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U.S. Migration, Translocality, and the Acceleration of the Nutrition Transition in Mexico

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Abstract

Migrant flows are generally accompanied by extensive social, economic, and cultural links between origins and destinations, transforming the former's community life, livelihoods, and local practices. Previous studies have found a positive association between these translocal ties and better child health and nutrition. We contend that focusing on children only provides a partial view of a larger process affecting community health, accelerating the nutrition transition in particular. We use a Mexican nationally-representative survey with socioeconomic, anthropometric, and biomarker measures, matched to municipal-level migration intensity and marginalization measures from the Mexican 2000 Census to study the association between adult body mass and community migration intensity. Our findings from multi-level models suggest a significant and positive relationship between community-level migration intensity and the individual risk of being overweight and obese, with significant differences by gender and with remittance intensity playing a preponderant role.

Keywords

international migration; obesity; nutrition transition; Mexico; translocality

Translocal ties originating from international migration processes transform sending areas in profound ways (Jones 1998; Levitt 1998). Health is no exception. Previous studies have focused on the positive effects of migration on infant and child health (Kana'iaupuni and Donato 1999; Frank and Hummer 2002). Migration appears to be beneficial in these places primarily as the money transferred or brought back by migrants, generally known as remittances, help ameliorate the poverty conditions responsible for poor health and nutrition. However, a focus on infant and child health illustrates only one side of what we contend is a larger process in which the pecuniary and nonpecuniary exchanges associated with migration may be influencing community health by accelerating the nutrition transition in

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origin communities. The nutrition transition refers to an increased availability of high fatty and processed foods and altered home cooking practices (Popkin 2001).

Given that these changes translate into significant weight gains, the objective of this study is to understand if the exchanges that are part of the international migration process are associated with increases in adult body mass index (BMI). We use multi-level techniques and nationally-representative anthropometric data from Mexico to study whether the probability that an adult is overweight or obese is associated with the migration intensity of his/her municipality of residence.

We consider two mechanisms for this process: (1) the money remitted and brought back by migrants (Jones 1998) may allow households to afford a higher caloric intake, and (2) the transnational/translocal circulation of people and ideas (Levitt 1998) may change food, portion, and body size preferences. This second set of processes may be associated with an overall decline in health and a higher body mass index due to dietary and lifestyle changes adopted during immigrant tenure in the U.S. (Akresh 2007), a particularly problematic trend given the health problems known to be associated with obesity (Monteverde et al. 2010).

We also hypothesize that this acceleration should occur more rapidly in groups and places in which the nutrition transition is in its earlier stages. Given the rapid, but gendered and spatially uneven, pace of the epidemiological and nutrition transitions across Mexico, with women and people in large cities experiencing the transition earlier than men and rural residents (Rivera et al. 2002), we expect the relationship between migration and obesity to be especially strong among these latter groups. As such, our research questions are:

1. Is the migration intensity of a municipality (measured as the level of remittances and the level of return migration) associated with an increased likelihood of overweight or obesity, net of other factors?
2. Does the association between overweight/obesity and municipality level of remittances persist after controlling for the municipality level of return migration?
3. Do the relationships tested in (1) and (2) differ between men and women, and between people living in less and more populated areas?

Our findings support a general relationship between the level of migration of a community and the likelihood of overweight/obesity, but only partially support some of our more specific assertions. Overweight and obesity are indeed higher for people in places with higher migration intensities (net of a series of relevant controls). Moreover, translocal links associated with U.S. migration are strongly correlated with male obesity, consistent with the idea that these links may accelerate the nutrition transition for individuals who would otherwise experience it more slowly.

This association, however, seems to be mostly a function of the direct and indirect income effects of remittance intensity rather than of migrant return. These findings suggest that higher BMIs in migrant-sending communities are due mostly to increased caloric intake allowed by reduced budget constraints, or to decreased caloric expense. The higher relevance of remittances relative to return migration also suggests that the acceleration of the transition is not due to the fact that places with high migration intensity have a different set of preferences in terms of food or body size compared to similar places with lower migration intensities; nor it is explained by the fact that return migrants themselves have higher BMIs after experiencing the aforementioned dietary changes during their tenure in the United States. Lastly, we find significant differences in the effect of migration on overweight/obesity across less and more urban spaces, but only before controlling for the socioeconomic status of a community. We can thus only cautiously conclude that the acceleration of the

nutrition transition is quicker in less urban areas *provided* that these same migration-related translocal links were an important determinant of the socioeconomic status of those communities.

