The Effect of Rural-Urban Migration on BMI in Thailand

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Abstract

As countries undergo the "nutrition transition", reduced physical activity and increased consumption of saturated fats and sugars are growing concerns. Recent research suggests that migration to an urban area can play a role in these behaviors: rural to urban migration is associated with increased inactivity, consumption of fats and sugars, and risk of obesity and diabetes. Limitations exist, however, as most studies examining urbanization, migration and obesity have been limited to associations via cross-sectional data. We address this limitation by using data from Thailand to examine (1) potential selection of individuals with relatively higher or lower BMI into migration streams, and (2) the effect of rural to urban migration on BMI. The longitudinal nature of the data enables us to compare rural-urban migrants with non-migrant rural and urban residents; and to use fixed effects regression, thereby controlling for important unobserved time-invariant characteristics. We find a significant relationship between BMI and migration, which is explained by the selection of those with lower BMI into migration streams. We do not find any effect of migration on BMI for Thai young adults.

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Introduction

The rapid urbanization of many developing countries has important implications for the effect of migration on individual health. Research suggests that rural-to-urban migration is associated with changes in health-related behaviors, as migrants eventually adopt behaviors that are common among residents of their destination. As developing countries go through the “nutrition transition”, risk behaviors of particular concern are reduced physical activity and increased consumption of saturated fats and sugars (Popkin & Gordon-Larsen 2004; Mayosi et al. 2009). Such behaviors are typically more common in urban areas: recent research has found that rural-to-urban migration is associated with increased inactivity and consumption of fats and sugars (Torun et al. 2002), which likely explains increased risk among migrants of obesity and diabetes (Ebrahim et al. 2010; Sobngwi et al. 2004), high blood pressure (Sobngwi et al. 2004), and general cardiovascular risk (Sobngwi et al. 2004; Torun et al. 2002).

Two important caveats on the relationship between migration and obesity are evident in the literature. First, increased health risks are not universal for all migrants and urban areas in developing countries. In some cases urban residents have not shown greater risk of diabetes, obesity or elevated blood pressure (e.g. Ntandou et al. 2009; Unwin et al. 2006). Thus, urban areas do not always imply greater risk. Secondly, primarily due to the reliance on cross-sectional data, much of the research on the relationship between migration or urban residence and obesity has been limited to associations, rather than identifying effects (this limitation is described in Mbanya et al. 2010). Thus, in many cases it has not been possible to distinguish between selection and effect: does rural-to-urban migration cause changes in diet that lead to increased BMI, or are individuals with greater BMI more likely to migrate?

We use longitudinal panel data that includes measures of height and weight in 2005 and 2007 for Thai young adults. This longitudinal design is an important advantage over the cross-sectional approaches of most previous studies, as it enables us to (1) measure change in BMI over time, and (2) examine pathways that explain differences in BMI between migrants and non-migrants, and (3) use analytic approaches that control for unobserved time-invariant characteristics that may otherwise produce biased estimates of relevant relationships (fixed effects regression). A key feature of these data is a sub-sample of internal migrants who moved to urban areas between 2005 and 2007.

To examine the relationship between BMI and rural-urban migration in Thailand, we proceed in the following steps. First, we determine whether there are differences in BMI between migrants and non-migrants. Next, we evaluate two mechanisms that could produce differences in BMI between migrants and non-migrants. We begin with an examination of migrant selection. Using longitudinal data, we examine whether individuals with higher BMI are more likely to migrate from rural to urban Thailand. Then we move to the effect of migration on BMI, in which we use fixed effects regression to assess the impact of migration on BMI.

Setting

Thailand is an advantageous setting to study urbanization, migration, and BMI-related characteristics, as it has recently experienced important changes in each. Recent research has examined dietary changes, rates of physical activity, and prevalence of obesity in Thailand. This research shows an increase in obesity prevalence (Aekplakorn & Mo-suwan 2009), which has coincided with declining rates of physical activity (Banks et al. 2011) and changes in diet (Kosulwat 2002).

