Educational Gradients and Pathways of Disability Onset among Older Mexicans: Birth Cohort and Gender Differences?

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Abstract

Introduction: Educational disparities research is less common in developing countries. We evaluate whether educational gradients of disability onset exist in Mexico across groups (birth cohort and sex) and whether the association is direct or indirect via health (health behaviors and chronic conditions) or economic (income and wealth) pathways.

Method: Data come from the Mexican Health & Aging Study. Activities of Daily Living are reported in 2001, 2003, and 2012 by respondents and spouses age 50+ (n=9,584). Groups are analyzed separately using logistic regression to test education-disability onset associations.

Results: Significant education-ADL onset gradients were observed across groups. A large educational direct effect was observed. Indirect effects operated primarily through the economic pathway for all groups.

Discussion: Those with less education are disadvantaged in terms of disability regardless of birth cohort and sex. A large direct effect of education may suggest unobserved mediators or differential returns to resources by educational level.

Author Bios

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Introduction

Research in the United States and other developed countries has consistently found relationships between socioeconomic status (SES) and health (Braveman, Egerter, & Williams, 2011). Indeed, SES is argued to be a *fundamental cause* of disease (Phelan, Link, Diez-Roux, Kawachi, & Levin, 2004). Lamentably, research on the SES-health relationship has not been as common in developing countries most likely due to a lack of data to support analyses in many developing countries. Research that has focused on these environments has found conflicting results with not all developing countries exhibiting SES-health gradients (Smith & Goldman, 2007). The necessity of research on SES-health relationships in developing countries is clear for several reasons. First, many developing countries are experiencing rapid aging (Shrestha, 2000) with scarce or lacking institutional support for the elderly (Wong & Palloni, 2009). The sheer numbers of older adults will represent a great challenge as more developing countries will grapple with the need to provide health care and old-age financial support. Additionally, current elderly populations in many developing countries have survived periods with higher burdens of infectious disease while chronic conditions are becoming more important causes of mortality (Shrestha, 2000). For these reasons, developing countries must be researched from an independent lens. That is, SES-health relationships cannot be generalized from developed to developing countries or even across developing countries. Understanding socioeconomic disparities, life style risk factors throughout the life course and disability processes in developing countries that are experiencing rapid aging is a vital step towards improving population health in these contexts. We evaluate whether educational gradients in disability onset exist across birth cohorts and sexes in Mexico and analyze the pathways through which education impacts disability onset.

Literature Review

Research that has examined the SES-health relationship in developing countries has found inconsistent results. We begin by presenting three cases: Taiwan, China and Costa Rica. These countries are similar to other developing countries in that they are all experiencing rapid population aging. Analyses of mortality using national death registries in Taiwan have demonstrated educational gradients in mortality which are somewhat explained by health indicators (Zimmer, Martin, & Lin, 2005). Additionally, researchers using data from the Survey of Health and Living Conditions of the Aged has found educational gradients in mortality in Wuhan, China as well and that this association was direct and indirect (Liang et al., 2000). From Latin America, however, researchers using data from the Costa Rican Study of Longevity and Healthy Aging have found results that are inconsistent with developed nations. While lower education was associated with lower self-rated health, educational gradients were not observed for mortality. Additionally, higher rates of cardiovascular risk factors (hypertension and obesity) were observed for persons of higher SES in Costa Rica (Rosero-Bixby & Dow, 2009). Results from these diverse studies may inform research in other countries but researchers must be careful not to generalize these findings outside of the country from which the samples were drawn.

Disability Onset and the Mexican Context

While much research has focused on SES and health, one major concern of these analyses is the operationalization of SES which is often measured through facets including education, occupation, income and wealth. While this practice is common, these facets of SES should not be treated as interchangeable constructs. Research has found differences in how individual facets of SES are related with stages of disease. For example, multiple studies have found education to predict the onset of functional limitations while income predicts the

progression of functional limitation in the United States (Herd, Goesling, & House, 2007; Zimmer & House, 2003). This same framework has been applied to other developed countries including the United Kingdom (Grundy & Glaser, 2000). However, it is necessary to extend this framework to a developing country such as Mexico.