MIGRATION AND HEALTH IN SENDING COMMUNITIES

Several studies have demonstrated that remittance receipt and/or migration experience at the household and community scales are significantly associated with lower odds of low birth weight and infant mortality (Kana'iaupuni and Donato 1999; Frank and Hummer 2002; Frank 2005; Hildebrandt et al. 2005; McKenzie 2006; Hamilton, Villarreal, and Hummer 2009). However, by focusing on child health outcomes, these studies have provided only a partial view of the mechanisms through which migration may influence community health. We posit that several types of exchanges associated with international migration may accelerate the nutrition transition in sending communities in Mexico not only by improving child nutrition but also by increasing adult body mass index (BMI), another typical byproduct of this transition (Popkin 2001). We describe two categories of mechanisms producing these results.

Economic Mechanisms

Remittances from migration have a direct income effect on the households receiving them, lowering food deprivation and thus increasing total caloric consumption. In rural areas, this additional income may also be used to purchase equipment and tools that allow households to move from labor- to capital-intensive agricultural methods (Taylor and Lopez-Feldman 2010). As these flows generate nontrivial multiplicative effects in local economies (Taylor et al. 1996), remittances may also have indirect income effects, influencing the nutrition of nonmigrant households as well. A community-wide measure of remittance rates, like the one we use in our analyses, would capture both direct and indirect effects.

Noneconomic Mechanisms

Serving sizes and food preferences may also be altered by migration. Translocal, transnational ties may help diffuse nutritional norms and eating habits prevalent in the U.S., where fruit and vegetable consumption has decreased while intake of refined sugars has been on the rise (Levi et al. 2009). Immigrants generally adopt these habits, especially as their tenure in the host society increases (Akresh 2007), resulting in increased overweight and obesity (Antecol and Bedard 2006; Akresh 2007).

As migrants bring these practices back to their communities of origin, they may subsequently influence the lifestyles and preferences of nonmigrants (Levitt 1998). One of the previously mentioned studies on child health has shown evidence suggesting that migration sociocultural aspects of community life in sending areas (such as health knowledge), which in turn lower the risk of poor infant health outcomes (Hamilton, Villarreal, and Hummer 2009). Likewise, ideas about portion size, food preferences, and body type could be different in communities with high levels of return migration over and beyond income effects. We thus hypothesize that these altered preferences and practices would be captured by a positive association between measures of return migration at a larger scale, such as the municipality, and body mass (even after controlling for remittance intensity).

The Nutrition Transition in Mexico: Gendered Patterns and Variation across Place

The nutrition transition is well under way in Mexico (Rivera et al. 2002; Rivera et al. 2004; Barquera et al. 2009) and has maintained a rapid pace in the past decade. As a result, Mexico has one of the highest levels of obesity in the world, at 32 percent (WHO 2009), 37

percent for women and 24 percent for men (Barquera et al. 2009). Not only is this level high and increasing at a rapid rate in recent years, but the excess mortality attributable to obesity is also higher in Mexico than in the United States (Monteverde et al. 2010).

Although these changes are certainly occurring independently of the particular brand of translocal ties created by international migration, we assert that migration-related exchanges are *accelerating* the nutrition transition. This association should manifest as higher BMI levels in communities with more established migratory traditions. Furthermore, given the gendered and spatially uneven nature of the transition, we should expect this association to be particularly evident among groups that have traditionally experienced the transition more slowly, such as men and people living in rural areas (Rivera et al. 2002; Rivera et al. 2004).

Alternative Explanations: Development and Globalization-Related Changes

Health and nutrition conditions in a community could be influenced by other forms of translocal exchanges of ideas and norms about health, food, and body size not associated with the international migration process *per se*, but linked to the development and globalization processes believed to drive the nutrition and epidemiological transitions (Chaput and Tremblay 2009; Huneault, Mathieu, and Tremblay 2011). These processes could also be influencing international migration (Sassen 1988; Stark and Bloom 1985), thus potentially creating spurious relationships between community migration and health if one does not control for the level of development and globalization of a community. We take these impacts into account by controlling for local levels of development and foreign direct investment, the latter as a proxy for capital penetration processes (Sassen 1988; Massey and Espinosa 1997) in addition to other relevant correlates of health. Again, we do not argue that the influence of migration predates or is more relevant than broader development and globalization processes; our claim is that migration accelerates the transition, not that it initiates it.

