How Does Adult Child Migration Affect the Health of Elderly Parents Left Behind? Evidence from Mexico *

Francisca M. Antman†
Department of Economics, *University of Colorado at Boulder*

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Abstract

This paper considers whether the health of elderly parents is adversely affected by the international migration of their children. Estimation of a causal effect is complicated by the fact that children may migrate in response to a parent's health status and there may be other unobserved factors influencing both parental health and child migration. I address this endogeneity problem by using instrumental variables methods where I instrument for having a child in the U.S. with the sex and married ratios of the children of the elderly respondents. To ensure the instruments are not influencing elderly health directly, I include children's contributions to their parents in the analysis. I also perform falsification tests which support the view that the causal mechanism is operating through children's migration. Overall, the evidence suggests that having a child migrate to the U.S. raises the probability that the elderly parent in Mexico will be in poor physical health. I conclude by exploring the possibility that the deleterious effects of children's migration on mental health are driving this relationship.

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†Contact: francisca.antman@colorado.edu, Department of Economics, University of Colorado at Boulder, 256 UCB, Boulder, CO 80309.

1 Introduction

In developing countries with high rates of international migration and rapidly aging populations, a critical public policy concern is who cares for the elderly dependents of migrants while they are away. In the case of Mexico, conventional wisdom suggests that the large flow of remittances from the U.S. to that country implies that elderly parents should benefit from a child's international migration. Nevertheless, little is known about the extent to which remittances are directed at elderly parents, particularly when migrants are old enough to have established households of their own. At the same time, the possibility that elderly parents may require physical care from their children for which there may be no close substitutes suggests that elderly parents may suffer when a child migrates. In addition, elderly parents in Mexico may suffer emotionally from a lack of contact with an adult child who migrates to the U.S., particularly when that child lacks documents to legally cross the international border.

This paper aims to establish the overall consequences of a child's migration to the U.S. for the health of his elderly parent remaining in Mexico. The data are from the 2001 wave of the Mexican Health and Aging Study (MHAS) that collects health and financial information from elderly participants in Mexico and indicates whether they have children living in the U.S. Using the MHAS, this paper sets out to estimate the effect of having at least one child in the U.S. on the health of elderly parents in Mexico.

In the economics literature, the question of how international migration affects family members left behind has begun to receive some attention. For Mexico, most of the focus has centered on how parental migration affects the educational outcomes of children [Hanson &

Woodruff (2003), McKenzie and Rapoport (2006), Antman (2010a), and Antman (2010b)]. In regards to the health effects of migration, Hildebrandt and McKenzie (2005) find that children in migrant households in Mexico have lower infant mortality rates and higher birth-weights. Similarly, Kuhn, et al. (2009) find positive effects of children's internal migration on the health of elderly parents in Indonesia. Of course, parental health may also affect children's migration. Giles and Mu (2007) examine Chinese data and find that poor parental health reduces the likelihood of rural-urban migration for male children. Their findings highlight the need for an identification strategy robust to the critique of reverse causation between parental health outcomes and children's migration.

Another important factor to consider is how children remaining in Mexico respond to the migration of one sibling by altering their own contributions toward their elderly parents. If, for instance, children remaining in Mexico were to fully substitute for the absent child's time contributions, then elderly parents may not be harmed by the migration of one child. Antman (2008) explores this possibility by estimating best response functions for individual time and financial contributions to elderly parents as a function of siblings' contributions in the context of international migration. Using these estimates, the results from a simulation generating an exogenous switch in a child's migrant status show a decrease in time and potentially even financial contributions for elderly parents. The question remains whether changes in these contributions following one child's migration have an impact on the overall health of elderly parents.

The main methodological obstacle is the endogeneity of migration. This may be manifested as a problem of reverse causation if children make migration decisions in response to their parent's health status. *A priori*, we cannot say whether this would generate a spurious

positive or negative correlation as children may migrate to earn additional funds for medical services or stay home to care for their ailing parents. Alternatively, child migration and elderly health could be correlated with some other unobserved variable that might generate a spurious negative correlation, such as a genetically inherited health deficiency, that precludes children from migrating and keeps their parents in poor health.

To ensure my results are not driven by these factors, I use instrumental variables (IV) estimation where the instrumental variables are the sex and married ratios of the children of elderly parents. Since men and married persons are more likely to migrate to the U.S., a parent with a higher fraction of sons and married children is more likely to have a child who is in the U.S. While I can show this set of instruments strongly predicts having a migrant child, one might be concerned that these instruments also influence elderly parental health directly, since the gender and married mix of children might also predict their contributions to their parents. To address this, I perform a check that the instrumental variables are not influencing elderly health through children's time and financial contributions to parents by including the contribution variables directly in the analysis.

Although I control for wealth directly in all specifications, another concern might be that the likelihood of children marrying are driven by some unobserved variable that also predicts child migration and parental health. Thus, as a robustness check, I also limit the IV analysis to the use of the sex ratio variable alone. To add support to the validity of the IV strategy, I also show that the instruments do not directly influence the health outcomes for parents with no migrant children in the U.S., suggesting that the causal mechanism does not operate independently of children's migration. I also perform a falsification test to confirm that the IV strategy does not yield results indicating that children's migration affects health

problems that the parents experienced early in life–outcomes that should not be affected by children's migration.

Overall, I find evidence that a child's U.S. migration leads to a greater chance that his elderly parent in Mexico will be in poor physical health. While I cannot conclusively pin down the mechanism driving this relationship, by controlling for contributions directly in the analysis, I establish that this effect is independent of children's contributions. I then use the same identification strategy to present evidence that a child's U.S. migration also leads to worse mental health outcomes for elderly parents in terms of a greater likelihood that the elderly parent will suffer sadness, loneliness or depression. The medical literature has long examined the mind-body connection and suggests that mental health can have a significant impact on health outcomes for elderly persons. In this case, the relationship between mental health and child migration could be driven by the psychological cost of having an absent child or the anxiety associated with having a child living abroad. Nevertheless, I cannot rule out that children's migration is affecting parental physical health and thereby resulting in mental health deterioration for elderly parents.

The paper proceeds as follows: Section 2 discusses the Mexican institutional context within which to understand the relative vulnerability of the elderly population; Section 3 describes the MHAS data set used in the analysis; Section 4 discusses the IV strategy, Section 5 presents the main results regarding the effect of child migration on the physical health of elderly parents; Section 6 goes through several robustness checks including controlling for children's contributions as well as falsification tests supporting instrument validity; Section 7 discusses mental health as a possible mechanism underlying the observed relationship; Section 8 concludes.

