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Adult children's education and changes to parents' physical health in Mexico

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Abstract

The well-being of older adults is frequently tied to support from their adult children. Here, we assess whether the education of adult offspring is associated with changes to older parents' short- and long-term health in Mexico, a rapidly aging context with historically limited institutional support for the elderly. Educational expansion over the past half century, however, provides older adults with greater resources to rely on via the education of their children. Using longitudinal data from the Mexican Health and Aging Study (2001–2012), we find that offspring education is not associated with short-term changes in parents' physical functioning, but is associated with increased parental longevity, net of children's financial status and transfers. In addition, we find that mothers' longevity is more sensitive to offspring education than fathers. Our findings add to a growing body of literature that urges policy-makers to consider the multi-generational advantages of expanding educational opportunities in Mexico.

Keywords

Aging; Education; Family; Functional limitations; Mortality; Mexico

1. Background

That higher education is positively associated with health is one of the most well-established findings in population science (Baker et al., 2011). At the individual level, more education is associated with better mental and physical health, lower levels of disability, fewer chronic conditions, and increased longevity (House and Williams, 2003; Hummer and Lariscy, 2011; Montez and Hayward, 2014). An emerging body of research also documents how the educational resources of *family* members may shape individual health outcomes. With regards to the health of older persons, recent work points to the positive association between adult offspring education and their parents' longevity (Friedman and Mare, 2014; Lundborg and Majlesi, 2015; Sabater and Graham, 2016; Torssander, 2013; Yang et al., 2016; Zimmer et al., 2007).

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A growing share of this work investigates whether these patterns exist in low- and middle-income countries (De Neve and Harling, 2017; Yahirun et al., 2016; Yang et al., 2016; Zimmer et al., 2002, 2007). These contexts differ from high-income countries because they are characterized by more recent and rapid educational expansion. Perhaps more importantly, offspring education and resources may be especially important for elderly health in these countries given limited public resources to support older adults.

In this paper, we investigate whether the education of adult children influences short- and long-term health outcomes among older parents in Mexico. We also assess whether these associations are sensitive to parents' gender. Mexico is a middle-income country where educational expansion has occurred rapidly and norms of family obligation to older parents remain strong. We extend prior research by examining changes in both long-term (i.e., mortality) and short-term (preventing or overcoming) health problems. Prior research has focused largely on long-term outcomes and parents' current health status. Our focus on both long-term and short-term changes thus allows us to better understand the dynamics of parental health associated with offspring education.

1.1. Institutional context and aging in Mexico

Like other low- and middle-income countries, educational attainment in Mexico expanded rapidly throughout the latter half of the 20th century. Educational reforms began in the late 1950s and were marked by sustained spending aimed at increasing student enrollment (Creighton and Park, 2010; Post, 2001). Gains in educational attainment were substantial throughout the 1970s and culminated in an increase in compulsory schooling at the lower grade levels in the 1990s (Creighton and Park, 2010; Santibañez et al., 2005; Torche and Costa Ribeiro, 2007).

An obvious long-term effect of these changes is that younger cohorts attained higher levels of education than older cohorts. In addition, the rapid pace of educational expansion means that these gaps are substantial. Using data from the first wave of the Mexican Health and Aging Study, we find that parents born before 1925, for example, have an average of 2.6 years of schooling. Their adult offspring, however, have approximately 7.5 years of schooling – an almost 5-year advantage over parents. While family socioeconomic background continues to play a significant role in individual educational trajectories (Cortés and Escobar Latapí, 2005; Marteleto et al., 2012; Torche, 2010), rapid schooling reforms in Mexico allow us to observe how generational increases in education might influence health outcomes among family members.

Offspring education may be a particularly important family resource in Mexico, where adult children have been traditionally responsible for parents' well-being in later life (Bridges, 1980; Gomes, 2007). Intergenerational obligations center on the expectation that offspring will provide financial and economic assistance to older parents, where offspring, especially daughters, are expected to live with or care for parents (Kanaiaupuni, 2000; Schmalzbauer, 2013). For example, nearly 60% of households with adults aged 60 and over in Mexico include offspring (de Oca et al., 2014). Here, monetary transfers move “up” the generational ladder from offspring to parents (Wong and Palloni, 2009; Wong and DeGraff, 2009) and

approximately 35% of older adults' income can be attributed to transfers from kin, primarily offspring (Wong and Espinoza, 2004).

Older adults' reliance on family members to provide care and support may be shifting, however, as public resources available to the elderly increase. Until recently, Mexico had limited public resources for older adults despite its burgeoning aging population. The introduction of universal health care in 2009 through *Seguro Popular* was critical in drastically increasing the number of older adults with access to health insurance (Parker et al., 2014; Teruel et al., 2014). Yet many older Mexicans still rely on their children for financial support because they lack pensions or retirement accounts (Juarez and Pfitze, 2015); a large share of the older population worked and continues to work in the informal sector (Aguila et al., 2011; OECD, 2013; Sheehan and Riosmena, 2013).

