The Role of U.S Migration Translocality in the Epidemiological Transition in Mexico: A Look at Diabetes and Hypertension

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ABSTRACT

Migrant flows are generally accompanied by extensive links between origins and destinations, deeply transforming sending areas. Previous studies have found a positive association between migration and better child health and nutrition and a positive association between migration and obesity. Both trends suggest that translocality may be accelerating the nutritional transition in sending areas. As this transition generally accompanies the broader epidemiological transition, we look into the association between migration and the prevalence of hypertension and diabetes in sending areas in Mexico. We nationally-representative data with socioeconomic, anthropometric, and biomarker measures, matched to municipal-level migration intensity and marginalization measures from the Mexican Census. Preliminary findings seem to support this idea among urban residents in diabetes and men in hypertension.

Keywords: *international migration; diabetes; hypertension; epidemiological transition; Mexico; translocality*

Translocal ties created by international migration processes have a deep imprint in sending areas (Jones 1998; Levitt 1998). Health is no exception. Previous studies have found positive effects of migration on infant and child health (Frank and Hummer 2002; Hildebrandt et al. 2005), and infant survival (Kana'iaupuni and Donato 1999). Migration appears to be beneficial to the left behind primarily as the money remitted or brought back by migrants helps ameliorate the poverty conditions responsible for poor health and nutrition. More recently, however, studies have also found a positive association between migration and child/adolescent (Creighton et al. 2011) and adult (Riosmena et al. Forthcoming) obesity. Both sets of results suggest that the pecuniary and nonpecuniary exchanges associated with migration may be influencing community health by accelerating the nutrition transition in sending areas. The nutrition transition refers to an increased availability of high fatty and processed foods and altered home cooking practices, which translate into significant weight gain (Popkin 2001).

The nutritional transition generally accompanies a broader process of epidemiological shifts that imply an increase the prevalence of chronic diseases (Popkin and Gordon-Larsen 2004), a process generally known as the epidemiological transition (Frenk, Bobadilla and Lozano 1996; Omran 1971).[1] Given that obesity is a major risk factor for type-2 diabetes, hypertension, and cardiovascular disease (Hubert et al. 1983; Mokdad et al. 2003) and their related causes of death (Krueger et al. 2004), we hypothesize that the aforementioned changes in body mass experienced by adults might translate into a higher prevalence of diabetes and high blood pressure. We use migration and remittance intensity data from the 2000 Mexican Population and

[1] Although the epidemiological transition implies the dramatic reduction of the prevalence of (and, especially, mortality from) infectious diseases, note that in some settings (e.g., rural areas in many developing countries) the transition is slow (and not linear), resulting in a "double burden of disease" for individuals, who start becoming affected by chronic diseases while not being rid of infectious diseases altogether Lozano, R., C. Murray, J. Frenk, and J.L. Bobadilla. 1995. "Burden of disease assessment and health system reform: results of a study in Mexico." *Journal of International Development* 7(3):555-563..

Housing Census and migration data from the 2005 Population Count and blood specimen, blood pressure, and socioeconomic data from the 2006 Mexican National Health and Nutrition Survey (ENSANUT by its Spanish acronym) to analyze the relationship between the migration intensity of a municipality and an (adult) individual's likelihood of having 1) blood glucose levels associated with type-2 diabetes and 2) systolic or diastolic blood pressure levels that indicate hypertension. Elevated diabetes and hypertension levels in turn may be an indication of an *acceleration* of the epidemiological transition in migrant-sending areas relative to non-sending areas of similar socioeconomic characteristics. That is, we do not claim migration is the only vehicle through which the transition is taking place, but rather an additional set of forces influencing its occurrence.

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. In both cases, *sustained* excess obesity rates in migrant-sending areas relative to those with lower migration levels of similar characteristics would translate into higher diabetes and hypertension levels. We also test if the effects of translocal ties associated with the Mexico-U.S. migration process operate differently in urban and rural areas and for men and women given the uneven pace of the nutrition and epidemiological transition between these groups and places.

DATA AND METHODS

The 2006 ENSANUT, carried out by the National Institute of Public Health, is a nationally representative, multistage sample of the noninstitutionalized Mexican population.[2] The data are representative at urban/rural levels within each state, yielding 48,600 households (Olaiz et al.

[2] See http://www.insp.mx/encuesta-nacional-salud-y-nutricion-2006.html

2006). One child, adolescent, and adult (aged 20 and over) were selected in each household (Olaiz et al. 2006).

We use data from the adult samples, which contain socioeconomic, health and anthropometric information on each respondent. The latter include height and weight, which we use to measure Body Mass Index (BMI) using conventional cutoffs for overweight (BMI ≥ 25 kg/m^2) and obese (BMI ≥ 30 kg/m^2) individuals (see http://apps.nccd.cdc.gov/dnpabmi). We also use systolic and diastolic blood pressure (SBP and DBP respectively) measurements performed by a special "nutrition" field team (Olaiz et al. 2006) to classify individuals with high risk of hypertension (SBP ≥ 1400 mm-Hg or DBP ≥ 90 mm-Hg, cutoffs used by the American Heart Association). We also use data from blood glucose levels collected from blood specimens (as opposed to dried blood spots) to classify individuals as in risk of type-2 diabetes (for those fasting at least 8 hours before the test, with glucose levels of more than 125 mg/dL while we used a cutoff of 200 mg/dL for individuals not fasting).