DATA AND METHODS

We use data from the Mexican Health Survey (hereafter, ENSA, its Spanish acronym). The ENSA was conducted by the National Institute of Public Health between September 1999 and March 2000 and is a nationally representative, multistage sample of the Mexican population with a 97 percent participation rate. The data are representative at the state and urban/rural levels, yielding 45,756 households (Barquera et al. 2008). The sampling procedure began with the random selection of 14 counties in each state. Within each county, five basic geostatistical areas (analogous to a census tract) were selected. Seven households in three different blocks within each of these areas were randomly selected. One child, adolescent, and adult (aged 20 and over) were selected in each household (Barquera et al. 2007; Barquera et al. 2008; for more details, see Valespino et al. 2003).

We use data from the adult samples, which contain socioeconomic, health and anthropometric information on each respondent. Height and weight, measured in light clothing and without shoes (Valespino et al. 2007), were recorded to the nearest 5 mm and 0.1 kilogram, respectively (Sanchez-Viveros 2008). Overweight and obesity are categorized using BMI cutoffs created for adults 20 years old and older (<http://apps.nccd.cdc.gov/dnpabmi>.) BMIs that fall in the range between 25 and 29.9 kg/m² are categorized as overweight, and BMIs that are 30.0 kg/m² and above are categorized as obese. By these definitions, 39 percent of the sample is classified as overweight and 24 percent are obese (see Table 1). Approximately 7 percent of the adult sample was excluded because of missing or implausible values on the weight and height variables.

We matched the adult sample of the ENSA with municipality-level indices constructed using 2000 Mexican census data and published by the National Population Council (hereafter, CONAPO, see www.conapo.gob.mx.) While it is unlikely that the mechanisms through which translocal exchanges may affect health as laid out above operate at a higher scale than the municipal, it is more likely that they operate at a finer scale, for instance in an area composed by several dwellings and public places, bound by different types of inter-local relations and located within part of a locality (i.e., township, Fussell and Massey 2003) or spanning part of several localities. As such, the municipal scale and zoning used here should capture the average influence of translocal exchanges from migration on health from different communities plus spatial lags related to the influence of these on surrounding towns in the same municipality. Although greater flexibility in the spatial scale of our contextual information would be desirable to test for the robustness of our model specifications to potential scale and, especially, zoning biases (Kwan 2009), this is not possible as the survey only includes municipal identifiers and census measures (which come from a long form sample) are likewise only available for municipalities.

First, we included an index of migration-related patterns that came from the International Migration Supplement of the 2000 census. The migration index was constructed using the percentage of households in the municipality (1) receiving remittances, (2) with at least one member emigrating to the U.S. in 1995-1999, (3) with at least one member returning from the U.S. in 1995-1999, and (4) with at least one member emigrating to and returning from the U.S. in 1995-1999. This normalized index, with mean around zero and a standard deviation close to 1 (see Table 1), is the main measure we use in models shown below. We also present results using these measures separately, with a focus on remittance receipt and return migration in an attempt to distinguish income effects from those associated with the degree of transnational connections in the community.

We also control for various community-level socioeconomic characteristics to avoid confounding the impact of the migration intensity level with those of the development and globalization forces as discussed in the previous section. For this purpose, we use an index of marginalization from CONAPO, also based on 2000 census data and composed of the proportion of households in the municipality (1) with dirt floors, (2) without indoor plumbing or a toilet, (3) without electricity, (4) without access to piped water, and (5) with more than two people per room; as well as the proportion of adults in the municipality (6) who are illiterate, (7) who have not completed primary education, and (8) who earn less than twice the minimum wage. Finally, also at the *municipio* level, we include a measure of the proportion of the active labor force that is employed in the *maquiladora* sector (a factory run by a foreign company exporting virtually all of its production), our main measure of capital penetration and globalization.

We further include measures of the urbanization level of the community, which are particularly relevant for our third research objective. We classified households as more urban if their locality has more than 15,000 inhabitants. Localities are smaller units than municipalities and are generally used to classify the level of urbanization of a place in the Mexican context. Although rural localities are generally defined as those with less than 2,500 inhabitants, the 15,000 cutoff is the only classification available in the ENSA. To further consider the heterogeneity of communities below the cutoff in terms of their level of urbanization, we also control for the percent of the municipality's population living in localities with less than 2,500 inhabitants.

