

## Original Article

# Lifetime Socioeconomic Status and Late-life Health Trajectories: Longitudinal Results From the Mexican Health and Aging Study

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## Abstract

**Objective:** This article examines the association between childhood and adult socioeconomic status (SES) and late-life health trajectories for older adults in Mexico.

**Method:** Data are from the Mexican Health and Aging Study, a panel survey that began with a nationally representative sample of Mexican adults 50 years and older at baseline (2001), with follow-up in 2003 and 2012. We use a hierarchical repeated measures model to estimate the relationship between SES and depressive symptoms, functional limitations, and self-rated health, respectively. We tested both discrete measures of SES in childhood and adulthood, as well as a combined indicator of lifetime SES.

**Results:** Childhood SES was significantly associated with later-life health trajectories net of adulthood SES indicators. Adult SES was significantly associated with late-life health trajectories, with some differences by gender and outcome. There were significant SES disparities in health outcomes over the 11-year study period. However, there were no significant multiplicative interactions between SES and age, which would have indicated either diminishing or widening SES health disparities with age.

**Discussion:** Socioeconomic disparities in health appear to persist into old age in the Mexican context. Efforts to reduce late-life health disparities in Mexico should target socioeconomic and material conditions across the life course.

**Key Words:** Aging—Cumulative disadvantage—Health trajectories—Mental health—Mexico—MHAS—Socioeconomic status

In the context of rapidly aging populations in low- and middle-income countries, it is increasingly critical to understand the impact of social determinants on late-life health. Mexico is one such country facing a dramatic increase in the older adult population (Wong & Palloni, 2009). Although previous research has examined socioeconomic differences in the health of older Mexicans in cross-section, with short-term follow-up, or for a limited subset of the Mexican population (Alvarado, Guerra, &

Zunzunegui, 2007; García-Peña et al., 2008; Huang, Soldo, & Elo, 2011; Smith & Goldman, 2007), no study to our knowledge has examined how socioeconomic status (SES) influences long-term health trajectories in old age using national-level data. Our study aims to understand the relationship between lifetime SES and health trajectories over an 11-year period for a national sample of middle-aged and older Mexican adults. We apply a life-course perspective in our approach, examining the persistent effects of

childhood socioeconomic conditions, as well as socioeconomic advantage and disadvantage experienced over the entire life course, on late-life health trajectories.

## Background

Research on the relationship between SES and health in Mexico has uncovered important associations between individual SES indicators from childhood and adulthood and health in late life. For example, [Huang and colleagues \(2011\)](#) found a significant association between early-life SES (e.g., mother's educational attainment) and later-life functional limitations using 2-year follow-up (2003) data from the Mexican Health and Aging Study (MHAS), a nationally representative sample of older Mexican adults. In addition, lifetime occupation in professional or industrial jobs was significantly associated with lower odds of functional limitations in late life relative to those who were employed in agricultural work. Researchers have uncovered additional cross-sectional associations between higher SES in childhood and adulthood and better self-rated health status ([Smith & Goldman, 2007](#)) and fewer depressive symptoms ([Alvarado, Zunzunegui, Béland, Sicotte, & Tellechea, 2007](#); [Torres & Wong, 2013](#)). For example, [García-Peña and colleagues \(2013\)](#) found that each year of additional education attained in early life was associated with between 6% and 8% lower odds of reporting significant depressive symptoms over a 2-year study period for urban-dwelling older adults covered by Mexico's social security system. These studies are suggestive of the importance of both early- and mid-life SES in shaping late-life health outcomes, as well as late-life health trajectories over a short-term follow-up period.

On the other hand, there has been some heterogeneity in findings linking SES to late-life health in Mexico. In particular, some scholars have reported null or weak associations between numeric indicators of income or wealth and late-life health in Mexico ([Huang et al., 2011](#); [Smith & Goldman, 2007](#); [Torres & Wong, 2013](#)). This might reflect the fact that monthly income or wealth may be distributed unevenly among household members, particularly for households that include members of multiple generations or in which women have less decision-making power over how financial resources are used ([Salinas-Rodriguez, Torres-Peneda, Manrique-Espinoza, Moreno-Tamayo, & Téllez-Rojo Solis, 2014](#)). Furthermore, in rural areas of low- or middle-income countries, income measures that are based on annual earnings may not capture seasonal fluctuations in households that rely on agricultural production, or on other means of household production (e.g., growing one's own food) ([Howe et al., 2012](#)), and may therefore not accurately capture dimensions of SES that matter for late-life health and well-being. Researchers have proposed that measures of durable household items may better represent the ways in which income or monetary assets translate to the actual living conditions of older adults, and in turn

impact overall well-being. Measures of durable household items have less often been utilized as proxies for SES in the Mexican context. Lifetime occupation is also less often considered in studies of SES and late-life health in Mexico, although it is likely a critical contributor to later-life functional limitations, given the potentially long-term impacts of physical labor on health and mobility ([Huang et al., 2011](#)).