Despite its advantages in terms of having a nationally-representative sample of household and the availability of anthropometric measures and blood samples, the ENSANUT lacks migration questions at the household level, which would have allow us to measure these effects more directly among the left behind as done in other studies (e.g., Kana'iaupuni and Donato 1999). However, as our argument relates to changes in community –not only family– change, our use of migration indicators at a broader (municipal) scale seem adequate (if not appropriate) and should capture the direct and indirect effects of migration on community health. We matched the ENSANUT 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 2004) 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 the census long form sample, not the complete enumeration) are likewise only available for municipalities.

We include two migration-related measures coming from the International Migration Supplement of the 2000 Mexican Population and Housing Census, namely the percentage of households in the municipality (1) receiving remittances, and (2) with at least one member returning from the United States in 1995-1999. The first measure should approximate the impact of pecuniary exchanges due to migration while the second, a measure of migrant circulation and contact with the community of origin, should be a proxy for nonpecuniary translocal exchanges (particularly net of the first).

We also control for an index summarizing community-level socioeconomic characteristics to avoid confounding the impact of the migration intensity level with those of the development as discussed in the previous section.[3] 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.

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 ENSANUT.[4] Finally, we also include state-level fixed effects in our calculations.

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 will use hierarchical linear modeling (HLM) in our analysis.[5] 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 having a glucose/blood pressure profile that puts them in much higher risk of having (1) diabetes and (2) hypertension. In addition to the variables described above, we

[3] In the full paper, we will also include a measure of the proportion of workers in the municipality working in maquiladoras as a general measure of local foreign direct investment and, thus, of connections to national and global markets. We do this to assess if the effects of migration are not being confounded with those associated with globalization Sassen, S. 1988. *The mobility of labor and capital: A study in international investment and labor flow*. Cambridge: Cambridge University Press..

[4] To further consider the heterogeneity of communities below the cutoff in terms of their level of urbanization, we will also control for the percent of the municipality's population living in localities with less than 2,500 inhabitants.

[5] For the time being, we present models using conventional logit models.

include controls for socioeconomic characteristics at the individual and household levels, all of which are listed in Tables 2 and 3.

PRELIMINARY FINDINGS

Tables 1 and 2 show results of (non-multilevel) logistic regression models predicting diabetes and hypertension classifications for I) all individuals, II) men living in urban areas, III) women living in urban areas, IV) men living in rural areas, and V) women living in rural areas.[6] As expected, our results show a positive association between the municipal level of remittances (net of the levels of return migration) and the likelihood that an individual is classified as in higher risk of diabetes and hypertension. The remittance index is statistically significant for diabetes for men and women in urban areas (Models I and II, Table 2), implying that a 1% increase in the percentage of households receiving remittances in the community is associated with a 4% and 5% (i.e., $100 \cdot [\exp\{0.037 \text{ and } 0.048, \text{respectively}\} - 1]$) higher odds of being classified as in high risk of having diabetes. In rural areas, these effects are very small (not always positive) and not statistically significant.

-TABLES 2 AND 3 ABOUT HERE-

Likewise, remittance intensity net of return migration strength is associated with a slightly higher likelihood of high blood pressure associated with hypertension, in this case for men in both urban and rural areas (Table 3, Models I and III). Men in urban (rural) areas have 1.5% (1.7%) higher odds of being classified as hypertensive. These effects are moderate but non-trivial considering the standard deviation in the remittance variable is around 10%.

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[6] In our full paper, we will perform these models in a multilevel setting as proposed above and include three different models, all controlling for all sociodemographic and contextual controls but where we our two different migration variables separately. This will allow us to evaluate if the remittance/return migration indicators are significant even after controlling for our return migration/remittance indicator (in order to evaluate if it is pecuniary or nonpecuniary exchanges that seem to be making a clearer difference in terms of their potential effects on health, see Riosmena et al. Forthcoming)

FUTURE DIRECTIONS FOR FULL PAPER

Our findings support the notion that community-level migration processes influence not only health-related behaviors but also chronic health, specifically high glucose and blood pressure levels. This is only true, however, for men and women in urban areas in the case of diabetes and men in both urban and rural areas in the case of hypertension. Although these effects are moderately large at best (and we will also calculate predicted probabilities for all these groups across the inter-quartile range of the remittance variable), they do suggest that translocal links associated with the Mexico-U.S. migration process may be accelerating the epidemiological transition in sending areas. These influences operate mostly through direct and indirect income effects from remittance flows, which may 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.