2 Institutional Context

Elderly parents in Mexico face considerable challenges in maintaining good health in old age. While all Mexicans are entitled to health care protection under the Mexican Constitution, in practice access to quality care is far from universal.[1] The Mexican health care system is comprised of an array of institutes, social programs, and private providers, that can largely be categorized into three distinct entities: (1) the social security system, (2) the public health institutions under the auspices of the Ministry of Health and the State Health Services which target the population not served by the social security system, and (3) a largely unregulated private sector which mainly operates on the basis of fee-for-service (OECD 2005a). The mechanism for determining the sector to which an individual belongs is largely employment based. Employers in the formal sector are required to register their employees with the relevant social security institute which provides a range of social insurance that can include old-age pension benefits and health insurance for the employee and her dependents. As formal sector employment is somewhat rare in Mexico, it is estimated that only around half of the population are covered by the social security system. Individuals not employed in the formal sector can access the State Health Services system and pay heavily subsidized user fees for care, but it is widely viewed as lower quality care than that provided in the social security system (OECD 2005b).

Funding for the social security institutes is based on contributions from employees, employers, and the federal government, and is significantly higher than that of the publicly-

[1] The section draws heavily from OECD (2005b). I exclude a discussion of the recent changes made to the Mexican health care system, most notably the expansion of coverage for the uninsured population under *Seguro Popular*. The data used in this paper predate those reforms.

financed State Health Services. The public health systems are also vertically integrated in the sense that each institute operates its own facilities at all levels of care, contributing to the inequality in health care across the population at large. Not surprisingly, there are also significant inequalities in the Mexican health care system across states in Mexico, rural and urban areas, and of course income categories since poorer people are more likely to be informal workers. One measure of the significant underprovision of health care by government sources and the resulting excess demand for quality care is the fact that more than half of total health expenditures in Mexico are in the private sector. Another testament to the link between health expenditures and poverty is that almost 20 percent of households in the bottom quintile have experienced health expenditures that resulted in pushing them below a poverty threshold (OECD 2005b).

A final factor making it difficult for elderly parents to maintain good health is the fact that the provision of long-term care in institutions such as hospitals and nursing homes is very limited in Mexico. The social security system has limited capacity for this type of assistance and for those outside of the social security system, hospitalization would only cover acute conditions (OECD, 2005a). Thus, most elderly parents are likely to turn to their families for assistance in maintaining their health and coping with any adverse shocks in old age.

3 Data

3.1 Description

The data come from the Mexican Health and Aging Study (MHAS), a joint project between Mexico's statistical agency, INEGI, and researchers at the Universities of Pennsylvania, Maryland, and Wisconsin.[2] The MHAS was designed as a nationally representative panel data set of Mexicans born before 1950 with surveys in 2001 and 2003. I limit the sample to those elderly parents whose demographic information such as gender and age do not present a conflict between the two waves and who have complete data on the health and demographic information used in the analysis.[3] Nevertheless, attrition remains considerable as only about 19% of parents (1,286) satisfying these criteria are observed in both waves. In addition, only 121 of these parents experience a change in their children's migration status over this relatively short window of time, effectively ruling out the use of parental fixed effects in the analysis. Thus, I limit attention in this paper to the first wave of the study in 2001.

MHAS respondents are asked questions regarding their income, assets, and labor supply, detailed questions on health status, and whether they have any children that are currently in the U.S. The survey also asks whether the respondent's children have ever lived or worked in the U.S. and the IV results using that measure of children's migration exposure are very similar to the results from the analysis indicating whether the parent has any child currently

[2] Available at http://www.mhas.pop.upenn.edu/english/home.htm.

[3] The MHAS identifies an elderly sampled person and subsequently also interviews his spouse. However, since spouses are not always parents of the children of the sampled person, I limit the sample here to the elderly sampled person alone.

in the U.S. In this paper, I focus on current migration status because it most closely matches the measures of financial and time contributions to elderly parents described below.

The main outcome variables of interest relate to the parent's physical health. For this, two variables are used in the analysis. The first is a self-reported health quality variable ranging from one, excellent, to five, poor. Figure 1 shows the distribution of this variable by migration status. As can be seen from the figure, the distribution of health quality of parents with a child in the U.S. is shifted right from that of parents with no children in the U.S., already suggesting that the former group reports poorer health outcomes. Parents with no children in the U.S. are more likely to report they are in excellent, very good, or good health, while parents with at least one child in the U.S. are more likely to report their health is fair or poor. I convert the health quality variable into a dichotomous outcome, "Poor Health Quality," equal to one if the respondent claims his health is poor, and zero if the respondent describes his health as fair, good, very good, or excellent.

One concern with the poor health quality measure is that it is inherently subjective, and thus may not give us an accurate portrayal of the true cost or benefit of child migration on elderly parent health. To address this critique, I construct another health outcome, "Poor Physical Health," a dummy variable equal to one if the respondent claims that he has ever been told that he has had a stroke or heart attack. While other, less extreme measures of health problems are also available, they are arguably more subject to resulting biases due to the endogeneity of diagnosis and self-reporting.[4] Finally, for Section 7, where I investigate a possible mechanism driving the relationship between child migration and elderly health, I

[4]For instance, many respondents may suffer from diabetes or hypertension without ever having received a formal diagnosis.

construct a mental health outcome variable, "Poor Mental Health, " which is equal to one if the respondent reports having felt depressed, lonely, or sad for the majority of the time in the week prior to the administration of the survey.

In Section 6, I also examine the role played by contributions toward the elderly above and beyond the migration status of his children. For this purpose, I exploit the information about financial transfers between the respondent and his children contained in the MHAS. The financial variable is the result of a series of questions regarding how much money the child contributed to the elderly parent in the past 2 years.[5] Most participants that respond refer to a monthly contribution from each child and for those who do not, I convert the answer into a monthly average. Respondents who were not sure of the amount were allowed to respond with a pre-specified range of values. I converted these responses to the mean of the range specified using the continuous data as the empirical distribution. These values are then aggregated so that the financial contribution variable reported here is the monthly financial support from all children of the elderly respondent.