Thailand has also experienced rapid urbanization in recent decades. As of 2012, 34% of the population resides in urban areas, and the United Nations projects that this figure will reach 56% by 2050 (UN online database, 2012). The National Migration Survey of Thailand (NMS), conducted in 1992, shows high levels of internal movement of the Thai population. Approximately one-fourth of the population were migrants within the five-year period before the NMS and 15 percent had moved in the two-year period before the NMS (Chamratrithirong et al. 1995). NMS data indicate that temporary migration, both seasonal and circular, constitutes approximately one-third of all internal migration in Thailand. Most of the temporary migration is directed towards Bangkok and surrounding areas in the Central region, and originates from the Northeast. Inflows occur during the dry season and outflows occur during the wet season (Guest et al 1994; Richter et al. 1997). Longer term migrants, compared to temporary migrants, are more likely to be younger, female and better educated (Guest et al. 1994).

Data

The Health Impacts of Rural to Urban Migration in Thailand Study

We use data from the Health Impacts of Rural to Urban Migration (HIRUM) Study in Thailand, a longitudinal study based upon a repeated census of 100 villages in Kanchanaburi province of Thailand. The HIRUM waves of 2005 and 2007 extend the Kanchanaburi Demographic Surveillance Site (KDSS), which completed five earlier rounds of data collection beginning in 2000.

The first round of HIRUM took place in Kanchanaburi province during the fall of 2005. The target population was individuals age 15-29. During the fall of 2007, HIRUM re-interviewed all original respondents who remained in one of the original study communities, along with a sub-sample of individuals who had migrated to the provincial capital (Amphur Muang, or the "city district"), the other urban area within the province (Amphur Tamaka), or metropolitan Bangkok between the two waves of data collection in 2005 and 2007.

HIRUM interviewed a total of 6,967 respondents in 2005, of whom 4,001 were re-interviewed in 2007. Among these 4,001 interviewed in both waves, 3,952 individuals have valid information on all variables of interest in 2005 and 2007.[2]

The HIRUM data are well-suited to address our research questions of interest. These data include a broad range of measures required for our analyses, including measures of height and weight to calculate BMI. HIRUM also includes measures of employment, household residence, and other background characteristics that serve as useful control variables. The longitudinal HIRUM sample includes 399 migrants (of the 3,952 above) who were re-interviewed at urban destinations in 2007 to compare with Kanchanaburi residents who did not migrate between 2005 and 2007.

Variables of Interest

[2] The remaining 49 individuals interviewed in 2005 and 2007 had either missing or invalid values for variables used in this analysis.

We focus on two variables of interest in this research. First, we use height and weight data collected in 2005 and 2007 to calculate a continuous measure of BMI for all participants. Our independent variable of interest is migration status, which is categorized as "current rural-to-urban migrant" for individuals who were interviewed in Kanchanaburi province in 2005 and in one of the urban destinations in 2007. Individuals who were interviewed in one of the 100 KDSS villages in both waves are categorized as non-migrants.[3] We also have measures of migration experience prior to 2005. We also control for behaviors and characteristics that are likely to affect both migration and the outcome measure, including age, level of education, marital status, and an asset-based measure of economic status calculated using principal components analysis (Filmer and Pritchett 2001).[4,5]

Methods

We conduct our analysis in the following steps. As described above, we are interested in (1) whether there are significant differences in BMI between migrants and non-migrants, (2) if these differences are due to the selection of those with systematically different BMI into migration, and (3) the effect of migration on BMI. To address the first question, we examine whether there are differences in BMI between migrants and non-migrants in 2005 and 2007 by comparing these groups using t-tests.

Next, we examine whether migration selects individuals with different BMIs from non-migrants. To do so, we use data from 2005 and identify individuals who subsequently moved to an urban area by 2007, and we compare BMI at baseline (*i.e.*, before migration) between these future migrants and the non-migrants. We run two sets of regressions, each with BMI as the dependent variable. In the first set, migration status between 2005 and 2007 is the lone independent variable, which determines the basic association between migration and BMI. Next, we add several characteristics that may differ by migration status and may also affect BMI, including age, level of education, household wealth, marital status, and previous migration. We run regressions separately for men and women.

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[3] As shown in Table 1, some of these "non-migrants" have moved before 2005.

[4] The asset indicator is a principal components analysis measure of 12 household amenities, including a TV, VCR, satellite, stereo, radio, cell phone, telephone, computer, generator, air conditioning, refrigerator, and a vehicle.

