

The Geography of Excess Weight in Urban India: Regional Patterns and Labour Market and Dietary Correlates

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1. Introduction

The focus of health economics in poor countries has understandably been the deficient levels of nutrition suffered by large swaths of the population including vulnerable sections such as women and very young children (Tarozzi and Mahajan (2007), Maitra, et al. (2013) among others). However, the fact that many developing countries have been steadily exhibiting a bimodal distribution, with sizable density at both low and high levels of nutrition, has so far not been on most economists' radars. Research on the phenomenon of overweight and obese in relatively poor countries is now growing, with attention being paid to the concomitant rise in the incidence of non-communicable diseases (NCDs) such as blood pressure and diabetes that often accompanies unhealthy weight levels (Gaiha, et al. (2010)). Scholars now understand that problems of excess weight and the associated health risks are no longer issues restricted to developed countries. This paper contributes to the literature by analysing the topic of excess weight among adults in urban India using a regional lens.

Proportions of those who are at unhealthy weight levels in India are startling. India comes third behind the United States and China in terms of numbers of people who are overweight or obese, with one in five adults in this excess weight category (Lancet (2014)). There are several contributing factors including increases in income,

lifestyle changes (higher propensity to eat outside the home, greater likelihood of owning labour-saving devices like washing machines and assets like cars and bikes, and the increased availability of household help), aggressive advertising that promotes the consumption of foods high in oil, sugar and fat, dietary preferences including reliance on foods like rice that are high in starch, and more sedentary work profiles that often accompany structural transformation of the labour market as countries develop. Perhaps underlining the importance of increases in income as an important factor, in India, the prevalence of excess weight is most evident among those in the higher income echelons. This is in contrast to developed countries like the United States where overweight and obesity is most evident among the poor.

We use the most recent 2011-2012 round of the Indian Human Development Survey (henceforth IHDS2) to analyse patterns in overweight and obesity rates for adult men and women in urban India, using regions of India as a common denominator. We find that the incidence of overweight and obese is most prevalent in the North-West and the South, and is more evident among women than men in urban India.¹ The income, labour market and dietary correlates that we investigate reveal that each has a role to play in explaining the patterns that we document. In particular, per capita expenditure (proxy for permanent income) and measures of a sedentary lifestyle like hours spent watching television, and possession of cars, bikes, and scooters, as well as availability of domestic help (again, proxies for income), are correlated with weight patterns in the North-West. What appears to matter most in predicting excess weight in the South is dietary markers such as monthly per capita rice consumption, especially rice that is sourced from the public distribution system (PDS). Our results therefore complement that of Upadhyay (2012) who argues that economic growth, an expanding

¹ See Figure A1 for a categorization of the states into region.

middle-class population, growing urbanization, and an increasingly sedentary lifestyle, all contribute to the ever-increasing importance of over-nutrition as a major health challenge in India.

To emphasize the urgency of the problem, we analyse the influence of being overweight or obese on the individual incidence of weight-related NCDs such as blood pressure, diabetes and heart disease. Understandably, the impact of these diseases on household budgets is likely to be substantial. It is argued that in India, the risk of impoverishment due to NCDs like heart disease is about 40% higher as compared to communicable diseases, and households in India with a heart disease patient are estimated to spend up to 30% of their annual income on health care expenses (Engelgau, et al. (2012)). We find that the underlying correlations between weight status and NCDs are substantial. We offer a few ameliorative strategies to tackle this epidemic but given the multitude of contributory factors, conclude that there is no single magic bullet solution to the regional patterns evident in India.

2. Parameters of this paper

This section lays out the parameters along which we examine the question of excess weight in India. First, the measure that we use for gauging individual weight status is their body mass index (BMI), which is defined as the ratio of weight in kilograms to the square of height in meters. An individual can be categorized into different weight groups based on their BMI. The World Health Organization (WHO) categorizes individuals as being underweight if $BMI < 18.5$, of normal weight if $BMI \in [18.5, 25)$, overweight if $BMI \in [25, 30)$, obese if $BMI \in [30, 40)$ or morbidly obese if $BMI \geq 40$. For the purposes of this analysis, we focus on individuals who are overweight or

obese ($BMI \geq 25$). This group is therefore a composite category comprised of individuals that are overweight, obese or morbidly obese.²

Second, despite evidence that rates of overweight and obese are rising in rural India, our focus here is on urban settings where this increase has been particularly pronounced (Maitra and Menon (2017)). Further, underlying causes are likely to differ by sector; hence studying both rural and urban areas may confound factors, thus clouding judgement on policy prescriptions. Adequate attention to increases in unhealthy weight levels in rural areas is important of course, but for purposes of this paper, we focus on urban areas as trends here are most magnified and appear to be of first order importance.

Third, for reasons outlined below, we study patterns of excess weight by regional aggregations. The regions that we create cover all parts of India and include the major states that encompass the majority of the population. In particular, “North” includes Uttar Pradesh, Uttarkhand, Rajasthan, Delhi, Madhya Pradesh and Chhattisgarh, “North-West” includes Jammu and Kashmir, Himachal Pradesh, Punjab and Haryana, “West” spans Maharashtra, Gujarat and Goa, “East” includes Assam, Bihar, Jharkhand, Orissa and West Bengal, and “South” denotes Tamil Nadu, Kerala, Karnataka and Andhra Pradesh. See Figure A1 (in the Appendix). We do not consider states individually given that there are 29 of them and each is distinct from the other. We also exclude union territories like Daman and Diu and Dadra and Nagar Haveli as they are relatively small. Finally, we do not consider states in the Northeast as there is

² WHO (2004) argues that these general cut-offs might not be appropriate for the Asian population: in particular, Asian populations have different associations between BMI, percentage of body fat and health risks compared to the European population. WHO (2004) suggests new cut-offs so that individuals are underweight if BMI is less than 18.5, normal weight if BMI is 18.5 but less than 23, overweight if BMI is 23 but less than 27.5, obese if BMI is 27.5 but less than 32.5, and morbidly obese if BMI is 32.5 or higher. Results are stronger with these cut-offs and are available on request.

evidence that patterns and behaviour there are measurably different from the rest of India (Dreze and Sen (2013)).

3. Data and selected descriptive statistics

Our analysis uses the second wave of the Indian Human Development Survey (or IHDS2) data, which was collected in 2011-2012. The first wave of the survey (the IHDS1 data) was a nationally representative multi-topic survey of 41,554 households in 1,503 villages and 971 urban neighbourhoods across India collected by the National Council of Applied Economic Research and the University of Maryland. 83% of the households from IHDS1 were re-surveyed in IHDS2. The response rate was more than 90% for both waves. The survey collected information on health, education, employment, economic status, marriage, fertility, gender relations, and social capital. While both rounds of the survey collected data on height and weight of women, the data for men was collected systematically only in IHDS2. Given we are interested in gender differences in weight, we use the IHDS2 data alone for our analysis. We cannot consider intertemporal effects as there is no panel dimension for men.

Descriptive statistics for the IHDS2 urban sample are presented in Table 1. We restrict ourselves to adult males (columns 1 – 2) and females (3 – 4) aged 18 – 60. The average age is 37 years for both men and women, 71% of men are married, compared to 79% of women. Overall 29% of men are overweight or obese compared to 34% of women. There is considerable gender difference in educational attainment and labour market engagement. 10% of men have no schooling, 12% have some primary schooling, 60% have completed primary but less than secondary schooling, and 19% have completed secondary schooling or higher. The corresponding proportions for women are 22%, 14%, 52% and 12%, respectively. Almost 34% of men work for salary

and 24% in a business; the corresponding percentages for women are 10% and 6%. Indeed, while 42% of men report not working, this percentage is a considerably higher at 83% for women. About 60% of women report having their first child by the age of 25. On average, women spend 3 hours a day watching television compared to 2 hours a day for men.

In terms of household characteristics, men and women appear to reside in similar households. These households are primarily Hindu, with an average size of 6 members, not particularly likely to have a flush toilet, but fairly likely to have access to piped water and equally likely to own a car or a motor cycle. Approximately 6% to 7% of households report having domestic help.