The data set also includes information on the number of hours of help the respondent receives, however these responses are conditional on the respondent reporting difficulty with "Activities of Daily Living" (ADLs). These tasks are divided into basic ADLs and higher level "Instrumental Activities of Daily Living" (IADLs). The basic ADLs involve getting in and out of bed, bathing oneself, using the toilet, eating, and walking across a room. The IADLs involve preparing a hot meal, shopping for groceries, taking medications if needed, and managing money. Since these are the only measures of hourly help in the study, the time contribution variable used here should be viewed as a measure of more critical hourly

[5] All financial data were converted to 2002 Mexican pesos using the national Consumer Price Index.

help, where respondents who have no need for a particular type of assistance receive zero hours of help.

When considering the role of time contributions in elderly health, I limit the sample to families where the parent reported difficulty with at least one ADL or IADL. While cutting the data set on this dimension limits the number of observations to around 11 percent of the usable sample, focusing on this restricted group is arguably of more interest from a policy perspective since they are the most vulnerable. One might also expect that families with parents with these difficulties might differ considerably from families where the parent is more independent. Thus, the restricted sample can be thought of as a more flexible specification where I have allowed all effects to vary based on the parent having difficulties with one or more activities of daily living.

Once respondents are identified as requiring help with this set of activities, they are asked to list the amount of time individuals spend helping them with these particular tasks. The respondents are then asked how many days in the last month and how many hours per day the individuals specified spent helping the respondent with any ADLs or IADLs. The time contribution variable is the total number of monthly hours of help a parent receives from all children. In the case where a non-resident child's spouse or children (grandchildren of the respondent) helped the elderly person, the survey records this time contribution as deriving from the child of the elderly parent, so the time contributions can be thought of as hourly help flowing from the families of the respondent's children.[6]

While the MHAS does not collect data on the detailed migration histories of a re-

[6] This actually makes the time contribution variable more consistent with the financial contribution variable which certainly can be viewed as stemming from the child's immediate family.

spondent's child, the child's earnings, or any transfers among children, it does collect basic information on a child's education, marital status, current U.S. migration status, and the number of his children (grandchildren of the respondent). For the instrumental variables, I focus on the sex ratio of the children of the elderly respondents (number of daughters/ number of children) and the children's married ratio (number of married children/number of children). In the robustness section below, I limit the set of instruments to the children's sex ratio alone and describe the falsification tests I perform to lend support to the identification strategy.

3.2 Descriptive statistics

Table 1 presents descriptive statistics for the 6,730 observations of elderly parents, 22 percent of which have at least one child in the U.S. at the time of the survey. Even in a simple comparison of means between parents with children in the U.S. and those without, worse health outcomes are apparent for parents with at least one child in the U.S. The latter group is more likely to report poor health quality (21% versus 14%), poor physical health (6% versus 5%), and poor mental health (60% versus 52%). They are also more likely to be female, are slightly older, and have fewer years of education, although they are just about as likely to be married as those without children in the U.S. In terms of resources, parents of children in the U.S. receive less monthly income, although the magnitude of financial assistance from children is significantly higher for parents with children in the U.S. The difference in assets between the two groups is not statistically significant.

Parents with children in the U.S. are also less likely to report having access to medical

services, have more children (7 versus 4.9) and grandchildren (14.4 versus 8.7), and are less likely to live in more urban areas. The instrumental variables also demonstrate some differences by migration status in the summary statistics, showing that parents with children in the U.S. have a slightly lower fraction of daughters and higher fraction of married children.

These descriptive statistics point to significant differences between elderly parents based on the migrant status of their children. However, they do not rule out the possibility that these differences are driven by some variable correlated with children's migration status or that children's migration status is actually responding to the outcomes observed here. I now turn to controlling for the observed characteristics discussed above and establishing the case for a causal effect of a child's migration on his parent's health.

4 Empirical strategy

I begin with a simple regression model where the health of an elderly parent is a function of his children's migration status and other characteristics thought to determine elderly health outcomes:

$$Health_i = \beta MigrantChildUS_i + \gamma\prime X_i + \epsilon_i \ , \tag{1}$$

where the dependent variable, $Health_i$, denotes the health outcome of the parent remaining in Mexico, either "Poor Health Quality" or "Poor Physical Health."[7] The effect

[7] I have also run the analysis using an indicator for reporting a difficulty with at least one basic "Activity of Daily Life" as the dependent variable. The results are similar in sign to those shown below, but in part because relatively few people report these problems, the coefficient on having a child in the U.S. is not statistically significant.

of interest is captured by the coefficient on $MigrantChildUS_i$, a dummy variable which indicates whether the respondent has at least one child currently in the U.S.[8] The vector of covariates X_i , includes the following characteristics of the elderly parent: age, age squared, education categorical variables (corresponding to educational attainment of 1-6 years, 7-9 years, 10-12 years, and 13 or more years), a married dummy variable, assets, monthly income, a dummy indicating whether the respondent reports having access to medical services, number of children and grandchildren, and a dummy variable indicating that the respondent lives in a more urban area (population of 100,000 or more).

As discussed in the introduction, one concern with estimating the equation above is that OLS estimation will yield biased estimates of β since the $MigrantChildUS_i$ variable is endogenous. One potential source of endogeneity is the relationship forged by genetics and experience that results in a correlation between unobserved components that influence the migration choices of the child and the health of the parent. Another possible source is reverse causation where a child chooses whether to migrate in response to the health of his elderly parent.

The solution proposed here relies on instrumental variables methods. The instrumental variables include the sex ratio of the children of the elderly parent and the fraction of children that are married.[9] The sex ratio is believed to affect whether the elderly parent

[8]Instead of using current migration status, I have also tried estimating the equation above with an indicator for whether the elderly parent has ever had a child work or live in the U.S., not counting vacations or short visits. The IV results are very similar to those presented here and are available upon request.

[9]Some might be concerned that, since I am controlling for the number of children of the elderly parent, the sex ratio of those children may be endogenously determined by parents through some sort of stopping rule. To address this, in place of the sex ratio variable I have also used an indicator for whether the first-born

has any migrant children in the U.S. because it is more likely that men will migrate than women, as immigrants are more heavily concentrated in male-dominated industries such as manufacturing and construction (Grieco and Ray, 2004). Similarly, it has been found that married children are more likely to migrate to the U.S. than unmarried ones, perhaps because of the increased responsibility that implies. As the sex ratio is more likely to be purely random, I limit the IV regression to this sole instrument in the robustness section below. The main empirical model amounts to estimation of the equation above by instrumental variables where the migration status of the children is estimated via the following first-stage regression:

$$MigrantChildUS_i = \pi\prime Z_i + \theta\prime X_i + \epsilon_i \ , \tag{2}$$

where Z_i is a vector of instrumental variables excluded from equation (1). The set of variables Z_i is the fraction of women among the children of the elderly parent as well as the fraction of her children that are married.

