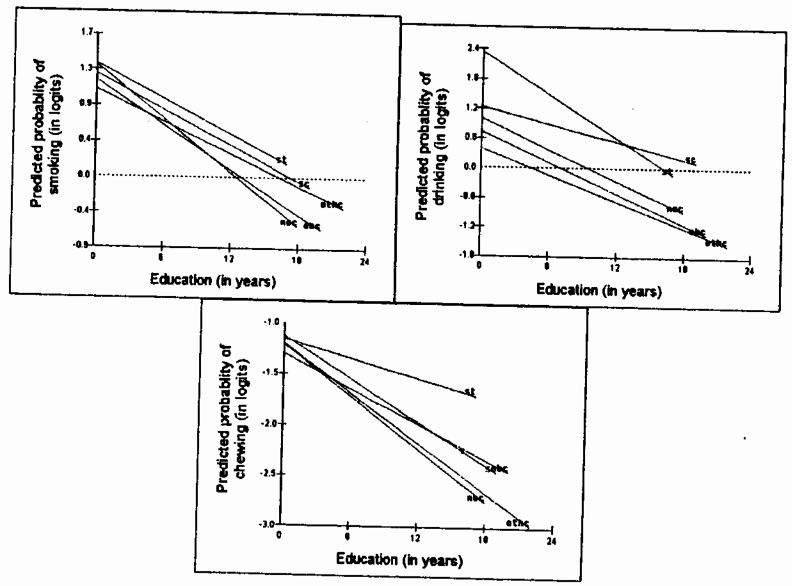
The second interaction that we considered was between caste and education. Often education, more than standard of living, is considered to be vital for changing health behaviours, and given the persistent caste gradients in health behaviours, the motivation to explore this interaction was to investigate whether education played a differential role among different castes. While the relevant results related to this interaction are presented in Table 7, the accompanying graphs are plotted in Figure 6.

Table 7: Fixed interaction effects (in logits) between education and caste (additionally included to Model 4)

Parameters	Smoking	Drinking	Chewing
Main effects			
Constant	1.041	0.263	-1.201
Scheduled Caste	0.182 (0.070)	0.840 (0.110)	*0.075 (0.058)
Scheduled Tribe	0.305 (0.082)	1.947 (0.118)	*0.047 (0.066)
Other Backward Caste	*0.111 (0.066)	0.335 (0.107)	-0.100 (0.054)
No Caste	0.288 (0.142)	0.604 (0.277)	*-0.010 (0.125)
Education	-0.064 (0.006)	-0.089 (0.012)	-0.081 (0.005)
Caste and Education Interaction			
Scheduled Caste.Education	*-0.007 (0.010)	0.031 (0.016)	0.011 (0.009)
Scheduled Tribe.Education	*-0.006 (0.013)	-0.056 (0.017)	0.049 (0.010)
Other Backward Caste. Education	-0.025 (0.008)	*-0.015 (0.015)	0.024 (0.007)
No Caste.Education	-0.043 (0.019)	*-0.016 (0.040)	*-0.004 (0.018)

Notes: Figures in the brackets represent the standard errors. Coefficients marked with * are not significant at the 0.05 probability level.

Figure 6: Fixed interaction effects between Social Caste and Educational attainment for smoking, drinking and chewing



In general, there does not seem to be strong evidence that the positive effects of education are different among different caste groups, and this is especially so with regards to smoking. There are, however, some noticeable differences for drinking and chewing. For instance, education does not have the same effect on drinking behaviour for the SC as it has on the remaining castes. On the other hand, when it comes to chewing it is the ST population group where there is a very weak relationship between education and chewing. This preliminary exploration of interaction effects suggest that while there may be finer aspects to the general relationship between SEP and health behaviours, for instance by caste and across different states, it does not diminish the dominant SEP based patterning observed for health behaviours in India.

Does the context of local areas and districts matter for health behaviours?

So far we have shown how individual and household SEP are systematically associated with the three health behaviours, with caste, education and HSLI all having independent effects on health behaviour. Furthermore, except for drinking, where we found a significant effect of local area ASLI, for smoking and chewing our results do not seem to suggest that local ASLI matters. Can we then conclude that context, whether seen in terms of the local areas, districts and states, does not matter for health behaviours? Indeed, for states, we do notice significant differentials, and except for smoking these differences remain even after controlling for individual and household SEP. We now present and discuss the results that help us comment on the extent to which local areas and districts make a difference to the different health behaviours. Table 8 presents the random part results for the three behaviours across the four models.