[5] Other variables such as household composition and employment we tested in our analysis, but were not significantly associated with outcomes of interest and therefore excluded.

In the third step, we examine the effect of migration on BMI. To do so, we run fixed effects regression models in which the dependent variable is BMI. As with the above, the independent variable is migration status between 2005 and 2007, and we control for background characteristics such as education, wealth, and marital status. We run separate models for men and women. We run the fixed effects regressions in two steps, as above, in which the first step includes only migration status and survey year, and the second includes background characteristics as control variables.

The use of fixed effects is appealing here, as this method controls for unobserved time-invariant characteristics that could affect the relationship between migration and BMI. This is particularly important in research on migration, since research has demonstrated that migrants differ from non-migrants in many important characteristics, some of which are unmeasured but may be related to health behaviors (such as risk-aversion, genetic composition).

Results

Background characteristics for HIRUM men and women in 2005 and 2007 are presented in Table 1 and Figure 1. Table 1 shows that approximately 9-11% of our sample migrated to an urban area by 2007. The average ages are about the same between men and women (approximately 22 years in 2005). Larger percentages of men had secondary education (55.3%, compared to 50.6% of women), and men also had greater wealth. Differences in marital status are also evident, in which men were more likely to be never married in both 2005 and 2007 and women more likely to be currently married or divorced/separated.

Relatively few HIRUM respondents were obese. Figure 1 shows the distribution of BMI for the HIRUM sample. Overall, the vast majority of Thai young adults were at normal or below normal weight in 2005: approximately 86% of men and 83% of women fall into the first two categories. Of the 14% and 17% that were above normal weight, most were overweight (BMI between 25 and 29), as opposed to obese (BMI > 30).

Before turning to the multivariate regression results, we examine levels and trajectories of BMI for HIRUM men and women between 2005 and 2007, and compare between migrants and non-migrants. BMI levels (and changes) appear in Figure 2 (for men) and 3 (women). Not surprisingly, both migrant and non-migrant men and women experienced increases in BMI over these two years. There are, however, differences by sex in the relationship between BMI and migration status. Whereas there are no significant differences in t-tests for BMI between male migrants and non-migrants in 2005 or 2007, female migrants had significantly lower BMI than non-migrants in both years.

Moving to next stage of analysis, it is apparent that migration selects individuals with lower BMI than non-migrants. As shown in Table 2, women who migrated between 2005 and 2007 had significantly lower BMI in 2005 than those who did not migrate. This significant difference persists even after controlling for other factors that are potentially associated with both BMI and migration. Of these control variables, age, education and marital status are significantly associated with BMI in 2005.

Interestingly, results are different for men: men who migrate between 2005 and 2007 do not have significantly different BMIs than non-migrant men. Aside from this, many of the same covariates are significantly associated with BMI in 2005 for men (age, education, and marital status), although the exact relationship with BMI differs: greater education is associated with higher BMI and currently-married status is associated with lower BMI for men; but the opposite relationships exist among HIRUM women.

Finally, there appears to be minimal effect of migration on BMI, as shown in the fixed effects regression results (Table 3). For men, marital status and survey wave are positively associated with BMI, but migration status is not. In contrast, when controlling only for survey wave, migration status is associated with lower BMI for women; but the coefficient for migration status is no longer significant when the other control variables (education, wealth, marital status) are added to the fixed effects models for women.

Discussion

As countries like Thailand continue to economically develop, urbanize, and proceed through the "nutrition transition", it is important to examine the effect of migration on health outcomes like BMI. It is not surprising that we find differences in BMI between migrants and non-migrants. However, the fact that female migrants have significantly lower BMI than non-migrants is perhaps unexpected. Interestingly, we find very limited evidence that migration causes changes in BMI for Thai young adults. The only evidence of a relationship is for women, and it disappears after controlling for other characteristics that are associated with migration in Thailand. This suggests that migration itself does not affect BMI, but characteristics that differ between migrants and non-migrants are instead the important influences. The relationship between BMI and migration in Thailand seems to be best characterized by the selection of Thai women of lower BMI into migration streams.