4. Regional dimensions

Documenting weight patterns by region in India is important given how large and heterogeneous the country is. Indeed, research demonstrates that disaggregate entities like states, and even regions within states are so varied, that most “one-size-fits-all” strategies designed and implemented at the national level often fail to address problems effectively (Krishna and Abusaleh (2011)). As Dreze and Sen (2013) note, variations across areas reflect differences in history, politics, economics and geography, but also in religion and social institutions like caste and class. This is evident from Table 2 that constructs regional median values of income, health, literacy and overall level of development measures based on statistics reported in Dreze and Sen (2013). Focusing on average household expenditure per capita in 2009-2010, Table 2 reports that states in the North-West have the highest levels across both rural and urban areas. The next highest levels are reported in the South and West. Correspondingly, poverty rates as measured by the headcount ratio are lowest in the North-West followed by the South.

Health and literacy measures also show marked variation by region. The infant mortality rate in 2011 is lowest in the South, followed by the West and the North-West. The highest rates of literacy for men and women are found in the West and South. The lowest rates for women are recorded in the North and for men in the East. Gender-related measures such as the sex ratio in 2011 is highest in the South across both sets of ages considered. Finally, measures of aggregate development such as location of the source of drinking water and whether electricity is the source of lighting, also show differences across regions. The lowest rates for those who report that the source of drinking water is far away in 2011 are found in the North-West, West and the South, in that order. Using access to electricity as the indicator of progress shows that the most advanced regions in India are the North-West and the South. The data presented in Table 2 imply that valuable insights may be lost if we ignore using a regional lens to understand the issue of excess weight in India.

Patterns of distribution of weight by region

In light of the regional variation along different socio-economic dimensions, it is not surprising that there is considerable regional variation in the proportion of men and women in different weight categories. The incidence of overweight or obese by region and gender are reported in Figure 1. Note that in no region is the proportion of those who are overweight or obese lower than 25%. By these computations, the lowest proportion of people with excess weight are in the West with 28%, and the highest proportions are in the North-West and South with 45% and 37%, respectively. Hence in the North-Western states of Jammu and Kashmir, Himachal Pradesh, Punjab and Haryana, close to one in two people are overweight or obese. In the southern states of Tamil Nadu, Kerala, Karnataka and Andhra Pradesh, more than one in three people are

in this category. These are unacceptably high numbers for a lower middle-income country.

Table 3 presents the proportion of men and women in the different weight categories by region. Overall 13% of urban males are underweight, 58% are normal weight, 24% are overweight and 6% are obese (or morbidly obese). The corresponding proportion of females in the four categories are 12%, 53%, 25% and 10%, respectively. Consistent with the proportions presented in Table 1, overall more women than men are categorized as overweight or obese. There is however considerable variation across regions. This is made clear in Figure 2, which presents the proportion of urban males and females in the different regions of the country categorized as overweight or obese. In every region, the proportion of women who are overweight and obese exceeds that of men. Up to 49% of urban women in the residing in the North-West states are categorized as overweight or obese, down to 29% of urban women residing in the West. The gender differential varies from a low of about 2% in the West to a high of approximately 10% in the North-West. The second highest proportion of women with unhealthy weight levels is found in the South at 38%. The North-West and the South are the same regions that report the highest proportions for men of 38% and 35%, respectively. The lowest proportion of men with excess weight is in the North at 24%.

5. Understanding regional variation in weight

It is unlikely that there is any one factor that can explain the variation in weight across regions. Instead we look at regional variations in a few factors including permanent income, dietary patterns, labour market engagement, and use of labour-saving devices, to gauge their contribution to regional differences in weight.

5.1. Differences in the effect of permanent income

As we show in Table 2, there is considerable variation in per capita household expenditure across regions. This is consistent with what we find at the household level using the IHDS2 data. The average per capita expenditure (our measure of permanent income of the household) in our sample varies from Rs. 41,263 in the North-West to Rs. 26,235 in households residing in the East. To what extent does this difference in permanent household income contribute to the regional variation in weight? To examine this issue, we compute and present in Figure 3 the lowess plots for the non-parametric regression of BMI on log per capita household expenditure, separately for urban males and females aged 18–60. In general, and not surprisingly, there is a positive correlation between log per capita household expenditure and BMI for both urban males and females in all regions of the country. There are of course variations: for example, the relationship has an inverted u-shape for women in the Southern states of the country and an inverted u-shape for males in the North-West of the country. Men in the East exhibit an almost positive and linear association between BMI and log expenditure. A similar linearity is found for women in the West. Hence, while there might be regional differences in the pattern of weight, it appears that the extent of association of weight with expenditure is mostly positive across the different parts of the country.

5.2. Differences in the effect of diet

Reflecting heterogeneity in preferences arising from geographical and socio-cultural and historical differences, estimates of expenditures on items as shares of total food expenditure also show variation across regions. These are reported in Table 4. Consider first, grains such as rice and wheat. Conditional on serving size, white rice has more calories, more starch, and fewer proteins and fibres than wheat. Brown rice

is healthier than white rice but it is the latter that is more widely consumed. In particular, there is evidence that whole grains such as wheat, brown rice and barley may reduce the risk of cardiovascular disease (Hallfrisch, et al. (2003)). Turning to Table 4, as expected, highest shares of expenditures on rice peak in the East and South whereas consumption of wheat and other cereals is highest in the North followed by the West and the North-West. In consequence, expenditures shares on wheat is lowest in the South. Shares of expenditures on rice from the PDS is highest in the East and South and lowest in the North.³ Hence from a nutrition stand-point, the relatively high share of rice and the relatively low share of wheat and other cereals in the Southern diet is supportive of the argument that starch and carbohydrates underlie the excess weight patterns that characterize this region of India. We discuss rice in greater detail below.

In terms of consumption shares on dairy including milk and dairy products (clarified butter, butter, ice-cream, milk power, yoghurt and cheese), eggs, fish and meat, the estimates are highest in the North-West followed by the South and the North. Expenditure shares on dairy and related products are lowest in the East. Focusing next on oils and sugars, the highest expenditure shares are in the Western states followed by states in the North. These estimates indicate that shares of total food expenditures on this category is lowest in the South. Finally, the highest rates of expenditures on processed food and eating out of the home are in the West, but the rates are not that much lower in the East and South.

Table 4 reveals that in terms of expenditures on “bad foods” that include dairy products, meats, oil and sugar, and expenditures on processed foods and eating out of

³ The PDS is India’s food security system which was established in 1965 to provide food items such as rice, wheat and sugar, and non-food items such as kerosene, to the poor at subsidized rates (Masiero (2015)). The Food Corporation of India is the main government body that is in charge of procuring items from producers, and then distributing it to the poor through fair price shops, also called ration shops, established throughout India (Mooij (1998)).

the home, there is no consistent pattern in that some regions of India are better than others in some categories but worse in others. On average, the preponderance of excess weight in the South and North-West may be attributed to relatively high shares of spending on milk and milk products, eggs, meat, processed foods, and spending at restaurants. But the manner in which the South and North-West dominate other regions when it comes to weight is not reflected in their emphasized presence across the “bad food” categories we consider.

However, this is not the case once consumption of rice and in particular, consumption of PDS rice is taken into account. As we note above, it is the South that lies at the intersection of relatively high expenditures on rice and is marked by a large proportion of people who are overweight or obese. We explore the impact of rice consumption in greater detail in Figure 4, which shows patterns of rice consumption per capita by region in the last thirty days. Panel A reports estimates for total rice consumed in the last month per capita. It is evident that the South has the highest per capita consumption followed closely by the East. In particular, the average person consumed a little over 8 and a little under 8 kilograms of rice in the South and East, respectively. The next highest level of rice consumption is in the North at a very distant 3 kilograms per capita. The North-West has the lowest rice consumption per capita at 2 kilograms per capita in the last month. Hence, the “rice consuming” regions of India are by far the South and the East.