Studies of the relationship between SES and adult health in Mexico and Latin America have also pointed to important differences by gender. In a cross-sectional analysis of urban-dwelling adults 60 years and older in Latin America, [Alvarado, Zunzunegui, and colleagues \(2007\)](#) found that women were more likely to report insufficient incomes and less likely to receive a pension or employment income than their male counterparts. Women's greater exposure to adult socioeconomic disadvantage accounted for their significantly higher number of reported depressive symptoms compared with men. On the other hand, data from the same study suggest that differential exposure to socioeconomic disadvantage did not fully account for poorer health observed in women across a number of other measures, including poorer self-rated health and physical functioning ([Zunzunegui, Alvarado, Beland, & Vissandjee, 2009](#)).

Our study fills gaps in the extant research on SES and late-life health trajectories in Mexico. For one, the extant research has largely been cross-sectional or with short-term follow-up, and few studies have been able to observe health outcomes over time, including the possibility of changing relationships between SES and health as individuals age. In addition, to our knowledge no study of late-life health in Mexico has utilized SES predictors that *combine* childhood and adulthood SES to reflect long-term exposure to conditions of SES advantage or disadvantage, as well as SES mobility across the life course. We aim to fill these gaps with a study of lifetime SES and late-life health trajectories for a national sample of older Mexican adults. We captured health along three different dimensions—functional limitations, self-rated health, and past-week depressive symptoms. The choice of these three outcomes reflects our conceptualization of lifetime SES as a “fundamental” cause of multiple health outcomes ([Link & Phelan, 1995](#)) that may reflect both short-term and more permanent health states.

## A Life-course Perspective on SES and Later-life Health Trajectories in Mexico

SES at multiple points across the life course has been linked to late-life health trajectories in studies based in the United States and Europe ([Kahn & Pearlin, 2006](#); [Luo & Waite, 2005](#); [Miech & Shanahan, 2000](#)). This scholarship suggests that socioeconomic conditions in childhood may be particularly important predictors of late-life health ([Lynch & Smith, 2005](#)). For example, exposure to conditions of poverty in early life may become biologically “embedded” ([Hertzman, 1999](#)), through potentially lasting effects on

neurocognitive processes, immune dysregulation, inflammation, and development that may in turn influence health outcomes across the life course (Barker & Clark, 1997; Fagundes, Glaser, & Kielcolt-Glaser, 2013; P. Kim et al., 2013).

Childhood SES may also contribute to late-life health indirectly, by influencing adult SES, which in turn influences late-life health trajectories. Those with lower adult SES may be disproportionately exposed to difficult life events and chronic stressors of daily living in mid and later life, such as ongoing financial strain and poor housing conditions, as well as occupations that are associated with low social standing and little control, demanding physical work that can lead to poorer physical functioning later in life, and fewer resources to cope with the onset of health conditions (Kahn & Pearlin, 2006; Pudrovska, Schieman, Pearlin, & Nguyen, 2005; Turner, Wheaton, & Lloyd, 1995). Health may also have a reciprocal association with SES (i.e., through social selection) if those who have poorer physical and mental health work less and experience fewer returns to their labor, which can have adverse economic consequences over one's lifetime (Warren, 2009). Nevertheless, given the evidence supporting the lasting impact of childhood socioeconomic conditions on late-life health, we hypothesize that childhood SES will be significantly associated with late-life health trajectories for older Mexican adults net of adult socioeconomic indicators. In particular, we expect that greater childhood socioeconomic disadvantage will be associated with significantly poorer health across the 11-year study period (H1).

It is also possible that lifetime SES, or a combined measure that reflects persistent lifetime socioeconomic advantage/disadvantage, as well as shifts in SES is associated with long-term health disparities for older Mexican adults. That is, experiences of low SES may add up from childhood to adulthood to have a combined influence on later-life health in a dose-response relationship (J. Kim & Durden, 2007; Wickrama, Mancini, Kwag, & Kwon, 2013). We expect that for older Mexican adults, the combined effect of low childhood and adulthood SES will be associated with significantly worse health with age when compared with those with consistently high SES in both childhood and adulthood. We further expect that any period of low SES (in childhood or adulthood) will also be associated with worse health over time compared with those with consistently high SES (H2).

Finally, lifetime SES and health trajectories may have nonlinear effects on later-life health trajectories with age. Socioeconomic disparities may widen with age, as experiences of socioeconomic disadvantage and exposure to social stressors have cumulative effects over the life course (Willson, Shuey, & Elder, 2007). Alternatively, SES disparities in health may diminish as the least healthy members of the population are selected out of older age (Xu, Liang, Bennett, Botosaneanu, & Allore, 2014). We therefore expect that there will be significant multiplicative interaction terms

between SES and age in the estimates of late-life health trajectories for older Mexican adults. Specifically, we expect that SES-health associations will widen as respondents age, after accounting for attrition of the least healthy members from the sample (H3).