Looking across the random coefficients at the local area level and district level in the Models 1, 2 and 3 for smoking, it is clear that individual and household factors do not explain the smoking variation that can be attributed to local areas and districts. Indeed, as can be seen, the variances for local areas and districts increase between the baseline model (Model 1) and the model that controls for the individual and household socio-demographic factors (Model 2). This finding is contrary to the usual expectation, where place variances are almost always seen to be over-estimated, with the assumption then being that we may have omitted individual predictors. More importantly, such arguments are rooted in the notion that individual health behaviours are simply a function of individual attributes, such as SEP. Besides the substantive problem associated with this reasoning (Macintyre, Ellaway 2000), the evidence here suggests that not accounting for the composition of places can actually mask the "true" contextual differences between places. While SEP reduces the place variances (Model 3), the variations between local areas and districts remain highly significant, suggesting that contexts do matter for smoking.

A similar trend is observed for drinking, with local area and districts variances showing an increase once we control for socio-demographic predictors. While SEP attenuated the differences in the case of smoking at both the local area and district levels, they do not do so for districts in

Table 8: Random part results for the multilevel analytical models (in logits) for smoking, drinking and chewing

Parameters	Model 1	Model 2	Model 3	Model 4
Smoking				
Between-district variation	0.078 (0.016)	0.236 (0.046)	0.204 (0.040)	0.205 (0.040)
Between-local area variation	0.111 (0.011)	0.296 (0.027)	0.261 (0.025)	0.260 (0.025)
Between-household variation	*0.000 (0.000)	1.058 (0.045)	0.972 (0.045)	0.970 (0.045)
Drinking				
Between-district variation	0.421 (0.079)	0.815 (0.157)	0.864 (0.158)	0.854 (0.160)
Between-local area variation	0.570 (0.041)	0.943 (0.087)	0.864 (0.080)	0.856 (0.080)
Between-household variation	0.225 (0.028)	2.757 (0.094)	2.522 (0.090)	2.588 (0.092)
Chewing				
Between-district variation	0.326 (0.056)	0.408 (0.071)	0.421 (0.072)	0.420 (0.071)
Between-local area variation	0.204 (0.018)	0.259 (0.024)	0.225 (0.021)	0.225 (0.021)
Between-household variation	0.685 (0.026)	1.165 (0.036)	1.094 (0.035)	1.093 (0.035)

Notes: Figures in the brackets represent the standard errors; Coefficients marked with * are not significant at the 0.05 probability level; Model 1 is the baseline model with only state and urban dummies in the fixed part of the model. Model 2 additionally includes age, sex, caste, religion and marital status in the fixed part. Model 3 additionally includes educational attainment and HSLI; and Model 4 additionally includes ASLI.

the case of drinking as can be seen in the increase in district coefficients from 0.815 (Model 2) to 0.864 (Model 3). SEP, however, does account for some of the local area and inter-household variation suggesting some clustering of places along individual and household SEP lines. Since the ASLI (a local area predictor) was significant for drinking (Model 4), there is a small reduction in the local area variance suggesting that the economic status of places may explain some of the local area variations. An identical trend in the behaviour of random coefficients before and after accounting for the different individual and household predictors is observed for chewing. Interestingly, controlling for individual and household variables also increases the inter household differences. This may be expected since household-level clustering of behaviors, especially smoking and drinking, is more pronounced once we condition it on individual and household standard of living rather than examining the unconditional clustering of the behaviors.

In terms of the relative size of the variances, the amount of clustering observed in smoking, drinking and chewing for the local area and district levels are substantial. While it is not straightforward to compute the

Table 9: Spatial intra-class correlations based on Model 3 for for smoking, drinking and chewing

Parameters	Percent variation attributable to areas
Smoking	
Between-district variation	4.31
Between-local area variation	5.52
Total variation	100.00
Drinking	
Between-district variation	11.45
Between-local area variation	11.45
Total variation	100.00
Chewing	
Between-district variation	8.36
Between-local area variation	4.47
Total variation	100.00

IntraClass Clustering (ICC) or the Variance Partitioning Coefficient (VPC) in non-linear logit models, we do so by employing one the strategies that can be used to approximate the relative contribution of the local area and district levels to health behaviours (Goldstein, Browne, Rasbash 2003). Using this method, we computed the total variances across all levels (essentially the sum of individual, household, local area and district variances) and apportion the variances attributable to local areas and districts in relation to the total. We do so using the estimates for Model 3, since this model arguably measures the true contextual variances after adjusting for the possible confounding by individual and household factors. Table 9 presents the VPC attributable to local areas and districts based on the random part results from Model 3 (Table 8).