Of course, the second well-known criterion for IV analysis is the exclusion restriction. Certainly, the sex ratio can be argued to be randomly assigned, however, the question remains whether it does not influence elderly health independently of the migration status of children. For instance, having a higher fraction of daughters might make it less likely that a parent will have a child in the U.S., but it might also translate into higher contributions from her children which might affect her health directly. To address this, in the robustness section below I include time and financial contributions in the analysis, both as controls and, for

child is female. I find that the F statistic from the first stage is only slightly smaller (15.11) and the IV results are very similar to those reported here.

the case of financial contributions, as a single endogenous variable where the instruments are again the sex ratio and the married ratio of the children. There it is argued that the instrumental variables do not affect elderly health outside of their influence through migration and contributions. This more comprehensive model can also be viewed as a framework for exploring whether the migration status of children affects elderly health over and above its effect on the contributions from those children. A potential channel to consider might be the psychic cost of missing children that are out of the country and with whom the parent inherently has more limited contact.

5 Results

5.1 Regression Results

As a baseline, Table 2 presents the results of the least squares regression, linear probability model (LPM), without accounting for the endogeneity of migration. All poor health outcomes appear to be positively related to having a child in the U.S., although the magnitudes of the coefficients are very small (ranging from 0.01 to 0.04) and the coefficient in the physical health equation is not statistically significant at the 10 percent level (p-value equals 0.115). Other interesting correlations show that women are more likely to report poor health quality and educational attainment above zero years is negatively associated with poor health outcomes. Assets and monthly income are also negatively related to poor health outcomes, although these relationships are not always statistically significant.

Table 3 shows the results from the same regression model implemented as a probit. The

coefficients of interest are all very close to those obtained using OLS, suggesting that the linear probability model is not far off the mark. The marginal effects range from 0.04 for the poor health quality outcome to 0.01 for the poor physical health outcome. In light of the fact that predicted probabilities are 0.14 and 0.05 for these respective outcomes, the effective magnitudes of the coefficient estimates appear to be relatively large. The question remains whether this finding is driven by reverse causation or unobserved heterogeneity. Antman (forthcoming) discusses descriptive evidence suggesting that most migrant children left before the parent experienced a heart attack or stroke, but that still leaves open the question of whether some unobserved variable drives both elderly health and child migration.

Of course, the IV analysis provides a more thorough treatment of this type of endogeneity. Table 4 shows the results of the IV linear regressions using the two instrumental variables discussed above interpreted within the context of the linear probability model. Having a child in the U.S. results in a greater likelihood of reporting poor health quality and suffering poor physical health. These coefficient estimates are significant at the 5 and 10 percent levels, respectively, and the high p values from the overidentification tests indicate that we can fail to reject the null hypothesis of valid instruments in all regressions.

The magnitudes of the estimates suggest that having at least one child in the U.S. increases the likelihood of poor health quality by 37.5 percentage points, and poor physical health by almost 21 percentage points. As in the least squares results, being a woman is positively related to poor health quality, although the female indicator has a negative coefficient in the poor physical health regression. This is consistent with women being at lower risk for heart attack and stroke, after controlling for other demographic variables. In addition, educational categories above zero years are negatively associated with poor health outcomes,

suggesting that higher educated people are less likely to be in poor health.

6 Robustness

6.1 Children's Contributions to Elderly Parents

As mentioned in the empirical strategy above, one concern with the IV results may be that children's sex and married ratios violate the exclusion restriction by influencing elderly health directly through the contributions received from children. Table 5 addresses this concern by entering financial contribution variables into the regression model for the full sample of elderly parents. Panel A reports the results when monthly financial aid from all children is included as a control variable. Despite being measured in thousands of pesos, the magnitude of the coefficient on this variable is close to zero in both equations and is not statistically significant. These results suggest that contributions do not play a significant role in determining elderly health after considering migration status.

More importantly, the estimates of the impact of having a child migrant in the U.S. are almost identical to those reported in the specification without controlling for financial help (Table 4), indicating that the migration results are robust to considerations of child contributions. Table 5, Panel B reports the results from a similar regression, but where the financial contributions variable is also treated as endogenous and instrumented for with the sex and married ratios of children. The results are almost identical to those in Panel A. Thus, it would appear that the exclusion restriction is not threatened by concerns regarding financial contributions.

If, however, financial and time contributions are not perfectly substitutable, there may still be a concern that an omitted variable, time contributions, is resulting in a violation of the exclusion restriction necessary for IV analysis. To address this, I consider the sample of parents for whom the survey collects data on both financial and time contributions. Table 6 presents the results from this robustness check where financial and time contributions are allowed to play a role in elderly health beyond the migration status of children. Panel A reports the results from the baseline IV regression without contributions on this smaller sample of 769 parents who report difficulties with ADLs. Panel B reports the results of the IV regression where financial and time contributions are included as control variables.

The results from the baseline IV regression on this smaller group of parents are considerably different from the results from Table 4, and understandably so since this set of parents is a selected sample. However, none of the coefficient estimates of interest are statistically significant. More importantly, the results from Panel B closely match those from Panel A, again suggesting that the effects of child migration on elderly health outcomes are very similar whether or not contributions are included as controls. These results again appear to indicate that contributions do not play a significant role in determining elderly health outcomes once we account for children's migration. This is also suggestive evidence that the exclusion restriction is robust to concerns involving children's time and financial contributions.

6.2 Instrument Validity

The IV strategy proposed here relies critically on the validity of the instruments used. To address this, Table 7 presents first-stage results from a least squares regression where the dependent variable is whether the elderly parent has a child in the U.S. at the time of the survey. As expected, the fraction of daughters is found to decrease the probability of having a child in the U.S. and having a greater fraction of married children is found to raise the probability of having a migrant child. Female parents are also more likely to have migrant children as are parents with no education (the omitted category), parents with more children, and parents living in less urban areas. The probability of having a child in the U.S. is increasing in parental age up until about age 64, at which point older parents are less likely to have a child in the U.S. The coefficient estimates on the instrumental variables are significant at the 1 percent level, reflecting the predictive power of the sex and married ratios individually. In addition, the F statistic on the excluded instruments, a commonly used diagnostic for detecting weak instruments, is 17.73, indicating the relative strength of this set of instrumental variables.