Given our use of data at both the individual and municipal levels and our interest in reliably estimating the effects and significance of cross-level interactions, we use hierarchical linear modeling (HLM) in our analysis. Our main approach is to assess the independent effect of

community-level migration intensity (and that of its different components) on an individual's risk of being (1) overweight and (2) obese. In addition to the variables described above, we include controls for socioeconomic characteristics at the individual and household levels, all of which are listed in Tables 2 and 3. All models were estimated using HLM 6.0.7.

FINDINGS

Tables 2 and 3 show results of our multilevel multinomial regression models predicting overweight and obesity (both relative to being underweight/normal) for women and men separately. We present four sets of models in each of the tables, each with a different migration indicator or set of migration indicators (all of them also include our full set of controls). In Model I, we include the global migration intensity index. Models II and III include the remittance intensity and circulation components entered separately, while Model IV includes both of them entered simultaneously.

Our results generally show a positive association between the municipal level of migration and the likelihood that an individual is classified as obese or—to a lesser extent—overweight. Looking at Model I in Tables 2 and 3, the coefficients of the migration intensity index are statistically significant and nontrivial in magnitude for obesity for both sexes, implying that women have 11.3 percent (i.e., $100 \cdot [\exp\{0.107\} - 1]$) higher odds of being obese and 10.0 percent (i.e. $100 \cdot [\exp\{0.095\} - 1]$) higher odds of being overweight for each unit change (i.e., a standard deviation) in the migration intensity index. The equivalent figure for obesity among men is more than two times higher than that of women at 26.5 percent (i.e. $100 \cdot [\exp\{0.235\} - 1]$). While these coefficients are substantial and significant after controlling for potential confounders such as our local measure of foreign investment, note that this measure, i.e., the percent of manufacturing workers in the municipality working in a *maquiladora*, is significantly and associated with obesity for both women and men.

The notion that migration may be accelerating the nutrition transition for men in particular is also reflected in the implied effects of our schooling variable. The education gradients for women in Table 2 imply that women with more schooling are less likely to be classified as overweight or obese, whereas the results in Table 3 imply that men with more schooling are *more* likely to be overweight and obese. As the correlation between obesity and education changes from positive to negative over the evolution of the nutrition transition (e.g., Smith and Goldman 2007), these results suggest that men have yet to experience many of these changes, an inference confirmed by the fact that male obesity levels are lower than those of females (see Table 1).

The association between BMI levels and the migration intensity index seems to be mostly explained by the additional income that migration generates and less by other types of translocal links related to it. Although both remittance intensity (Model II) and return migration (Model III) indicators are positively associated with the likelihood of obesity among men and overweight among women, the return migration indicator loses statistical significance when we add remittance intensity, which does not decrease in magnitude and retains almost most of its statistical power (see Model IV in Tables 2 and 3). For women, the odds of being classified as overweight or obese relative to underweight/normal rise by 9.5 and 16.0 percent when the municipality's remittance intensity increases by one standard deviation in the remittance indicator (i.e., ~4.8 percent). For men, again, these effects are only significant for obesity: for them, an additional standard deviation in municipal remittance intensity levels increases the odds of obesity by 26.5 percent. These results suggest that most of the association between the level of circular migration from a

municipality and BMI levels as shown in Model III is likely an artifact of the former's correlation with remittance levels. They also confirm the notion that migration more profoundly influences obesity than overweight for both men and women.ⁱ

In order to test whether the migration indicators are associated with a particularly dramatic acceleration of the nutrition transition in less urban places, Model I in Table 4 shows results of models similar to those of Tables 2 and 3 (showing women in Panel A and men in Panel B) while adding interactions between the level of urbanization of the locality in which the household is located and our migration intensity index. While these models include the same controls as Tables 2 and 3, for the sake of brevity, we report only the coefficients of the urbanization, migration, and marginalization variables along with the interactions. As the interactions are not significant for either men or women in the prediction of obesity or overweight, there is no *prima facie* evidence that migration is accelerating the nutrition transition at a faster pace in less urban areas.