## Materials and Methods

### Data Set

We use three waves of the Mexican Health and Aging Study (MHAS) (Wong, Michaels-Obregon, & Palloni, 2015). The MHAS began at baseline as a nationally representative sample of Mexican adults 50 years and older in 2001, and follow-up waves were completed in 2003 and 2012. The baseline sample included households with adults 50 years and older who were previously surveyed in the nationally representative 2000 Mexican Employment Survey (ENE-2000). Within each household, a target respondent was interviewed; probability of selection was proportionate to the number of adults 50 years and older living in the household. Respondent spouses were interviewed, as well as proxy respondents for selected older adults who could not respond on their own. Response rates were as follows: 91.8% in 2001, 93.3% in 2003, and 88.1% in 2012.

From the baseline sample of 15,186, which included proxy respondents and spouse respondents younger than 50 years of age, we were left with 11,087 age-eligible, non-proxy respondents at baseline. The analytic sample size (i.e., nonproxy age-eligible) was 9,954 at follow-up in 2003 (462 had died and 671 were lost to follow-up between 2001 and 2003) and 6,672 in 2012 (2,184 had died and 1,098 were lost to follow-up between 2003 and 2012). After excluding respondents with missing data on all health outcomes and predictor variables, our analytic sample had 10,558 participants (i.e., less than 5% of the eligible sample was missing across all outcomes). Respondents who died by 2003 or 2012 were significantly more likely to report low SES across their lifetime by baseline than those who remained in the study, and had more depressive symptoms, functional limitations, and poorer self-rated health. Those otherwise lost to follow-up had *higher* lifetime SES and significantly better health outcomes than those who remained in the sample, likely reflecting the fact that those lost to follow-up had the economic and health-related resources to be mobile between follow-up waves.

### Health Outcomes

Self-rated health was assessed with the question, "would you say your health is excellent, very good, good, fair or poor?" Responses are reverse coded such that higher values equal poorer self-rated health. Past-week depressive symptoms were measured with a 9-item scale based on the revised 8-item Centers for Epidemiologic Studies—Depression (CES-D) scale (Radloff, 1977) as used in the U.S. Health and Retirement Study (Steffick, 2000). The

MHAS version included 9 items given the difficulty of translating the phrase, “could not get going” into Spanish; the item was translated into two items (Supplementary Table 1). Responses to each symptom were “yes” or “no,” and items were summed such that higher scores equal more depressive symptoms. This revised 9-item version of the CES-D scale has been validated for use among older adult populations in Mexico (Aguilar-Navarro, Fuentes-Cantú, Ávila-Funes, & García-Mayo, 2007) and has a reliability coefficient of  $\alpha = 0.80$  for the MHAS sample. Lower-body functional limitations were measured with 8 items related to lower-body physical performance, including running one mile, walking one or several blocks, climbing one or several flights of stairs, stooping, kneeling, or crouching. Items were coded as 0 (“no trouble” with activity) or 1 (“has trouble, can’t do, or doesn’t do”) and summed such that higher values equal more limitations.

### Lifetime SES

We include two individual measures of childhood SES: (a) whether or not respondents had sanitation facilities before age 10, given the utility of household or asset-based measures for measuring SES in low- and middle-income groups (Galobardes, Shaw, Lawlor, Lynch, & Davey Smith, 2006) and (b) a binary indicator of no versus any formal education (about a quarter of the sample had no formal education).

We measured adulthood SES with indicators of (a) respondents’ primary lifetime occupation, dichotomized as domestic or agricultural work versus other work (including no history of work outside the home) and (b) household assets, indicated by ownership of up to six different items: a radio, a TV, a refrigerator, a washing machine, a phone, and a heater. We contrasted respondents who had fewer than or equal to the mean (4) number of durable household assets with those who had more than the average number of household items. The measure of household items was strongly associated with monthly household income and wealth, measured as total household assets minus total debts (Wong & Espinoza Higgins, 2003), and in ancillary analyses that included all three measures, the household measure had a larger effect size than income and wealth across models predicting later-life health trajectories. Given these findings, as well as our interest in capturing dimensions of SES that may more accurately reflect the living conditions of older adult respondents, we elected to include only the measures of lifetime occupation and household item measures to reflect SES in adulthood.

Finally, we created a composite measure combining childhood SES and baseline adulthood SES measures (Galobardes, Lynch, & Smith, 2007). The two measures of child SES were combined such that answering “yes” to either (i.e., no sanitation facilities or no formal education) was equated with low childhood SES. The measures of adulthood SES were combined such that answering “yes” to either (i.e., low status lifetime occupation or owning

fewer than the mean of household items, which is four) was equated with low baseline adult SES. We cross-tabulated SES in childhood and adulthood, to create a measure of lifetime SES with the following categories:

- (1) Persistently low SES or low SES in childhood and adulthood (baseline).
- (2) High child SES and low adult SES.
- (3) Low child SES and high adult SES.
- (4) Persistently high SES or high SES in childhood and adulthood.