This research contributes to the literature on migration and BMI in several ways. First, and most importantly, the longitudinal nature of the HIRUM data enable us to distinguish between the effect of migration and migrant selection in terms of BMI, which is an improvement over previous cross-sectional approaches. In addition, the use of fixed effects is important for studies of migrants, as they often differ from non-migrants in both observed and unobserved characteristics. That said, some limitations of fixed effects are important to consider. Fixed effects controls only for time-invariant unobserved characteristics, and any time-varying unobserved characteristic presents a potential bias for the relationships of interest. Fixed effects also includes only individuals with measures in both 2005 and 2007; and thus an analysis of potential attrition bias is an important next step for this research.

We intend to improve our approach in several ways. First, we plan to include the third wave of longitudinal HIRUM data (collected in 2009) to examine whether the differences in BMI between migrants and non-migrants (or lack thereof, for men) persisted after longer durations since migration. Second, we intend to further refine the analysis to include two additional populations of interest: a comparison sample of permanent urban residents (data in 2007 and 2009), and a group of migrants who moved to an urban area and later returned to rural origins. Finally, we plan to expand our analysis beyond just BMI to also examine the relationship between migration and diet and exercise (HIRUM data includes several measures of each).

Figures and Tables

Table 1: Background Characteristics, 2005 and 2007 HIRUM Men and Women

	Men		Women	
	2005	**2007**	**2005**	**2007**
Rural-urban migration by 2007	----	11.2%	----	9.3%
Mean age	21.5	23.5	22.1	24.1
Level of education				
No edu/primary/religious school	35.4%	32.6%	39.0%	36.8%
Secondary	55.3%	51.6%	50.6%	47.0%
University/post-secondary	9.3%	15.8%	10.4%	16.2%
Wealth	0.27	0.15	0.09	0.07
Marital status				
Never married	62.5%	55.2%	39.0%	33.7%
Currently married	36.2%	42.5%	58.2%	62.9%
Divorced/separated	1.3%	2.3%	2.8%	3.4%
Migrated prior to 2005	23.9%	----	30.7%	----
N=	1654		2297	

Figure 1: 2005 BMI Distribution, HIRUM Men and Women

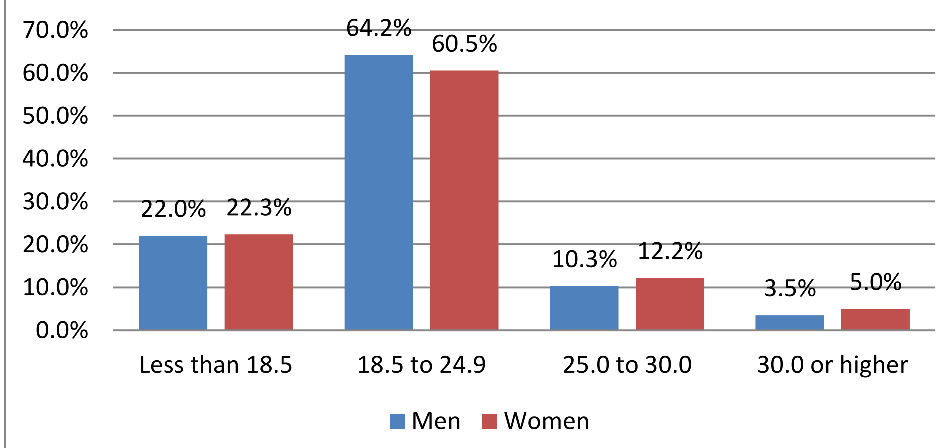
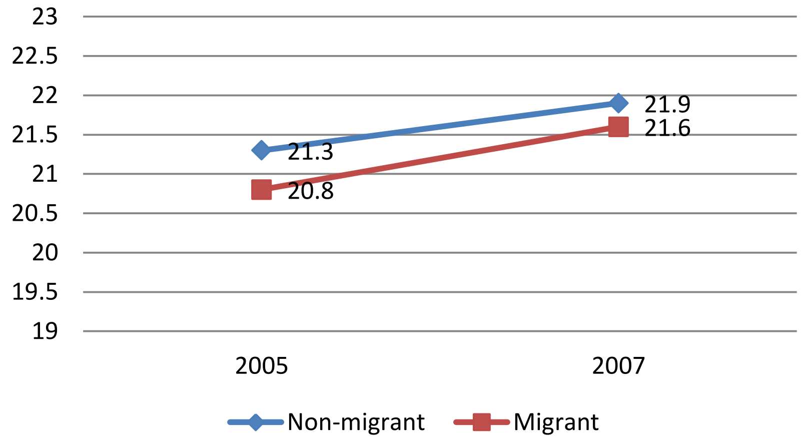
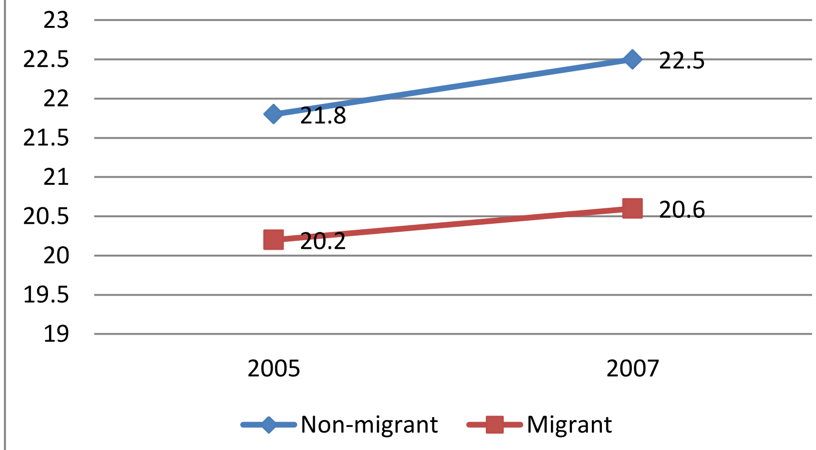