1.2. Gender, health, and intergenerational relationships

Women may rely more on the support of their offspring than men for several reasons. In Mexico, as elsewhere, the gender gap in longevity favors women: women have a life expectancy of 78 years, compared to 73 years for men (Population Reference Bureau, 2014). Despite living longer, Mexican women are more susceptible to developing chronic conditions in later life compared to men (Salinas and Peek, 2008). In addition, older women have far fewer financial resources given their loose attachment to the labor market. Only 15% of Mexican women aged 50 and older are eligible for pensions, versus 46% of men (Salinas and Peek, 2008). Finally, cultural norms in Mexico have traditionally socialized women into caregiving roles. Even in later life, mothers continue to provide invisible and unpaid care to children and grandchildren (Gomes, 2007). These roles place them in close physical proximity to offspring and potentially open up additional avenues through which mothers and children can support one another.

1.3. Linking offspring education and parental health

Prior studies find a positive link between adult children's education and parents' health. Zimmer et al. (2007) pioneered this work in Taiwan, where norms of filial obligation may be similar to Mexico, but public support for the elderly is historically more pronounced, including a 20-year-old public health insurance system, an expanded public pension program, and monthly stipends for the elderly (Cheng, 2015; Kim and Choi, 2011). Despite these supports, the Taiwanese studies show that schooling of the most well-educated child is negatively correlated with the severity of parents' functional limitations (Zimmer et al., 2002) and positively associated with parental longevity (Zimmer et al., 2007). A more recent study from China found similar results, where the education of co-resident children is positively associated with parental longevity (Yang et al., 2016). Even in contexts where norms of intergenerational obligation are not as strong and older adults often rely on non-familial resources to maintain their well-being, having better-educated children also delays parents' mortality. Using Swedish registry data, Torssander (2013) found that higher levels of schooling among the eldest children are also linked to lower parental mortality.

Despite growing evidence, understanding the pathways through which children's education shapes parental health is less clear. In Sweden, Torssander (2013) suggests that highly

educated children may improve parents' health by providing valuable informational support, such as knowledge about specific healthcare services and health-related behaviors. This idea is strengthened through Torssander's use of sibling fixed effects models, which control for unobserved family characteristics. In the United States, Friedman and Mare (2014) used detailed information on parents' cause of death and found that children's education is more closely associated with parental death linked to specific self-reported health behaviors. Because smoking and exercise explain part of the association between children's education and parents who died of lung cancer, for example, the authors argue that the spillover effects of offspring education cannot be overlooked.

Although the bulk of research documents a positive association between offspring schooling and parental health, identifying a causal effect is difficult given the endogeneity of children's schooling and problems of omitted variable bias. Using Swedish registry data and taking advantage of historic compulsory schooling reforms that increased education from seven to nine years, Lundborg and Majlesi (2015) applied an instrumental variable approach and found that offspring education is not significantly associated with parents' longevity. The authors (2015) suggested that their results differed from previous studies (e.g., Friedman and Mare, 2014) because of the focus on changes in education at the lower end of the educational distribution (Lundborg and Majlesi, 2015). Although their study is innovative in its use of compulsory schooling reforms, Lundborg and Majlesi's (2015) findings may not extend to other contexts with substantially different expectations surrounding obligations to older parents, fewer public supports for the elderly, and larger generational differences in achieved education.

2. The current study

Using data from the Mexican Health and Aging Study (MHAS), a nationally representative survey of Mexican adults aged 51 and older, this paper asks the following questions. First, is offspring education helpful in mitigating physical health deterioration or in preventing the onset of physical decline? Second, what is the association between offspring schooling and parental mortality? Functional health and mortality are far from isomorphic concepts, and while often related, different factors may come into play in influencing these health outcomes (Verbrugge and Jette, 1994). Third, how do these results differ for mothers versus fathers in Mexico? We posit that the association is stronger for mothers compared to fathers because of women's looser attachment to the labor market and their role as family caregivers, which may engender closer relationships with adult children in later life compared to fathers.

3. Methods

3.1. Sample

MHAS is a nationally representative panel study of non-institutionalized individuals born in 1952 or earlier and was modeled after the U.S. Health and Retirement Study with similar design features, including detailed information on health, socioeconomic status, and offspring, regardless of residence. The base-line sample was collected in 2001. Households with at least one member aged 50 and over were eligible for inclusion. If more than one

person was age-eligible, then one respondent was randomly selected. Resident spouses and partners of the randomly selected person were also recruited for the study, regardless of their age. In 2001, 11,000 households were initially sampled, totaling 15,186 respondents. Two follow-up interviews were conducted in 2003 and 2012.

Our analytic sample includes any respondent aged 51 and over who had at least one child aged 25 or older at baseline with the following exclusions. We first excluded those who used a proxy-respondent in 2001 ($n = 1,032$) and dropped anyone younger than 51 in 2001 ($n = 2,328$). We removed respondents due to missing values on the MHAS imputed wealth and income variables ($n = 2$), and dropped respondents if they reported no children or all their children were younger than 25 with the assumption that by age 25 most offspring will have finished school ($n = 1,557$). This led us to an analytical sample of 10,227 parents. We use information on all children aged 25 and older, regardless of whether they are biological, step-, adopted or foster children. It should be noted, however, that only 5% of respondents reported having any non-biological children in this sample.

3.1.1. Functional limitations sample—Our analytic samples differ for the functional limitation and mortality analyses. The functional limitation analyses, used to assess changes in short-term health, draw on the first two waves of data from 2001 to 2003 and are limited to respondents who were present and responded to questions about functional limitations in both waves ($n = 7,629$). We excluded those who were lost to follow up ($n = 516$), died ($n = 358$), or did not report functional limitations at either wave ($n = 1,724$). We do not use information from Wave 3 because of the large and unequal gap between the three waves and the likelihood that physical functioning will have fluctuated more than once over the nine year interval separating the 2003 and 2012 waves. This left us with a sample of 3,817 parents who had no limitations in 2001 (health decline sample) and 3,812 parents who had at least one limitation in 2001 (health improvement sample).

