Urbanization, Women, and Weight Gain: Evidence from India, 1998-2006

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Urbanization, Women, and Weight Gain: Evidence from India, 1998-2006

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Abstract

While malnutrition remains an important public health concern in poor countries, particularly in rural areas and among the urban poor, overweight and obesity are emerging as important public health concerns. The globalization of the fast food industry and shifts in physical activity patterns related to urbanization can result in different risks for overweight and obesity among urban and rural residents but also among women and men. City size may also be positively correlated with obesity and the prevalence of chronic diseases. We examine Indian National Family Health Survey data on women ages 15-49, focusing on the effect of urbanization on gains in BMI among women in the past two survey years. Using multivariate models that assess the role of individual characteristics, including urban residence, in the likelihood of being overweight or obese, we find that urban living for women in India is strongly positively associated with being overweight or obese. Larger city size is also associated with higher proportions of overweight and obese women, but this relationship needs further evaluation based on geocoded data. Findings suggest that public health planning in established and emerging metropolitan areas in India should consider focusing on women’s diet and their opportunities for exercise.

1 This study was made possible in large part by a CUNY Demography Fellowship to Ms. Dev.
Introduction

The world has seen a doubling of obesity rates in the past three decades, with more than 10% of the world’s population at risk for deaths related to excessive and unhealthy weight gain.\(^1\) Overweight and obesity, once considered high-income country problems, are also on the rise in low- and middle-income countries, particularly in urban settings. While malnutrition remains an important public health problem in poorer countries, changes in lifestyle and dietary intake as a result of economic growth and urbanization, can lead to a "double burden" of disease in cities, i.e. the co-existence of diseases related to under- and over-nutrition.\(^2,3\) Obesity is associated with higher mortality from chronic conditions such as diabetes, hypertension, and cardiovascular disease\(^4\) and a recent study shows that even being overweight increases the risk of myocardial infarction and ischemic health disease.\(^5\) While developing countries, such as India, have much lower levels of chronic conditions, in large part due to the lower levels of obesity, an increase in overweight can move a large number of people into higher risk groups or exacerbate chronic conditions such as diabetes that are on the rise from population aging alone.\(^6\)

Urban environments offer greater food choices at lower prices, while urban work and built environment demands less physical exertion than rural areas.\(^7\) An urban lifestyle may limit time for home cooked meals with replacement from energy-dense foods that are high in fat.\(^8\) The global rise in per capital income and improved access to a greater variety of food in urban areas is changing food consumption patterns toward more meats, sweeteners and fats.\(^9\) At the individual level, studies of overweight and obesity in developing countries have shown a strong positive association between
socioeconomic status (SES) and body mass index (BMI), especially SES and overweight. However, no study has closely examined the role of urbanization in increasing rates of overweight and obesity in the developing world. This study aims to fill that gap. We examine the Indian National Family and Health Survey (NFHS) data on women (ages 15-49), focusing on the role of individual characteristics, including urban residence, in the likelihood of becoming overweight or obese. We intend to add to the existing literature, an assessment of any effect of urban living on BMI gain.

Urbanization has been linked to a global increase in the prevalence of overweight and obesity among adults and children in all regions of the world. By 2030, the combined effect of a wider availability of high calorie food products and sedentary conditions associated with urban living, could contribute to a 75% increase in the prevalence of overweight and obesity among adults ages 20 years and older worldwide. In hub cities, such as Accra, Ghana, urban residents have become more vulnerable to unhealthy weight gain due to consumption of energy-dense processed foods, late working hours, and greater alcohol consumption. Children are also vulnerable and may be experiencing faster rates of increases in overweight and obesity compared to adults. These increases are especially notable for urbanized and developed countries such as the US, where one in four urban school-age children is overweight or obese. Similar trends have also been observed in Western Europe, Australia and urban areas in middle-income countries such as Brazil and China. Furthermore, though city residents are more likely to walk or cycle, due to urban features such as higher density, greater connectivity, and more land use mix, than their sub-urban or rural counterparts, the causal relationship between this form of ‘active transport’ and health remains unclear. Even though active
city residents may be in better health, the duration and intensity of physical activity required to prevent transitioning to overweight and obesity is much higher than previously recommended, and higher than the average city dweller may walk or cycle in a day.\textsuperscript{17,18}