Panel B is a closer snapshot of Panel A where we consider rice consumption separately from PDS and non-PDS sources. There is evidence from evaluation studies of the PDS that the system works more efficiently, in that there is less leakage, in the “functioning” states of the South (Khera (2011a)). This is clear from the right-hand side of Panel B which reports estimates for per capita rice from the PDS source. On

average, per capita consumption from this source in the Southern states is 3 kilograms per capita in the last month. This is head and shoulders above the next highest level of consumption from the PDS source which is in the East at 1 kilogram per capita. This is followed by the North-West, North and West, in declining order. Hence, PDS rice consumption is exceptionally high in the South. PDS rice is likely to be of inferior quality, both in terms of the actual grain and the overall quality of the rice (Khera (2011b)). The nutritional quality and content of PDS rice is critical as well.⁴ Most of PDS rice is polished white rice which does not have the nutritional content and other advantages of more expensive brands like Basmati (Little, et al. (2017)).⁵ For these reasons, we hypothesize that unhealthy weight levels in the South are strongly correlated to the easy and abundant availability of rice from the PDS source. The left-hand side of Panel B shows that in terms of per capita consumption from non-PDS sources, the South, while still second highest, now loses out to the East. Since the East does not depict as high rates of overweight or obese as the South, we conclude that PDS rice, is an important factor that drives excess weight in states such as Tamil Nadu, Kerala, Karnataka and Andhra Pradesh.

5.3. Differences in labour market engagement

⁴ The nutritional content of rice is based on several measures including the glycemic index (GI) and caloric content. The GI index measures how quickly food is converted into blood sugar in relation to either glucose or white bread which is normalized to 100 (Kennedy and Burlingame (2003)). Low GI rice, like the Basmati and parboiled varieties, are usually preferred, especially in controlling diseases such as diabetes mellitus (Nisak, et al. (2010)). There is also evidence that Basmati rice has fewer calories than other rice varieties (<https://www.livestrong.com/article/320971-basmati-rice-diet/>. Accessed February 26, 2018). Given its nutritional and other advantages, Basmati rice is relatively more expensive on world markets (<https://www.statista.com/statistics/255953/export-prices-for-selected-varieties-of-rice-since-2008/>. Accessed February 26, 2018).

⁵ Polished white rice has low fiber content, a high glycemic index, and a poor micronutrient profile as compared to brown and other varieties of white rice. (<https://rayalseemadiaries.wordpress.com/2014/02/26/nutritional-insecurity-through-the-pds/>).

Evidence on India indicates that the average calories intakes have not witnessed significant increase over time, rather there has been a modest decline in average intakes (Deaton and Drèze (2009), Ramachandran (2014)). Hence, reduction in physical activities might be one of the factors responsible for the increase in over-nutrition.

Panel A of Figure 5 shows that only 14%-23% of women aged 18 – 60 are engaged in the labour market (i.e., working), the corresponding figure for men as expected is much higher at 69-75%. Southern states have the highest proportion of working women followed by North-Western and Northern states.⁶ For men, North followed by North-Western states have the highest rate of working men.

One of the possible factors promoting reduction in physical activities might include occupational activities. Activities at work are becoming more sedentary due to technological advancements in the work environment, as well as via changing labour opportunities i.e. transition away from physically active jobs towards sedentary jobs. Panel B of Figure 5 shows that conditional on working, the North-Western region which has the highest proportion of overweight or obese adults, also has the highest proportion of men and women engaged in white collar jobs, while southern region has the lowest. White-collar jobs are generally not physically strenuous and include professionals, technical or administrative workers, executives, managers and clerical workers. Blue-collar jobs are more physically demanding and include individuals working in agriculture, manufacturing, sales and those classified as service workers (such as maids, sweepers, and protective service workers such as policemen or military personnel).⁷

⁶ The IHDS2 survey contain information on whether any household member worked on farms, worked for payment (wage/salary), or worked for a household business during the 12-month period preceding the survey. Also included are questions on the type of occupation/business, number of days worked in the preceding year, and hours worked in a day in each occupation. Using this, we aggregate the number of days worked across all categories to get the total number of days worked in the preceding year. An individual is considered to be employed if he/she worked for at least 180 days in the preceding year.

⁷ We Use two-digit National Classification of Occupation (NCO) codes to identify the type of occupation associated with the primary activity, defined as one in which an individual spent maximum time in the preceding year. We then classify these occupations into white and blue-collar jobs.

We can alternatively consider a finer categorization of occupations in terms of intensity of activity associated with the relevant occupations: low, medium and heavy physical activities. All white-collar jobs are classified as low activity occupations. Blue-collar jobs are further divided into medium activity occupations (sales and service workers and those in transport and communications), or high activity occupations (production workers, those in construction work). Panel C of Figure 5 shows the distribution of working men and women in occupations involving low, medium and high physical activities. As clear, there is considerable variation across regions. Among working females, Eastern states followed by North-Western states have the lowest proportion of females employed in occupations involving high physical activity levels, and among males, North-Western and Western regions have the lowest proportion of men working in occupations demanding high levels physical work. The high proportion of males and females in the North-Western region working in sedentary occupations and the high incidence of over-nourished adults in the same region suggests that the sedentary nature of jobs might be an important determinant in understanding rising weight levels. Further, in support of this observation, Dang, et al. (2017) shows that the less active nature of job is causally associated with elevated weight levels in India.

5.4. Differences in reliance on labour-saving devices

Reliance on labour-saving devices within the household may also explain patterns of excess weight given that four out of five women are not working. Labour-saving devices include washing machines, motorized vehicles such as cars, bikes, scooters, and the hiring of domestic help. Moreover, engagement in sedentary leisure activities such as watching television may be a contributory factor. Table 5 shows that the proportion of households possessing motor vehicles such as car, bike and scooter is

highest in the North-West and lowest in the Eastern region at 59% and 29%, respectively. Similarly, about 50% of households in the North-West possess washing machines, the highest among all regions. In the North-West, 8% (second highest) of households hire servants for domestic work. These figures are suggestive of the fact that ownership of these assets and spending on domestic help can impact excessive weight by reducing time in physical exertive activities.

Table 6 reports the proportion of urban households watching television for more than an hour each day. Hours spent watching television and the accompanying food advertisements could also drive obesity. Television not only contributes to physical inactivity, but commercials and other programs encourage individuals to consume more. Studies have shown that television viewing increases snacking, portion sizes, the percentage of calories from fat, and overall calories (French, et al. (2001)). Table 6 shows that proportion of households with women watching television for more than an hour each day is the highest in the North-West and Southern region with 85% in each, while the Northern region with 80%, which is still substantial, has the lowest proportion. These patterns reflect those in overweight or obesity rates by region. The region with the highest proportion of households with men viewing television for more than an hour each day is the North-Western region (64%), again, resonating with weight trends in this region. Hence, it appears that sedentariness, whether at work or at home, is an important correlate of over-nutrition, particularly in the North-West.

6. Health impacts as measured by NCDs

We focus on excess weight because the incidence of chronic health problems and NCDs like blood pressure, cardiovascular disease, and diabetes is significantly higher for individuals with unhealthy BMI. The IHDS2 data contain health outcome variables

that pertain to blood pressure and diabetes. However, information on cardiovascular disease is not collected directly in the survey and so we use data on heart disease to examine this malady. While not exactly the same, cardiovascular disease is a subset of heart disease and the latter is the closest proxy we have for the former in these data. We also note that these outcomes are self-reported and thus may suffer from the problem of mis-reporting. However, we examine them as they are illustrative of the negative consequences of excess weight.

Table 7 presents evidence on the incidence of these problems by gender and region: heart disease, high blood pressure and diabetes. It is clear that the likelihood of reporting heart disease and high blood pressure is the highest for residents in the North-Western states of India, and this is true for both males and females. Additionally, while the proportion of women reporting heart disease and high blood pressure is greater than the corresponding proportion of men in all regions, this is especially true in the North-Western states. Diabetes is however a different story, with the South dominating other regions for both males and females. This may be partly related to the patterns of rice consumption, which, as we noted above, is highest in the Southern states.

To examine how the incidence of NCDs varies by weight status, in Figure 6 we present the likelihood of the individual reporting that he/she suffers from heart disease (Panel A), high blood pressure (Panel B) and diabetes (Panel C), by region, gender, and weight status (whether the individual is overweight or obese or not). It is clear that the likelihood of reporting a NCD is an order of magnitude higher for those who are overweight or obese, and this holds for both males and females across most regions of residence. These relative differences by weight status provide compelling support to the argument that excess weight is a major correlate of NCDs.