3.1.2. Parental mortality sample—For the mortality analysis, we use all three waves of data. Despite the large gap between Waves 2 and 3, MHAS had low attrition with a response rate of 88% in 2012, nine years after the previous wave (MHAS, 2015). We excluded those who were assumed dead but the year of death could not be identified ($n = 31$). Of the 10,196 respondents alive and accounted for in our sample in 2001, 2,421 died by 2012. Individuals who were lost to follow up are right censored at the mid-point year between the waves they were lost. Our mortality sample consists of 10,196 individuals, 93,086 person-years, and 2,432 deaths.

3.2. Outcome variables

Decedents' month and year of death are reported by next-of-kin in the MHAS data. In our analysis we use year, rather than month given that 4% of deaths were missing month data. We assess changes in parents' physical functioning using measures of functional limitations, which include whether the respondent indicated having difficulty with the following items: 1) stooping, kneeling or crouching, 2) climbing one flight of stairs, 3) walking several blocks, 4) picking up a coin, or 5) extending arms (reaching). The respondent is coded as having a functional limitation if s/he reported having difficulty but could still perform the

task, or if s/he reported not being able to perform the task at all. If respondents did not normally perform the task, or if they reported no difficulties, they are coded as not having that specific functional limitation. Our variable is the change in whether or not a respondent has any versus no functional limitations.

3.3. Explanatory variables

3.3.1. Offspring education—Our main explanatory variable is offspring education, which we code using the attainment of some college education (13 years of schooling or more) as a threshold. We distinguish between parents for whom none of their offspring received some college education (referent), parents for whom some offspring have some college education, and parents for whom all offspring completed some college education. In supplemental analyses (not shown here), we also examine other specifications of offspring education such as mean, median, and modal years of education, but the substantive results are similar. In addition, we tested various educational thresholds for children's education (primary school, high school, some college, etc.) by analyzing the proportion in each category and found that it was college attendance that differentiated parents' health.

3.3.2. Control variables—In our sample, a large share of parents received little to no formal schooling. Therefore, we categorize respondents' education into those with less than a primary education (6 years), those who completed primary education, and those with at least some secondary education. We control for several parental characteristics, including parents' age in years using both linear and quadratic terms, given our confirmation of the non-linear relationship between age and parental health trajectories. We also control for gender. Because of the sampling design of the MHAS, we also account for whether or not the respondent lives in a high migration state in 2001. We control for parental marital status and total number of living children (regardless of age). We also account for parents' migration history and urban/rural status, given prior research suggesting their associations with health in Mexico (Buttenheim et al., 2010; Smith and Goldman, 2007; Wong and Gonzalez-Gonzalez, 2010). In addition, we include controls for two measures of parents' socioeconomic status. We use an income measure that is constructed by MHAS, combining sources that include wages, pensions, businesses, etc. (Wong and Espinoza, 2004). We also use a similarly constructed wealth variable that includes parents' net worth of assets (Wong and Espinoza, 2004). We follow prior research in using terciles of income and wealth (Smith and Goldman, 2007).

When examining characteristics of parents' offspring, we include children's migration history at baseline and the gender composition of all offspring. We distinguish between parents who have no children who are currently or ever lived abroad, those with at least one child who lived abroad previously but have no current migrant children, and those parents with at least one child currently living abroad. We classified parents by whether they had all sons, all daughters, or both given research suggesting the importance of daughters in providing care for older parents in later life (Gomes, 2007; Mendez-Luck et al., 2009; Menjivar et al., 2016).

3.3.3. Mediating variables—To assess the way in which children's education could influence parental health, we also include two measures of children's socioeconomic status. First, we use parents' reports of children's financial status and average that status across all children with the assumption that offspring pool income to help parents. Parents are asked to rate each child's financial standing on a scale ranging from excellent (1) to poor (5); we recoded this scale so that higher values correspond with more favorable financial status. Second, we include a measure of financial transfers which asks whether parents received any transfers from a child/grandchild in the past two years. In earlier analyses, we included the amount of money received by parents overall. However, we found that health outcomes were not sensitive to actual amounts of transfers and thus use a simple dichotomous variable capturing whether any moneys were received instead. All variables in our analyses are time-invariant from Wave 1 given the large and unequal gaps between Waves 2 and 3.

Finally, there was relatively little missing data for the independent variables used. Indeed, the covariate with the most missing data was the indicator measuring financial transfers from children to parents, with just over 1% of missing values. Missing data on independent variables was handled with the Stata multiple imputation suite.

3.4. Analytical strategy

Our unit of analysis is the parent. We conduct three sets of analyses to assess how changes in parental health are associated with adult children's education. Our first and second analyses use logistic regression models to examine the decline and improvement in parents' physical health functioning between 2001 and 2003. Models of health decline include at-risk individuals who reported no reported functional limitations in 2001 ($N = 3,817$). We use logistic regression to predict the odds of having one or more reported functional limitations in 2003 versus experiencing no change. We employ the following progressive adjustment strategy: Model 1 consists of parents' characteristics, including parental education which we expect to be highly correlated with parental health. Model 2 adds in children's education, the main predictor variable in our model. In Model 3 we control for children's other characteristics (i.e., offspring migration history, gender composition) and include the potential mediating variables of offspring financial status and transfers to parents. We then stratify our sample for Model 3 to assess whether offspring education is associated with different health outcomes for fathers versus mothers.