As noted above, one concern about this set of instruments is over the exclusion restriction necessary for IV analysis. While I address the concern over children's contributions directly by controlling for financial and time contributions, due to data limitations I can only control for a specific measure of time contributions and only for a selected sample of elderly parents. Consequently, some might still be concerned that the children's married and sex ratios affect elderly parent health other than through the migration of children, if for instance daughters or single children are more likely to spend social time with parents and this has a direct

impact on their health. If this critique were true, then we would expect the married and sex ratios to operate outside the migration channel, by affecting the health of parents with no migrant children in the U.S.[10] This amounts to a falsification test that can be investigated by running the reduced form regression of the elderly health outcome on the instruments for the sample of parents with no migrant children in the U.S.[11]

Table 8, panel A shows the results from the reduced form regressions for the self-reported health quality and poor physical health measures. In neither regression does the effect of the instruments appear to have a significant impact on the health outcomes of elderly parents. I also fail to reject the hypothesis that the coefficients are jointly equal to zero, with a low F statistic around 1.8 in both regressions. In fact, the point estimates are all very close to zero, suggesting that the instruments do not appear to significantly affect elderly parent health outside of children's migration.

Another suggestive test of the identification strategy is to check that the instruments themselves are not responsible for generating spurious relationships between parental health and child migration. We would be concerned if, for instance, it appeared that children's migration were having an effect on parental health outcomes that are not affected by environmental factors. While information on purely genetic diseases is not available, the MHAS does ask whether respondents experienced a health problem before the age of ten

[10] Certainly, if there were a strong direct effect of the instruments on the outcomes, we would expect to see it expressed in a reduced form regression of the outcomes on the instruments for parents of non-migrants. However, a non-zero finding could also suggest a significant degree of selection into migration coupled with a powerful instrument. Since I find that the effect is small and statistically indistinguishable from zero, I take it as suggestive evidence in support of the exclusion restriction.

[11] Thanks to Craig McIntosh for suggesting this robustness check.

that affected their normal activities for at least one month. As with the case of genetic diseases, this type of health problem could not have been caused by children's migration, and thus using it as the dependent variable in the analysis amounts to a falsification test on the identification strategy.[12]

The results in panel B of Table 8 show that, as expected, children's migration has no statistically significant effect on whether a parent had a health problem before age ten, a finding that is consistent with a valid identification strategy.[13] In fact, the coefficient estimate on the migrant child dummy variable is actually negative, suggesting that parents with children in the U.S. are actually less likely to have experienced an early life health problem. Since this result is in the opposite direction of the main findings and in any case is not statistically significant, it also lends empirical support for the use of these instrumental variables.

[12] This type of falsification test is similar to that employed by Galiani, et al. (2005) who check that water privatization has a negligible impact on causes of death unrelated to the quality of water. In the same spirit, I have also checked whether children's migration has an impact on the probability that an elderly parent has had a cancer diagnosis which presumably has a significant genetic component. While I find no statistically significant effect, a cancer diagnosis is particularly uncommon in this sample, so I do not present the results here.

[13] Ninety of the 6730 respondents in my sample refused or said they did not know when asked about health shocks prior to age 10. For the analysis in Table 3, panel B, I drop them from the sample, explaining the drop in the number of observations. The results are almost exactly the same if the full sample is used and the problematic observations are treated as not having experienced a health shock. The IV results from the physical and mental health outcomes below are also very similar when the sample is limited to those respondents who answer either yes or no to this question about early life health problems.

6.3 Other Robustness Checks

Another point that may cast doubt on instrument validity is the use of the children's married ratio as an instrumental variable. One might argue that children's marital choices respond to elderly parent's health or that there may be some other unobserved component that might be correlated with a child's propensity to marry and his parent's health, for instance if the child is in poor health himself. To address this, in Table 9, Panel A, I limit the instrumental variables used in the analysis to the sex ratio variable alone. The magnitudes of the effects of migration on poor health outcomes drop somewhat relative to the results using both instruments, but are still positive, though not statistically significant. This may be due in part to the relative weakness of the instrument set when only sex ratio is used, with a first stage F statistic around 8.

Finally, I address the question of whether the use of the IV linear probability model skews the magnitude of the estimates. Table 9, Panel B presents the results from the IV-probit model and reports the marginal effects of having a child in the U.S. on elderly parent health. Having a child in the U.S. raises the probability of reporting poor health quality by 59 percentage points and raises the probability of poor physical health by 47 percentage points.

A final alternative to the IV linear and IV probit models is the seemingly unrelated bivariate probit model where health outcomes and child migration status can be treated as binary variables. Panel C shows the results from this estimation. The magnitudes of the estimates change somewhat from Panel B, so that the estimates now range from 0.42 for poor health quality to 0.59 for poor physical health. These results remain within reasonable

distance of the IV linear probability model estimates, suggesting that we can conclude that child migration has a deleterious effect on parental health.

7 Possible Mechanism: Mental Health

Thus far, the results presented have shown a significant effect of children's migration status on parental health that is independent of children's contributions. This leaves open the question of what mechanism could be driving the relationship between children's migration and a parent's physical health. One possibility alluded to in the introduction is the psychic cost of a child's migration on his elderly parent. Child migration could affect an elderly parent's mental health because the migration of a child necessarily means limited contact between the elderly parent and the migrant child. This is particularly true in the case of migration to the U.S. which is often undertaken illegally, thus limiting opportunities for travel between the two countries. Another possible channel could be the anxiety involved in worrying about a child who may have migrated illegally. The result could be a an increase in sadness, loneliness, and depression for the elderly parent as measured by the poor mental health variable introduced above.

Researchers in the medical community have found significant effects of depressive symptoms on subsequent physical and health outcomes (Vaillant 1979, McCusker, et al. 2007). In particular, this has been found to be true for patients with heart disease (Ruo, et al. 2003), a fact that relates to the use of the poor physical health measure used in the analysis here. The medical literature has also established a role for social interactions, particularly with children, to mediate the influence of mental on physical health (McCusker, et al. 2007,

Leifheit-Limson, et al. 2010). Results from this study are consistent with these findings. While I cannot pin down the direction of causality, I find a strong positive correlation between the poor mental health and poor physical health measures that is robust to controlling for the host of covariates included in the analysis above.