7. Conclusion

This paper studies the increasing girth of adults in India by focusing on urban areas using a regional lens. We find that overweight or obese populations are in all regions of India, but especially the North-West and the South. Although men are also impacted, the problem of excess weight is most clearly manifested among women. The factors that we examine to understand these regional weight patterns include variations in income, in diet, in labour market engagement, and in reliance on labour-saving technologies. In general, income and concomitant expenditures on labour-saving technologies such as washing machines and transportation assets such as cars and bikes, are strongly indicative of weight patterns in the North-West. On the other hand, diet, in particular, per capita consumption of PDS rice, appears to be a major driver of excess weight in the South. Labour market engagement as measured by the proportion of workers in white collar jobs is also suggestive of weight status in the North-West. Hence various factors have contributed to the troubling phenomenon of overweight and obesity among adults in India, and the regional flavours of this epidemic may be attributed to some underlying characteristics over others, depending on the locale. We conclude by investigating the influence of excess weight on NCDs including blood pressure, heart disease and diabetes. We find that being over-nourished is positively associated with these diseases.

The policy implications of this study are substantial, and both the government and non-governmental bodies have important remedial roles to play. This includes spreading awareness regarding the problem, its causes and its consequences, especially in the health sphere. These agents also bear the responsibility for creating and encouraging the use of policies to mitigate the burden of excess weight. The 14.5% tax on unhealthy food that the government of Kerala state imposed is a step in the right

direction; however regulatory measures of this nature alone may prove insufficient. Action is needed to make life-styles more active and exertive. Provision of tax concessions for gym memberships, incentives to schools to provide opportunities to children and young adults to engage in physical activity, policies that encourage more exercise among urban adult women such as group programs tailored to them, and the importance of green spaces in construction plans of new office buildings and residential complexes, are all important. A way to catch the attention of the audience that seems most impacted may be advertisement and information campaigns on television that emphasize the importance of more activity in daily life and the negative disease consequences that accompany a sedentary life profile. In the South in particular, more awareness on the need to diversify diets away from reliance on rice would be invaluable. A concerted effort of this nature is essential to reverse the disturbing regional trends in weight that we document.

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Table 1. Descriptive Statistics: Cross Sectional Sample

	Male		Female	
	Mean	SD	Mean	SD
Age	37.578	12.498	37.005	11.392
Married	0.709	0.454	0.785	0.411
Underweight	0.135	0.342	0.128	0.334
Normal Weight	0.574	0.495	0.532	0.499
Overweight/Obese	0.291	0.454	0.340	0.474
No Schooling	0.096	0.294	0.216	0.412
Primary School	0.122	0.328	0.140	0.347
More than Primary School	0.596	0.491	0.520	0.500
Secondary School or Higher	0.186	0.389	0.124	0.329
Age at First Birth 16 – 20			0.263	0.440
Age at First Birth 21 – 25			0.338	0.473
Age at First Birth 26 – 30			0.130	0.336
Age at First Birth 31 – 35			0.033	0.178
Age at First Birth Other			0.229	0.420
Works for salary	0.339	0.473	0.099	0.298
Works in business	0.243	0.429	0.064	0.245
Not Working	0.418	0.493	0.831	0.375
Average Hours TV Watching	1.876	1.159	2.705	1.493
Expenditure Q1	0.201	0.401	0.211	0.408
Expenditure Q2	0.242	0.428	0.251	0.434
Expenditure Q3	0.273	0.446	0.269	0.443
Expenditure Q4	0.284	0.451	0.270	0.444
Household size	5.373	2.442	5.666	2.624
Hindu	0.797	0.402	0.783	0.412
Muslim	0.142	0.349	0.158	0.364
Christian	0.034	0.181	0.033	0.177
Household has flush toilet	0.165	0.372	0.184	0.387
Household has piped water	0.721	0.449	0.711	0.453
Household owns car	0.068	0.252	0.074	0.262
Household owns motor cycle	0.486	0.500	0.462	0.499
Household has domestic help	0.055	0.227	0.068	0.251
Share of expenditure on processed food	0.107	0.092	0.111	0.091
Share of expenditure eating out	0.056	0.107	0.059	0.118

Notes: Sample restricted to 18 – 60 year old urban residents. IHDS2 data only.

Table 2: Variation across Regions in Socio-Economic Indicators

	Average Household expenditure per capita (Rupees/month) 2009-2010		Head-count ratio 2009-2010		Infant mortality rate 2011	Literacy rate ages 7 or above 2011 (%)		Sex ratio 2011		Drinking water source: far away 2011 (%)	Electricity as source of lighting 2011 (%)
	<i>Rural</i>	<i>Urban</i>	<i>Rural</i>	<i>Urban</i>		<i>Female</i>	<i>Male</i>	<i>All ages</i>	<i>0-6 years</i>		
North	903	1663	39	24	52	60	81	930	899	26	67
North-West	1523	2215	12	15	40	69	83	888	853	11	94
West	1132	2173	28	18	33	73	89	922	885	13	87
East	825	1584	40	26	44	64	79	947	943	27	43
South	1197	2146	22	15	29	71	85	994	945	13	93

Source: Dreze and Sen (2013). Table A.3. There are no statistics available for Delhi (North) or Goa (West). The infant mortality rate is the number of infants who were born alive but died in the first eleven months, expressed in per 1000 live birth. The sex ratio is the number of females per 1000 males.

Table 3: Proportion in Different Weight Categories by Region and Gender

	Male				Female			
	Underweight	Normal Weight	Overweight	Obese	Underweight	Normal Weight	Overweight	Obese
North	19.10	56.64	20.00	4.26	14.83	51.42	23.68	10.06
North-West	12.51	49.77	28.68	9.05	8.92	42.38	31.43	17.27
West	12.68	60.00	21.28	6.04	11.61	59.53	21.76	7.10
East	13.54	60.48	21.85	4.14	12.47	53.91	25.54	8.07
South	9.22	56.25	27.99	6.53	10.90	51.24	26.56	11.30
Total	13.02	57.5	23.8	5.67	12.18	53.09	24.86	9.86

Note: Authors' calculations using IHDS 2.

Table 4: Share of Total Food Expenditure by Region

Region	Rice	PDS Rice	Wheat/Cereals	Dairy/Fish/Meat	Oil/Sugar	Process/Eat Out
North	0.068	0.003	0.122	0.278	0.137	0.039
North-West	0.044	0.005	0.113	0.343	0.122	0.042
West	0.058	0.004	0.115	0.261	0.161	0.064
East	0.175	0.006	0.086	0.241	0.120	0.057
South	0.145	0.006	0.056	0.295	0.108	0.057

Note: Authors' calculations using IHDS 2.

Table 5: Proportion of Urban Households Possessing Labour-saving Devices, Hiring Domestic Help by Region

Region	Motor Vehicle	Washing Machine	Domestic Help
North	41.12	23.27	5.2
North-West	58.77	49.56	7.84
West	55.53	6.58	6.01
East	29.18	10.4	17.02
South	42.48	16.12	4.69

Note: Authors' calculations using IHDS 2.

Table 6: Proportion of Urban Households Watching Television for More than an Hour Each Day by Gender and Region

Region	Female	Male
North	80.07	61.23
North-West	85.09	63.87
West	81.71	50.04
East	82.89	53.18
South	85.09	58.91