Models of health improvement begin with at-risk respondents who reported having one or more reported functional limitations in 2001 ($N = 3,812$) and we predict the odds of having no functional limitations in 2003 versus still having one or more limitations. We use the same progressive adjustment strategy as outlined above. We measure health decline and health improvement separately, because it is unclear whether children's education should differentially influence parents' health decline and improvement.

Our third analysis uses Cox proportional hazard models to estimate the timing of parents' death. The risk of death starts at the age of first interview in 2001 and respondents are followed until the last interview date or death. Respondents who leave the country or who move into non-community dwelling units (institutions) are lost to follow up and therefore censored. Testing for proportionality, we find that there are slight violations of the

proportionality assumption at the oldest ages. Indeed, we accounted for non-proportionality in two uniquely conservative ways. First, we assessed whether interacting children's education with respondent's age affected the significance of our main variable and found that it did not. Second, we interacted children's education with a dummy variable for respondents older than 80. We find similar results in that offspring education remains a significant correlate of parental mortality. Given these results, and other research which suggests Cox models with large samples are robust to slight violations of proportionality (Denney et al., 2010), we are confident in our findings. All models adjust for household clustering. Multivariate analyses are not weighted because longitudinal weights are unavailable. This follows recent research using MHAS data that also does not use weights for similar reasons (e.g., Díaz-Venegas et al., 2016).

4. Results

Table 1 presents descriptive statistics for the three samples used in our analyses. We see that at least 80% of respondents across the samples have a primary school education or less. Parents have on average 6 to 7 children between samples. Approximately one-third of parents have some offspring, or all offspring who attended college. Online Appendix Table A1 shows the incidence rates of health improvement, health decline, and death rates by parents' and children's education.

Table 2 presents results in the form of odds ratios (*O.R.*) from our health decline model. Model 1 shows that parents with more than a 6th grade education are 31% less likely to become functionally limited compared to parents without a primary school education (*O.R.* = 0.69, $p < 0.01$). In Model 2 children's higher education is negatively associated with parents' functional decline, but is only marginally significant (*O.R.* = 0.78, $p < 0.10$). When offspring other characteristics and mediators for transfers and children's financial status are added to Model 3, the association between offspring education and parental health decline only slightly changes although the correlation (*O.R.* = 0.80, $p > 0.10$) is non-significant. The last two columns of the table show few gender differences with respect to the association between offspring education and health decline.

Table 3 presents results for becoming fully functional among persons with a limitation at baseline. In Model 1, we find that parents with more than a primary school education are 33% more likely to regain function (*O.R.* = 1.33, $p < 0.05$). When children's education is added in Model 2, offspring education is not significantly associated with regaining function. Model 3 includes children's other characteristics and the association between children's education and parental health remains non-significant as it also does when stratified by gender.

Table 4 presents the hazard ratios (*H.R.*) from the cox proportional hazard models for mortality. Model 1 shows that parental education and mortality are not associated net of other parental characteristics. Model 2 provides support for the hypothesis that parents for whom *some* of their children attended college have a lower hazard of mortality than parents who have no children who completed some college education (*H.R.* = 0.86, $p < 0.01$). Parents for whom *all* children completed at least 13 years of schooling have an even lower

hazard ($H.R. = 0.71, p < 0.001$) of mortality than respondents with no children who attended college. Model 3 adds in the remainder of children's characteristics and potential mediating variables with little change in the association between offspring education and timing of parents' death. In this final model, offspring education remains associated with parents' mortality whereas parental education is not. Finally, unlike our functional limitations models, gender differences are apparent. In the last two columns, we find that mothers' mortality is especially sensitive to varying levels of offspring education, with the strength of the association increasing for mothers for whom all their children attended college ($H.R. = 0.81, p < 0.01$), compared to those with only some children who attended college ($H.R. = .71, p < 0.05$). Fathers appear less sensitive, with mortality only significantly associated with those for whom all offspring attended college ($H.R. = 0.75, p < 0.05$), compared to those with no children who attended college, but a non-significant association for fathers with only some children who attended college ($H.R. = 0.90, p > 0.10$). Indeed, in testing an interaction term (not shown here) from the fully adjusted model, we find that the association between having some children who attended college was significantly less ($p < 0.05$) for fathers than for mothers.

5. Discussion

This study used longitudinal data from the Mexican Health and Aging study to assess whether offspring education is associated with changes to parental health and mortality. We find minimal statistical evidence that children's education is associated with short-term changes in parents' functional limitations at older ages. Although our models suggest a marginally significant association with health decline among parents whose children all attended college, this association is somewhat attenuated when offspring transfers and financial status are considered. This finding suggests that economic factors may act as a pathway linking offspring education with short-term parental functional problems in Mexico.