If in fact mental health is the mechanism by which child migration affects parental physical health, we would expect to find evidence that child migration also leads to worse mental health outcomes for elderly parents. Using the same identification strategy as detailed above, I present the results from this analysis in Table 10. Columns (1) and (2) show the results for the least squares and probit results showing a positive, statistically significant relationship between having a child in the U.S. and poor mental health outcomes for elderly parents in Mexico. While the point estimate is around 0.03 in the latter two specifications, the predicted probability is around 0.54, suggesting that the effective magnitude of the estimate is not very large. As was the case for the physical health measures, the magnitude of the effect rises in column (3) once endogeneity is accounted for by way of instrumental variables (point estimate around 0.48). The coefficient estimate remains virtually unchanged when children's financial contributions are included as a control or endogenous variable in the model (columns 4-5).

While these results are only suggestive, they are consistent with a story in which adult child migration results in worse mental health outcomes for elderly parents in Mexico and this mental health decline precipitates a deterioration in physical health as well. However, because I cannot pinpoint the direction of causality between physical and mental health, I cannot rule out the possibility that children's migration is affecting a parent's physical health through some other channel and thereby resulting in a decline in mental health.

8 Conclusion

The evidence presented above has shown that having a child migrate to the U.S. leads to a greater chance that elderly parents in Mexico will suffer poor physical health outcomes ranging from self-reported health quality to a greater incidence of heart attack and stroke. The robustness checks on the identification assumption, including falsification tests suggesting that the effects are operating through children's migration, support the findings that international migration has a causal effect on the health of elderly parents left behind. The fact that the results change so little after controlling for children's time and financial contributions suggests that children's migration is having a significant impact on elderly health that is independent of contributions to parents.

I have explored the possibility that the mechanism underlying this effect may be operating through the impact of children's migration on mental health, and the results are consistent with a story in which the migration of a child results in greater anxiety and depressive symptoms for elderly parents that subsequently affect their physical health. Further research should explore data on social interactions to see how children's migration affects the social support elderly parents receive and how parental health outcomes vary based on the duration of children's migration. Nevertheless, even these first steps into the investigation of this important topic cast further doubt on the view that families in Mexico always benefit from having a member migrate to the U.S. These findings should pose cause for concern in areas where high rates of migration have coincided with the rapid aging of the population and suggest policymakers should shore up alternative sources of support for elderly dependents.

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Table 1: Descriptive Statistics by Migration Status of Children

	No Child in US		Has Child in US			
	Mean	SE	Mean	SE	Difference	
Poor Health Quality[a]	0.14	0.00	0.21	0.01	-0.07	***
Poor Physical Health[b]	0.05	0.00	0.06	0.01	-0.01	*
Poor Mental Health[c]	0.52	0.01	0.60	0.01	-0.07	***
Female	0.54	0.01	0.58	0.01	-0.03	**
Age	61.27	0.13	62.86	0.23	-1.60	***
Education (years)	5.23	0.06	3.43	0.09	1.81	***
Married	0.62	0.01	0.62	0.01	0.00	
Assets (1,000s of 2002 pesos)	119.59	6.35	114.58	14.27	5.01	
Monthly Income (1,000s of 2002 pesos)	8.39	1.63	3.49	1.07	4.91	**
Financial Help from Kids (1,000s of 2002 pesos)[d]	0.96	0.10	2.12	0.36	-1.16	***
Right to Medical Services	0.69	0.01	0.55	0.01	0.14	***
Kids	4.86	0.04	6.96	0.07	-2.09	***
Grandkids	8.74	0.13	14.44	0.29	-5.70	***
More Urban Area (100,000 ppl +)	0.74	0.01	0.53	0.01	0.22	***
Kids Sex Ratio (Daughters/Kids)	0.49	0.00	0.48	0.01	0.01	*
Kids Married Ratio	0.60	0.00	0.71	0.01	-0.11	***
Number of Observations	5247		1483			

[a]Poor Health Quality is self-reported indicator variable: 1 = poor health; 0 = fair, good, very good, or excellent health

[b]Poor Physical Health is an indicator for whether the respondent has had a stroke or heart attack

[c]Poor Mental Health is an indicator for whether the respondent reports has felt any of the following conditions the majority of the time in the past week: depression, loneliness, sadness

[d] Financial help from kids is monthly financial assistance received from all children in 1000s of 2002 pesos

Table 2: Parental Health and Child Migration, OLS Regressions, LPM

	(1) Poor Health Quality[a]	(2) Poor Physical Health[b]
Has Child in US	0.038	0.012
	[0.012]***	[0.007]
Female	0.038	-0.009
	[0.010]***	[0.006]
Age	0.007	0.004
	[0.006]	[0.004]
Age Squared	-2.23E-05	-1.30E-05
	[4.787e-05]	[2.972e-05]
Education Category 1: 1-6 yrs.	-0.03	-0.009
	[0.013]**	[0.008]
Education Category 2: 7-9 yrs.	-0.082	-0.022
	[0.016]***	[0.010]**
Education Category 3: 10-12 yrs.	-0.118	-0.01
	[0.018]***	[0.016]
Education Category 4: 13 + yrs.	-0.098	-0.011
	[0.017]***	[0.013]
Married	0.009	0.006
	[0.011]	[0.006]
Assets	-1.12E-05	-3.76E-06
	[5.936e-06]*	[3.395e-06]
Monthly Income	-3.16E-05	-7.29E-06
	[1.907e-05]*	[5.870e-06]
Right to Medical Services	-0.019	0.016
	[0.010]**	[0.006]***
Number of Kids	-4.38E-04	0.001
	[2.348e-03]	[0.002]
Number of Grandkids	0.001	-1.64E-05
	[0.001]	[4.868e-04]
Urban Indicator (100,000 ppl +)	YES	YES
Constant	YES	YES
Observations	6730	6730
R-squared	0.047	0.011