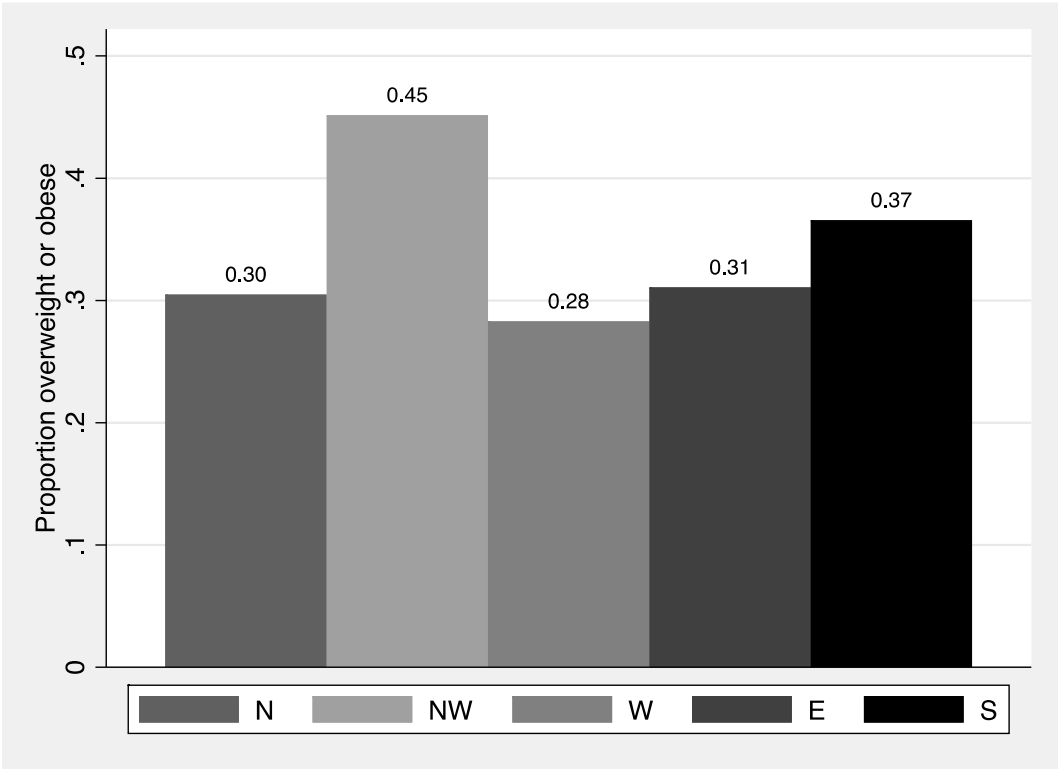
Note: Authors' calculations using IHDS 2.

Table 7: Likelihood of Reporting Non-Communicable Diseases by Gender and Region

Region	Male			Female		
	Heart Disease	High Blood Pressure	Diabetes	Heart Disease	High Blood Pressure	Diabetes
North	0.01	0.03	0.03	0.02	0.06	0.02
North-West	0.02	0.05	0.03	0.03	0.11	0.04
West	0.01	0.02	0.02	0.00	0.04	0.02
East	0.01	0.04	0.04	0.01	0.07	0.03
South	0.01	0.05	0.05	0.01	0.07	0.06

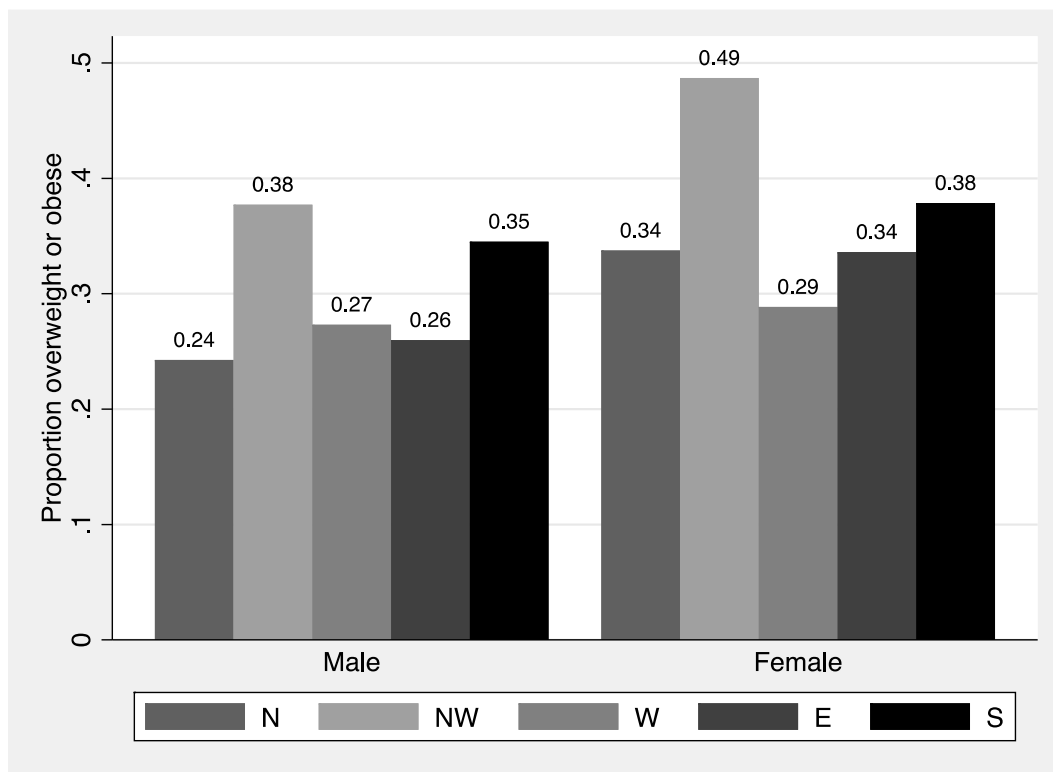
Note: Authors' calculations using IHDS 2.

Figure 1: Regional Variation in Proportion Overweight or Obese by Region



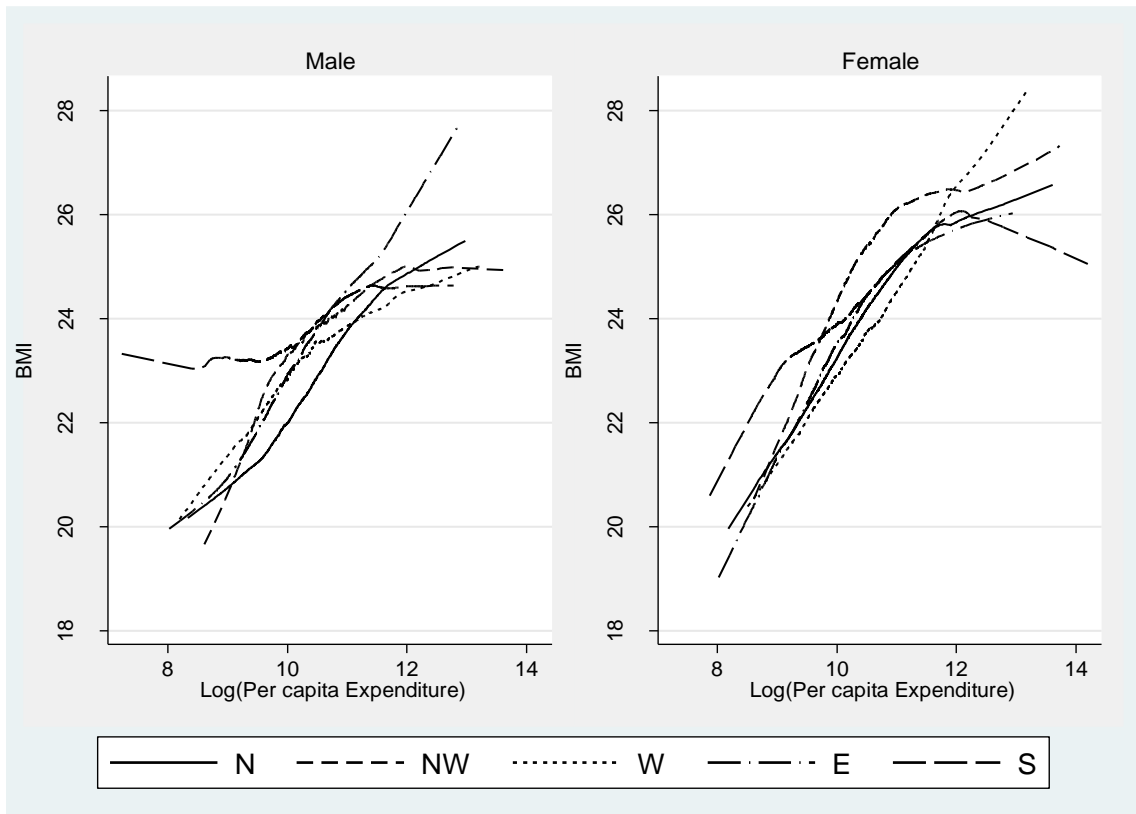
Note: Authors' calculations using IHDS 2.

Figure 2: Proportion Overweight or Obese by Region



Note: Authors' calculations using IHDS 2.

