

# **MIGRATION AND HEALTH OUTCOMES IN PUREPECHA SENDING COMMUNITIES**

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## **ABSTRACT**

Isaura Godinez: Migration and Health Outcomes in Purepecha Sending Communities  
(Under the direction of Amanda L. Thompson)

This pilot study explores the effects of remittances on health outcomes, dietary and physical activity patterns, and inequality among the Purepecha, an indigenous group of Michoacán, Mexico. Data were collected from 37 men and women in 5 Purepecha communities in Michoacán during July 2015. Data consisted of anthropometric variables, components of diet, levels of physical activity and key socioeconomic variables. Overweight and obesity are high; 74.4% of participants have a BMI above 25 kg/m<sup>2</sup>. Receiving remittances is not significantly associated with an elevated blood pressure, elevated BMI, or with higher consumption of soft drinks or meat. As for socioeconomic status, receiving remittances is negatively and significantly associated with income, occupation type, and ownership of key consumer goods. Further study with a larger sample size is necessary to further explore the influencing factors on high levels of overweight and obesity and on high levels of elevated blood pressure.

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## **CHAPTER 1 INTRODUCTION**

Chronic disease outcomes in Mexico have been worsening (Rivera, 2004) as a result of the changes outlined by the nutrition transition (NT). The NT refers to a dietary shift that increasingly resembles a Western diet, including a decreased consumption of foods high in fiber and an increase of foods with added fat and refined sugars (Popkin, 2001). In Mexico, the most pronounced changes include increases in consumption of fat, carbohydrates, and processed foods overall and a reduced intake of fruits, vegetables, meat, and milk products (Rivera 2004). The prevalence of overweight/obesity is on the rise and the increases in BMI are alarming when compared to other Latin American countries (Popkin, 2015). As a result of these changes, cardiovascular diseases and diabetes are the leading causes of mortality in Mexico (WHO 2015). The NT, and accompanying declines in health, may be accelerated by migration and the income that migrants send home, known as remittances (Riosmena et al., 2012). Studies of the effects of migration and remittances have largely focused on the decreases in mortality (Kanaiaupui and Donato, 1999; Hildebrandt et al., 2005) and low birth weight (Frank and Hummer, 2002; Hildebrandt et al., 2005) experienced by infants in origin communities. Studies also report decreases in stunting (Carletto et al., 2010) and wasting (Anton 2010) among children living in the migrant-sending communities.

Few studies address the effects of migration on the health of adults in the sending communities. Those investigations that do focus on adult health in the context of migration overlook Mexico's indigenous population. Approximately 21.5% of Mexico's population identify as indigenous (INEGI, 2015). Specific indigenous populations range from several

thousand to hundreds of thousands and live in highly diverse geographic and sociocultural conditions. The findings of studies that address migration and health and indigenous status and health suggest combining the two streams of research is not only interesting but also necessary. Prior work has found a positive association between the intensity of migration in a region and the prevalence of obesity in Mexico; however this work has not considered ethnic differences in obesity risk (Buttenheim et al., 2010). Past research in Mexico of health among indigenous groups points to lower prevalence of obesity, diabetes, and hypertension but these studies fail to incorporate the effects of migration (Stoddard 2011 et al., 2011; Guerrero Romero et al., 2000; Rodriguez-Moran et al., 2008; Schulz et al., 2006; Valencia et al., 1999). Migration and health research needs to be mindful of indigenous identities in Mexico because in addition to sociocultural differences, indigenous groups have historically experienced pronounced discrimination that may place them at differential risk for chronic conditions. A large body of literature documents the disproportionate burden of chronic disease among Native Americans in the U.S It is necessary to investigate whether chronic disease has a similar effect on indigenous groups in Mexico and whether migration has an attenuating or exacerbating effect.

Sociocultural differences and discrimination may mediate the changes that occur as a result of the NT and migration. There is a higher fruit and vegetable intake among indigenous than among non-indigenous individuals and this is thought to be protective against the development of obesity and the chronic conditions that tend to accompany it (Ramírez Silva, Rivera, Ponce, and Hernández Ávila, 2009). In addition, conscious efforts to preserve a separate identity from the larger Mexican population may have also instilled or protected behaviors that confer an advantage in terms of avoiding obesity and diabetes (Hall & Patrinos, 2005). Given the high levels of inequality and marginalization that indigenous communities experience, it is likely

that indigenous communities were not included in development schemes and so had fewer opportunities to participate in changes like decreased activity levels or increased consumption of calorie-dense foods (Stoddard et al 2011).

Regarding the role of remittances and inequality in receiving areas, past community-focused studies yield conflicting results, with some studies concluding that remittances exacerbate inequality in receiving communities (Mora, 2005; Acosta 2008) and others indicating that remittances diminish inequality (Taylor, 1992; Taylor et al 2009). Some past studies have been conducted in the state of Michoacán but have not addressed whether those who participated were indigenous. In addition, the studies conducted by Taylor investigated the effects of remittances on family operated, small-scale farms. This type of endeavor may or may not have been open to members of the indigenous community during the time of Taylor's study.

This pilot study focuses on the relationship among migration, health indicators, SES and inequality, diet and physical activity patterns in five indigenous Purepecha communities from Michoacán State, Mexico. Purepecha communities are well suited to this type of analysis due to their migration patterns. The group as a whole practices the modes of migration that have been described in earlier works, some areas within the Purepecha region having a high incidence of migration, while other communities have a low incidence. The pattern of repeat or single-time migration also differs within the community. To gain a better understanding of the complex relationship among migration, societal change, and the effects on health it is necessary to have a deeper understanding of the region of study than former investigations have undertaken. It is necessary to understand the relevant literature regarding migration. It is also necessary to understand the group of people under investigation. A high level of heterogeneity remains in this ethnic group in terms of socioeconomic conditions, sociocultural characteristics, and migration

experiences. This work begins an exploration into these conditions of life as they all interact and ultimately influence health in the population. This work seeks to answer the following questions:

- Do those receiving remittances from relatives in the U.S. have different health outcomes than those not receiving remittances?
- Do those receiving remittances have different SES indicators than those not receiving remittances?
- Are there differences in diet and physical activity patterns between the two groups?
- What are the effects of remittances on inequality, overall and as it regards health disparities, within Purepecha communities?