The migration-BMI relationship could be mediated in part by the socioeconomic status (SES) of a municipality, captured in the marginalization index. In less urban municipalities where migration rates are high and remittances represent a large portion of pecuniary flows, the level of marginalization would likely be much higher without these financial links. Model II in Table 4 illustrates this by showing results of a model similar to Model I but in which we did not include the marginalization index. The migration–urban place interaction in this case is significant for males in predicting overweight for females in predicting overweight and obesity, all with the expected sign (negative, implying that the effect of the migration intensity index is weaker in large urban areas, as expected). We regard this as weak evidence of a differential effect of migration in accelerating the epidemiological transition.

DISCUSSION

Our findings support the notion that community-level migration processes influence health-related behaviors, specifically observed in BMI levels, presumably accelerating the nutrition transition in sending areas. These influences operate mostly through direct and indirect income effects from remittance flows, which lower budget constraints and allow households to increase their caloric intake and potentially reduce their caloric expense. Although the eating habits and body mass of adult migrants themselves are altered (generally for the worse) through diet and lifestyle changes made while in the US, we do not find conclusive evidence that their transnational links rapidly diffuse new notions about health and nutrition throughout high-migration communities *net* of the remittance effect.

Our findings also support the notion that the translocal links associated with U.S. migration may have more far-reaching implications for men, who otherwise tend to experience the nutrition transition more slowly than women. Given that the evidence supports the importance of remittances and not of other forms of migration-related exchanges, remittances may be disproportionately increasing the caloric consumption of men (those returning from the U.S. and nonmigrants alike). Additionally, men in rural areas may benefit more from the transition to capital-intensive agricultural methods than women do, at least in those places where men do more of the agricultural work. As a result, men who would otherwise be overweight are more likely to become obese.

ⁱUnfortunately, with cross-sectional data, we cannot observe individual change. Thus, a shift from overweight to obese, for example, and a shift from normal weight to obese are observationally equivalent in our study.

Finally, our results show ambiguous support for the notion that the nutrition transition accelerates faster in less urban areas as a result of migration-related exchanges. If the marginalization level itself in rural areas is affected by these translocal exchanges, the links could be indirectly accelerating the nutrition transition, especially for overweight people and for men in general, at a particularly rapid pace in less urban areas. Our results provide weak support for this notion: that the stronger relationship between migration intensity and overweight/obesity in rural communities operates through migration's impact on the community's level of marginalization.

Overall, our results confirm the importance of remittances in changing migrants' places of origin. However, the particular effects we examine are negative: the changes associated with migration set the stage for weight-related health conditions that may continue to increase in prevalence and worsen in severity as time goes on. Our findings continue to highlight the importance of diffusing nutritional awareness throughout sending communities so that, as households enjoy the physically less demanding lifestyle that remittances support, they do not see a corresponding decline in health.

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REFERENCES

- Akresh IR. Dietary assimilation and health among Hispanic immigrants to the United States. *Journal of Health and Social Behavior*. 2007; 48(4):404–17. [PubMed: 18198687]
- Antecol H, Bedard K. Unhealthy assimilation: Why do immigrants converge to American health status levels? *Demography*. 2006; 43(2):337–60. [PubMed: 16889132]
- Barquera S, Carrión C, et al. "Methodology of the Fasting Sub-Sample from the Mexican Health Survey, 2000." *Salud Pública*. 2007; 49:S421–S426.
- R, Durazo-Arvizu A, Luke A, Cao G, Cooper RS. Hypertension in Mexico and among Mexican Americans: Prevalence and treatment patterns. *Journal of Human Hypertension*. 2008; 22(9):617–26. [PubMed: 18305546]
- L, Hernández-Barrera I, Campos-Nonato J, Espinosa M, Flores ABJ, Rivera JA. Energy and nutrient consumption in adults: Analysis of the Mexican National Health and Nutrition Survey 2006. *Salud Publica De Mexico*. 2009; 51(Suppl. 4):S562–S573. [PubMed: 20464232]
- Chaput JP, Tremblay A. Obesity and Physical Inactivity: The Relevance of Reconsidering the Notion of Sedentariness. *Obesity Facts*. 2009; 2(4):249–254. [PubMed: 20054231]
- Durand J.; Massey, DS. *Clandestinos: Migración México-Estados Unidos en los Albores del Siglo XXI*. Universidad Autónoma de Zacatecas; Zacatecas: 2003.
- Frank R. International migration and infant health in Mexico. *Journal of Immigrant Health*. 2005; 7(1): 11–22. [PubMed: 15744473]
- , Hummer RA. The other side of the paradox: The risk of low birth weight among infants of migrant and nonmigrant households within Mexico. *International Migration Review*. 2002; 36(3): 746–65.
- Fussell E, Massey DS. The limits to cumulative causation: International migration from Mexican urban areas. *Demography*. 2004; 41(1):151–171. [PubMed: 15074129]
- Hamilton ER, Villarreal A, Hummer RA. Mother's, household, and community U.S. migration experience and infant mortality in rural and urban Mexico. *Population Research and Policy Review*. 2009; 28(2):123–42. [PubMed: 20047012]