### Additional Covariates

We control for age, marital status, residence (urban vs rural, states with high vs low U.S. outmigration), and a count of chronic diseases (range 0–6, including hypertension, diabetes, cancer, stroke, heart attack, and arthritis). We additionally control for cognitive functioning: The MHAS includes the screening portion of the cross-cultural cognitive evaluation (Glosser et al., 1993), although we only included immediate and delayed verbal recall domains (range: 0–8), given prior research demonstrating the low correlation between education and verbal recall (Sampert-Ternent, Michaels-Obregon, & Wong, 2012). Controlling for other domains highly correlated with education may bias associations between education and health toward null results. The models predicting depressive symptoms include functional limitations as a control and vice versa. We stratify analyses by gender given the different patterns of mental and physical functioning in later life for men and women (Alvarado, Guerra, et al., 2007; Alvarado, Zunzunegui, et al., 2007; Zunzunegui et al., 2009).

### Analysis

We first describe frequencies for SES and health outcomes by gender for the panel sample. We then model the panel data using hierarchical models for repeated measures. After testing for main effect associations between SES and each health outcome, we test interaction terms between SES indicators and age to assess whether age-related change in health outcomes varied by categories of SES. We chose a one-way random effects model over a fixed effects model after running a Hausman specification test. The random effects model allows us to include time-invariant variables and to account for within- and between-subject variation in health outcomes. These models are analogous to ordinary least squares regression models, but instead the intercepts are random variables with a common mean in order to account for the nonindependence of values repeated for the same participant over the three waves of data. We tested a random slope to allow for the possibility that relationships between SES and health varied across participants with age. A likelihood ratio test showed no evidence of such variation across models of depressive symptoms and



self-rated health for both men and women and so we preferred random intercept models. In contrast, there was evidence that the relationship between explanatory variables (e.g., SES) and lower-body functional limitations did vary across participants with age, in which case we preferred a random slope model.

SES variables are included as time-invariant measures, as was respondent age. Given the possibility of nonlinear relationships between age and health outcomes, we test a quadratic age term. Because the quadratic age term is significant across many of the models, we retain it throughout. Marital status, residence characteristics, and additional health and cognitive functioning measures were included as time-varying measures. Health outcomes were modeled as linear and time varying. Although depression and functional limitation measures are skewed toward lower values, all three outcomes met the criterion of independence between residuals and covariates for linear modeling. We control for attrition effects with dummy variables indicating attrition from each wave due to mortality, loss to follow-up, or non response.

## Sensitivity Analyses

Given that the modeled health outcomes are likely to change as a function of age, we assess changes by age, rather than calendar time. However, in sensitivity analyses, we test for the possibility of changes over calendar time with dummy variables for each study year. We also test measures reflecting respondents' birth cohorts (i.e., before vs after 1930; and 5-year intervals from 1930 through 1950) as controls; we additionally test models stratified by birth cohorts before and after 1930, a cutoff that reflects institutional changes in education and literacy in Mexico, which we address in the discussion. Finally, we examine differences in the link between SES and health trajectories by residence, given previous findings of heterogeneity in SES–health gradients by rural versus urban residence in Mexico (Beltrán-Sánchez, Crimmins, Teruel, & Thomas, 2011; Buttenheim, Wong, Goldman, & Pebley, 2010; Smith & Goldman, 2007), and report on differences in the discussion.

## Results

Descriptive statistics are provided in [Supplementary Tables 2 and 3](#). Nearly two thirds of respondents lacked household sanitation facilities during childhood, whereas about 73% reported some formal education. About 31% labored in agriculture or domestic work as their primary lifetime occupation. The majority of respondents clustered in the categories of “mostly high” and “mostly low” SES over the life course, at 27% and 31% respectively.

[Tables 1](#) and [2](#) show the results of the full models using the three waves of data with the individual and composite measures of SES across the life course, respectively. [Figure 1A–F](#) depicts the relationship between lifetime

SES and each health outcome with age based on the fully adjusted models.

We found support for our first hypothesis that there would be significant associations between individual measures of childhood SES and health trajectories in old age. Childhood SES measures, including lack of household sanitation facilities and educational attainment, were significantly associated with late-life health trajectories across outcomes for both men and women. Specifically, results in [Table 1](#) show that lacking childhood sanitation facilities before age 10 was significantly associated with poorer self-rated health ( $b = 0.09$ ,  $p < .001$  for women and  $b = 0.16$ ,  $p < .001$  for men) and more depressive symptoms ( $b = 0.32$ ,  $p < .001$  for women and  $b = 0.21$ ,  $p < .01$  for men), respectively, net of other covariates. Lack of formal education was also significantly associated with poorer health with age, all else equal, with the exception of functional limitations for women and self-rated health for men.

Adulthood SES measures were also significantly associated with late-life health trajectories with heterogeneous effects by outcome and gender. Specifically, having below the average number of household items (4 or fewer) was significantly associated with poorer self-rated health ( $b = 0.09$ ,  $p < .001$  for women and  $b = 0.11$ ,  $p < .001$  for men) and more depressive symptoms ( $b = 0.54$ ,  $p < .001$  for women and  $b = 0.45$ ,  $p < .001$  for men), but there was no significant association between the indicator of household items and lower-body functional limitations for either gender.