Our longitudinal results differ from previous cross-sectional research citing a significant association between offspring high school completion and parents' functional limitations (Yahirun et al., 2016). There are a number of potential reasons for this. First, our analysis of functional decline and improvement may be constrained by sample size. In the health decline sample for instance, among the small number of parents whose children all attended college ($N = 413$), less than one-fourth, ($n = 97$) experienced a health decline. A longer period of observation, with multiple data collection points, would have provided a greater number of events, improving the statistical power of the test of the association. However, the small number of events may only partly explain the marginal significant finding, even though the coefficients are in the expected direction. Second, the significant association between offspring education and parental functional status in Yahirun et al. (2016) could very well have arisen earlier in the lives of parents, prior to observation. Examining changes that occur later in life may not capture the at-risk ages during which offspring education is more consequential for parental functional health.

In contrast to our analyses of short-term health changes, our mortality analysis confirms that higher levels of children's education are associated with a decreased risk of death among

parents. The negative association between the share of children who attended college and the timing of parents' death appears to be robust to the inclusion of children's transfers and financial status, which are likely mediators in the case of Mexico. These findings broadly support previous studies, citing the advantages of children's higher education for parental longevity (Friedman and Mare, 2014; Sabater and Graham, 2016; Torssander, 2013; Yang et al., 2016; Zimmer et al., 2007). Indeed, the results underscore how offspring education may matter most for older parents at the most extreme end of the health continuum.

In addition, we find that the timing of death among mothers is more sensitive to varying levels of offspring education than fathers. Although further work is needed to understand the reason behind these gender differences, we suspect that women's loose attachment to the labor market may leave them more dependent on the care of adult offspring compared to men. In addition, the cultural norm of mothers as caregivers, even in later-life when they provide care to children and grandchildren (Gomes, 2007; Mendez-Luck et al., 2009), may engender a different – possibly closer – relationship between mothers and their offspring compared to fathers.

Although this paper adds to mounting evidence on the importance of offspring education for parents' health outcomes, we note several limitations. First, our attempts to capture any causal effects are limited by the data at hand. Problems of reverse causality and omitted variable bias continue to be present in this type of longitudinal analysis. Although previous research has attempted to address this in different ways through the use of fixed effects models (Torssander, 2013) or instrumental variable approaches, this work has yielded mixed results (Lundborg and Majlesi, 2015). Future research should address these concerns more directly in the Mexican context. Second, this paper does not investigate other mechanisms beyond financial transfers and children's financial status, through which offspring education affects parent's short-and long-term health. It is possible that other factors, such as spillovers of health knowledge, behaviors, and values, mediate the relationship between offspring education and parental health. However, the advantages of higher education are easily transferable from one context to another and can readily affect multiple diseases and risk factors through shifting pathways (Link and Phelan, 1995). Thus, while we believe that further investigation of the mechanisms through which offspring schooling shapes parents' health is warranted, the broad brush story linking stratified health outcomes to educational inequalities is likely to remain the same.

6. Conclusions

Despite these limitations, results from this study provide an expanded understanding of how children's education affects parents' health and mortality. At least in the case of Mexico, offspring education is not significantly associated with improving or preventing physical health declines over the short term. That said, children's education is significantly associated with increased parental longevity. This association remains robust even after controlling for one of the most obvious ways in which children's higher education could benefit parents: monetary transfers, pointing to non-economic factors as potential explanations for this association. Furthermore, in the case of mortality, parents' life chances improve when only a fraction of their children complete some post-secondary education. These results highlight

the potential importance of non-monetary pathways through which family resources affect mortality in later life and suggest that children's educational resources are most important for parental survival rather than functional health changes that may be more contingent on earlier life exposures.

Our findings have implications for policy makers and key stakeholders who work with aging elderly in Mexico. The results hint at the positive health consequences that education has on all family members, not only those individuals who themselves are the recipients of higher education. Policies aimed at expanding education could improve population health, especially longevity, particularly in contexts without well-established elderly care systems. However, these findings also highlight the potential for magnifying existing health disparities in the future. Whereas the expansion of education through compulsory schooling has offered one way in which families can reap greater health advantages, recent research highlights how educational and social mobility in Mexico is stagnating (Cortés and Escobar Latapí, 2005; Torche, 2014), with fewer Mexicans from less-advantaged backgrounds able to complete post-secondary educations (Binder and Woodruff, 2002). A long-term implication is that parents who need the resources of their offspring the most are the *least* likely to have children who attend college and therefore, are the least likely to acquire the health benefits that come from highly-educated offspring. Future work should examine the cumulative health advantages that are associated with educational mobility in countries with rapid population aging and families remain important institutions where resources are pooled across generations.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at <http://dx.doi.org/10.1016/j.socscimed.2017.03.034>.

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Table 1

Weighted descriptive statistics, parents aged 51+.