Figure 2: BMI in 2005 and 2007, Migrants and Non-Migrants, HIRUM Men



Note: Difference in BMI between male migrants and non-migrants is not significant (at p<0.10 level) in 2005 or 2007.

Figure 3: BMI in 2005 and 2007, Migrants and Non-Migrants, HIRUM Women



Note: Difference in BMI between female migrants and non-migrants is significant (at p<0.001 level) in 2005 and 2007.

Table 2: Migration and BMI Selection: The Relationship Between 2005 BMI and Migration Between 2005 and 2007

	Men				Women			
	Coef.	**SE**	**Coef.**	**SE**	**Coef.**	**SE**	**Coef.**	**SE**
Rural-urban migration by 2007	**-0.47**	**0.31**	**-0.20**	**0.30**	**-1.54*** **	**0.30**	**-0.70** **	**0.30**
2005 Age			0.24***	0.03			0.17***	0.02
2005 Level of education								
No edu/primary/religious school (ref)			----	----			----	----
Secondary			0.10	0.22			-0.37*	0.21
University/post-secondary			0.81**	0.38			-1.92***	0.34
2005 Wealth			0.30***	0.06			0.14**	0.06
2005 Marital status								
Never married (ref)			----	----			----	----
Currently married			-0.58**	0.25			0.52**	0.25
Divorced/separated			-1.17	0.83			0.45	0.54
Migrated prior to 2005			0.04	0.21			0.30	0.20
N=	1654				2297			

Notes: *p≤ 0.10 **p ≤ 0.05; ***p ≤ 0.01.

Table 3: Fixed Effects Regression Results for BMI, 2005 and 2007 HIRUM Men and Women

	Men				Women			
	Coef.	**SE**	**Coef.**	**SE**	**Coef.**	**SE**	**Coef.**	**SE**
Rural-urban migration by 2007	**0.14**	**0.14**	**0.16**	**0.16**	**-0.37****	**0.15**	**-0.25**	**0.16**
Level of education								
No edu/primary/religious school (ref)			---	---			---	---
Secondary			-0.03	0.21			-0.35	0.24
University/post-secondary			0.09	0.28			-0.58*	0.30
Wealth			0.04	0.04			0.07**	0.04
Marital status								
Never married (ref)			---	---			---	---
Currently married			0.43**	0.17			0.87***	0.19
Divorced/separated			0.18	0.32			0.61**	0.29
Year (2007)	0.66***	0.05	0.63***	0.05	0.74***	0.04	0.70***	0.05
N=	1654				2297			

Notes: *p≤ 0.10 **p ≤ 0.05; ***p ≤ 0.01.

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