Mexico presents an interesting case as substantial demographic changes have taken place over the previous century including rising non-communicable disease mortality (Rivera et al., 2002), rapid population aging (Zúñiga & Vega, 2004), urbanization (Garza, 1999) as well as increases in education across sex and rural/urban areas (Wong & Palloni, 2009). Given these demographic changes, researchers must study birth cohorts separately as different birth cohorts have aged in distinct contexts and endured disparate living conditions. Also, women in Mexico have had relatively low participation in the formal labor sector compared to other countries (Jaumotte, 2003) such that older women in Mexico may not see the same economic benefits to their education that men do. For this reason, we choose to analyze sex and birth cohort groups separately.

Theoretical Framework and Aims

While much research has examined education-health gradients, less has considered the pathways. We consider two major pathways. The first is through health behaviors and chronic conditions. Through the disablement process (Verbrugge & Jette, 1994), lower education may impact disability onset through an increased risk of certain pathologies such as heart conditions and diabetes as a result of poorer health behaviors and lacking health knowledge (Braveman et al., 2011). The second is through income and wealth (Duncan, Daly, McDonough, & Williams, 2002; Pollack et al., 2007). Low education may predict low income which restricts one's access to favorable residence and health care. Additionally, those with higher income may be able to

afford diabetes treatment options and manage the disease more effectively to prevent complications. Finally, wealth may provide people with a resource to draw from in the event of a negative health event such as a stroke and may give individuals greater ability to shift careers if they face physically demanding jobs which increase disability risk.

The study of education and disability onset in late life requires the use of a life course framework which acknowledges the patterning of events throughout the life course. We frame our theory through a chain-of-risk model (Kuh & Ben-Shlomo, 2004) by arguing that education will predict late life disability onset indirectly through the pathways mentioned above (a) health behaviors and chronic conditions and (b) income and wealth. The aims of this analysis are (1) to determine whether educational gradients in disability onset are present across birth cohorts and sex among older Mexicans, and (2) to determine to what extent the education-disability onset association is mediated by health behaviors and chronic conditions or income and wealth across birth cohorts and sex among older Mexicans.

Research Design

Data come from Waves 1-3 of the Mexican Health & Aging Study (MHAS) (MHAS, 2001). The MHAS is a large, longitudinal, household based study using a sample of Mexican adults (age 50+ in 2001) and spouses regardless of age. Interviews were conducted in 2001, 2003 and 2012. The study was approved by the Institutional Review Boards or Ethics Committees of the University of Texas Medical Branch in the United States, the Instituto Nacional de Estadistica y Geografia (INEGI) and the Instituto Nacional de Salud Publica (INSP) in Mexico. The sample size at baseline was 15,186. Because this analysis is focused on late life disability onset, the analytic sample only includes respondents and spouses (age 50+ at baseline) who are free of Activities of Daily Living (ADL) disability in 2001 and were interviewed in at least one

wave after baseline. Respondents who are missing on covariates are also eliminated from the analysis making a final sample size of 9,584. The sample is divided into two birth cohorts by splitting the sample at the median birth year to create relatively equal sample sizes across birth cohorts. The resulting birth cohorts are 50-59 or 60+ at baseline.

We will include demographic, health and economic covariates in our analyses. Demographic covariates will be used as control variables while health and economic variables will be used to test health and economic pathways. Demographic variables come from baseline and include age, sex, marital status, education and whether the respondent lived in a rural or urban area. Marital status is categorized as married, widowed, or other (divorced, separated or never married). Education is categorized according to years of formal education as no education: 0 years, incomplete elementary education: 1-5 years, elementary education: 6 years, and beyond elementary education: 7+ years. Rural/urban is operationalized as whether the respondent lived in a more urban area (community size larger than 100,000 persons) or less urban area (less than 100,000 persons).

Health behavior covariates include smoking and binge drinking. Smoking is categorized as never smoker, former smoker or current smoker. Binge drinking is based on self-reported consumption of 4 or more alcoholic beverages in a single day during the previous 3 months. Chronic conditions assessed in the survey include self-reported hypertension, cancer, strokes, heart attacks, diabetes and pulmonary conditions. As few respondents report certain chronic conditions, the number of chronic conditions listed above that the respondent reports is created and used in analyses. Disability is captured through self-reported limitations with Activities of Daily Living (ADL) (Katz, Ford, Moskowitz, Jackson, & Jaffe, 1963). Respondents are asked in each wave whether they have trouble dressing, bathing, eating, getting out of bed and using the

toilet. Respondents who report any ADL disability in 2003 or 2012 are considered to have disability onset as the analytic sample is free of ADL disability at baseline (2001). ADL categorizations are based on those used by previous researchers using the MHAS (Díaz-Venegas, 2013).