## CHAPTER 2 BACKGROUND

### The Purepecha and the Region

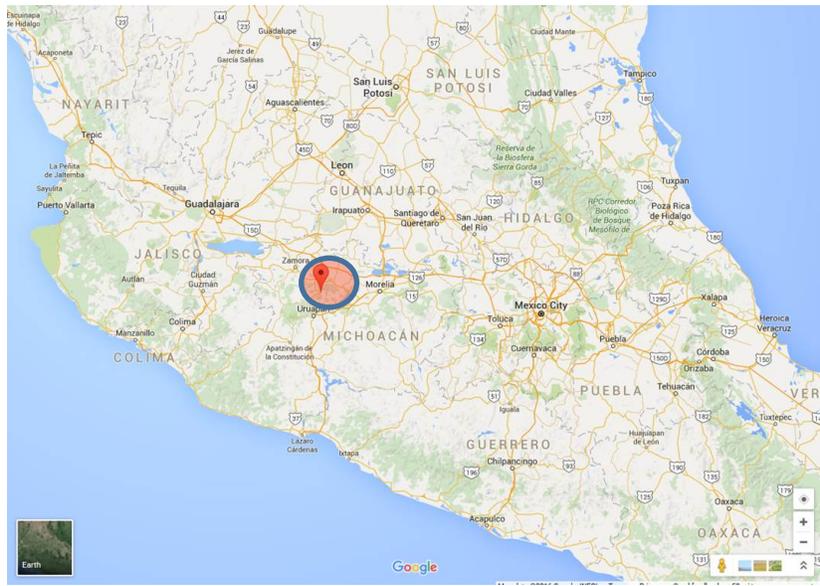


Figure 2.1 Partial map of Mexico depicting the approximate range of the Purepecha region.

The Purepecha people reside in the west-central state of Michoacán, Mexico. The population size is 127,318. This number reflects only those living in Michoacán who are able to speak the Purepecha language (Secretaria de Cultura 2014). There was a nearly 200% increase in the number of those able to speak the language in the period from 1970 to 2000. This reflects both language revitalization efforts and the higher fertility of Purepecha when compared with national rates (Fernandez Ham et al 2006). The Purepecha language is an isolate within Mexico (Malmstrom, 1995). Their religion and cultural practices are also different than neighboring groups. This has led to the suggestion that the Purepecha may have been migrants to Mexico

from South America (Malmstrom, 1995). Material culture found along Michoacan's Pacific coast resembling Andean material culture dates to as early as 1500 BCE (Coe, 1960).

The geographical space currently occupied by the Purepecha can be subdivided into five regions. Given the geographical differences that exist, it is important to describe these individually as the economic activities that are undertaken in each differ. The first region is the Cañada de los Once Pueblos. The principal economic activities here are agriculture for consumption, small-scale animal husbandry, pottery, and peddling. Migration varies within the region given different occupational niches that each of the eleven communities within the Cañada has found.

The banks of Lake Patzcuaro constitute a second, distinct region. Most in this area depend on fishing or crafts for sustenance in addition to limited agricultural activities for subsistence. Agriculture is practiced to a lesser degree in the lacustrine Patzcuaro region given the poor quality of the soils surrounding the banks. In addition to subsistence activities, tourism creates some forms of income. Tourists visit the area given the lake and the colonial history of the town of Patzcuaro. Lacustrine communities that are more accessible have a lower migrant proportion; they can rely more on profits from artisanal endeavors. Areas further away from the main thoroughfare have higher migration given the reduced attraction to tourists.

The third region is the Cienega de Zacapu. In this region, the economic activities that dominate are small-scale agriculture for subsistence, production of sand pottery, and forestry. In the towns comprising this sub-region, migration to the U.S. is highly prevalent. Up to 50% of the population resides permanently in the U.S. (Leco, 2009).

The fourth region is that of La Cantera. Here, there are a multitude of employments ranging from small-scale commerce of souvenirs, to working in the nearby avocado, strawberry,

and sugarcane farms to selling the crops in surrounding markets. Migration to the U.S. began here in the 1990s and is relatively low but increasing. The last region is the Sierra Purepecha. The principal economic activities in the region are forestry for furniture manufacture and agriculture for subsistence. Summertime complicates fabrication of furniture and so often individuals migrate to the U.S. during this time to supplement their income (Leco, 2009). As demands for products and profits decline, the options to supplement income decrease and migration once again becomes the answer.

The common denominator of each sub-region is the practice of subsistence agriculture to some degree. As it becomes more difficult to successfully cultivate the land without the use of fertilizers, herbicides, and pesticides, the net cost of agriculture is negative. The price paid to small-scale producers per ton of product, particularly corn, has continually decreased since the adoption of the North American Free Trade Agreement (NAFTA). Crop yields are hardly sufficient for individuals both to sell the necessary amount of the yield to pay off loans for seeds and necessary chemicals *and* to reserve enough for them to use during the year. Migration is often the only answer for individuals to clear the debts they have accrued through agricultural production.

### **Migration among the Purepecha**

Migration among the various Purepecha communities differs because of social and historical reasons. In the historical sense, Purepecha migration can be understood in three phases of increasing intensity. The first phase of Purepecha migration to the U.S. can be traced as far back as the 1890s (Beals 1992). During the first phase, migration out of the Purepecha area was sporadic and rare. The second phase was heralded by The Bracero Program during the 1940s. The Bracero program was initiated in 1942 to counteract agricultural labor shortages in the U.S.

(Calavita, 1992). It was a federal program; operated jointly by the State Department, the Department of Labor, and the Immigration and Naturalization Service (INS). The latter had substantial control over the entire program, as well as over individual participants (known as *braceros*, derived from the Spanish word for arm, *brazo*, and being indicative of the physically demanding nature of the work).