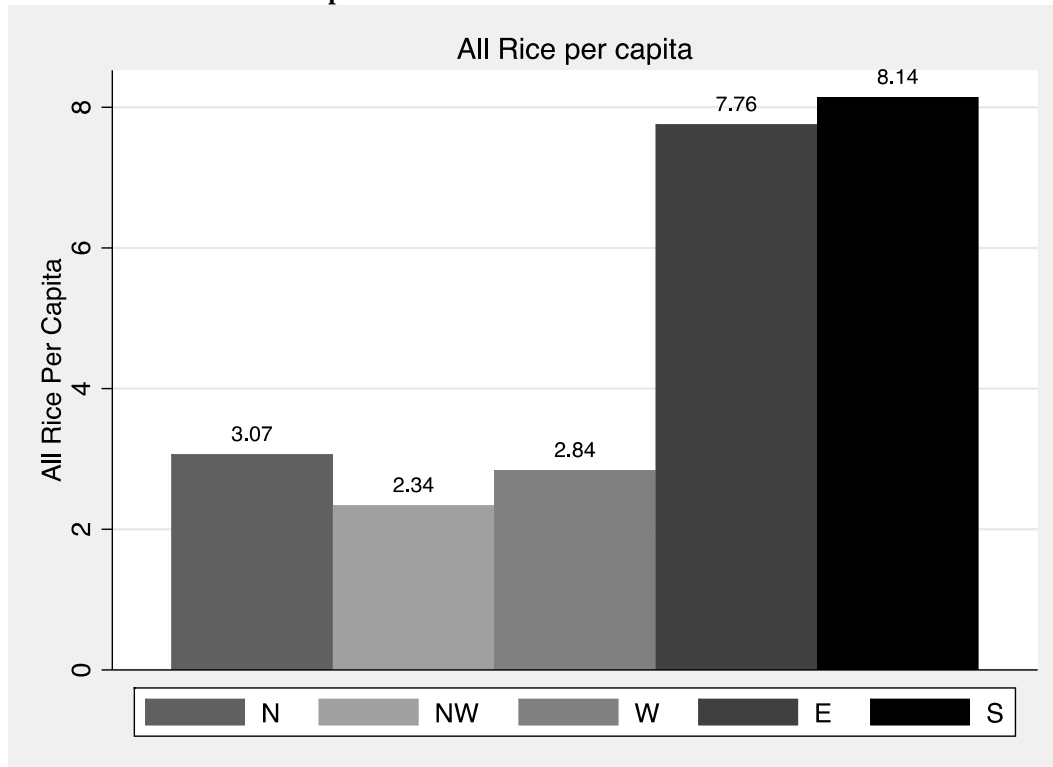
Figure 3: Lowess Plot of BMI and Log Per Capita Expenditure



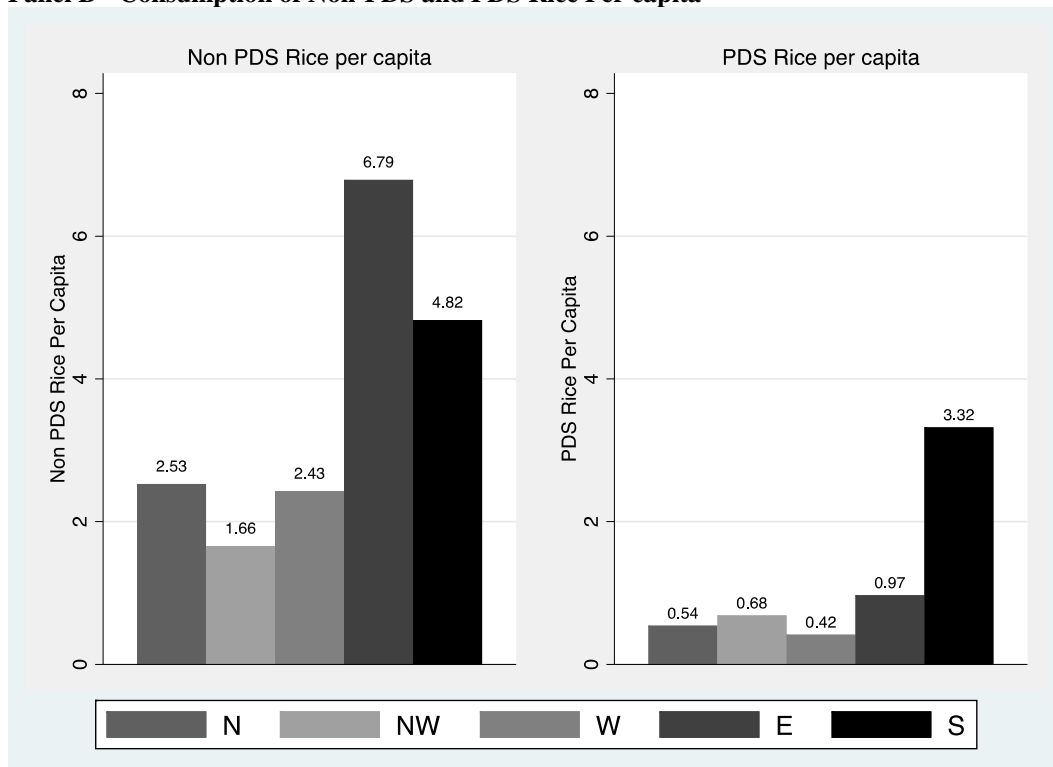
Note: Authors' calculations using IHDS 2.

Figure 4: Per Capita Consumption of Rice in Kilograms in the Last Month by Region

Panel A – Total Rice Per Capita



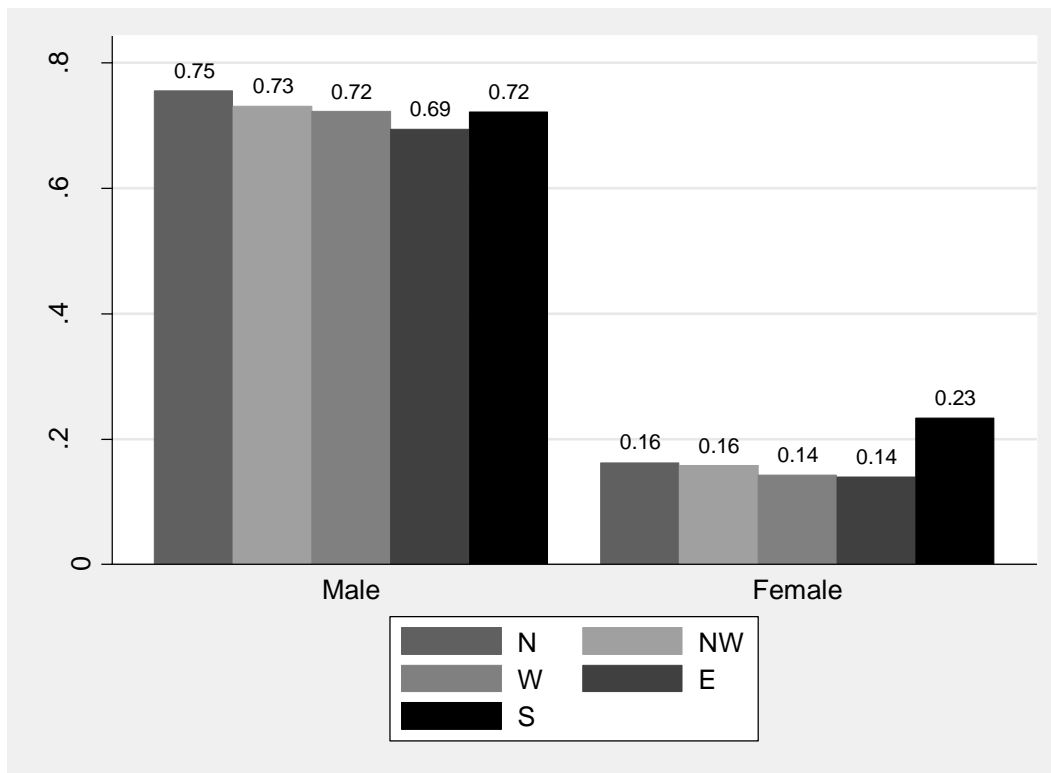
Panel B - Consumption of Non-PDS and PDS Rice Per capita