Income from various sources is assessed at the individual level to obtain estimates of total individual income. Income is then separated into tertiles with the highest income tertile used as the reference group in regressions. Missing income data was imputed by the MHAS (Wong & Espinoza, 2004). Wealth is assessed at the household level and is measured as the sum of the reported value of businesses, real estate, money in accounts and stocks, transportation and any other assets. Similar to income, wealth is then separated into tertiles with the highest wealth tertile used as the reference group in regressions. Although health insurance coverage may be a mediator between income/wealth and health, we do not include health insurance coverage in our analysis. This is because we consider that health insurance status is not exogenous to health as respondents may obtain health insurance as a result of health problems leading to a biased estimate of the effect of health insurance.

The sample is separated by sex and birth cohort to form 4 groups and each group is analyzed separately using logistic regression. Each Model is labeled with a number and a letter where the number indicates the group (1-4) and the letter indicates the covariates (a-d). Models 1-4a show the raw effect of education by including education and other variables which are not assumed to be mediators between education and disability onset (age, rural/urban and marital status). Models 1-4b illustrate whether the education-disability onset association is mediated through the health pathway by adding the covariates in this pathway (smoking behaviors, binge drinking and chronic condition count) to Models 1-4a. Models 1-4c demonstrate whether the

education-disability onset association is mediated through the economic pathway by adding income and wealth to Models 1-4a. Models 1-4d adds variables from the health and economic pathways to Model 1-4a because income and wealth may be correlate with health behaviors and chronic conditions.

Formal tests of mediation by the health and economic factors are performed using the KHB method which decomposes the total effect of an independent variable (education) on a dependent variable (disability onset) into direct and indirect (through mediators) components and allows the user to determine the percent of the indirect effect that is explained by individual variables in multiple mediator models. The KHB method has been used previously to assess mediation (Torres & Wong, 2013) and has been explained in greater detail elsewhere (Kohler, Karlson, & Holm, 2011). All models are fit using STATA SE 13 and include the number of waves the respondent was interviewed to account for differential length of follow up as some respondents are re-interviewed in 2003 but not 2012 due to loss to follow up and mortality.

Results

Descriptive Results

[Insert Table 1 about here]

Descriptive results are shown in Table 1. Of the 9,584 respondents in the analytic sample,1,999 (20.9%) experienced ADL onset over follow up. Sufficient sample size is seen in each of the 4 groups with 2,122 in the younger male group, 2,672 in the younger female group, 2,218 in the older male group and 2,572 in the older female group. ADL onset was more common among females (23.8% versus 17.3% in males) and in the older cohort (26.1% versus 15.6% in the younger cohort). As expected, educational attainment was higher in the younger birth cohort than the older birth cohort. Additionally educational attainment was higher among

men than women in both cohorts. Figure 1 shows the unadjusted percentage that have ADL onset over follow up according to level of education by birth cohort/sex group. For each birth cohort/sex group, the percent reporting ADL onset over follow up is lower for those with higher levels of education. While educational gradients in ADL onset are seen for all groups in Figure 1, these results are unadjusted and do not take into account mediating or confounding variables.

[Insert Figure 1 about here]

Regression Analyses

Regression analyses for the younger cohort are shown in Table 2. We first focus on younger males. In Model 1a, only education and non-mediating variables (age, rural/urban and marital status are included). A statistically significant educational gradient in ADL onset is observed with higher odds of ADL onset among those with lower levels of educational attainment. The odds ratio comparing those with no education to those with 7+ years of education was 3.06 ($p<0.001$) demonstrating significantly higher odds of disability onset among those with no education. A significant odds ratios is also observed comparing those with 1-5 years to those with 7+ years of education. In Model 1b we add health variables (chronic condition count, smoking behaviors and binge drinking) to determine whether the education odds ratios obtained in Model 1a decrease. Such a decrease would suggest that the health pathway may be mediating the relationship between education and ADL onset. Although having more chronic conditions is associated with higher odds of ADL onset, the introduction of the health variables did not substantially alter the education odds ratios obtained in Model 1a suggesting that the health pathway does not mediate the education-ADL onset association. In Model 1c we swap the health variables for income and wealth to determine whether income and wealth mediate the education-ADL onset association. Although neither income nor wealth is

significantly associated with ADL onset on their own, their combined effects reduced education odds ratios suggesting that income and wealth may partially mediate the education-ADL onset association. In Model 1d, we include the health, income and wealth variables and obtain education odds ratios that are similar to those observed in Model 1c.