Working in either the domestic or agricultural sector as one's primary lifetime occupation was significantly associated with more functional limitations ( $b = 0.15$ ,  $p < .01$ ) and depressive symptoms for women ( $b = 0.16$ ,  $p < .05$ ) and poorer self-rated health ( $b = 0.07$ ,  $p < .001$ ) and more depressive symptoms ( $b = 0.16$ ,  $p < .01$ ) for men. The effect sizes and significance levels for lifetime occupation were mostly modest compared with those for sanitation conditions in childhood or material conditions in adulthood.

We additionally found support for our second hypothesis that lifetime SES would be associated with poorer late-life health ([Table 2](#)). Persistently low SES, in both childhood and adulthood, was significantly associated with poorer health across all three outcomes compared with persistently high SES across the life course. Reporting *any* period of lower SES (i.e., high childhood but low adult SES; low childhood but high adult SES) is also significantly associated with poorer health across all three outcomes for women and with poorer self-rated health and more depressive symptoms for men. Those who reported relatively higher childhood SES but low adult SES were still estimated to have significantly more depressive symptoms and poorer self-reported health than those who experienced high SES across the life course, but the magnitude of the effects are smaller than for the groups who experienced persistently low SES or low SES during childhood. We further note that reporting high childhood SES and low adult SES was significantly associated with more functional limitations relative

**Table 1.** Adjusted Regression Coefficients and Robust Standard Errors for Models of 11-Year Health Trajectories by Individual Childhood and Adulthood SES Measures for Mexican Adults Born Before 1951 ( $N = 10,558$ )

	Women ( $n = 5,817$ )			Men ( $n = 4,741$ )		
	Self-rated health <sup>a</sup>	Depressive symptoms <sup>b</sup>	Functional limitations <sup>c</sup>	Self-rated health <sup>a</sup>	Depressive symptoms <sup>b</sup>	Functional limitations <sup>c</sup>
	$b$ (SE)	$b$ (SE)	$b$ (SE)	$b$ (SE)	$b$ (SE)	$b$ (SE)
Socioeconomic status						
Childhood						
No household sanitation facilities by age 10	0.09 (0.02)***	0.32 (0.06)***	0.08 (0.05)	0.16 (0.02)***	0.21 (0.06)**	0.17 (0.05)**
No formal education	0.03 (0.02)*	0.18 (0.06)**	0.12 (0.06)*	0.04 (0.02)	0.29 (0.07)**	0.18 (0.06)**
Adulthood						
Domestic/agricultural lifetime occupation	0.01 (0.02)	0.16 (0.05)*	0.18 (0.05)**	0.06 (0.02)**	0.16 (0.06)**	0.02 (0.06)
>4 durable household items	0.09 (0.01)***	0.54 (0.05)***	0.09 (0.05)	0.11 (0.02)***	0.45 (0.06)***	-0.03 (0.05)
Age	0.04 (0.01)***	<-0.01 (0.04)	-0.05 (0.03)	0.04 (0.01)***	-0.05 (0.03)	-0.01 (0.03)
Age <sup>2</sup>	<-0.01 (0.00)***	<-0.01 (0.00)	<0.01 (0.00)**	<-0.01 (0.00)***	0.00 (0.00)	<0.01 (0.00)***
Wald $\chi^2$	4,275.9***	2,637.4***	3,520.1***	3,627.6***	2,055.2***	3,127.2*

Notes: Source: Mexican Health and Aging Study, 2001–2012.

SES = socioeconomic status.

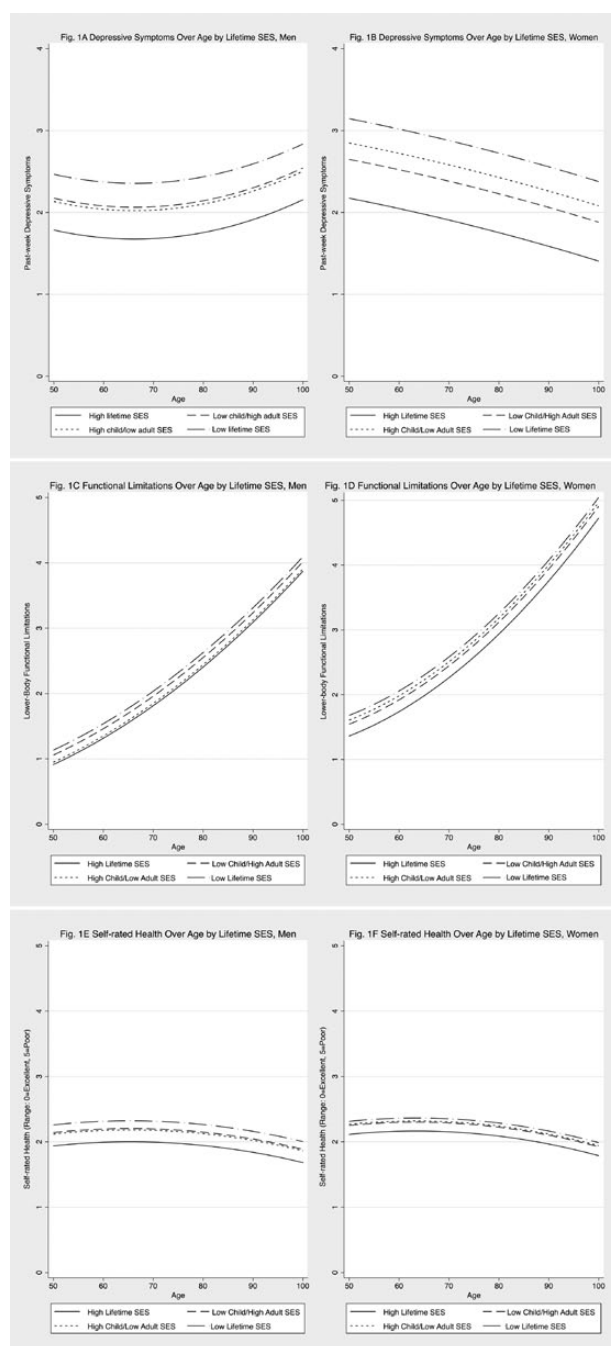
All models control for residence characteristics (urban vs rural, high U.S. outmigration state vs other state), marital status, number of chronic diseases (range 0–6), cognitive functioning (verbal recall only), and attrition effects.