During the tenure of the Program (1942-1964), migration to the U.S. by Purepechas noticeably increased. The Bracero program was important in establishing migration experience in communities. Some of those who migrated as part of the Bracero program are still alive today and thus serve as sources of information and as an example given the respect that the elders are accorded in Purepecha societies. The structure of the program is relevant because it has echoes with the current modalities of migration among Purepecha communities.

Despite the program being a response to shortages caused by WWII, it outlived the war given that it provided “uninterrupted supply of cheap, essentially captive, Mexican workers” (Calvita, 1992). The program passed back and forth between federal and private control. It was also continually rejuvenated through changes that facilitated agricultural growers’ abilities to continue to access Mexican workers. One of these changes was “legalizing” undocumented immigrants already present in the U.S. This prioritization encouraged undocumented entry to the U.S. since it was easier to obtain both legalization and a job this way than through direct recruitment in Mexico. Workers thus legalized were “paroled” to the growers. This patriarchal relationship between workers and employers is echoed in the current program for temporary workers (H2-A and B visas). The legalization of migrants allowed them to bring families to the U.S. and to extend their status to their children who became part of the next generation of migrants to the U.S.

The third phase of Purepecha migration to the U.S. began during the 1980s as a response to the economic downturn that began then in Mexico. This last phase of migration is still ongoing. The migrant stream coming from the Purepecha area to the U.S. includes both documented and undocumented migrants following a pattern established by the Bracero program. Under the program an *enganchador* (akin to a contractor) would arrive at a community advertising work in the U.S. and would help with the process, for a fee. Given the lack of regulation and oversight at the federal level of both the U.S. and Mexico, the *enganchador* practice still continues for obtaining H2-A and B visas. What is novel in the current phase of migration is that a large percentage of Purepecha migrants to the U.S. are arriving outside areas where migrants from Mexico traditionally concentrated (Leco, 2009). This is important because the new arrivals could potentially experience the stress of being the first. On the other hand, this novelty could be protective since they may not deal with prejudiced reactions from other Mexican migrants. Further work is necessary to disentangle the effects of being the first immigrants from Mexico among the Purepecha, particularly in the context of health.

### **Migration in the context of socioeconomic factors**

In addition to the inability to pursue subsistence agriculture (Leco, 2009:77), conflicts within the region have driven people to look for opportunities elsewhere. The highland region has been embroiled in extensive conflict over the use of forests. Some of the issues include illegal logging by organized crime and overexploitation of forests. Poverty has increased within Purepecha communities after legislation limiting forest exploitation and those protecting the biosphere reserve for Monarch butterflies (Leco, 2009).

According to Leco, migration is both fueled by economic necessity and by culturally established patterns. There is prestige in migration, particularly if individuals are able to

accomplish a concrete goal as a result of said migration. There is also prestige in holding a permit to work in the U.S. Leco applies Bourdieu's notion of *habitus* to describe the importance that migration has come to play among some Purepecha communities, particularly those with high migration prevalence. Because some communities have a very high proportion of migrants, the idea of migration permeates almost every aspect of life. Locals have internalized the notion of *el Norte* (the term commonly used to refer to the U.S. in Mexico) and thus migrating has become a way of life (Leco, 2009; 23). Migration is ever present both at the level of the family and community. Observing the practice of migration, Leco claims, leads to its incorporation into an individual's habitus. As such, said individual will place a high value on engaging in migration and by doing so will further strengthen this cultural practice (Leco, 2009; 33). In some Purepecha towns, conversations about migration can be found anywhere: "the topic is discussed on the street, on the corner, among friends, in the home, with family, in school, and athletic fields, (any) where people become socialized" (Leco Tomas, 2009;34. Translated from Spanish, parenthetical addition mine). Migration becomes a set of practices that guide behavior and ultimately serve to reinforce and reproduce it. Due to its pervasiveness, migration becomes the appropriate action in life for some Purepecha (Leco Tomas, 2009; 35)

### **Migration in context of social and religious pressures**

Discussions regarding migration and the reasons to migrate often involve the portrayal of the migrant as calculating with the end goal obtaining economic advancement, as illustrated by the reference to migration as an investment. On the other side of this is the representation of the migrant as desperate for survival willing to engage in poorly-paid labor for the maintenance of him/her self and family. While these depictions are not inaccurate, they do not capture the entire range of the migration experience. This work discusses a third, social, perspective sparked by

Leco's use of *habitus*. In addition to the classic economic explanations, migration among Purepecha communities has an association with religion (Leco, 2009; 91). The income from migration is not only used for typical subsistence activities but it also fulfills a social and religious dimension. Elaborate celebrations can be observed in Purepecha communities. While these may initially be seen as reasons to indulge in over-the-top celebrations, these festivities have a role that is tightly linked with Purepecha Catholicism and a wider system of social redistribution. The celebrations form part of the *cargo* system which dates to colonial times and functioned as a way to mesh Purepecha Catholic practices and colonial modes of governance. A cargo entails the responsibility to celebrate the holiday and fulfill religious duties for a specific saint (Lara, 2005). This responsibility is undertaken as a way to reciprocate the protection and help that the saint has conferred to the *carguero*; that is the person assuming said responsibility. Assuming cargo is a practice that is highly valued in Purepecha society. The overall cargo system is hierarchical. There is a multiplicity of cargos of ranked importance. Holding a cargo and successfully fulfilling its obligations renders a sense of prestige to the *carguero*. Holding all the cargos through the hierarchy entails a sense of honor after which the person receives a status akin to an elder. There are close ties with the local government and, depending on the specific community; civic responsibilities are alternated with religious duties. An individual may submit their name for consideration to the deciding body or the deciding body itself may attempt to convince a particular person to undertake a specific cargo. Either self-nomination or being chosen by the electing body renders a sense of joy (*gusto*). Nominees are evaluated in terms of their financial and social situations to determine whether they would be able to fulfill the requirements of their post. The final responsibility rests on the individual *carguero*, yet a substantial amount of cooperation from others is necessary. For this reason, participating in the

system creates and reinforces ties with the larger community (Lara, 2005). The extended family network of the carguero is engaged to help him successfully complete his duties. This is particularly true of the carguero's household. Many of the responsibilities fall on women. Food preparation, caring for the altars and the saints, caring for visitors, and ensuring that rules are followed according are all part of a woman's job. For this reason, marriage is almost always a prerequisite to hold a cargo (Lara, 2005).