	Functional Improvement Sample		Functional Decline Sample		Mortality Sample	
	Mean/Proportion	S.E.	Mean/Proportion	S.E.	Mean/Proportion	S.E.
Parent's Demographic Characteristics						
Age	63.9	0.27	60.9	0.26	63.4	0.20
Male	37.6%		51.8%		45.1%	
Education (<Primary)	31.8%		27.9%		32.0%	
Primary	55.5%		52.9%		51.7%	
>Primary	12.7%		19.2%		16.3%	
Migrant heavy state (/Not heavy)	20.6%		18.3%		18.6%	
Marital status (/Married)	68.0%		75.0%		69.3%	
Single	1.1%		1.5%		1.2%	
Divorced	9.1%		8.8%		9.5%	
Widowed	21.8%		14.7%		20.0%	
Migration history (/No migration history)						
U.S. migrant	7.5%		6.8%		7.3%	
Internal migrant	62.6%		56.9%		59.4%	
Urban (/Rural)	47.9%		45.7%		45.9%	
Number of children	7.0	0.10	6.3	0.10	6.7	0.06
Income (/First tercile)	35.7%		32.1%		36.0%	
Second tercile	37.0%		35.2%		34.8%	
Third tercile	27.3%		32.7%		29.2%	
Wealth (/First tercile)	32.7%		29.9%		33.2%	
Second tercile	35.0%		36.1%		34.5%	
Third tercile	32.3%		34.0%		32.2%	
Children's Characteristics						
Education (/No children with college)	67.4%		65.2%		66.6%	
Some children with college	26.3%		24.0%		24.2%	
All children with college	6.2%		10.8%		9.2%	
Migration History (/No children currently or ever abroad)	63.8%		71.7%		68.4%	

	Functional Improvement Sample		Functional Decline Sample		Mortality Sample	
	Mean/Proportion	S.E.	Mean/Proportion	S.E.	Mean/Proportion	S.E.
1 + child has lived abroad	7.8%		6.1%		6.7%	
1 + child currently living abroad	28.4%		22.1%		24.9%	
Sex Composition (/All sons)	11.8%		15.9%		13.2%	
All daughters	10.6%		13.1%		12.3%	
Sons and daughters	77.6%		71.0%		74.5%	
Mean financial status of children	3.8	0.02	3.7	0.03	3.8	0.02
Financial transfers to parents (/None in past two years)	60.3%		49.1%		55.7%	
N	3,812		3,817		10,196	

Source: *MHAS, 2001–2003*.

Table 2

Logistic models predicting health decline among parents aged 51+ (zero functional limitations in 2001 to 1+ limitations in 2003).

	M1 (Men and Women)			M2 (Men and Women)			M3 (Men and Women)			Men			Women		
	O.R.	SE	p-value	O.R.	SE	p-value	O.R.	SE	p-value	O.R.	SE	p-value	O.R.	SE	p-value
Parent's Characteristics															
Age	0.89	0.05	0.046	0.89	0.05	0.058	0.90	0.05	0.085	0.93	0.08	0.403	0.89	0.08	0.164
Age ²	1.00	0.00	0.011	1.00	0.00	0.014	1.00	0.00	0.021	1.00	0.00	0.195	1.00	0.00	0.083
Male	0.53	0.04	0.000	0.52	0.04	0.000	0.52	0.04	0.000						
Education < Primary															
Primary	0.91	0.08	0.294	0.92	0.08	0.377	0.92	0.09	0.386	0.95	0.13	0.696	0.89	0.11	0.356
> Primary	0.69	0.09	0.004	0.75	0.10	0.036	0.78	0.11	0.063	0.68	0.14	0.053	0.85	0.16	0.383
Migrant heavy state (Not heavy)	0.63	0.05	0.000	0.63	0.05	0.000	0.64	0.06	0.000	0.58	0.08	0.000	0.69	0.08	0.002
Marital status (Married)															
Single	1.51	0.49	0.201	1.49	0.48	0.213	1.47	0.48	0.231	4.48	3.74	0.072	1.33	0.44	0.387
Divorced	0.79	0.11	0.089	0.79	0.11	0.085	0.79	0.11	0.083	0.75	0.20	0.267	0.82	0.14	0.224
Widowed	0.89	0.10	0.291	0.88	0.10	0.253	0.88	0.09	0.227	0.82	0.16	0.330	0.94	0.12	0.612
Number of children	1.03	0.01	0.037	1.02	0.01	0.077	1.02	0.01	0.066	1.03	0.02	0.065	1.02	0.02	0.346
Migration history (No migration history)															
U.S. migrant	1.05	0.14	0.730	1.04	0.14	0.738	1.08	0.14	0.544	0.96	0.15	0.792	1.49	0.43	0.167
Internal migrant	0.77	0.06	0.001	0.77	0.06	0.001	0.77	0.06	0.001	0.82	0.09	0.075	0.73	0.08	0.002
Urban (Rural)	0.93	0.08	0.399	0.95	0.08	0.510	0.94	0.08	0.502	1.03	0.12	0.796	0.87	0.10	0.253
Income (First tercile)															
Second tercile	0.91	0.09	0.319	0.91	0.09	0.347	0.91	0.09	0.338	0.76	0.10	0.040	1.07	0.13	0.607
Third tercile	0.81	0.08	0.045	0.83	0.09	0.068	0.83	0.09	0.082	0.74	0.11	0.040	0.90	0.13	0.484
Wealth (First tercile)															
Second tercile	0.92	0.09	0.390	0.93	0.09	0.419	0.93	0.09	0.464	1.01	0.14	0.918	0.87	0.11	0.255
Third tercile	1.02	0.10	0.817	1.04	0.10	0.664	1.07	0.11	0.509	1.21	0.17	0.186	0.95	0.13	0.714
Children's Characteristics															
Education (No children with college)															
Some children with college				0.93	0.08	0.405	0.94	0.09	0.505	0.94	0.12	0.626	0.94	0.12	0.624
All children with college				0.78	0.11	0.070	0.80	0.11	0.104	0.90	0.18	0.602	0.72	0.13	0.076

	M1 (Men and Women)			M2 (Men and Women)			M3 (Men and Women)			Men			Women		
	O.R.	SE	p-value	O.R.	SE	p-value	O.R.	SE	p-value	O.R.	SE	p-value	O.R.	SE	p-value
Migration History (/No children currently or ever abroad)															
1 + child has lived abroad															
1 + child currently living abroad															
Sex Composition (/All sons)															
All daughters															
Sons and daughters															
Mean financial status of children															
Financial transfers to parents (/None in past two years)															
Constant	17.63	33.59	0.132	14.93	28.62	0.159	7.75	15.10	0.294	0.94	2.62	0.982	19.14	52.25	0.280
<i>Log likelihood</i>	-2,305.4			-2,303.2			-2,299.5			-1,126.7			-1,164.0		
N	3,817			3,817			3,817			2,022			1,795		

Source: *MHAS, 2001–2003*.