India experienced significant economic growth starting in the early 1990s, which has led to widespread changes in the urban environment, as well as the continued growth or emergence of new metropolitan areas. Since 1990, the country’s urban population has increased from 26\% to 31\% and the pace of annual urban growth far surpasses annual rural growth.\textsuperscript{19} It is estimated that by 2025, over 37\% of the Indian population will be urban.\textsuperscript{20} While these may be seemingly low urban fractions, India already has more large cities than any other country except China: in 2010, India had 43 cities of more than 1 million persons, three of which had close to 15 million or more persons.\textsuperscript{21} Although less than a third of India’s people live in cities and towns, they generate over two-thirds of the country’s gross domestic product and account for 90\% of government revenue; most future economic growth is projected to result from moving the labor force from farming to non-farm activities.\textsuperscript{22} The population and economic growth has come at the cost of increasing income inequality\textsuperscript{23}; urban sprawl resulting in long work commutes, lack of quality outdoor spaces, and poor safety for pedestrians and cyclists\textsuperscript{7}; growth of large informal settlements and slums\textsuperscript{24}; and greater consumption of sugars and fat.\textsuperscript{25}

Rising trends in overweight and obesity have also been observed in India in the recent past, mostly in urban areas and among adults.\textsuperscript{19} The prevalence of overweight and obesity has been documented to be 28\% in urban Delhi, and was higher among females than males.\textsuperscript{26} Higher income adults in Indian urban areas also have higher rates of
overweight and obesity (32.2% among males, 50% among females) than the middle
classes (16.2% males, 30.3% females), lower socio-economic groups (7.0% males, 27.8%
females), followed by those living in urban slums (1.0% males, 4.0% females). Subramanian and colleagues\textsuperscript{28} found similar associations of pre-overweight, overweight, and obese categories with a more than 2-fold socioeconomic gradient across standard-of-living index quintiles for pre-overweight women and 7-fold gradient for obese women in India. At least one study from India also found 4 times higher rates of obesity among urban school children in private versus public schools, and significantly higher rates of overweight in metropolitan versus non-metropolitan areas.\textsuperscript{29} Longitudinal data also suggests that there is a trend toward faster overweight prevalence growth rates for the lowest wealth and education groups in urban areas as well.\textsuperscript{30} A study of rural to urban migrants in India found that urban male and female migrants reported an increase in fat intake and reduced physical activity compared to their rural siblings, with corresponding higher levels of obesity and diabetes.\textsuperscript{31} Combined with food consumption patterns, slum dwellers could be vulnerable to unhealthy weight gain as they age.

The Indian NFHS data have been used to estimate prevalence of overweight and obesity among women by education and socioeconomic status.\textsuperscript{28} However, the effect of urban residence itself on the rates of overweight and obesity prevalences over the reproductive life span of women in India is not known. This paper provides a “thick” description of the proportions of overweight and obese women in India, a fuller understanding of who is more likely to become overweight, and a discussion of the role of urbanization in these trends. In the sections that follow, we describe the data and sampling frame, including the greater attention to Indian cities that allows for this
analysis, the basic description of BMI among Indian women, and the results of a multivariate analysis on BMI gains.

**Data and Sample**

The data set included the last two rounds of the Indian NFHS, a representative cross-sectional survey of women aged 15-49 years. NFHS-2 (1998-1999), covered all 26 states and interviewed 90,303 women while NFHS-3 (2005-2006) covered all 29 states (including 3 new states that were created) and interviewed 124,385 women. In each state, the rural sample was typically selected in two stages involving the selection of Primary Sampling Units (PSUs) or villages with probability proportional to population size (PPS) in the first stage and random selection of households within each selected PSU in the second stage. In urban areas, the sample was selected in three stages: the first stage was PPS selection of wards arranged by geographic region and female literacy, followed by random selection of one census enumeration block (CEB) from each selected ward, and the random selection of households from each CEB. In NFHS-3, CEB-wise data were also acquired for eight selected cities of which four are India’s well-known mega cities (see map Figure 7) and four are emerging urban areas. The third round also oversampled urban households in states with very small urban populations as well as slum and non-slum households in the eight selected cities, to yield a sample large enough to calculate stable estimates. District code names for NFHS-2 districts were supplied by the data provider, ICF Macro International, and were used to identify the eight selected cities that are included by name in NFHS-3. We make the assumption that districts with the same city name in the earlier round only include the urban population. We restricted our sample to women who were not pregnant and who were not missing
data for the outcome variable. As opposed to prior studies, we did not exclude women who were smoking or breastfeeding as we wanted to adjust for these variables during analysis. This yielded a final sample of 77,613 women in NFHS-2 and 113,075 women in NFHS-3. Ancillary data from the Indian Census (2011) is used to map the proportion of each districts level of urbanization and correlations with district-level proportions overweight, though this information is not used in the individual-level analysis because the more specific NFHS data on the individual’s residence (city-size or rural) is used instead.