- Hildebrandt N, McKenzie DJ, Esquivel G, Schargrodsky E. The effects of migration on child health in Mexico [with comments]. *Economia*. 2005; 6(1):257–89.
- Huneault L, Mathieu MÉ, Tremblay A. Globalization and modernization: an obesogenic combination. *Obesity Reviews*. 2011; 12(5):e64–e72. [PubMed: 21366834]
- Jones RC. Remittances and inequality: A question of migration stage and geographic scale. *Economic Geography*. 1998; 74(1):8–25. [PubMed: 12321333]
- Kana'iaupuni SM, Donato KM. Migradollars and mortality: The effects of migration on infant survival in Mexico. *Demography*. 1999; 36(3):339–53. [PubMed: 10472498]
- Kwan M-P. From place-based to people-based exposure measures. *Social Science & Medicine*. 2009; 69(9):1311–1313. [PubMed: 19665828]
- Levi, J.; Vinter, S.; Richardson, L.; Laurent, R. St.; Segaml, LM. *F as in fat: How obesity policies are failing in America: Trust for America's Health*. Robert Wood Johnson Foundation; Princeton, NJ: 2009.
- Levitt P. Social remittances: Migration driven local-level forms of cultural diffusion. *International Migration Review*. 1998; 32(4):926–48. [PubMed: 12294302]
- Massey DS, Espinosa KE. What's driving Mexico-U.S. migration? A theoretical, empirical, and policy analysis. *American Journal of Sociology*. 1997; 102(4):939–999.
- McKenzie, DJ. Beyond remittances: The effects of migration on Mexican households. In: Schiff, M.; Özden, C., editors. *International migration, remittances and the brain drain*. World Bank; Washington, DC: 2006. p. 123–47.
- Monteverde M, Noronha K, Palloni A, Novak B. Obesity and excess mortality among the elderly in the United States and Mexico. *Demography*. 2010; 47(1):79–96. [PubMed: 20355685]
- Palloni, A.; Riosmena, F.; Wong, R. SES gradients among Mexicans in the U.S. and Mexico: A new twist to the Hispanic paradox? Paper presented at the Center for U.S.-Mexican Studies Colloquium Series. University of California; San Diego: May. 2008
- Popkin BM. Nutrition in transition: The changing global nutrition challenge. *Asia Pacific Journal of Clinical Nutrition*. 2001; 10:13–18.
- Rivera JA, Barquera S, Campirano F, Campos I, Safdie M, Tovar V. Epidemiological and nutritional transition in Mexico: Rapid increase of non-communicable chronic diseases and obesity. *Public Health Nutrition*. 2002; 5(1a):113–22. [PubMed: 12027273]
- , Barquera S, González-Coss o T, Olaiz G, Sepúlveda J. Nutrition transition in Mexico and in other Latin American countries. *Nutrition Reviews*. 2004; 62(Supplement s2):S149–S157. [PubMed: 15387482]
- Sassen, S. *The mobility of labor and capital: A study in international investment and labor flow*. Cambridge University Press; Cambridge, UK: 1988.
- Smith KV, Goldman N. Socioeconomic differences in health among older adults in Mexico. *Social Science & Medicine*. 2007; 65(7):1372–85. [PubMed: 17618717]
- Stark O, Bloom DE. The new economics of labor migration. *American Economic Review*. 1985; 75(2):173–78.
- Taylor JE, Arango J, Hugo G, Kouaouci A, Massey DS, Pellegrino A. International migration and community development. *Population Index*. 1996; 62(3):397–418.
- , Lopez-Feldman A. Does migration make rural households more productive? Evidence from Mexico. *Journal of Development Studies*. 2010; 46(1):68–90.
- Valespino, JL.; Olaiz, G., et al. *Encuesta Nacional de Salud 2000. Tomo II. Vivienda, Población y Utilización de Servicios de Salud*. Instituto Nacional de Salud Pública; Cuernavaca, Morelos, Mexico: 2003.
- WHO. [last accessed November 10, 2009] World Health Organization Statistical Information System. 2009. Available from <http://apps.who.int/whosis/data/Search.jsp>