Table 3
Logistic models predicting health improvement among parents aged 51+ (1 + functional limitations in 2001 to 0 limitations in 2003).

	M1 (Men and Women)			M2 (Men and Women)			M3 (Men and Women)			Men			Women		
	O.R.	SE	p-value	O.R.	SE	p-value	O.R.	SE	p-value	O.R.	SE	p-value	O.R.	SE	p-value
Parent's Characteristics															
Age	1.14	0.06	0.022	1.14	0.06	0.024	1.13	0.06	0.030	1.19	0.11	0.051	1.09	0.08	0.253
Age ²	1.00	0.00	0.002	1.00	0.00	0.003	1.00	0.00	0.004	1.00	0.00	0.017	1.00	0.00	0.083
Male	1.61	0.12	0.000	1.61	0.12	0.000	1.58	0.12	0.000						
Education (<Primary)															
Primary	1.09	0.09	0.325	1.08	0.09	0.358	1.08	0.09	0.393	1.18	0.17	0.258	1.03	0.11	0.776
>Primary	1.33	0.17	0.023	1.30	0.17	0.050	1.25	0.17	0.091	1.20	0.26	0.397	1.30	0.22	0.116
Migrant heavy state (Not heavy)	1.09	0.09	0.271	1.09	0.09	0.267	1.11	0.09	0.174	1.07	0.14	0.619	1.16	0.11	0.136
Marital status (Married)															
Single	0.47	0.15	0.022	0.47	0.15	0.022	0.48	0.16	0.027	0.39	0.42	0.381	0.53	0.18	0.062
Divorced	0.93	0.12	0.586	0.93	0.12	0.595	0.95	0.12	0.696	0.67	0.19	0.165	1.07	0.16	0.649
Widowed	1.05	0.10	0.585	1.05	0.10	0.574	1.07	0.10	0.466	0.98	0.19	0.933	1.14	0.13	0.251
Number of children	1.00	0.01	0.665	1.00	0.01	0.748	1.00	0.01	0.793	0.99	0.02	0.466	1.01	0.02	0.403
Migration history (No migration history)															
U.S. migrant	0.89	0.12	0.366	0.89	0.12	0.371	0.92	0.12	0.514	0.99	0.16	0.967	0.75	0.20	0.295
Internal migrant	0.86	0.06	0.046	0.86	0.06	0.044	0.86	0.07	0.053	0.74	0.09	0.016	0.94	0.09	0.530
Urban (Rural)	1.24	0.10	0.008	1.24	0.10	0.010	1.20	0.10	0.026	1.57	0.21	0.001	1.02	0.11	0.886
Income (First tercile)															
Second tercile	0.92	0.08	0.345	0.92	0.08	0.337	0.92	0.08	0.362	0.95	0.14	0.715	0.91	0.10	0.383
Third tercile	1.03	0.10	0.791	1.02	0.10	0.842	1.02	0.10	0.869	1.04	0.17	0.813	1.02	0.13	0.846
Wealth (First tercile)															
Second tercile	1.04	0.09	0.682	1.04	0.09	0.684	1.04	0.09	0.680	1.01	0.15	0.947	1.06	0.12	0.619
Third tercile	1.02	0.09	0.834	1.01	0.10	0.897	1.01	0.10	0.951	0.93	0.14	0.624	1.05	0.12	0.678
Children's Characteristics															
Education (No children with college)															
Some children with college				1.02	0.09	0.793	1.02	0.09	0.786	0.97	0.13	0.834	1.04	0.11	0.704
All children with college				1.10	0.17	0.527	1.06	0.16	0.699	1.15	0.28	0.558	1.01	0.19	0.944

	M1 (Men and Women)			M2 (Men and Women)			M3 (Men and Women)			Men			Women		
	O.R.	SE	p-value	O.R.	SE	p-value	O.R.	SE	p-value	O.R.	SE	p-value	O.R.	SE	p-value
Migration History (/No children currently or ever abroad)															
1 + child has lived abroad							0.77	0.10	0.051	1.08	0.24	0.747	0.64	0.11	0.007
1 + child currently living abroad							0.93	0.08	0.433	1.06	0.16	0.678	0.86	0.09	0.162
Sex Composition (/All sons)															
All daughters							1.02	0.16	0.908	1.14	0.28	0.589	0.97	0.19	0.890
Sons and daughters							0.98	0.12	0.884	1.02	0.19	0.913	0.96	0.14	0.794
Mean financial status of children							0.90	0.06	0.091	1.03	0.11	0.759	0.82	0.07	0.012
Financial transfers to parents (/None in past two years)							0.85	0.07	0.039	0.80	0.10	0.065	0.87	0.08	0.163
Constant	0.03	0.05	0.043	0.03	0.05	0.047	0.05	0.09	0.108	0.01	0.02	0.099	0.29	0.68	0.598
<i>Log likelihood</i>	-2,426.8			-2,426.4			-2,420.0			-894.4			-1,514.9		
N	3,812			3,812			3,812			1,374			2,438		

Source: MHAS, 2001–2003.