**Dependent variable**

Our outcome of interest is BMI, calculated as weight in kilograms divided by height in meters squared (kg/m$^2$). Both weight and height were measured by the interviewer. The following cut-offs were used for bivariate analysis with BMI as a categorical outcome: <16 (severely thin), 16–18.49 (moderately to mildly thin), 18.5–22.9 (normal), 23-24.9 (Indian overweight), 25-29.9 (global overweight), and >30 (obese). A BMI cutoff of 23 kg/m$^2$ was used in the context of recommendations to use lower cut-offs for Asian Indians who might be at higher risk of type 2 diabetes and cardiovascular disease at lower BMIs than the existing WHO cut-off point of 25 kg/m$^2$ for overweight, hence the Indian overweight classification. For the multivariate analysis, BMI was used as a continuous variable and represents the full range.

**Results**

**Sample Characteristics**

Not surprisingly, urban women in both survey years were more likely to have completed secondary school and much more likely to have even higher education levels
than rural women. Both rural and urban women were also better educated in the third
than the second survey; 49.6% of urban and 31.9% of rural women had completed
secondary education in NFHS-3 compared to 34.7% of urban and only 17.7% of rural
women in NFHS-2. The proportion of rural women with a secondary education also
doubled between the two surveys and a similar, though smaller, increase was seen among
urban women too. Age distributions across the two surveys were similar except for
teenagers, who formed a higher proportion of sample in NFHS-3. A majority of the
women were non-smokers with rural women having somewhat higher proportions of
smoking. Urban women also had fewer children on average and were less likely to be
breastfeeding at the time of the survey. Parity decreased for both urban and rural women
from the second to the third survey. A larger proportion of urban women in each survey
year also had a higher standard of living than rural women.

Spatial Patterns

We also explored spatial, urban patterns of weight distribution. Urban areas,
owing to their comparably small geographic land area, are hard to visualize on a map,
however it is important to note that the proportions of overweight and obesity are
spatially clustered among women. The map in Figure 1 shows the proportion of women
whose BMI is greater than 23 kg/m² by district in NFHS-3. The global Moran’s I using
first-order polygon contiguity was 0.40 (p= 0.000), indicating a high degree of spatial
autocorrelation or “hot spots” of neighboring districts with higher proportions of
overweight and obese women (25% or more). A district’s level of urbanization (shown
in Figure 1 as circles of varying sizes) was also positively correlated with the proportion
of overweight and obese women in that district (shown as red hues in Figure 1), with a
Pearson’s correlation coefficient of 0.465 (p=0.000) between percent urban and overweight/obese. However, with the exception of the eight oversampled cities, the districts of which are fully urban, we cannot spatially distinguish between the urban and rural populations within districts. Survey data that identifies specific urban and rural locations within districts would be necessary to further explore spatial patterns and identify potential contributors in the urban environment, including the size (and form and expansiveness) of the city. While a map at this scale is not a precise tool for policy, it allows for preliminary identification of regions with disproportionately high risk.

**Bivariate Analysis**

We looked at the proportion of women in each BMI category by simple residence (i.e. urban vs. rural), size of the city (town, small city, large/capital city), and for the eight selected cities (Figure 2). Rural women were much more likely to be severely or moderately thin than urban women in NFHS-2 (38% vs. 21%) and NFHS-3 (36% vs. 23%). In contrast, urban women were nearly three times more likely to be overweight at BMI ≥ 23 kg/m$^3$ in NFHS-2 (25% vs. 12%) and twice as likely in NFHS-3 (30% vs. 15%) than rural women. Obesity was much higher among urban than rural women: 6% versus 1% in NFHS-2 and 6% vs. 2% in NFHS-3. In selected cities, which include some of India’s largest cities, the proportions of obese women were even higher: 8% in both rounds. However, these cities also had their share of severely and moderately thin women: 16% in NFHS-2 and 21% in NFHS-3. Comparing the two rounds, it was notable that there were higher proportions of malnourished women in urban areas and obese women in rural women in the more recent survey, although the increases were small. Proportions of overweight women increased in both urban and rural areas.
There is an unambiguous urban gradient in the share of overweight and obese women by city size. Figure 3 shows that the largest proportion of women in these categories are to be found in large cities, followed by small cities and towns, and finally rural areas. In NFHS-3, 32% of the women in capital or large cities were overweight at BMI $\geq 23$ kg/m$^3$, compared to 30% in small cities, 28% in towns, and 15% in rural areas. Obesity was measured in 8% of women in large cities, followed by 6% in small cities, 4% in towns, and 2% in rural areas. These comparisons are even more stark if the Indian Overweight benchmark is used instead of the global cut-off; 40% of women in large cities are overweight or obese, and while smaller shares are found in the medium sized cities and town, more than a third of women in these localities are also overweight; the proportions of rural women in this category is about half as much. Data from NFHS-2 is not presented here due to the absence of city size classifications.