<sup>a</sup>Random-intercept only model; also controlling for depression and lower-body functional limitations.

<sup>b</sup>Random-intercept only models; also controlling for lower-body functional limitations.

<sup>c</sup>Random intercept, random slope models; also controlling for depressive symptoms.

\* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .



**Figure 1.** Depressive symptoms over age by lifetime socioeconomic status (SES) for (A) men and (B) women. Functional limitations over age by lifetime SES for (C) men and (D) women. Self-rated health over age by lifetime SES for (E) men and (F) women.

to those who reported persistently high SES across the life course for women but not for men.

Finally, we found no support for our third hypothesis of nonlinear effects of lifetime SES on late-life health trajectories. Specifically, there were no significant multiplicative interaction terms between measures of SES and health trajectories across any of the outcomes of interest, suggesting that socioeconomic disparities in health outcomes neither widened nor diminished over the 11-year study period (Supplementary Table 3).

## Discussion

This study examines the relationship between lifetime SES and later-life health trajectories using national-level survey data from Mexico, a middle-income country with a rapidly aging population. Overall, we found support for our hypotheses of significant main effect associations between individual markers of SES in both childhood and adulthood and late-life health. There were particularly robust associations between lifetime socioeconomic disadvantage

**Table 2.** Adjusted Regression Coefficients and Robust Standard Errors for Models of 11-Year Health Trajectories by Lifetime SES for Mexican Adults Born Before 1951 ( $N = 10,558$ )

	Women ( $n = 5,817$ )			Men ( $n = 4,741$ )		
	Self-rated health <sup>a</sup>	Depressive symptoms <sup>b</sup>	Functional limitations <sup>c</sup>	Self-rated health <sup>a</sup>	Depressive symptoms <sup>b</sup>	Functional limitations <sup>c</sup>
	$b$ (SE)	$b$ (SE)	$b$ (SE)	$b$ (SE)	$b$ (SE)	$b$ (SE)
Cumulative SES (ref = consistently high)						
Consistently low	0.33 (0.02)***	0.97 (0.07)***	0.33 (0.06)***	0.43 (0.03)***	0.73 (0.07)***	0.24 (0.07)***
High child/low adult	0.25 (0.03)***	0.67 (0.11)***	0.26 (0.09)**	0.24 (0.04)***	0.40 (0.10)***	0.05 (0.09)
Low child/high adult	0.20 (0.02)***	0.47 (0.07)***	0.19 (0.06)**	0.26 (0.03)***	0.30 (0.07)***	0.16 (0.07)*
Age	0.03 (0.01)**	<-0.01 (0.04)	-0.05 (0.03)	0.03 (0.01)**	-0.05 (0.03)	-0.01 (0.04)
Age <sup>2</sup>	<-0.01 (0.00)*	<-0.01 (0.00)	<0.01 (0.00)**	<-0.01 (0.00)**	<0.01 (0.00)	<0.01 (0.04)*
Wald $\chi^2$	1,597.2***	2,607.08***	3,511.09***	1,608.2***	1,986.91***	3,115.4***

Notes: Source: Mexican Health and Aging Study, 2001–2012.

SES = socioeconomic status.

All models control for residence characteristics (urban vs rural, high U.S. outmigration state vs other state), marital status, number of chronic diseases (range 0–6), cognitive functioning (verbal recall only), and attrition effects.

<sup>a</sup>Random-intercept only model; also controlling for depression and lower-body functional limitations.

<sup>b</sup>Random-intercept only models; also controlling for lower-body functional limitations.

<sup>c</sup>Random intercept, random slope models; also controlling for depressive symptoms.

\* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

and poorer self-rated health and more depressive symptoms in late life, respectively. In tests of a combined measure of lifetime SES and health, respondents with *any* period of socioeconomic disadvantage, either in childhood or adulthood, had poorer estimated health outcomes than those who reported consistently high SES across the life course. Nevertheless, associations between lifetime SES and late-life health reflected a gradient, whereby those with consistently low SES across the life course were estimated to have the poorest health trajectories, followed by those with low childhood but high adulthood SES. Those with relatively high childhood SES but low adulthood SES were estimated to have the smallest—although still significant—differences in late-life health trajectories compared with those with consistently high SES. Although these findings highlight the adverse health effects of *any* period of socioeconomic disadvantage, they point to the importance of childhood SES in shaping late-life health: Those who experienced socioeconomic disadvantage in childhood were estimated to have poorer late-life health even if they experienced some degree of socioeconomic mobility by adulthood.

Overall we found that relationships between SES and health trajectories were similar in direction, significance, and magnitude for both men and women. This is consistent with prior cross-sectional research on older adults in urban Latin America, which has found that although older women in the region reported higher levels of socioeconomic disadvantage across the life course and higher rates of morbidity, the relationships between SES and health were similar by gender (Alvarado, Guerra, et al., 2007; Alvarado, Zunzunegui, et al., 2007). One of the primary exceptions was for estimations of functional limitations:

Laboring in the domestic or agricultural sectors was significantly associated with more functional limitations for women relative to working in other occupations or not working outside the home, but there was no significant association between lifetime occupation and late-life functional limitations for men. This could be due to the fact that although less than half of men reported working in agricultural or domestic occupations, even men who worked in other sectors may have otherwise been engaged in physically demanding labor, including small-scale agricultural work for household consumption. This would limit the underlying variability in occupational exposures that might have contributed to physical limitations in late life for men in this study cohort.

On the other hand, childhood SES markers were significantly associated with functional limitations for men over the 11-year study period, but had weak or null associations with functional limitations for women. It may be that educational attainment might have influenced the specific positions that men held within agricultural or domestic sectors. Specifically, those who had lower socioeconomic attainment in early life might have held positions with less power that also involved greater physical exertion and risk of injury than those who had attained some education or came from wealthier families with better material circumstances, in turn contributing to more physical limitations in late life. For women, on the other hand, childhood SES may have had more influence on subsequent entry into the paid workforce, and on the specific occupations taken up by those who did work for pay (e.g., domestic, agricultural, or other kinds of work), which would explain why childhood SES was no longer significant in models that also included



lifetime occupation. That is, any association between early-life SES and later-life functional limitations for women might be fully mediated by mid-life circumstances, including occupational exposures. Further research might explore the indirect associations between early-life SES and late-life functional limitations. In addition, further research might explore the relationship between lifetime occupation and later-life health for both men and women with more nuanced attention to the relative power that individuals held within these occupations (e.g., farm worker vs farm owner), the length of time in these occupations, and injuries and other occupation-related exposures.

We found no evidence to support our hypothesis that socioeconomic disadvantage would have a cumulative effect, contributing to widening health disparities as respondents aged over the 11-year study period. That is, there were no significant multiplicative interactions between socioeconomic measures and age across health outcomes for both men and women. This finding of no significant SES–age interactions also suggests that the effect of SES on late-life health did not diminish as respondents aged. Researchers analyzing U.S. samples have found some evidence that socioeconomic health disparities—and health disparities based on educational attainment in particular—tend to diminish in old age (i.e., age-as-leveler) (J. Kim & Durden, 2007; Xu et al., 2014). One of the explanations for this finding in the U.S. context is that entitlement programs such as Medicare and Social Security mitigate the adverse consequences of early-life SES on access to medical care and exposure to financial strain and other stressors. Mexico has historically lacked analogous entitlement programs, which may explain the persistent socioeconomic disparities in health for this cohort (Wong & Palloni, 2009).

We note there were efforts to improve the socioeconomic conditions of older adults in Mexico during the study period, although it may be that these efforts have yet to make dramatic improvements in health inequities determined by earlier-life SES. In particular, the “70 Plus” (70 y más) program was launched in 2007 to provide a monthly cash benefit to many of Mexico’s older adults who were not receiving a formal pension (Amuedo-Dorantes & Juarez, 2012); there is evidence that the program has had beneficial effects on depression outcomes among recipients, potentially by increasing recipients’ sense of empowerment around household economic decisions and reducing the emotional strain and social stigma associated with poverty and financial insecurity (Salinas-Rodriguez et al., 2014). Recent research suggests that state-based efforts to supplement the income of older adults in Mexico are associated with improved health for low-income older adults via mechanisms of improved nutrition and access to health care (Aguila, Kapteyn, & Smith, 2015). Health reform in Mexico has also aimed to reduce the rates of catastrophic spending on health care, particularly for families with older adults (Knaul, Arreola-Ornelas, Méndez-Carniado, & Torres, 2007). Finally, conditional cash transfer programs

that have targeted families with young children in Mexico have been found to be associated with improved well-being of older adults who reside with beneficiaries of this program (Behrman & Parker, 2013). Despite the potential impact of these important changes for the socioeconomic and health conditions of older Mexicans, we find that SES disparities in health trajectories continued over the study period for MHAS respondents. Although these policies address poverty in late life, our results point to the persistent impact of early-life SES on late-life health and emphasize the need for policies addressing poverty and SES disparities across the entire life course in order to alter late-life health.