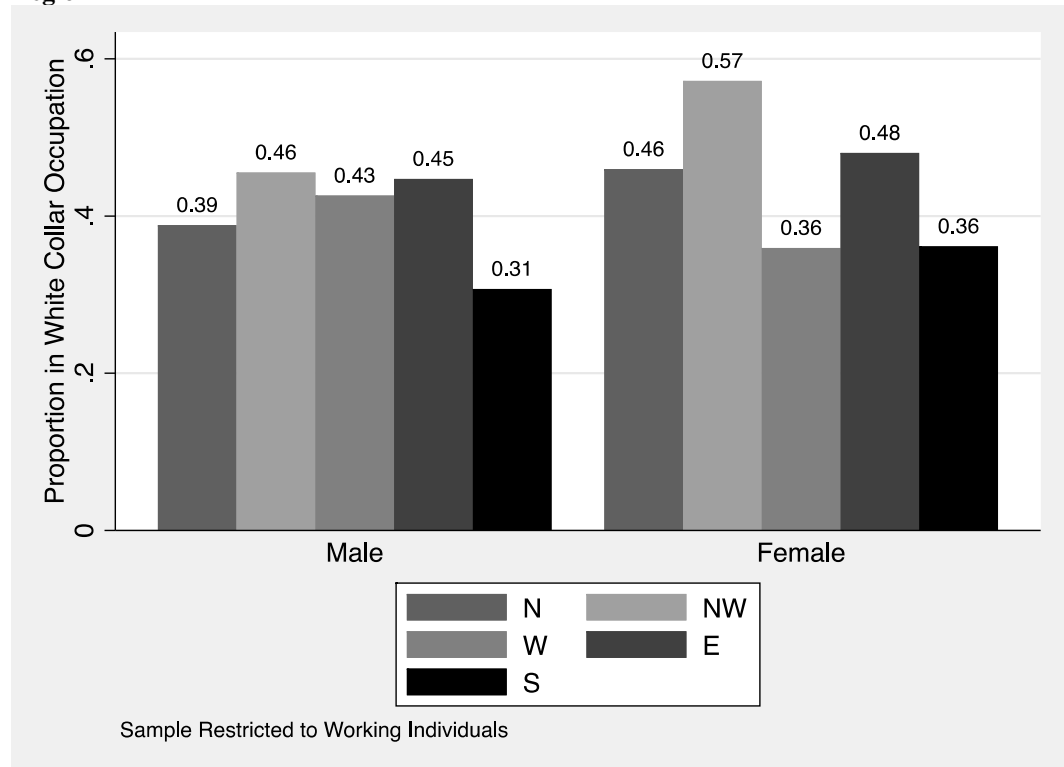
Note: Authors' calculations using IHDS 2.

Figure 5: Labour Market Engagement

Panel A: Proportion of Working Individuals by Gender and Region

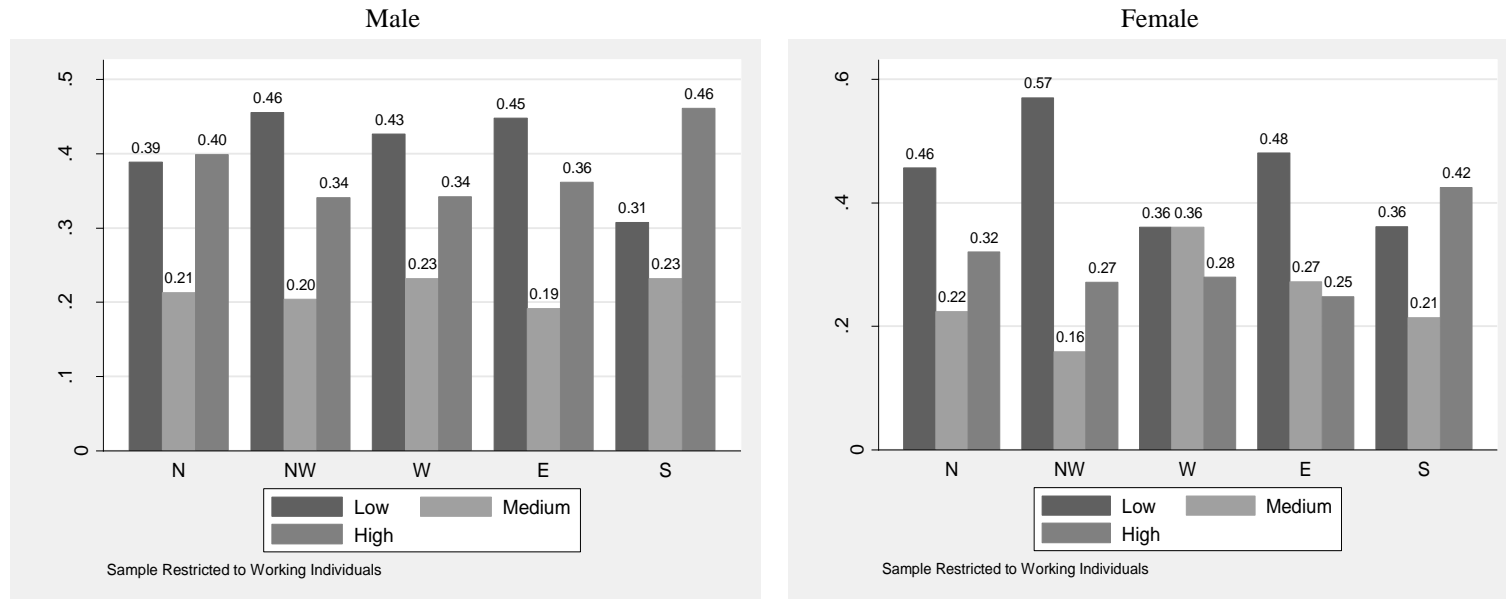


Panel B: Proportion in White Collar Occupation (Conditional on Employment) by Gender and Region



Note: Authors' calculations using IHDS 2.

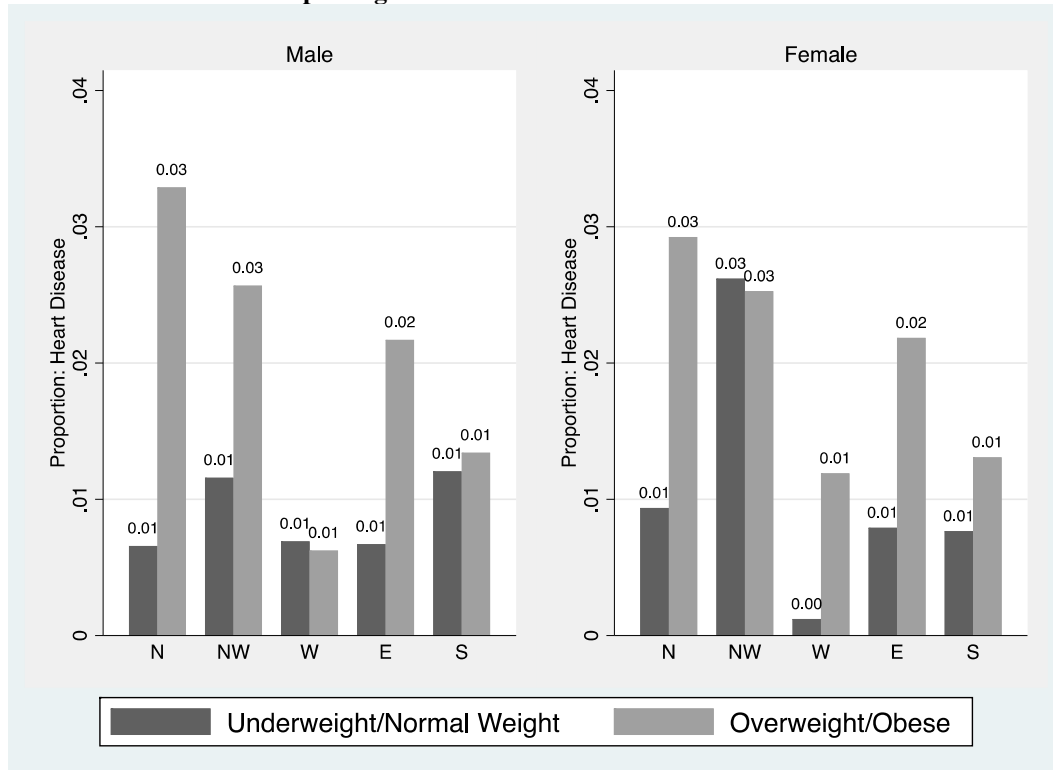
Panel C: Proportion of Working Individuals in Low, Medium and High Physical Activities by Gender and Region