Marriage in itself also requires lots of resources because a gendered perspective of marriage remains dominant; men are expected to provide for their families while women take care of their family members in the home. Marriage is a very significant part of life, and in situations it can be considered necessary to live a fulfilled life (Lara, 2005). Holding a cargo can also have a similar importance, and in some situations a person can only see themselves as having lived a full life after undertaking some or all the cargos. Given the lack of employment in the Purepecha area, the income obtained from migration can enable individuals to partake of these experiences. When viewed from this context, seeking to live a better life moves beyond the material. In this light, migration does not simply allow individuals material gain but allows them to live life according to what makes a life worthwhile.

### **Who migrates?**

Selectivity is widely used as an explanation for the multiplicity of differences observed in migrant populations to the U.S. These include selectivity in health status, skills, education, and income, to name a few. There is considerable debate regarding income selectivity and migration in the existing literature. One of the purposes of this work is to explore the association between income and migration because income is tied with different opportunities and risks regarding

health. Higher income may allow individuals to afford healthcare but it may also allow them to afford a dietary intake that surpasses nutritional needs.

According to the existing literature, income inequality may be a prerequisite for migration. Stark et al., (1986) propose that where migration is rare, those that migrate will be at the upper limits of the SES distribution. Those with sufficient resources will be the ones able to afford a “high risk, high return investment.”

Jones (1998) found that in the initial stages of migration, migrants come from well-off households, lending support to Stark et al’s (1986) conclusion. Similarly, Mora Rivera’s (2006) work with Mexico’s National Rural Household Survey (ENHRUM, acronym from the Spanish name) found that migrants to the U.S. come from the middle and upper middle of the income distribution. He argues that international migration has high costs and risks that those in the lower end of the income distribution would not be able to afford; at the same time, those in the uppermost end of the distribution would not benefit as much from migration to the U.S. as those in the middle (Mora Rivera, 2006). McKenzie and Rapoport (2007) found that initially, migrants are likely to be drawn from the middle of the income distribution. When compared to the upper or lower ends of the distribution, those in the middle would have both the means and incentives to migrate. They also found that in communities with high migration prevalence, first-time migrants are less likely to be selected based on wealth.

Garip’s (2012) analyses, using data from the Mexican Migration Project (MMP) and taking into account communities’ migration prevalence and repeat migration, expand on the existing literature regarding selectivity. First-time and non-migrants have similar levels of wealth. This finding disagrees with the above literature stating that migrants come from households in the middle or upper ends of the income distribution. This is clarified when number

of migrations by an individual is taken into account. When compared to repeat migrants, first-time migrants come from poorer households (Garip, 2012). By lumping repeat and first-time migrants together, it looks as if though only the wealthier households send migrants out.

Garip also looks at community-wide levels of migration. The probability of first migration declines with the increase in number of properties owned in low-prevalence communities. This suggests that where migration prevalence is low, first-time migrants come from poor households. In high migration communities, repeat migration likelihoods increase with land and property ownership. Wealthy households tend to be the source of repeat migrants in high prevalence communities (Garip, 2012). It is also interesting to note that first-time and repeat migrants differ from one another (Garip, 2012). As opposed to first-time migrants, repeat migrants are older, have completed less education, and are more likely to be married or have children. Repeat migrants come from communities with already-established migration patterns and/or where cultivation was damaged by drought conditions. They are also more likely to have documentation in the U.S. and to bring higher savings to their communities.

Migrants are accumulating wealth through trips to the U.S. Wealth increases with trips to the U.S. only up to the fifth trip, after which there is no difference in the value of land or possessions from those with three or four trips (Garip, 2012). The upper limit on wealth accumulation agrees with past observations (Cohen, 2002; Jones, 1995; Mines and Janvry, 1982; Mines and Massey, 1985). First-time migrants belong to poorer households and repeat migrants belong to wealthier households. However, selection by wealth does not apply to all migrants. The selection varies depending on past migration experience and the migration prevalence of their community of origin (Garip, 2012).

### **What does migration do to inequality?**

The relationship between migration and inequality is complex and highly dependent on context of the household and the community. The majority of the literature concludes that existing inequality is ultimately diminished through migration, though the exact effect depends on the prevalence of migration in a community. Taylor (1992) conducted investigations regarding the effects of remittances in the Patzcuaro area, one of the Purepecha sub-regions included in this study. It is important to note that Taylor's investigations were conducted among household-farm producers and thus their sample may or may not include indigenous participants. This is because the proportion of indigenous inhabitants varies by location going from very high in the *banks* of Lake Patzcuaro to much lower in the vicinity of the *town* of Patzcuaro. In addition, it is unclear whether household-farming opportunities were available to indigenous Purepecha during this time. Nevertheless, Taylor (1992) found that remittances have an equalizing effect in the sending communities under study.

Stark et al (1986) suggested that inequality due to migration increases during the early period of migration in a community. Since migrants are selected on wealth, initially only the households with the most resources will receive remittances thereby exacerbating inequality. As migration becomes more prevalent in the community, the cost of migration will decrease and those with fewer resources will use the existing migrant networks. This will lead to a decrease in inequality in the sending community as remittances begin to reach the poorer households. As a community reaches migration saturation, meaning no more new migrants, inequality will increase again because remittances will not be reaching the poorest households (Stark et al 1986)

Mora Rivera (2006) argues that remittances decrease inequality by acting as substitutes for credit and insurance markets in rural Mexico. Although there is a decrease in overall income soon after migration because labor is lost, this decrease in production is remedied when

remittances allow for hiring of replacement labor or for investment in equipment, livestock, land, or other properties.