Robust standard errors in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

[ab] See notes below Table 1 for description of dependent variables

Table 3: Parental Health and Child Migration, Probit Marginal Effects

		(1)	(2)
		Poor Health	Poor Physical
	Mean	Quality[a]	Health[b]
Has Child in US	0.220	0.036	0.011
		[0.011]***	[0.007]
Female	0.552	0.039	-0.008
		[0.009]***	[0.006]
Age	61.619	0.014	0.006
		[0.005]***	[0.003]*
Age Squared	3884	-7.19E-05	-3.00E-05
		[3.989e-05]*	[2.398e-05]
Education Category 1: 1-6 yrs.	0.541	-0.023	-0.008
		[0.010]**	[0.007]
Education Category 2: 7-9 yrs.	0.136	-0.069	-0.02
		[0.012]***	[0.008]***
Education Category 3: 10-12 yrs.	0.036	-0.107	-0.008
		[0.014]***	[0.014]
Education Category 4: 13 + yrs.	0.070	-0.093	-0.007
		[0.014]***	[0.011]
Married	0.617	0.009	0.006
		[0.010]	[0.006]
Assets	118	-2.58E-05	-5.13E-06
		[1.759e-05]	[6.637e-06]
Monthly Income	7.314	-0.001	-6.09E-05
		[0.000]***	[4.926e-05]
Right to Medical Services	0.657	-0.019	0.015
		[0.009]**	[0.006]***
Number of Kids	5.326	0.001	0.001
		[0.002]	[0.001]
Number of Grandkids	9.992	4.78E-04	-6.24E-06
		[6.230e-04]	[3.920e-04]
Urban Indicator (100,000 ppl +)	0.694	YES	YES
Predicted Prob. (at mean of Xs)		0.139	0.049
Observations		6730	6730

Robust standard errors in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

[ab] See notes below Table 1 for description of dependent variables

Table 4: Parental Health and Child Migration, IV Regressions, LPM

	(1) Poor Health Quality[a]	(2) Poor Physical Health[b]
Has Child in US	0.375	0.208
	[0.187]**	[0.117]*
Female	0.03	-0.014
	[0.011]***	[0.007]**
Age	1.79E-04	-0.001
	[7.791e-03]	[0.005]
Age Squared	3.24E-05	1.88E-05
	[6.010e-05]	[3.735e-05]
Education Category 1: 1-6 yrs.	-0.029	-0.008
	[0.014]**	[0.008]
Education Category 2: 7-9 yrs.	-0.076	-0.018
	[0.017]***	[0.011]*
Education Category 3: 10-12 yrs.	-0.097	0.003
	[0.022]***	[0.019]
Education Category 4: 13 + yrs.	-0.091	-0.007
	[0.019]***	[0.014]
Married	0.009	0.006
	[0.011]	[0.007]
Assets	-1.64E-05	-6.77E-06
	[6.803e-06]**	[4.046e-06]*
Monthly Income	-2.45E-05	-3.16E-06
	[1.862e-05]	[6.542e-06]
Right to Medical Services	0.002	0.029
	[0.016]	[0.010]***
Number of Kids	-0.013	-0.007
	[0.007]*	[0.005]
Number of Grandkids	0.001	-7.27E-05
	[0.001]	[5.194e-04]
Urban Indicator (100,000 ppl +)	YES	YES
Constant	YES	YES
Observations	6730	6730
Overidentification p value	0.729	0.537
F stat on excluded instruments	17.73	17.73

Robust standard errors in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

[ab] See notes below Table 1 for description of dependent variables

Instruments: Kids Sex Ratio, Kids Married Ratio

Table 5: Parental Health and Child Migration with Financial Contributions
Full Sample

Panel A: Financial Contribution as Control, IV Regression, LPM

	(1) Poor Health Quality[a]	(2) Poor Physical Health[b]
Has Child in US	0.376	0.209
	[0.187]**	[0.117]*
Financial Help from Kids[d]	-0.001	-3.96E-04
	[0.001]	[3.159e-04]
Overidentification p value	0.754	0.551
Observations	6730	6730

Panel B: Financial Contribution as Endogenous Variable, IV Regression, LPM

	(1) Poor Health Quality[a]	(2) Poor Physical Health[b]
Has Child in US	0.376	0.209
	[0.191]**	[0.124]*
Financial Help from Kids[d]	-0.01	-0.011
	[0.029]	[0.020]
Observations	6730	6730

Robust standard errors in brackets
* significant at 10%; ** significant at 5%; *** significant at 1%
[ab] See notes below Table 1 for description of dependent variables
[d] Financial help from kids is monthly financial assistance received from kids in 1000s of 2002 pesos
See Table 6 for additional control variables
Instruments: Kids Sex Ratio, Kids Married Ratio

Table 6: Parental Health & Child Migration with Financial & Time Contributions
Sample of Elderly Reporting Difficulties with Activities of Daily Living

Panel A: IV Regression, LPM in Limited Sample

	(1) Poor Health Quality[a]	(2) Poor Physical Health[b]
Has Child in US	1.059	-0.475
	[0.738]	[0.455]
Observations	769	769

Panel B: Contributions as Controls, IV Regression, LPM

	(1) Poor Health Quality[a]	(2) Poor Physical Health[b]
Has Child in US	1.137	-0.418
	[0.809]	[0.468]
Hourly Help from Kids[c]	0.011	0.006
	[0.017]	[0.010]
Financial Help from Kids[d]	-1.29E-04	2.71E-03
	[6.627e-03]	[3.775e-03]
Observations	769	769

Robust standard errors in brackets
* significant at 10%; ** significant at 5%; *** significant at 1%
[ab] See notes below Table 1 for description of dependent variables
[c] Hourly help from kids is monthly hours of help with activities of daily living received from kids in 100s of hours
[d] Financial help from kids is monthly financial assistance received from kids in 1000s of 2002 pesos
See Table 6 for additional control variables
Instruments: Kids Sex Ratio, Kids Married Ratio

Table 7: Determinants of Having a Child in US
First stage Regression, LPM

	(1)
	Has Child in US
Kids Sex Ratio (Daughters/Kids)	-0.042
	[0.016]***
Kids Married Ratio (Married Kids/Kids)	0.076
	[0.015]***
Female	0.022
	[0.011]**
Age	0.016
	[0.007]**
Age Squared	-1.25E-04
	[5.049e-05]**
Education Category 1: 1-6 yrs.	-0.005
	[0.014]
Education Category 2: 7-9 yrs.	-0.015
	[0.018]
Education Category 3: 10-12 yrs.	-0.059
	[0.021]***
Education Category 4: 13 + yrs.	-0.01
	[0.020]
Married	0.001
	[0.011]
Assets	1.60E-05
	[1.120e-05]
Monthly Income	-2.23E-05
	[1.361e-05]
Right to Medical Services	-0.066
	[0.011]***
Number of Kids	0.039
	[0.003]***
Number of Grandkids	-0.001
	[0.001]
Urban Indicator (100,000 ppl +)	-0.104
	[0.012]***
Constant	YES
Observations	6730
F stat on excluded instruments	17.73
R-squared	0.12