Of the slum dwellers sampled in the eight selected cities in NFHS-3, those meeting the interviewer team-designated or census-based slum definition criteria were included in the analysis. There were 10,982 slum dwelling women and 8,741 non-slum dwelling women in this sample. With regard to the slum sample from eight cities in NFHS-3, women in slums were not as obese as women in non-slum urban areas but they did show some evidence of the ‘double burden’ of underweight and overweight (Figure 4). In slums, 22% of the women were severely or moderately thin while 32% were overweight and 8% obese. Among non-slum women, there were only slightly greater proportions of overweight (36%) and obese (9%) women but fewer thin women (18%). In other words, and noteworthy, slum dwellers are more likely than other women to be underweight (and presumably malnourished) than other urban women, but living in a
slum does not prevent women from becoming overweight.

The last bivariate description we consider before a multivariate analysis is age structure. Stratifying on place of residence for BMI outcome by age shows that BMI increases with age much more so in urban areas and especially in the four mega-cities of Chennai, Delhi, Kolkata, and Mumbai (Figure 5). In each survey, younger urban women had lower BMI than their rural counterparts but by age 20, urban women gain BMI much more than rural women. By age 30, women living in the four mega cities had an average BMI of 23 kg/m$^3$ or above while women in all urban areas (including the four megacities) reached overweight by age 38, on average, in NFHS-2 and by age 35 in NFHS-3. At all post-adolescence ages and in all settings, BMI is higher among women in the more recent survey round.

These two pieces of evidence suggest that this issue may be a fast evolving one for women in urban India. We specifically refer to women here because a bivariate analysis comparing men and women suggests that increase in weight gain is much more pronounced among women than men (Figure 6). This finding will require further analysis of the male sample, controlling for socioeconomic status, lifestyle and gender-specific risk factors and cultural norms. Smoking, for example, is much more prevalent among both urban and rural men than women, and may be associated with lower rates of overweight in men.

**Multivariate Analysis**

To further explore our bivariate findings for BMI and place, we modeled several known confounders of weight gain among women, including: age, education, parity, breastfeeding, smoking, occupation, standard of living, and wealth score. Age,
education, wealth, and parity were included as continuous variables while breastfeeding, smoking, occupation, and standard of living were categorical. Occupation was recoded to three categories to reflect potential physical strain: agricultural, laborer, and clerical/professional. Standard of living was included in both surveys and a more refined measure of socioeconomic status, the wealth score, was also available and used for NFHS-3. Both measures were based on a weighted combination of household living conditions and assets. Standard of living was measured as being low, medium or high, while wealth was included as a raw score.

We estimated weighted, multivariate, linear regression models to assess the independent effect of place of residence on BMI and how the magnitude of this effect changed after controlling for the covariates. We added in an effect for the interaction between urban residence and age as well as urban residence and wealth. We also estimated multivariate, logistic regression models for Indian overweight or obese (BMI ≥ 23) and underweight (BMI < 18.5) outcomes as well as multinomial logistic regression models to compare the effect of residence and urban-age interaction on BMI for Indian overweight or obese and underweight compared to normal weight. All models accounted for clustering at the PSU level (rural) or CEB level (urban).