Garip's (2012) distinction among non-migrant, first-time migrant, and repeat migrant seems to suggest that pre-migration inequality is less severe than post-migration inequality at the community level. His results add nuance to the relationship between remittances and inequality in sending communities. The amount that individuals in the U.S. remit is related to the value of household land and properties in sending communities. This means that a higher amount of remittance income reached wealthier households. In high migration communities, remittances increased per capita over time and these came primarily from repeat migrants. In low migration communities, remittances were lower than in high migration areas and they were likely to come from both first-time and repeat migrants. That repeat migrants dominate in high prevalence communities means that inequality is likely to increase there. Repeat migrants can avail themselves of past experience to earn and send higher amounts to their households. Using the number of rooms in their property as a proxy for wealth, Garip (2012) found that repeat migrants have a statistically higher number of rooms than both first-time migrants and non-migrants. In areas of low migration, the average wealth was not statistically significant across migration groups. Although this supports Garip's assertion that migration will not worsen inequality in low migration communities, it is important to note that first-time migrants and non-migrants are similarly poor prior to migration. Once first-time migrants begin remitting to their households, their contributions are likely to elevate their income above that of non-migrants.

Reichert's (1982) study among a community in Michoacán (again does not specify location or ethnic make-up of the sample) found that migration, and particularly migrant status contributed to inequality within the community. Migrants with documentation to work in the

U.S. were able to own significantly more land, more livestock and more consumer goods than those with no documentation or non-migrants. The homes of documented migrants were of brick and concrete construction and these migrants were also more likely to own vehicles. The social distance between migrants and non-migrants in this community contributed to a breakdown of traditional systems of exchange in the community that went well beyond the economic. Non-migrants could not hope to enter into reciprocal relationships with migrants as there was nothing of equal value they could offer (Reichert, 1982).

Many Purepecha individuals lament similar social changes that are they attribute to migration. Most salient was the lack of adherence to traditions such as respecting the elders and following social sanctions. The damages done by migration may go beyond the social. The potential for exposure to an obesogenic environment may be higher in the U.S. Coupled with an increase in earnings this may place migrant Purepecha and their families at increased risk for chronic conditions. The following pilot study attempts to discern some of the effects of migration on health indicators, diet, and physical activity patterns and to consider socioeconomic inequality in the context of remittances.

## **CHAPTER 3 THE STUDY**

### **Methods**

Data collection took place during the month of July 2015 in Michoacán, Mexico. Study participants were recruited from the Lake Patzcuaro region and the Meseta Purepecha. Indigenous government councils, where these existed, served as the first point of contact to obtain permission to conduct research within the community. Members of indigenous government provided direction as to which community organizations to contact to recruit participants. Individuals visiting community health and cultural centers were approached. The project was explained to them and they were asked whether they wanted to participate. If someone did wish to participate, informed consent was obtained according to guidelines provided by UNC's Institutional Review Board. Measurement collection took place within community centers or at participants' homes they preferred it. Blood pressure was measured with an Omron upper arm cuff monitor. Two readings were taken from a sitting participant. The average of these was recorded. Weight, height, waist, and hip circumference were collected according to standard methods (Frisancho, 1990).

Health indicators are blood pressure, BMI, waist circumference to height ratio, waist circumference to hip ratio. Blood pressure was labeled as elevated if systolic was above 120mm Hg or diastolic pressure was above 80mm Hg (AHA). Systolic and diastolic blood pressure was analyzed individually as well as combined. BMI was labeled as elevated if above 25 kg/m<sup>2</sup>. Central obesity was defined using waist to height ratio. A value above 0.5 determined central obesity for both men and women (Ashwell, Gunn, and Gibson 2012; Ashwell and Hsieh, 2005).

Age was dichotomized based on the average age of participants. Participants were asked to estimate the amount of hours they spent in vigorous physical activity each on a typical day. This was multiplied by 7 to give a weekly value. Dietary variables consisted of estimated daily consumption of soft drinks, meat, and milk. A daily reported value was multiplied by 7 to obtain a weekly amount.

Participants were also asked to report their occupation and their average monthly income, including remittances for those who received them. Median monthly income was 4000 pesos. Those with an income above the median were labeled as having a high income; those with an income below the median were categorized as having a low income.

The different occupations represented in the sample were grouped into two broad categories to facilitate analysis. The discriminating factor was whether a formal education, one institutionalized by the national government, was necessary to enter into the occupation. This gives the categories of "Professional Occupation" vs. "non-Professional Occupation." The latter consists of homemakers, potters, artisans, and small-scale businesses based out of the home and selling grocery items and/or locally produced pottery. Occupations making up the formal education category consist of government employees, workshop coordinators, teachers, doctors, and those retired from government positions and now receive a pension from their former employment.

Given the differences in the U.S.-Mexico education system, educational status was defined as follows: None (no formal education received), some elementary (up to 6<sup>th</sup> grade, but did not graduate), High school + (includes those graduating from primary school and secundaria [9<sup>th</sup> grade in U.S.], those graduating from preparatoria/bachillerato [12<sup>th</sup> grade in U.S.], and those

with some college, but no degree), College + (Includes those graduating with a bachelor’s degree, those that have a master’s, PhD, or professional degree).

For all the these variables, those with a consumption higher than the average were labeled as having a high value and those below the average were labeled as having a low value. The average itself was excluded in creating high/low categories because participants reported discrete quantities, thus no one had an average value and by excluding the mean, no participants are excluded.

Participants were also asked whether the owned washing machines, automobiles and/or telephones. These items tend to be considered inessential in the region of study. These durable consumer goods are moderately expensive. The rationale for selecting these is that it would help discern emerging inequality as well as the adoption of a mode of life more similar to the U.S.