Results for younger females are similar to those observed among younger males. A significant educational gradient in ADL onset is observed in Model 2a with an odds ratio of 2.35 ($p<0.001$) comparing those with no education to those with 7+ years of education. Additionally, those with 1-5 or 6 years of education had significantly higher odds of ADL onset over follow up. The introduction of income and wealth in Model 2c reduces the education odds ratios more substantially than the introduction of the health variables in Model 2b. This result suggests that income and wealth may partially mediate the education-ADL onset association. Similar to the results for younger males, having more chronic conditions is associated with higher odds of ADL onset. However, among younger females, lower income is associated with higher odds of ADL onset over follow up.

[Insert Table 2 about here]

Regression analyses for the older cohort are shown in Table 3. For older males, a significant educational gradient in disability onset is observed in Model 3a with higher odds of ADL onset among the lower educated. The odds ratios comparing those with no education to those with 7+ years of education was 1.46 ($p<0.05$). Those with 1-5 years of education also had significantly higher odds of ADL onset compared to those with 7+ years of education. The inclusion of health variables in Model 3b does not decrease the education odds ratios although chronic condition count is significantly associated with ADL onset in the expected direction. Finally, education loses significance when income and wealth are included in Model 3c where

lower income significantly predict ADL onset. This result, once again, suggests that income and wealth are mediating the relationship between education and ADL onset. In the combined model, Model 3d, education odds ratios remained insignificant and similar to those observed in Model 3c. Having more chronic conditions and lower income are associated with ADL onset in the combined model.

Similar results are seen among older females. A significant educational gradient is observed in Model 4a. Respondents with 0 years, 1-5 years or 6 years had significantly higher odds of ADL onset. The odds ratio comparing those with no education to those with 7+ years was 2.10 ($p<0.001$). The inclusion of income and wealth in Model 4c reduces the education odds ratios more substantially than the inclusion of the health variables in Model 4b. Having more chronic conditions and having less income are associated with ADL onset in the combined model (Model 4d).

[Insert Table 3 about here]

Mediation Analyses

Mediation analyses are done separately by birth cohort/sex group. For each group a logistic regression model predicting ADL onset using years of education and all proposed mediators (health behaviors, chronic conditions, income and wealth) are included. We use years of education instead of education categories to facilitate interpretations of the decomposition results. Only the mediators that reduce the education-ADL onset association are treated as mediators in final models (shown in Table 4). The upper panel shows that for younger males, the total effect of education is -0.08 suggesting a decrease in odds of disability onset with increasing years of education. However, this total effect can be broken into a direct (-0.07) and an indirect (-0.01) effect that sum to the total effect. The percentage of the total effect that is indirect conveys

that only 17.6% of the education-ADL onset association is operating through either health or economic pathways. To determine which pathway is playing a greater role in mediating the education-ADL onset association, we decompose the indirect effect to assess the contribution of each individual pathway. The lower panel shows that for younger males, of the indirect effect, 92.5% is explained by the economic pathway while only 7.5% is explained by the health pathway. Similar results are obtained across birth cohort/sex groups. The majority of the education-ADL onset association is direct and the majority of the indirect effect can be attributed to the economic pathway.

[Insert Table 4 about here]

Discussion

The results of this analysis are consistent with results obtained in developed countries showing educational gradients in disability onset (Grundy & Glaser, 2000; Herd et al., 2007; Zimmer & House, 2003). In reference to our first aim, we find little difference in the education-ADL onset association across four groups defined by birth cohort and sex. Respondents with lower education had higher odds of ADL onset in all groups. Ubiquitous gradients and a strong direct effect of education on ADL onset suggest that more work is needed to reduce educational disparities in Mexico. For our second aim, we find that although a relatively small portion of the education-ADL onset association is indirect (approximately 15%), the indirect effect operates primarily through income and wealth in contrast to health behaviors and chronic conditions. Income and wealth may operate as stronger mediators because those with lower education may have less income and wealth which may disadvantage them in terms of access to quality health care, treatment options and rehabilitation. Also, educational gradients in health behaviors such as smoking may be weaker in Mexico than in developed countries (Buttenheim, Wong, Goldman,

& Pebley, 2009) where poor health behaviors such as smoking may be a luxury that those with fewer resources may not be able to afford (Buttenheim, Goldman, Pebley, Wong, & Chung, 2010). For this reason the health pathway may not mediate the education-ADL onset association in Mexico in the same way that it may in developed countries.