Table 4

Cox proportional hazard models predicting mortality among parents aged 51+.

	M1 (Men and Women)			M2 (Men and Women)			M3 (Men and Women)			Men			Women		
	Hazard ratio	SE	p-value	Hazard ratio	SE	p-value	Hazard ratio	SE	p-value	Hazard ratio	SE	p-value	Hazard ratio	SE	p-value
Parent's Characteristics															
Age	1.17	0.06	0.003	1.18	0.06	0.002	1.18	0.06	0.002	1.29	0.10	0.001	1.09	0.08	0.225
Age ²	1.00	0.00	0.004	1.00	0.00	0.003	1.00	0.00	0.003	1.00	0.00	0.002	1.00	0.00	0.217
Male	1.37	0.06	0.000	1.36	0.06	0.000	1.38	0.06	0.000						
Education (<Primary)															
Primary	1.00	0.05	0.942	1.03	0.05	0.539	1.03	0.05	0.526	0.97	0.06	0.672	1.10	0.07	0.156
>Primary	0.95	0.07	0.462	1.07	0.08	0.426	1.09	0.09	0.286	1.21	0.13	0.076	0.93	0.11	0.524
Migrant heavy state (/Not heavy)	1.04	0.05	0.383	1.04	0.05	0.424	1.03	0.05	0.493	1.11	0.07	0.090	0.94	0.06	0.356
Marital status (/Married)															
Single	1.14	0.22	0.500	1.12	0.22	0.543	1.14	0.22	0.491	2.00	0.90	0.121	1.04	0.22	0.845
Divorced	1.16	0.09	0.059	1.16	0.09	0.068	1.15	0.09	0.069	1.35	0.17	0.018	1.07	0.11	0.519
Widowed	1.12	0.06	0.024	1.12	0.06	0.029	1.12	0.06	0.034	1.20	0.09	0.019	1.07	0.07	0.360
Number of children	1.00	0.01	0.420	1.00	0.01	0.653	1.00	0.01	0.663	1.00	0.01	0.600	1.00	0.01	0.880
Migration history (/No migration history)															
U.S. migrant	1.03	0.07	0.654	1.02	0.07	0.728	1.01	0.07	0.839	1.01	0.08	0.898	1.01	0.16	0.936
Internal migrant	0.98	0.04	0.552	0.98	0.04	0.638	0.97	0.04	0.555	0.94	0.06	0.260	1.02	0.06	0.701
Urban (/Rural)	1.07	0.05	0.116	1.10	0.05	0.035	1.12	0.05	0.019	1.21	0.08	0.004	1.03	0.07	0.707
Income (/First tercile)															
Second tercile	0.99	0.05	0.915	1.01	0.05	0.863	1.00	0.05	0.941	0.99	0.07	0.834	1.01	0.07	0.846
Third tercile	0.84	0.05	0.003	0.87	0.05	0.017	0.86	0.05	0.013	0.82	0.07	0.015	0.90	0.08	0.243
Wealth (/First tercile)															
Second tercile	0.92	0.04	0.092	0.93	0.05	0.119	0.93	0.05	0.132	0.97	0.07	0.636	0.89	0.06	0.081
Third tercile	0.82	0.04	0.000	0.84	0.05	0.001	0.85	0.05	0.002	0.88	0.07	0.102	0.80	0.06	0.004
Children's Characteristics															
Education (/No children with college)															
Some children with college				0.86	0.04	0.002	0.85	0.04	0.001	0.90	0.06	0.133	0.81	0.06	0.003

	M1 (Men and Women)			M2 (Men and Women)			M3 (Men and Women)			Men			Women		
	Hazard ratio	SE	p-value	Hazard ratio	SE	p-value	Hazard ratio	SE	p-value	Hazard ratio	SE	p-value	Hazard ratio	SE	p-value
All children with college				0.71	0.06	0.000	0.73	0.07	0.000	0.75	0.09	0.024	0.71	0.09	0.011
Migration History (/No children currently or ever abroad)															
1 + child has lived abroad							1.03	0.08	0.654	0.86	0.10	0.181	1.21	0.12	0.061
1 + child currently living abroad							1.02	0.05	0.721	1.06	0.07	0.434	0.96	0.07	0.584
Sex Composition (/All sons)															
All daughters							0.87	0.08	0.125	0.86	0.11	0.239	0.87	0.11	0.303
Sons and daughters							1.02	0.07	0.747	1.05	0.10	0.572	0.98	0.10	0.855
Mean financial status of children							1.04	0.04	0.230	1.08	0.06	0.120	1.00	0.05	0.966
Financial transfers to parents (None in past two years)							1.12	0.05	0.011	1.20	0.07	0.002	1.05	0.07	0.447
<i>Log likelihood</i>	-17,886.8			-17,877.6			-17,871.0			-81,444.8			-8,031.5		
N	10,196			10,196			10,196			4,538			5,658		

Source: *MHAS, 2001–2003*.