**Analysis**

STATA 14 was used for statistical analysis. Bivariate analyses were first conducted on the association of remittances with health outcomes, SES variables, and dietary and physical activity variables. A separate bivariate analysis of health outcomes and SES, dietary and physical activity characteristics was conducted. An initial multivariate model included a health outcome of interest (systolic bp, diastolic bp, bp combined, BMI) and SES, diet, and physical activity variables. Backwards selection was used to determine which variables to retain in a second model which tested for the association between the health outcome, remittances, and SES, diet, and physical activity variables. A significance value of .05 is used for all analyses.

**Results**

**Table 1. Summary of sample characteristics by remittances (continues on next page)**

	<b>Remittances</b>	<b>No Remittances</b>	<b>Total</b>
	<b>N (%)</b>	<b>N (%)</b>	<b>N (%)</b>
<b>Health Measures</b>			

Elevated BP (>120/80)	13 (35.1)	9 (24.3)	22 (59.5)
Elevated Systolic BP (>120)	13 (35.1)	8 (21.6)	21 (56.6)
Elevated Diastolic BP (>80)	12 (32.4)	8 (21.6)	20 (54.1)
Elevated BMI (>25)	14 (37.8)	14 (37.8)	28 (76.7)
Central Obesity (W/Ht)	18 (48.6)	17 (45.9)	35 (94.6)
Central Obesity (W/Hip) Men	2 (33.3)	4 (66.6)	6 (100% of men)
Central Obesity (W/Hip) Women	13 (41.9)	12 (38.7)	25 (80.6% of women)
<b>Education</b>			
None	4	0	4 (10.1)
Some Elementary	5 (13.5)	6 (16.2)	11 (30.5)
High School +	10 (27.0)	3 (8)	13 (36.1)
College +	0	8 (21.6)	8 (22.2)
<b>SES Measures</b>			
Owens Washing Machine	8 (22.2)	16 (44.4)	24 (66.6)
Owens Telephone	16 (45.7)	16 (45.7)	32 (91.4)
Owens Automobile	2 (5.7)	9 (25.7)	11 (31.4)
Above Median Income	8 (21.6)	14 (37.8)	15 (40.5)
Below Median Income	11 (29.7)	4 (10.8)	22 (59.4)
<b>Activity</b>			
< 14 Hours/week	8 (21.6)	8 (21.6)	16 (43.2)
>14 Hours/week	11 (29.7)	10 (27.1)	21 (57.8)
<b>Diet (Weekly)</b>			
High Meat Consumption	7 (18.8)	6 (16.2)	4 (11.1)
High Milk Consumption	8 (18.9)	6 (16.2)	14 (40.5)
High Soft Drink Consumption	5 (13.5)	6 (16.2)	11 (29.7)
<b>Age</b>			
Below Average	10 (27)	10 (27)	16 (43.2)
Above Average	9 (24.3)	8 (21.6)	21 (56.7)
<b>Occupation</b>			
Professional	2 (5)	7 (19.4)	9 (25)
Non-Professional	17 (47.2)	10 (27.7)	27 (75)
<b>Marital Status</b>			
Married	12 (32.4)	15 (40.5)	27 (73)
Single	4 (10.8)	3 (8.1)	7 (18.9)
Other	3 (8.1)	0	3 (8.1)

Table 1 shows a summary of sample characteristics by whether participants receive remittances. Average participant age was 44.5 years. A total of 37 individuals make up this

sample. The majority of the sample has elevated blood pressure, combined systolic/diastolic and individual, and elevated BMI. The prevalence of central obesity, as determined by the waist to height ratio was 94.6%. A larger percentage of those with elevated health measures belonged to the remittances category. Those with High School+ education (up to some college) were more likely to receive remittances. Those with education beyond college did not receive remittances. Those that received remittances were less likely to own washing machines or automobiles. Telephone owners, was equally distributed among those receiving remittances and those not receiving them. 18 of participants received remittances and had a below median income compared to 1 participant that received remittances and had an above average income.

**Table 2. Effects of remittances on health indicators, SES measures, and diet and physical activity patterns**

<b>Characteristic</b>	<b>OR (95% CI)</b>
<b>Health Measures</b>	
Elevated BP (>120/80)	2.17 (0.569-8.26)
Elevated Systolic BP (>120)	2.71 (0.71-10.4)
Elevated Diastolic BP (>80)	2.14 (0.57-7.99)
Central Obesity (Waist/Height)	1.06 (0.061-18.30)
Elevated BMI (>25)	0.80 (0.18-3.62)
<b>SES Measures</b>	
Washing Machine	0.05 (0.0054-0.46)*
Telephone	0.50 (0.04-6.08)
Automobile	0.13 (0.023-0.76) *
“Professional” Occupation	0.17 (0.29-0.97) *
Above Median Income**	0.21 (0.05-0.87)*
<b>Diet and Physical Activity Measures</b>	
High Meat Consumption (>2.3 x)	1.17 (0.30-4.5)
High Milk Consumption (>3.30x)	1.68 (0.48-6.8)
High Soft Drink Consumption (>3.42)	0.71 (0.17-2.94)
High Physical Activity (>14hrs)	2.34 (0.59-9.20)

\*significant at p < .05

\*\* Median monthly income is 4000 Pesos, including remittances.

The odds ratios and 95% confidence intervals for the effects of receiving remittances on health outcomes, socioeconomic status (SES) measures, and dietary and physical activity measures are reported in table 2. Remittances are associated with increased odds of having an elevated blood pressure, elevated systolic blood pressure, and elevated diastolic blood pressure; however there was no statistical significance. Similarly, the reduced odds of having an elevated BMI among those receiving remittances did not reach statistical significance. The association between dietary and physical activity variables and remittances was not statistically significant. The association among SES variables and remittances did reach statistical significance. Compared with those not receiving remittances, those that received remittances were less likely to own a washing machine, own an automobile, have a professional occupation, or have an above average income.