In both surveys, predicted BMI was positively correlated with age, education, being a non-smoker, high standard of living/wealth (Table 2). The interaction between wealth and urban residence was not statistically significant suggesting that while wealth increases BMI, its affect is equal in urban and rural areas (result not shown). The interaction between urban residence and age was positively associated with BMI—importantly, urban residence doubles the effect of age on BMI. All else being equal,
urban women had about 0.10 point higher BMI per year of age than rural women in each survey year. This was in addition to a similar gain just due to age alone. In contrast, BMI was negatively associated with higher parity, breastfeeding, low standard of living, and working in agriculture or manual labor, all else being equal and conforming to a priori expectations. Having a high standard of living or greater wealth as well as the effect of urban residence on age had the largest effect on BMI but as noted, the magnitude of the urban interaction with wealth was quite small (results not shown).

Multinomial predicted probabilities for weight class support the interaction between age and urban residence for increased BMI (Figure 7). Other things being equal, women in urban areas have a higher probability of being overweight rather than underweight at age 26 while women in rural areas only experience this crossover at age 45, which points to the vast difference in risk factors among urban and rural dwellers in a poor country like India. In urban areas however, place clearly accelerates the effect of aging by putting women at risk of overweight at a very young age. Multinomial logistic regression results confirm the above finding (results not shown). Additionally, women in slums were more likely to be overweight and not likely to be underweight, highlighting the complexity of slum life and its relationship to urban exposures. Women in slums, for example, could be poor but still have access to cheap, high fat foods and engage in much less physical activity than agricultural women in rural areas.

**Discussion**

We looked at the effect of urban residence on overweight at the WHO-recommended cut-off of 23kg/m² for Indian women ages 15-49 years across two rounds of the Indian demographic health surveys spanning eight years. The effect of urban
residence on BMI is consistent across both surveys: women who live in urban areas are more likely to be overweight and obese than women who live in rural areas, holding equal individual level factors such as education, parity, age, and socioeconomic status. Spatial clustering at the district level is also present in the proportion of overweight and obese women. This pattern is strongly associated with the level of urbanization. On a linear scale, the effect of urban residence doubles the effect of aging on BMI, while the effect of rural residence has no additional impact on raising BMI beyond the expected effect of aging, i.e. women become overweight in later reproductive years. Women in urban areas also have a higher probability of being overweight than underweight nearly 20 years earlier than women in rural areas, suggesting that urban residence is an important modifier of the association between aging and BMI gain.

Indian women’s increase in overweight and obesity has been associated with higher socioeconomic status at every age. According to the socioeconomic indicators available in the Indian NFHS data, urban women are wealthier than rural women and controlling for place of residence may mask the independent effect of place on BMI. Our finding that living in urban areas leads to more weight gain at much earlier ages than living in rural areas goes beyond the expected effect due to education or socioeconomic status alone, both of which are also higher in urban areas. Unmeasured factors regarding changes in lifestyle due to the changing urban environment clearly increase BMI among urban women when compared to rural women. Rural women, even those who are secluded, may be involved in physical agricultural activities, but secluded urban women may have disproportionately few opportunities for physical activity. Future studies
should aim to identify behavioral mechanisms as well as features of urban place that may contribute to this trend.

Furthermore, it is notable that there were still considerable proportions of underweight women in urban areas in both surveys, with an increase between NFHS-2 and NFHS-3. This is alarming because it suggests that cities in India may experience a double burden of malnutrition (both under and over-nutrition). Without a direct indication of physical activity, it becomes more difficult to interpret the effect of the urban environment, as income or socioeconomic status can be related to food consumption (both in quantity and quality) or it may reflect physical activity. We attempted to proxy this through occupation and found results in the expected direction – that more laborious work led to decreases in BMI at every age. However, given that a majority of the sample reported being a homemaker, it is not possible to generalize these findings. We assume that wealthier women are not physically active but there may be an income threshold beyond which women choose to and can afford to engage in regular exercise.

There could be additional neighborhood level inequities if poor people live alongside the wealthier classes in mixed neighborhoods as has been suggested in a review of over 80 DHS surveys. Richer women in mixed neighborhoods may be at risk from the availability of higher-fat, western style fast foods combined with lower rates of exercise while poor women could be at greater risk of malnutrition from low wages and poor availability of affordable food. The motivation for this study was to disentangle the effects of the degrees of urbanization underway in India, on weight status, especially on going over normal weight status. While socioeconomic status has a large effect on gain
in BMI, this is not the complete picture as clearly, unmeasured factors in the urban environment also contribute to BMI gain as women get older. This was certainly suggested in our finding of the likelihood of being overweight and obese in urban slum as well. Therefore, future studies of nutrition in India’s urban population must consider inclusion of higher level characteristics of city life.