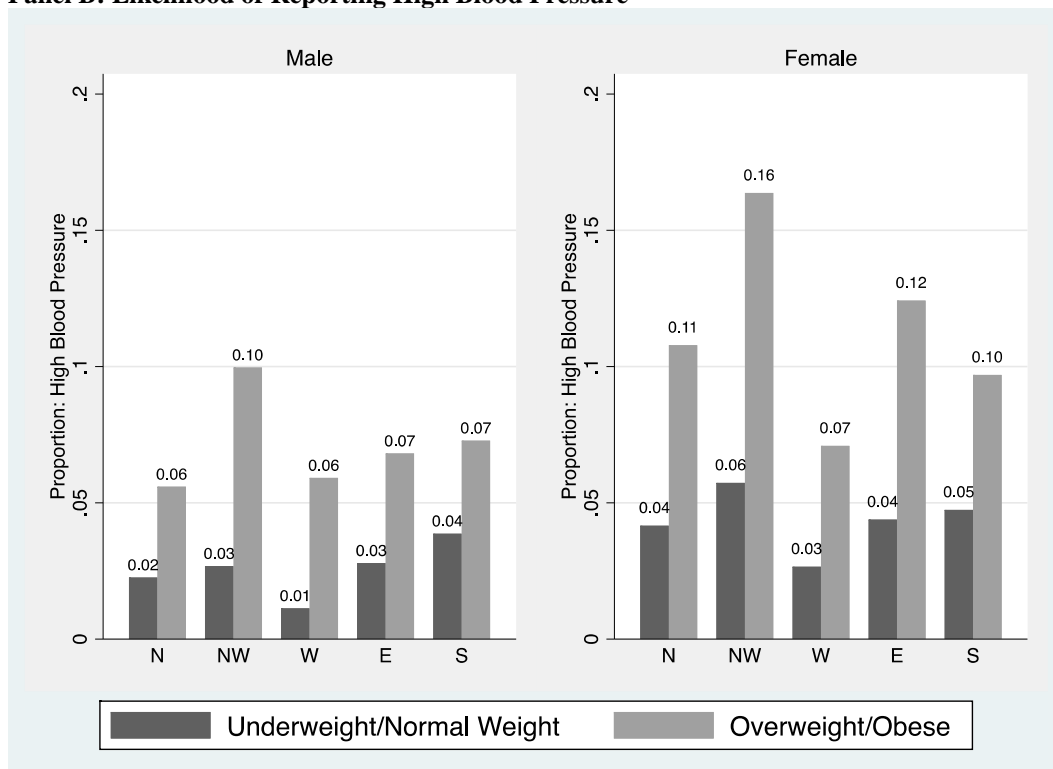
Note: Authors' calculations using IHDS 2.

Figure 6: Likelihood of Reporting Heart Disease, High Blood Pressure and Diabetes by Region, Gender and Weight Category

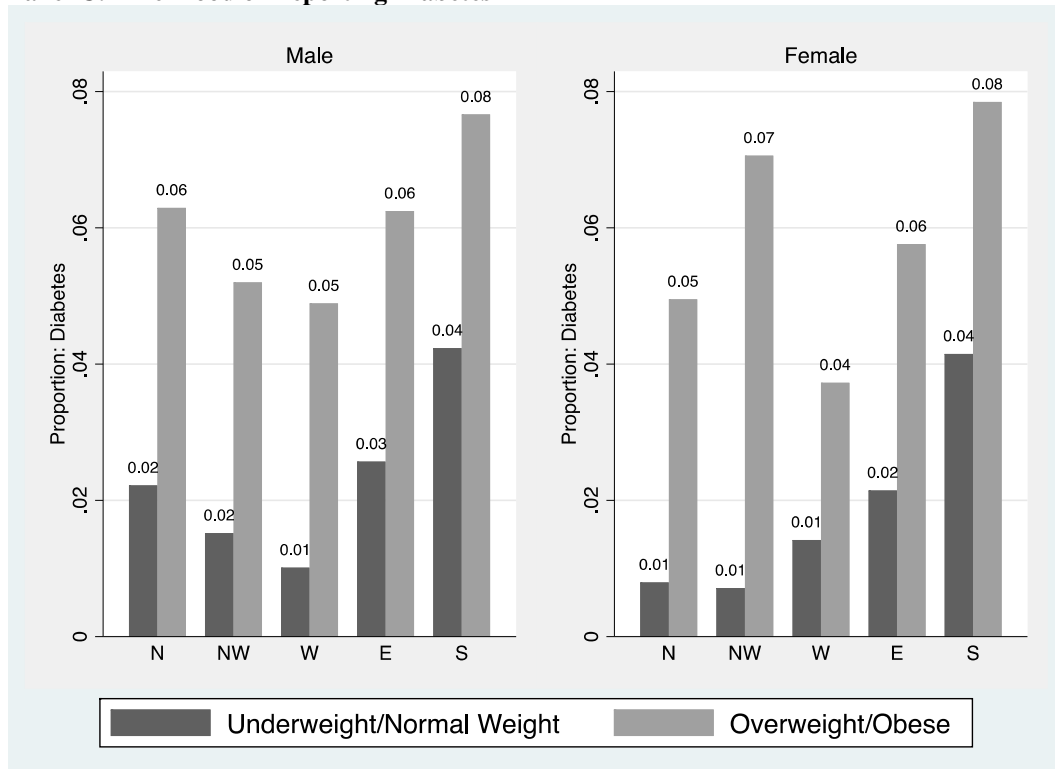
Panel A: Likelihood of Reporting Heart Disease



Panel B: Likelihood of Reporting High Blood Pressure

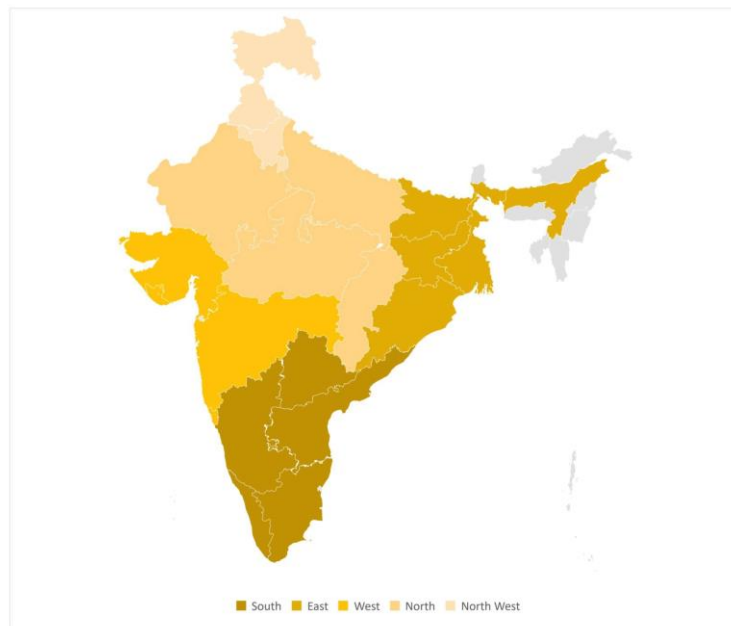


Panel C: Likelihood of Reporting Diabetes



Note: Authors' calculations using IHDS 2.

Figure A1: Categorization of States of India into Regions



Notes: Categorization of States is as follows:

South: Andhra Pradesh, Karnataka, Kerala, Tamil Nadu and Telangana

West: Goa, Gujarat and Maharashtra

East: Assam, Bihar, Jharkhand, Odisha, West Bengal

North: Chhattisgarh, Madhya Pradesh, Rajasthan, Uttarkhand, Uttar Pradesh

North-West: Haryana, Himachal Pradesh, Jammu and Kashmir and Punjab