An additional concern is the strong direct effect of education on ADL onset. This may be explained in two ways. First, a strong direct effect might be caused by omitted variables that would operate as additional mediators. If other variables mediate the relationship between education and ADL onset, we may be observing an inflated direct effect of education by excluding them from models. Other researchers have suggested that in addition to health and economic mechanisms, education may impact health through psychosocial resources (Ross & Wu, 1995). As our analyses do not include psychosocial resources, their omission may inflate the direct effect of education. Second, the strong direct effect of education may be a true direct effect. For example, it may be that a respondent with low education may have health insurance and resources similar to a respondent with high education but that the respondent with higher education may be able to utilize these resources more effectively to reap greater returns (Leigh, 1983).

There are additional limitations worth mentioning. First, as suggested above, there may be omitted mediators which inflate the direct effect of education. Although concerns for omitted variables are always present in secondary data and we included a wide variety of covariates, future research should include a more exhaustive list of mediators. Second, although we include a variable for how many waves the respondent contributed to the study to account for attrition and timing of disability onset, discrete time hazard models may be able to more accurately account for differential lengths of follow up. However, the MHAS has had remarkably low

attrition with a response rate of 88% from 2003 to 2012 (Estudio Nacional de Salud y Envejecimiento en México, 2013). Finally, access to health insurance may clearly mediate the education-ADL onset association. We chose not to include this variable because health insurance reflects not only the availability but also the need for health care. That is, health insurance may be determined endogenously as persons may obtain health insurance if they are experiencing health problems. Future research should attempt to address the role of health insurance in mediating the education-ADL onset association and address the problems of endogeneity. Notwithstanding these limitations, this analysis comes with several strengths. First, we were able to analyze a nationally representative sample of older Mexican adults with a large enough sample size to examine differences by birth cohort and sex. Second, the study has eleven years of follow up providing a great opportunity to detect ADL onset. Finally, the MHAS has a large variety of detailed information on respondents which allows us to examine disability using many variables and a multidimensional approach by analyzing health and economic pathways.

Conclusion

Lower educational attainment is associated with higher odds of disability onset in old age regardless of birth cohort and sex among older Mexicans. The majority of the effect of education on disability onset is direct while the indirect effect is mainly driven by economic mechanisms (income and wealth) and not health mechanisms (chronic conditions and health behaviors). While great strides have already been made in Mexico which may reduce socioeconomic health disparities including the Progresa/Oportunidades and Seguro Popular programs, public policy should continue to focus on improving educational opportunities and facilitating effective use of health care, particularly among groups with low education, possibly through preventive medicine. Future research on educational gradients in disability onset in Mexico should aim to

delineate other pathways from education to disability onset and explain more in depth the direct effect of education.