**Table 3 Bivariate analysis of health outcome interactions with social and behavioral characteristics, excluding migration**

	<b>Elevated Systolic BP OR (95% CI)</b>	<b>Elevated Diastolic BP OR (95% CI)</b>	<b>Elevated BP OR (95% CI)</b>	<b>Above Normal BMI OR (95% CI)</b>
<b>Female</b>	0.21 (0.02-2.04)	1.21 (0.21-7.0)	0.24 (0.025-2.39)	0.58 (0.058-5.69)
<b>Age</b>	<b>8.67</b> <b>(1.84-40.79)*</b>	<b>6.04</b> <b>(1.42-25.7)*</b>	<b>7</b> <b>(1.51-32.5)*</b>	<b>10.67</b> <b>(1.17-97.2)*</b>
<b>High Physical Activity</b>	2.73 (0.55-15.17)	<b>5.70</b> <b>(1.24-26.3)*</b>	4 (0.88-18.2)	1.29 (0.27-6.28)
<b>Above Median Income</b>	2 (0.53-7.60)	1.65 (0.44-6.20)	2.45 (0.63-9.49)	2.25 (0.49-10.34)
<b>Professional Occupation</b>	0.29 (0.06-1.44)	0.34 (0.70-1.67)	0.47 (0.10-2.17)	2.8 (0.30-26.6)
<b>High Meat Consumption</b>	3.94 (0.86-18)	<b>4.67</b> <b>(1.02-21.4)</b>	<b>6.5</b> <b>(1.18-35.8)*</b>	1.11 (0.22-5.43)
<b>High Milk Consumption</b>	1.25 (0.33-4.73)	2.4 (0.61-9.37)	1.67 (0.42-6.51)	0.44 (.097-2.04)
<b>High Soft Drink Consumption</b>	1.5 (0.35-6.39)	3.11 (0.67-14.43)	2.28 (0.49-10.60)	1.66 (0.29-7.64)

\*Significant at  $p < .05$ ,

Analysis of health outcomes by social and behavioral characteristics is shown in Table 3. Age is the only variable that consistently shows a significant association with health outcomes. Those with high physical activity (> 21.3 hours per week) were 5.70 (95 % CI: 1.24-26.3) times as likely to have elevated diastolic blood pressure as those with low physical activity. Those with high meat consumption were 6.5 (95% CI 1.18-35.8) times as likely to have elevated combined blood pressure as those with low meat consumption.

**Table 4. Odds ratios of the interaction between health outcomes and all variables shown on 1st column**

	<b>Elevated Systolic BP OR (95% CI)</b>	<b>Elevated Diastolic BP OR (95% CI)</b>	<b>Elevated BP OR (95% CI)</b>	<b>Above Normal BMI OR (95% CI)</b>
<b>Remittances</b>	7.20 (0.77-66.96)	3.36 (0.47-24.0)	5.27 (0.52-53.41)	0.72 (.14-3.73)
<b>Female</b>	-	-	-	-
<b>Age</b>	<b>24.87</b> <b>(2.29-269.88)*</b>	<b>59.75</b> <b>(2.53-1411.10)*</b>	<b>57.52</b> <b>(2.55-1295.27)*</b>	<b>10.86</b> <b>(1.18-99.72)*</b>
<b>High Physical Activity</b>	-	-	-	-
<b>Above Average Income</b>	-	-	-	-
<b>Professional Occupation</b>	-	-	-	-
<b>High Meat Consumption</b>	<b>13.14</b> <b>(1.12-154.23)*</b>	11.72 (0.83-166.24)	<b>24.28</b> <b>(1.27-462.37)*</b>	-
<b>High Milk Consumption</b>	-	<b>12.81</b> <b>(0.81-205.56)</b>	5.29 (0.44-63.95)	-
<b>High Soft Drink Consumption</b>	-	-	-	-

Table 4 shows the results of the final multivariate model for each health outcome. The association between remittances and health outcomes did not reach statistical significance in any of the models. As in Table 3 analyses, age consistently reaches statistical significance across all

models. High meat consumption is associated with both elevated systolic blood pressure and elevated blood pressure combined and is statistically significant at  $p < .05$ . High milk consumption is also associated with elevated diastolic and combined blood pressure, but does not reach statistical significance at 0.5.

## **Discussion**

This pilot study analyzed remittance status and its association with health outcomes, SES, and dietary and physical activity patterns among 37 Purepecha participants. The overall pattern points to remittances having some effect on poor health outcomes, diet, and physical activity. This study finds 32% of participants are obese using BMI. In addition, using waist circumference to height, 94.6% of the participants in this study are obese. The prevalence of obesity (based on BMI) in this study nears the nationwide obesity prevalence of 33%, which recently surpassed the U.S. (Pollani, 2013). The current results add nuance to aspects of the existing literature regarding obesity. In comparison, Stoddard et al 2011 found lower odds of obesity among indigenous when compared to non-indigenous participants in the Mexican Family Life Survey (MxFLS). In their analysis, Stoddard et al 2011 found that 21% of indigenous survey participants were obese. Earlier studies found that obesity among indigenous groups ranged from 7% to 20% (Guerrero-Romero et al., 1997; Rodriguez Moran et al., 2008; Schulz et al., 2006; Valencia et al. 1999).

A number of factors could underlie the divergence of this study with these earlier studies. As mentioned in the introduction, previous studies did not take into account migration and so it is possible that the higher proportion of obesity may be fueled by factor related to migration. The studies mentioned above conducted their investigations among groups in the northern part of Mexico. It may be probable that indigenous groups from northern Mexico are different in terms

of their exposures to obesogenic environments, have a different history of admixture which results in different genetic susceptibilities, or have other endogenous features that alone or in combination with the two above factors lower their risk of obesity and diabetes. Finally, it is also possible that the passage of time has led to changes responsible for the differences observed. It may be that if the same analyses were done in 2015, they would find an increase in obesity among the same indigenous groups.

Sociocultural causes are often deployed as explanations of differences in health. Food preferences fall within the sociocultural explanation and they have been used to explain both changes that lead to worsening health (Riosmena et al 2012) and as a protective mechanism that supports better health outcomes (Stoddard et al 2011). However, participants in this study reported consuming processed foods and foods prepared outside the home infrequently. If indeed food preferences are not changing toward that described by the NT, a different causal factor is responsible for the high levels of obesity and overweight in the Purepecha area.