Table 1

Weighed means (and Standard Deviations)

Means	Total	Men	Women
<i>Outcome Variables</i>			
Overweight	0.39	0.41	0.36
Obese	0.24	0.19	0.28
<i>Individual-Level Attributes</i>			
>			
Female	0.53	---	---
Age	37.37 (14.95)	37.63 (15.80)	37.14 (14.50)
Union Status [Single]			
Married	0.57	0.57	0.57
Cohabiting	0.15	0.15	0.16
Divorced or Widowed	0.08	0.04	0.11
Education [College or More]			
High School	0.19	0.19	0.20
Secondary	0.23	0.25	0.21
Primary or Less	0.48	0.43	0.53
HH in Large Urban Area	0.64	0.64	0.64
<i>Municipality scale indicators</i>			
Migration Measures			
Migration Index	-0.29 (0.68)	-0.29 (0.65)	-0.28 (0.70)
Percent Remitting	4.18 (4.84)	4.15 (4.70)	4.22 (4.90)
Percent Return Migrants	0.83 (1.15)	0.81 (1.09)	0.84 (1.17)
Marginalization Index	-1.13 (0.89)	-1.12 (0.90)	-1.14 (0.88)
Percent Rural municipalities	23.12 (27.81)	23.45 (27.98)	22.82 (27.73)
Proportion <i>Maquiladoras</i>	0.03 (.08)	0.03 (.08)	0.03 (.08)
Unweighted N	39,843	12,395	27,448

Table 2
Coefficients from Multinomial Multi-Level Logistic Regression of Overweight/Obesity Risk among Mexican WOMEN

Variable Individual level	Model I			Model II			Model III			Model IV		
	Overweight	Obese		Overweight	Obese		Overweight	Obese		Overweight	Obese	
Age	0.025 ***	0.037 ***		0.026 ***	0.037 ***		0.026 ***	0.037 ***		0.026 ***	0.037 ***	
Union Status [Single]												
Married	0.633 ***	0.691 ***		0.633 ***	0.691 ***		0.633 ***	0.691 ***		0.633 ***	0.691 ***	
Cohabiting	0.488 ***	0.497 ***		0.487 ***	0.497 ***		0.484 ***	0.493 ***		0.487 ***	0.497 ***	
Divorced/Widowed	0.262 **	0.136		0.261 **	0.136		0.261 **	0.135		0.261 **	0.135	
Educ. [College]												
High School/Tech	0.244 *	0.371 **		0.244 *	0.371 **		0.244 *	0.371 **		0.243 *	0.370 **	
Secondary	0.418 ***	0.611 ***		0.419 ***	0.612 ***		0.420 ***	0.613 ***		0.419 ***	0.611 ***	
Primary or Less	0.453 ***	0.907 ***		0.455 ***	0.908 ***		0.457 ***	0.909 ***		0.455 ***	0.908 ***	
HH in Large Urban Area	0.123 †	0.114		0.120 †	0.113		0.114 †	0.103		0.118 †	0.108	
Municipality scale												
<i>Migration Measures</i>												
Migration Index	0.095 *	0.107 *										
Percent Remittances				0.012 *	0.014 *					0.019 *	0.031 **	
Percent Return Migrants							0.034	0.028		-0.041	-0.094 *	
Marginalization Index	-0.146 *	-0.320 **		-0.151 *	-0.321 **		-0.173 *	-0.359 **		-0.153 *	-0.326 **	
Percent Rural	-0.001	-0.002		-0.000	-0.002		0.001	-0.000		-0.000	-0.002	
Proportion Maquiladoras	0.342	1.268 **		0.359	1.284 **		0.285	1.240 **		0.457	1.508 **	
Intercept	-1.944 ***	-3.159 ***		-2.028 ***	-3.252 ***		-2.046	-3.284		-2.030 ***	-3.256 ***	
u ₀	0.05	0.16		0.05	0.16		0.05	0.16		0.05	0.16	
Df	316	316		316	316		316	316		315	315	
N Individual Level (Unweighted)	27448			27448			27448			27448		
N Community Level	321	321		321	321		321	321		321	321	