The strengths of our study are that we look at large datasets across two national surveys with reliable and spatially-specific (district-level) measures of BMI during a period of extensive economic growth and urban change in India. Therefore, we are able to capture an urban effect that had not yet extended into rural areas of the country at the time of the surveys. Our study identifies a strong association of BMI increase with a simple risk factor, age, among urban women. This finding proves useful to help focus public health policy in India. However, the persistent problem of undernutrition in urban areas needs to be addressed by municipal public health systems.

A limitation of this study is that we are not able to consider any specific urban factors that may affect BMI outcome due to de-identification of data beyond the urban-rural distinction. Although DHS datasets include a variable for city size, these general definitions are based on population size and do not convey information about the specific features of their urban environments, including those relating to access to physical activity, exercise and diet. A lack of comparable definitions of urban and rural as well as the differences in urban environment has been noted as a common limitation across similar studies. Further, the spatial process of urbanization, especially outward spatial growth (or sprawl) of cities, could be an impediment to adequate coverage of urban public health services. This study does not present information on the spatial
aspect of urban growth and its potential impact on BMI outcome and is limited by holding the physical and social environment as a static condition. However, we do find spatial clustering of overweight and obesity as has been suggested in other settings as well.\textsuperscript{39,40} Further research is warranted to better understand any spatial effect of the economic, environmental, and social drivers of obesity that restrict healthy behavior among individuals.\textsuperscript{41}

Research is also needed to determine the replicability of these results among men in the same setting, as well as across the urban-rural gradient in other developing countries to inform the implications for urban health planning in India and elsewhere. Datasets with geocoded urban locations and anthropometry measures would be much more ideal for identifying intra-urban differences in BMI by specific features of the local environment. Research into the framing of obesity as a public health concern by municipal public health officials is also needed in light of the profusion of obesity-related myths and presumptions.\textsuperscript{42} Finally, policy environments tailored to the urban setting, with particular attention to city size differences and city growth can shape preventive individual and environmental factors that reduce obesity.\textsuperscript{43}
Figure 1. District-level proportions overweight or obese, and percent urban population, India.

Statistics:
- Global Moran’s I (of proportions overweight/obese): 0.41 (p=0.000)
- Pearson’s r (of proportions overweight/obese and urban): 0.446 (p=0.000)

Source: NSFH-3 (2005-6) and Census of India (2001). Grey indicates districts omitted from the survey.

NB: Survey sampling design is not intended to be representative at the district level, but are nevertheless illustrative.
Figure 2: Proportion in Weight Category by Residence: NFHS-2 (1998-99) & NFHS-3 (2005-06)

NFHS 3
- Rural
- Urban
- Selected Cities

NFHS 2
- Rural
- Urban
- Selected Cities

Figure 3: Proportion in Weight Category by City Size: NFHS-3 (2005-06)

Countryside
- Town
- Small City
- Large City/Capital

Legend:
- Severe Thinness
- Mild/Mod Thinness
- Normal
- Asian Overweight
- Global Overweight
- Obese
Figure 4: Proportion in Weight Category by Slum Residence: NFHS-3 (2005-06)
Figure 5: Mean BMI by Age among Indian Women: NFHS-2 (1998-99) & NFHS-3 (2005-06)

In the legend: (3) refers to NFHS-3 and (2) refers to NFHS-2. Four cities include: Chennai, Delhi, Kolkata, and Mumbai.
Figure 6: Mean BMI by Age among Indian Women and Men: NFHS-3 (2005-06)

Mean BMI (kg/m²)

Age (years)

Indian Overweight

Urban-F

Urban - M

Rural - F

Rural - M

Four Cities - F

Four Cities - M
Figure 7: Predicted Probability for Weight Class by Age among Women 15-49 years (NFHS-3)

*U*: urban, *R*: rural

NB: Circles indicate the age at which the probability of being overweight or obese exceeds the probability of being underweight, on average, among urban (solid) and rural (dashed) women.
Table 1: Sample characteristics by place of residence

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Table 2: OLS Regression Coefficients for BMI on Selected Covariates
(Unless noted, all coefficients are significant at p = 0.000)

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<td>8%</td>
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*p > 0.05  **p ≤ 0.01
References


11. Kelly SA, Melnyk BM. Systematic Review of Multicomponent Interventions with Overweight Middle Adolescents: Implications for Clinical Practice and