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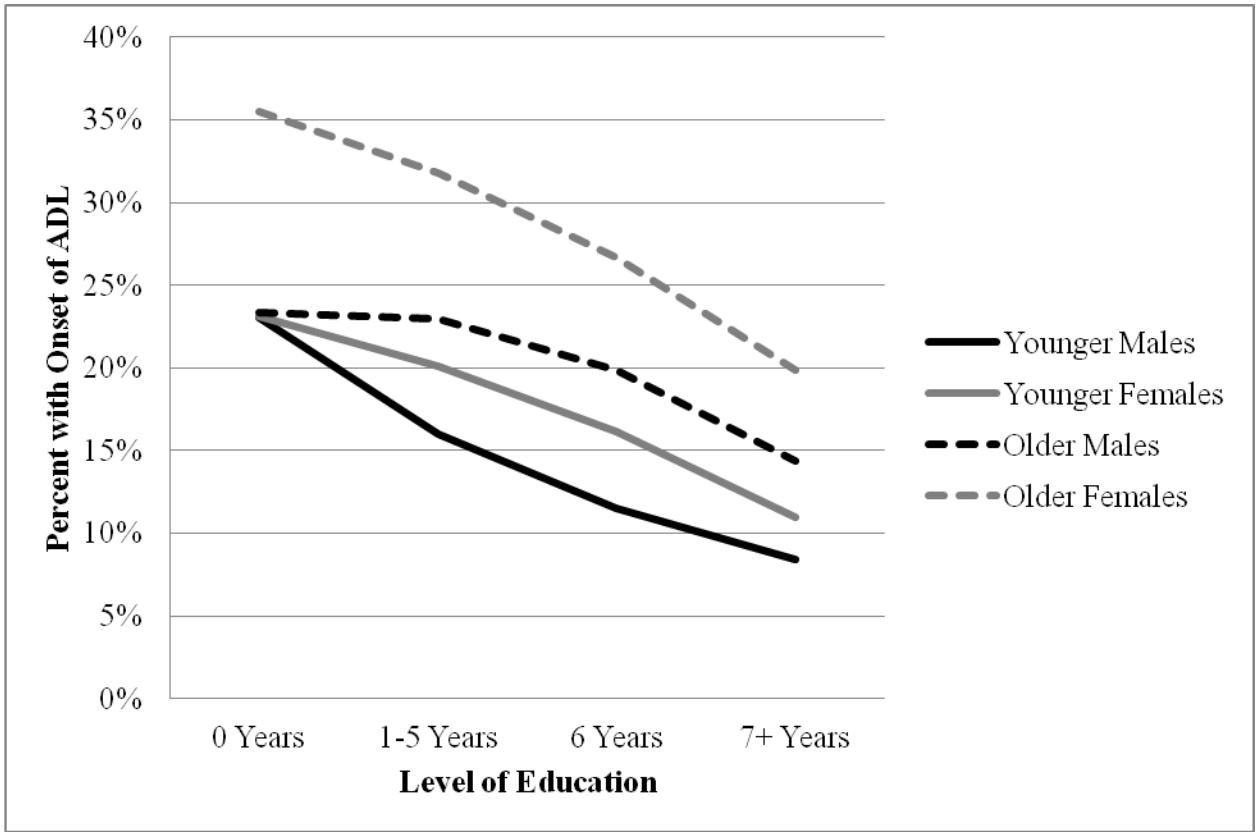
Figure 1: Percent of Respondents with ADL Onset between 2001 and 2012 by Sex, Birth Cohort and Level of Education.



Source: Own calculations using data from the Mexican Health and Aging Study (MHAS), n=9,584.
Note: Younger birth cohort = individuals aged 50-59 at the 2001 baseline. Older birth cohort = individuals aged 60+ at the 2001 baseline.

Table 1: Distribution of Baseline Variables and Activities of Daily Living (ADL) Onset among Older Mexicans by Birth Cohort* Sex.

	Younger Males (n=2,122)	Younger Females (n=2,672)	Older Males (n=2,218)	Older Females (n=2,572)
Onset of ADL				
Onset of ADL %	13.3	17.4	21.2	30.4
Level of Education				
0 Years %	12.7	18.6	26.9	33.1
1-5 Years %	30.3	34.4	39.9	36.2
6 Years %	23.4	20.4	17.0	15.4
7+ Years %	33.6	26.7	16.3	15.3
Age				
Mean, Standard Deviation	54.2 (2.81)	54.2 (2.81)	68.7 (6.91)	68.1 (6.68)
Area of Residence				
More Urban %	67.7	69.3	62.0	66.3
Marital Status				
Widowed %	2.9	12.1	12.5	37.1
Other %	8.0	17.9	7.9	14.3
Married %	89.1	70.1	79.5	48.6
Chronic Condition Count				
Mean, Standard Deviation	0.44 (0.68)	0.68 (0.78)	0.58 (0.76)	0.77 (0.78)
Smoking Behavior				
Former Smoker %	34.3	12.8	45.3	16.7
Smoke Now %	31.0	10.6	22.5	7.9
Never Smoker %	34.8	74.6	32.2	75.4
Binge Drinking				
Binge Drinking %	21.7	1.7	12.0	1.1
Income				
Low Tertile %	27.5	33.8	30.6	37.5
Mid Tertile %	28.5	31.9	38.0	37.2
High Tertile %	44.0	34.4	31.5	25.4
Wealth				
Low Tertile %	29.1	30.3	32.8	38.7
Mid Tertile %	34.7	34.6	34.8	32.6
High Tertile %	36.2	35.1	32.4	28.7

Source: Own calculations using data from the Mexican Health and Aging Study (MHAS), n=9,584.
* Younger birth cohort = individuals aged 50-59 at the 2001 baseline. Older birth cohort = individuals aged 60+ at the 2001 baseline.

Table 2: Logistic Regressions for Onset of Limitations in Activities of Daily Living (ADL) between 2001 and 2012 in the Younger Cohort (Age 50-59 in 2001) by Sex.