The total variance for smoking was estimated as 4.72, and the percent proportion of this total variation that is attributable to local areas and districts, after taking account of individual and household factors, is 4.31 and 5.52 percent respectively. For drinking, the apportioned percent variance attributable to local areas and districts was 11.45 percent each (out of a total variance of 7.54). Finally, for chewing out of the total variance of 5.03, 8.36 percent can be attributed to districts, while 4.47 percent is attributable to local areas. It is clear that local areas are either more (in the case of smoking and chewing) or at least as important (in the case of drinking), suggesting the relative significance of proximate environments compared to more macro environments, such as districts, although they seem to be of considerable importance as well.

Essentially, the results presented here strongly suggest that individual and household characteristics do not account for the substantial differences in health behaviors observed between-local areas and between-districts, compelling us towards a reasoning that inequalities in health behaviours are to some extent contextual. To put the above reported intra-class correlations into perspective, to find that 10 percent of the total variation is attributable to spatial contexts is considered to represent "small" levels of clustering when the response is continuous (Raudenbush, Xiaofeng 2000). In binary logistic models, where the information contained in the response is substanlly lower (0 or 1), the observed levels of clustering can be expected to be generally much lower. Consequently, we can interpret our findings to be an evidence of moderate levels of spatial clustering.

CONCLUSION

The aim in this paper was not so much to develop an explanatory model of health behaviours in India. Rather, given the lack of any population-based account on these behaviours, the aim was to describe the socio-demographic and economic patterning of smoking, drinking and chewing behaviours in India. This was done by considering three individual behaviours (smoking, drinking and chewing) within the context of their households, local areas, districts and states. Our preliminary exploration of smoking, drinking and chewing behaviours suggests the following:

First, there is a strong relationship between the health behaviours and individual/household SEP, with the better-off smoking, drinking and chewing less;

Second, although SEP attenuates the social caste based gradients in health behaviours, they remain statistically significant, suggesting strong caste based stratification of health outcomes and behaviours;

Third, significant differences remain between the four states, however, the urban-rural differences in health behaviours seems to be attenuated by individual and household SEP; and

Finally, although ASLI was seen to be associated only with drinking and not with smoking and chewing, it does not necessarily follow that the context of local areas and districts do not matter. As was shown, significant variations exist between local areas and districts even after controlling a range of individual and household factors.

The preceding analysis has a number of limitations. The first relates to the self-reported nature of our outcome variables. Indeed, it is not even direct self-reporting, since respondents answering on behalf of other household members could have been 'any capable adult member'. Given public attitudes regarding the acceptability smoking and drinking, there may be reporting biases in this regard. In general, the bias is likely to be towards under-reporting, especially by younger, dependent individuals, and women. One can see the observed SEP/health behaviours relationship being affected by this problem. For instance, it is somewhat paradoxical to find lower levels of smoking, drinking and chewing among high SEP in

developing countries whereby one might anticipate some of health behaviours (such as smoking) to be high among high SEP groups. Clearly, such a result also highlights the issue of different types of smoking (cigarettes, *bidi*) (VenkatNarayan et. al. 1996; Gupta, Mehta 2000; Chhabra, Rajpal, Gupta 2001) and drinking (local arrack, manufactured) (Rahman 2002) and their differential relationship to individual and household standard of living and caste. Second, the prevalence for females on both smoking and drinking was substantially small and it is necessary to understand that while drawing inferences about the gender-effect on its own and in particular as it may relate to the different socioeconomic groups, one needs to be cautious. Since a "male-only" analysis did not yield a different result we decided to include both men and women in the analysis. While recognizing the above limitations may have some influence on the observed associations and findings, the lack of any population based account on these health behaviours in India outweigh the option of not analyzing and discussing the data on the health behaviours. Analyses of health behaviors in the context of developed countries show not only important patterns which provide insights into the etiological understanding of what influences these behaviors, but also are important basis for population-based interventions (Diez-Roux, Nieto, Muntaner 1997; Hart, Ecob, Davey Smith 1997; Reijneveld 1998; Duncan, Jones, Moon 1999). The analysis presented here was a step in this direction and therefore necessarily exploratory.

In summary, our study suggests strong independent effects of SES and social caste on health behaviours related to smoking, drinking and chewing. The social disparities in health behaviours should be a key concern for health policy and interventions. In addition, the study clearly suggests that over and above individual SES and social caste, there are significant local area, district and state variations suggesting the importance of contexts in shaping these health behaviours. While our analysis was limited in terms pinning down the exact causal local area or district or state variables that may explain this variation, the evidence presented is substantial in any argument for an ecology of health behaviours that may require more than an individual behavioural change. Rather, the direction for policy might well be to focus on macro environments and make them more conducive to promoting health behaviours.

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