Robust standard errors in brackets
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 8: Do the Instruments Affect Health Outcomes Directly?
Suggestive Evidence

Panel A: Reduced Form Results for Sample of Parents of Non-migrants

	(1) Poor Health Quality[a]	(2) Poor Physical Health[b]
Kids Sex Ratio (Daughters/Kids)	-0.02	-0.011
	[0.017]	[0.011]
Kids Married Ratio (Married Kids/Kids)	0.024	0.017
	[0.016]	[0.010]
Observations	5247	5247

Panel B: Falsification test of IV strategy

	Parent Experienced Health Shock Before Age 10
Has Child in US	-0.048
	[0.157]
Overidentification p value	0.3392
F stat on excluded instruments	17.849
Observations	6640

Robust standard errors in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

[a]Poor Health Quality is self-reported indicator variable: 1 = poor health; 0 = fair, good, very good, or excellent health

[b]Poor Physical Health is an indicator for whether the respondent has had a stroke or heart attack

See Table 2 for other control variables

Table 9: Other Robustness Checks

Panel A: Sensitivity to Instrumental Variables Used
Kids Sex Ratio as only IV, LPM

	(1)	(2)
	Poor Health Quality[a]	Poor Physical Health[b]
Has Child in US	0.257	0.075
	[0.378]	[0.232]
F stat on excluded instruments	7.99	7.99
Observations	6730	6730

Panel B: Alternative Estimation Method 1
IV Probit Marginal Effects

	(1)	(2)
	Poor Health Quality[a]	Poor Physical Health[b]
Has Child in US	0.586	0.470
	[.15592]***	[.26853]*
Predicted probability	0.200	0.100
Observations	6730	6730

Panel C: Alternative Estimation Method 2
Seemingly unrelated bivariate probit

	(1)	(2)
	Poor Health Quality[a]	Poor Physical Health[b]
Has Child in US	0.419	0.590
	[0.252]*	[0.299]**
Observations	6730	6730

Robust standard errors in brackets
* significant at 10%; ** significant at 5%; *** significant at 1%
[abc] See notes below Table 1 for description of dependent variables
See Table 6 for additional control variables
Instruments (unless otherwise noted): Kids Sex Ratio, Kids Married Ratio

Table 10: Possible Mechanism-Mental Health and Child Migration Status

	(1)	(2)	(3)	(4)	(5)
	LS	Probit	IV	IV + Fin. Help as Control	IV + Fin. Help as Endog.
	Poor Mental Health[a]	Poor Mental Health[a]	Poor Mental Health[a]	Poor Mental Health[a]	Poor Mental Health[a]
Has Child in US	0.031	0.032	0.475	0.476	0.477
	[0.015]**	[0.016]**	[0.254]*	[0.254]*	[0.261]*
Financial Help from Kids[b]				-0.002	-0.016
				[0.001]**	[0.040]
Observations	6730	6730	6730	6730	6730

Robust standard errors in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

[c]Poor Mental Health is an indicator for whether the respondent reports has felt any of the following conditions the majority of the time in the past week: depression, loneliness, sadness

[b] Financial help from kids is monthly financial assistance received from kids in 1000s of 2002 pesos

See Table 6 for additional control variables

Instuments: Kids Sex Ratio, Kids Married Ratio

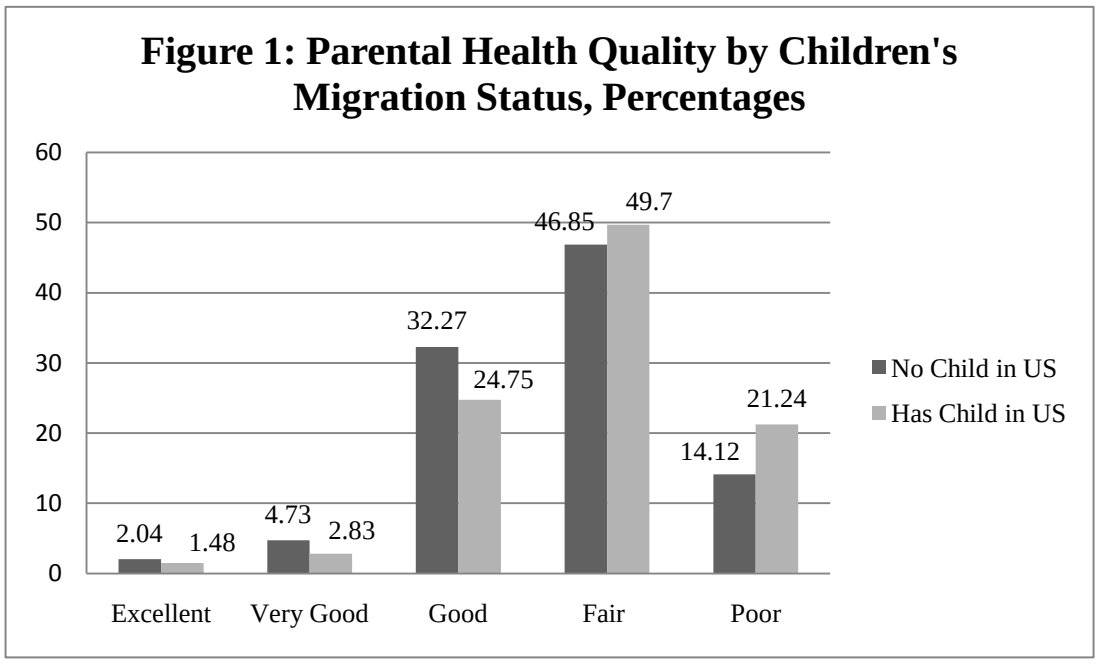
Figure 1: Parental Health Quality by Children's Migration Status, Percentages
60
50
40
30
20
10
0
2.04
1.48
4.73
2.83
32.27
24.75
46.85
49.7
14.12
21.24
Excellent
Very Good
Good
Fair
Poor
No Child in US
Has Child in US