Gender differences have not been satisfactorily explored in the migration and health investigations to date. Women seem to experience the NT at a rate faster than men (Rivera et al 2004). The results of this sample regarding above normal BMI (76.7% of sample), central obesity (94.6% of sample), and hypertension (59.5% of sample) may be due to the observation of more women than men. However, Ullman (2012) reports that the women whose husbands migrate to the U.S. are more likely to experience heart disease, emotional/psychiatric disorders, and be overweight/obese than those whose husbands do not migrate. That this study's results do not align with Ullman's may indicate ethnic differences in experiencing the NT. Riosmena et al (2012) report the NT taking place at a much slower rate in rural areas. All but one of the regions included in this study were rural yet the conditions that result from the NT are prevalent. This

difference with the Purepecha sample is concerning. It either points to NT causal factors for obesity, overweight, and hypertension that were not appropriately captured in this pilot study or to factors outside the NT that are fueling the high levels of these poor health measures.

SES measures have a significant negative association with receiving remittances. Those with a higher than median income were significantly less likely to receive remittances than those with a below median income. This may be explained by Garip's (2012) results. Those with a below-median income may belong to low-prevalence communities. This is difficult to determine given that a comparable prevalence measure was not calculated for these communities. In addition length of migration was not established for each individual's household member, so whether this captures the effects of a first-time migrant in a low-prevalence setting cannot be determined from the present data.

That those receiving remittances are less likely to own washing machines or automobiles was surprising. Based on evidence from the literature discussed above, it seemed more likely that this subset would be the one owning such markers of higher SES. Although not owning washers or cars does not inherently mean a person cannot afford them, the relationship between income and remittances may support that this is indeed the case. Since the reported income included income from remittances, I expected to see those that received remittances report an above average income. The negative association between professional occupation and receiving remittances echoes findings regarding advanced education and lower propensity for migration (Garip, 2012). Those who have a professional occupation undergo longer educational exposure and not only have they not migrated themselves, but they also did not report receiving remittances. Stark et al (1986) reported low returns to education for U.S. migrants. There were greater returns to education for those who remained in Mexico. In a context of low migration to

the U.S. Stark et al argue that it seems people decide to invest in education to remain in Mexico where there are high returns rather than invest in a much-riskier prospect of migrating to the U.S. Those that receive remittances are at the level observed by Stark et al. This may represent a sort of double-income boosting technique to remain in Mexico with some education and have some income that can be supplemented with remittances from the U.S. It is difficult to fully disentangle this however, given that I do not have the ability to separate communities by migration intensity.

Garip (2012) found that the effects of remittances and migration on wealth inequality depend on the migration intensity of the community. Perhaps the same is true for health indicators. It may be that like inequality, health outcomes are worse in areas of high migration. High migration prevalence communities are mostly repeat migrants (Garip, 2012); the opportunities for adoption of behaviors detrimental to health may be higher in such communities. Areas of lower migration may have lower exposure to both increased income and detrimental behaviors. That there is no significant association between remittances and health outcomes may be due to the undifferentiating of high and low migration prevalence communities in this study.

### **Limitations and Further Study**

This pilot study sought to explore the relationships that remittances has with health indicators, socioeconomic status, and dietary and physical activity measures in five Purepecha communities of Michoacan state, Mexico. Although remittances are associated with worse health outcomes, the small sample size is a limiting factor of this study. The data is also subject to reporting and recall bias as all measures regarding SES, diet, and physical activity were self-reported by those participating in this study. Participants were asked to report their consumption of *refrescos* (sodas); this particular term does not take into account other sugar-sweetened

beverages such as *aguas frescas* (fruit-flavored water with usually high sugar content), store-bought juices, or other added-sugar beverages. Questions regarding remittances specifically asked for income coming from the U.S. This did not address the interactions with health of Mexico's various cash transfer programs or the income from a household member working in a different region within Mexico.

Future studies will address the above issues and will explore other important topics. I will need to establish a more solid baseline in terms of the conditions of the region. In addition to an expanded array of biomarkers, inclusion of self-reported health is necessary to compare more broadly with existing literature. Many individual participants stated that the prevalence of diabetes within their communities is high and they expressed a desire for diabetes measures to be included in future studies. In addition, community prevalence measures of migration comparable to those existing in the literature will be created for each community. I will also include a broader examination of the social context that includes examining access to health care at different localities, the particular migration history of each community, and the length for which individuals have been migrating to the U.S.

## **Conclusion**

That obesity among the Purepecha study participants is near the Mexican national figure (the largest in the Latin American region) is alarming. It is imperative to explore in more detail to arrive at causal factors and more importantly at prevention of conditions for which obesity increases risk, such as cardiovascular disease. Taking specific ethnic identities into account of this research is important. Unfortunately in Mexico, as in many other places, social identity is itself a risk for disease. In Mexico, an indigenous identity has meant curtailed access to beneficial social and economic opportunities and a greater exposure to conditions detrimental to

well-being. The poverty and marginalization that some indigenous individuals suffer may be a reason for to migrate in search of wider opportunity. In addition, the obligation to fulfill ethnically-specific requirements, such as in the case of cargos, may serve as an incentive for others to migrate. Through migration, individuals may be able to mitigate some of the negative conditions of life and reach a greater degree of fulfillment. However, this is not without risk.

Further clarifying the role that migration plays in the development of obesity and hypertension among the Purepecha is important for Purepecha communities. They can include health outcomes when they weigh the benefits and risks of migration. Even if migration is significantly associated with poor health outcomes, it is unlikely that it will decrease or disappear among Purepecha communities. It is far too embedded, culturally and economically to stop suddenly. However, as Purepecha communities continue to engage in efforts for self-determination, knowing that migration may damage the body as well as the culture may be one more reason fueling the struggle to develop economic opportunities within their own communities. Learning more about migration and its role in overall well-being allows Purepecha individuals to manage their risks on their own terms.

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