From a more historical perspective, there were important institutional changes earlier on in Mexico that may have contributed to differences in SES and the meaning of SES for health for the distinct birth cohorts included in the MHAS. For example, the Mexican Ministry of Education was founded in 1921 and began to influence rural literacy rates around 1930, after many of the respondents in our sample would have finished their educational trajectories (DeGraff & Wong, 2014). Those born in later birth cohorts may have benefited from higher standards of educational quality enacted by the Ministry of Education relative to other cohorts. In addition, there were significant changes to the Mexican labor market across the 20th century: Women’s labor force participation increased during the latter half of the 20th century (Parrado & Zenteno, 2001), and a rise in labor migration to the United States enabled economic mobility for some male participants in the MHAS (Wong, Palloni, & Soldo, 2007), which may have led to changes in the meaning of occupation as a marker of SES for these diverse birth cohorts.

Given the dramatic changes related to education and occupation across the 20th century in Mexico, we tested for potential cohort differences in the effects of SES in health in ancillary analyses, stratifying analyses for birth cohorts born before and after 1930, around the rise of rural literacy. We found evidence of substantial cohort differences in the relationship between education and health by cohort (Supplementary Table 4). The precision of these estimates is low for the oldest cohort given smaller sample sizes, so we interpret these supplemental findings with caution. Nevertheless, the findings are suggestive of null associations between education and either depressive symptoms or functional limitations for those born before 1930. This is in contrast to findings for the overall sample and the subsample born after 1930, for whom there is evidence of a significant association between lacking any formal education and more depressive symptoms and functional limitations, respectively, in mid to late life. For women, the association between lack of any formal education and poorer self-rated health is significant for those born in 1930 or earlier—as is true for the overall sample—but not for those born later.

Ancillary analyses (not shown) also confirm the heterogeneous associations between SES and health in rural versus urban settings, consistent with previous research

(Beltrán-Sánchez et al., 2011; Buttenheim et al., 2010; Smith & Goldman, 2007). For example, education and lifetime occupation, respectively, were not significantly associated with depressive symptoms for rural-dwelling women. There were also few significant associations between both individual and combined SES markers and both functional limitations and self-rated health for rural-dwelling men and women. Limited significant associations between SES and health for rural residents may be due to the fact that even those with relatively greater socioeconomic standing might have had limited access to health care or other health-related resources if they lived in rural areas of Mexico. That is, there may have been fewer health-related returns to socioeconomic attainment in rural Mexico, at least for the cohorts included in this analysis. Future research on SES and late-life health trajectories in Mexico should continue to consider heterogeneity across urban and rural regions.

### Limitations

There are several important limitations to this study. For one, we are unable to assess the timing of onset for depressive symptoms, functional limitations, or other health conditions that may contribute to self-rated health. This makes it impossible to fully establish a causal relationship between SES and health outcomes later in life. Specifically, there may be a reverse causal order whereby the onset of depressive symptoms, poor physical functioning, or overall poor health early in life might have limited respondents' ability to attend school or work, which would adversely affect SES in older adulthood. Our measures of early-life SES reflect time periods before the average age of depression onset in Mexico, at 21 years of age (Berenzon, Lara, Robles, & Medina-Mora, 2013), although these measures are also subject to the biases of retrospective reporting. For example, it is possible that individuals who are more depressed are more likely to report adverse childhood conditions, "anchoring" accounts of the past in their health-related experiences of the present (Haas, 2007). On the other hand, researchers have found evidence of sufficient reliability of recalled measures (Krieger, Okamoto, & Selby, 1998), particularly among older adults (Haas, 2007), and we control for factors that might influence retrospective reports, including age and cognitive functioning (Vuolo, Ferraro, Morton, & Yang, 2014). In addition, given the 9-year gap between the second and third study waves for this survey, there were likely intermittent changes across all measures of health and physical functioning that we were not able to capture; our analysis assumes continuous trajectories in between study waves.

### Conclusion

This study responds to the call for increased research into the health of rapidly aging populations in low- and middle-income countries with data from an 11-year panel survey of

older Mexican adults. We highlight the association between discrete indicators of SES in childhood and adulthood, drawing attention to critical periods for intervention. In addition, by summing up SES indicators across the life course, we draw attention to the impact of SES disadvantage over the life course, shedding light on a segment of the Mexican older adult population that has experienced poverty from childhood through adulthood, and that may be the focus of public health interventions. Although the size of the coefficients for individual measures of SES and health is very small given the distal, although fundamental, influence of these social determinants, the summary measure draws attention to the magnitude of the relationship between lifetime socioeconomic advantage and disadvantage and later-life health. We find evidence of socioeconomic disparities in health outcomes as respondents aged over the study period even as we account for the attrition of respondents with poorer average health. Findings suggest that investments in improving socioeconomic and material conditions across the life course, and particularly during childhood, may contribute to a lower burden of depression, disability, and poor overall health for Mexico's aging population.

### Supplementary Material

Please visit the article online at <http://gerontologist.oxfordjournals.org/> to view supplementary material.

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