	Younger Males (n=2,122)								Younger Females (n=2,672)							
	Model 1a		Model 1b		Model 1c		Model 1d		Model 2a		Model 2b		Model 2c		Model 2d	
	OR[1]	SE[2]	OR	SE	OR	SE	OR	SE	OR	SE	OR	SE	OR	SE	OR	SE
Level of Education																
0 Years (Ref: 7+ Years)	3.06	(.65)***	3.18	(.68)***	2.59	(.58)***	2.66	(.60)***	2.35	(.40)***	2.22	(.38)***	2.02	(.36)***	1.89	(.34)***
1-5 Years (Ref: 7+ Years)	1.98	(.36)***	1.96	(.35)***	1.76	(.33)**	1.73	(.33)**	1.99	(.30)***	1.87	(.29)***	1.75	(.28)***	1.63	(.26)**
6 Years (Ref: 7+ Years)	1.38	(.27)	1.30	(.26)	1.27	(.26)	1.20	(.24)	1.56	(.26)**	1.49	(.25)*	1.40	(.24)	1.33	(.23)
Demographics																
Age	1.02	(.02)	1.01	(.02)	1.02	(.02)	1.01	(.02)	1.03	(.02)	1.02	(.02)	1.02	(.02)	1.02	(.02)
More Urban (Ref: Less Urban)	0.89	(.13)	0.85	(.12)	0.92	(.13)	0.88	(.13)	0.91	(.10)	0.89	(.10)	0.95	(.11)	0.92	(.11)
Marital Status																
Widowed (Ref: Married)	0.85	(.33)	0.91	(.36)	0.88	(.35)	0.95	(.38)	0.78	(.13)	0.75	(.13)	0.80	(.14)	0.78	(.13)
Other (Ref: Married)	0.62	(.17)	0.66	(.19)	0.59	(.17)	0.62	(.18)	0.96	(.13)	0.97	(.14)	0.95	(.14)	0.96	(.14)
Health Behaviors and Chronic Conditions																
Chronic Condition Count			1.62	(.14)***			1.64	(.15)***			1.41	(.09)***			1.42	(.09)***
Former Smoker (Ref: Never)			0.89	(.14)			0.89	(.14)			0.89	(.14)			0.90	(.14)
Smoke Now (Ref: Never)			0.97	(.16)			0.96	(.16)			1.14	(.20)			1.18	(.20)
Binge Drinking (Ref: No)			0.81	(.14)			0.82	(.14)			1.70	(.62)			1.75	(.63)
Income																
Low Tertile (Ref: High Tertile)					1.21	(.20)	1.19	(.20)					1.43	(.20)**	1.49	(.21)**
Mid Tertile (Ref: High Tertile)					1.22	(.20)	1.23	(.20)					1.36	(.19)*	1.39	(.20)*
Wealth																
Low Tertile (Ref: High Tertile)					1.35	(.23)	1.40	(.24)					1.12	(.15)	1.11	(.15)
Mid Tertile (Ref: High Tertile)					1.03	(.17)	1.02	(.17)					1.06	(.14)	1.04	(.14)

Note: [1] OR refers to Odds Ratio. [2] SE refers to Standard Error. * denotes p≤0.05, ** denotes p≤0.01, *** denotes p≤0.001. All models include the number of waves the respondent was followed up to account for differential length of follow up. Source: Own calculations using data from the Mexican Health & Aging Study (MHAS).

Table 3: Logistic Regressions for Onset of Activities of Daily Living (ADL) Limitations between 2001 and 2012 in the Older Cohort (Age 60+ in 2001) by Sex.