As in a previous study (Riosmena et al. Forthcoming), 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 (however, it is particularly urban men who bore the brunt of this). 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 United States 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 (Riosmena et al. Forthcoming), which translate into higher hypertension and diabetes. In the full version of the paper, we will test if controlling for BMI absorbs the effect of the remittance variable.

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Table 1. Logistic Regressions of Diabetes Risk among Mexican Individuals, by Urban/Rural Residence and Gender

	Model I	Model II	Model III	Model IV
	Urban Male	Urban Female	Rural Male	Rural Female
Contextual measures				
% Remittances	0.037 (0.018)*	0.048 (0.023)*	-0.025 (0.023)	0.019 (0.023)
% Return Migrants	-0.140 (0.082)+	-0.030 (0.091)	0.016 (0.101)	0.021 (0.099)
Marginality index	-0.303 (0.084)***	-0.060 (0.110)	-0.080 (0.099)	-0.062 (0.092)
Individual-level measures				
Age	0.000 (000)	-0.124 (1.072)	0.000 (000)	0.000 (000)
Union (Cohabitating)				
Married	0.334 (0.112)**	0.110 (0.182)	-0.104 (0.193)	0.070 (0.254)
Separated	-0.267 (0.302)	0.094 (0.213)	0.054 (0.625)	0.214 (0.288)
Divorced	0.227 (0.382)	0.230 (0.291)	1.331 (1.122)	0.140 (0.634)
Widow(er)	0.690 (0.247)**	0.644 (0.207)**	0.420 (0.420)	0.023 (0.321)
Single	-0.455 (0.175)**	-0.577 (0.221)**	-0.648 (0.367)+	-0.407 (0.296)
Education (None)				
Primary	-0.231 (0.158)	-0.554 (0.174)**	-0.189 (0.205)	-0.109 (0.226)
Lower Secondary	-0.994 (0.174)***	-1.224 (0.204)***	-0.671 (0.288)*	-0.319 (0.274)
Higher Secondary	-1.145 (0.192)***	-1.728 (0.243)***	-0.958 (0.548)+	-0.359 (0.404)
College	-0.937 (0.191)***	-1.512 (0.251)***	-0.623 (1.039)	1.128 (0.587)+
Household income	0.000 (0.000)*	-0.000 (0.000)	-0.000 (0.000)*	0.000 (0.000)
Intercept	-3.411 (0.354)***	-2.276 (1.156)*	-2.856 (0.670)***	-2.079 (0.536)***
N	12293	6388	3720	1671
AIC	5152.179	2845.206	1504.310	1221.136

+ p<0.1   * p<0.05   ** p<0.01   *** p<0.001

Table 2. Logistic Regressions of Hypertension Risk among Mexican Individuals, by Urban/Rural Residence and Gender

	Model I	Model II	Model III	Model IV
	Urban Male	Urban Female	Rural Male	Rural Female
Contextual measures				
% Remittances	0.015 (0.009)+	0.007 (0.013)	0.017 (0.009)+	0.005 (0.016)
% Return Migrants	-0.040 (0.037)	-0.016 (0.053)	-0.029 (0.043)	-0.048 (0.062)
Marginality index	-0.115 (0.037)**	-0.117 (0.056)*	-0.022 (0.044)	-0.060 (0.067)
Individual-level measures				
Age	-1.474 (1.094)	0.281 (0.629)	-1.47 (1.20)	0.26 (0.69)
Union (Cohabitating)				
Married	0.134 (0.052)**	-0.164 (0.093)+	-0.062 (0.088)	-0.030 (0.183)
Separated	0.254 (0.129)*	0.368 (0.108)***	-0.349 (0.314)	-0.017 (0.210)
Divorced	0.161 (0.184)	0.718 (0.142)***		0.582 (0.399)
Widow(er)	0.339 (0.156)*	0.908 (0.122)***	0.392 (0.243)	0.507 (0.218)*
Single	-0.085 (0.066)	0.350 (0.097)***	0.186 (0.133)	0.368 (0.198)+
Education (None)				
Primary	0.020 (0.092)	-0.121 (0.123)	0.052 (0.101)	0.022 (0.151)
Lower Secondary	-0.222 (0.094)*	-0.571 (0.128)***	-0.023 (0.122)	-0.590 (0.191)**
Higher Secondary	-0.073 (0.098)	-0.720 (0.133)***	0.144 (0.188)	-0.452 (0.273)+
College	0.127 (0.102)	-0.710 (0.138)***	0.265 (0.360)	0.221 (0.496)
Household income	-0.000 (0.000)	0.000 (0.000)**	0.000 (0.000)	0.000 (0.000)
Intercept	1.752 (1.105)	-0.592 (0.666)	0.171 (0.236)	-0.137 (0.363)
N	12298	6388	3713	1707
AIC	16465.365	8296.639	5148.968	2191.499

'+ p<0.1 * p<0.05 ** p<0.01 *** p<0.001