1000.0 > d

100.0 > d
**
50.0 > d
*
p < 0.05
p < 0.10
p < 0.01

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Table 3
Coefficients from Multinomial Multi-Level Logistic Regression of Overweight/Obesity Risk among Mexican MEN

Variable Individual level	Model I			Model II			Model III			Model IV		
	Overweight	Obese		Overweight	Obese		Overweight	Obese		Overweight	Obese	
Age	0.015***	0.024***		0.015***	0.024***		0.015***	0.024***		0.015***	0.024***	
Union Status [Single]												
Married	0.689***	0.822***		0.690***	0.822***		0.690***	0.825***		0.690***	0.823***	
Cohabiting	0.454***	0.587***		0.451***	0.586***		0.452***	0.578***		0.451***	0.587***	
Divorced/Widowed	0.317 [†]	0.326		0.316 [†]	0.326		0.317 [†]	0.325		0.316 [†]		
Educ. [College]												
High School/Tech	-0.369**	-0.222		-0.369**	-0.222		-0.370**	-0.222		-0.370**	-0.222	
Secondary	-0.252*	-0.338*		-0.251*	-0.336*		-0.251*	-0.335*		-0.251*	-0.336*	
Primary or Less	-0.430***	-0.455**		-0.428***	-0.453**		-0.429***	-0.450**		-0.429***	-0.452**	
HH in Large Urban Area	0.223**	0.277*		0.216*	0.270*		0.215*	0.259*		0.216*	0.265*	
Municipality scale												
<i>Migration Measures</i>												
Migration Index	0.044	0.235**			0.031			0.087*		0.004	0.049**	
Percent Remittances				0.001			0.001			-0.015		
Percent Return Migrants										-0.225*		
Marginalization Index	-0.205*	-0.363**		-0.224*	-0.365**		-0.230*	-0.419**		-0.225*	-0.374**	
Percent Rural	0.001	-0.000		0.001	-0.000		0.002	0.003		0.001	-0.000	
Proportion Maquiladoras	0.286	0.926*		0.303	0.973*		0.306	0.768 [†]		0.342	1.232**	
Intercept	-1.024***	-2.506***		-1.077***	-2.700***		-1.082***	-2.749***		-1.078***	-2.710***	
u ₀	0.10	0.18		0.10	0.18		0.10	0.19		0.10	0.18	
Df	316	316		316	316		316	316		315	315	
N Individual Level (Unweighted)	12395			12395			12395			12395		
N Community Level	321			321			321			321		

1000.0 > d

100.0 > d
**
50.0 > d
*
p < 0.05
p < 0.10
p < 0.01

Table 4

Results of Models Interacting the Migration Intensity Index with the Level of Urbanization of the Locality of Residence, with community-level SES (first two columns) and without (second two columns)

A. WOMEN				
Variable	Model I		Model II	
	Overweight	Obese	Overweight	Obese
HH in Urban Area	0.107 [†]	0.113	0.217 ^{***}	0.367 ^{***}
Municipality scale				
Migration Index	0.102 [*]	0.097 [†]	0.128 ^{**}	0.145 [*]
Marg. Index	-0.154 ^{***}	-0.358 ^{***}	NOT INCL	NOT INCL
<i>Cross-level Interaction</i>				
HH in Large Urban	-0.068	-0.029	-0.187 [*]	-0.286 ^{**}
Area * Mig. Index				
N Individual Level	27448		27448	
N Community Level	321		321	

B. MEN				
Variable	Model I		Model II	
	Overweight	Obese	Overweight	Obese
HH in Urban Area	0.181 [*]	0.316 ^{**}	0.337 ^{***}	0.639 ^{***}
Municipality scale				
Migration Index	0.080	0.189 ^{**}	0.110 [†]	0.237 ^{**}
Marginalization Index	-0.178 ^{**}	-0.382 ^{***}	NOT INCL	NOT INCL
<i>Cross-level Interaction</i>				
HH in Large Urban	-0.150	0.196	-0.270 [*]	-0.391
Area * Migration Index				
N Individual Level	12395		12395	
N Community Level	321		321	

p < 0.001

**
p < 0.01

*
p < 0.05

[†]
p < 0.10