	Older Males (n=2,218)								Older Females (n=2,572)							
	Model 3a		Model 3b		Model 3c		Model 3d		Model 4a		Model 4b		Model 4c		Model 4d	
	OR[1]	SE[2]	OR	SE	OR	SE	OR	SE	OR	SE	OR	SE	OR	SE	OR	SE
Level of Education																
0 Years (Ref: 7+ Years)	1.46	(.28)*	1.50	(.29)*	1.29	(.25)	1.31	(.26)	2.10	(.32)***	2.08	(.32)***	1.83	(.29)***	1.82	(.29)***
1-5 Years (Ref: 7+ Years)	1.57	(.28)*	1.59	(.28)**	1.42	(.26)	1.43	(.26)	1.81	(.27)***	1.78	(.27)***	1.62	(.25)**	1.59	(.25)**
6 Years (Ref: 7+ Years)	1.46	(.29)	1.43	(.29)	1.35	(.28)	1.32	(.27)	1.47	(.25)*	1.42	(.25)*	1.35	(.23)	1.31	(.23)
Demographics																
Age	1.05	(.01)***	1.05	(.01)***	1.05	(.01)***	1.05	(.01)***	1.03	(.01)***	1.04	(.01)***	1.03	(.01)***	1.03	(.01)***
More Urban (Less Urban)	0.83	(.09)	0.80	(.09)	0.84	(.10)	0.82	(.09)	0.96	(.09)	0.93	(.09)	0.97	(.09)	0.95	(.09)
Marital Status																
Widowed (Ref: Married)	1.02	(.16)	1.04	(.17)	1.05	(.17)	1.08	(.17)	0.97	(.09)	0.98	(.10)	0.96	(.10)	0.97	(.10)
Other (Ref: Married)	0.75	(.17)	0.77	(.17)	0.75	(.17)	0.76	(.17)	1.00	(.13)	1.00	(.13)	0.98	(.13)	0.98	(.13)
Health Behaviors and Chronic Conditions																
Chronic Condition Count			1.26	(.09)***			1.27	(.09)**			1.34	(.08)***			1.34	(.08)***
Former Smoker (Ref: Never)			1.11	(.14)			1.11	(.14)			1.05	(.12)			1.06	(.12)
Smoke Now (Ref: Never)			0.88	(.14)			0.86	(.13)			1.09	(.18)			1.10	(.18)
Binge Drinking (Ref: No)			0.71	(.13)			0.72	(.13)			0.83	(.37)			0.83	(.37)
Income																
Low Tertile (Ref: High Tertile)					1.32	(.19)*	1.37	(.20)*					1.30	(.16)*	1.31	(.16)*
Mid Tertile (Ref: High Tertile)					1.34	(.18)*	1.35	(.19)*					1.40	(.17)**	1.41	(.17)**
Wealth																
Low Tertile (Ref: High Tertile)					1.13	(.16)	1.17	(.17)					1.15	(.13)	1.14	(.13)
Mid Tertile (Ref: High Tertile)					1.20	(.16)	1.21	(.16)					1.08	(.13)	1.07	(.12)

Note: [1] OR refers to Odds Ratio. [2] SE refers to Standard Error. * denotes p<0.05, ** denotes p<0.01, *** denotes p<0.001. All models include the number of waves the respondent was followed up to account for differential length of follow up. Source: Own calculations using data from the Mexican Health and Aging Study (MHAS).

Table 4: Decomposition of the Effect of Education on Onset of Activities of Daily Living (ADL) Limitations from 2001 to 2012 through Health and Economic Pathways by Birth Cohort* and Sex.

	Younger Males			Younger Females			Older Males			Older Females		
	β	p	%	β	p	%	β	p	%	β	p	%
Decomposition of Total Effect of Years of Education on ADL Onset (Health and Economic Pathways)												
Total Effect	-0.080	***		-0.084	***		-0.043	**		-0.076	***	
Direct Effect	-0.066	***	82.4%	-0.064	***	75.4%	-0.031	*	71.9%	-0.061	***	80.9%
Indirect Effect	-0.014	*	17.6%	-0.021	***	24.6%	-0.012	**	28.1%	-0.014	**	19.1%
Decomposition of Indirect Effect by Health and Economic Pathways												
Health Pathway$_1$	-0.001$_3$		7.5%	-0.006$_4$		29.6%	-0.001$_5$		9.6%	-0.002$_6$		12.8%
Economic Pathway$_2$	-0.013		92.5%	-0.015		70.4%	-0.011		90.4%	-0.013		87.2%

Source: Own calculations using data from the Mexican Health and Aging Study (MHAS), n=9,584.
Note: $_1$The indirect effect of the health pathway is assessed by health variables (chronic condition count, smoking and binge drinking) that reduce the education-ADL onset association. $_2$The indirect effect of the economic pathway is assessed by income and wealth in all groups as these reduced education-ADL onset associations in all groups. $_3$ Health pathway is assessed using chronic condition count. $_4$ Health pathway is assessed using chronic condition count and binge drinking. $_5$ Health pathway is assessed using binge drinking. $_6$ Health pathway is assessed using chronic condition count. Effects based on logistic regressions predicting ADL onset with years of education controlling for all covariates. p denotes p-value, * denotes $p \leq 0.05$, ** denotes $p \leq 0.01$, *** denotes $p \leq 0.001$. * Younger birth cohort = individuals aged 50-59 at the 2001 baseline. Older birth cohort = individuals aged 60+ at the 2001 baseline.