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Research Article

Gender, Personality, and Cognitive Resilience Against Early-Life Disadvantage

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Abstract

Objectives: Early-life disadvantage (ELD) relates to lower late-life cognition. However, personality factors, including having an internal locus of control (LOC) or a conscientious personality, relate to resilience and effective stress coping. We explore whether personality factors convey resilience against the negative effects of ELD on cognition, by gender, in Mexico.
Methods: Using the 2015 Mexican Health and Aging Study, we estimated expected cognition using multiple ELD markers to identify a subsample in the lowest quartile of expected cognition given ELD (n = 2,086). In this subsample, we estimated cross-sectional associations between personality and having above-median observed cognitive ability (n = 522) using logistic regression.
Results: Among those in the lowest quartile of expected cognition, a more internal LOC (β = 0.32 [men] and β = 0.44 [women]) and conscientious personality (β = 0.39 [men] and β = 0.17 [women]) were significantly associated with having above-median cognitive ability in models adjusted for demographic confounders. Larger benefits of conscientiousness were observed for men than women. Associations between personality and having above-median cognitive ability remained statistically significant after further adjustment for health, stress, and cognitive stimulation variables, regardless of gender.
Discussion: Personality factors may convey resilience among individuals who experienced ELD, potentially breaking the link between ELD and worse late-life cognition. Structural factors and gender roles may affect how much women benefit from personality factors.

Keywords: Aging, Cognitive resilience, Early life, Education, Life course

Background

Although the global population is aging, this is occurring rapidly in Mexico, where the population aged 60+ is projected to increase from 9.9 to 36.2 million from 2010 to 2050 (Consejo Nacional de Población, 2005). Over this period, the number of Mexicans living with dementia is projected to increase by 414% (Alzheimer's Disease International & Bupa, 2013). The pace of population aging coupled with increases in the number of individuals living with dementia has sparked research interest in factors related to poorer late-life cognitive outcomes. Findings in Mexico point to the importance of early-life environments for late-life cognitive ability. Early-life disadvantage (ELD) such as low childhood socioeconomic status (SES) and lack of education are related to lower levels of cognitive ability in late life (Al Hazzouri et al., 2011), mirroring findings in

high-income countries (Cermakova et al., 2018; Everson-Rose et al., 2003; Greenfield & Moorman, 2019; Lövdén et al., 2020; Ritchie & Tucker-Drob, 2018).

These findings are in line with cumulative (dis)advantage theory, which suggests that advantages and disadvantages experienced accumulate throughout the life course to affect health in later life (Dannefer, 2003). Although prior studies of ELD have suggested a damaging effect on cognitive ability, the association is not deterministic. There is substantial variation in health-related outcomes *within* strata of socioeconomic advantage/disadvantage where not all individuals experiencing life-course disadvantage ultimately have worse late-life outcomes (Ryff & Singer, 2009). Other factors may provide cumulative advantages throughout the life course, which may buffer ELDs. Work using the similar cumulative inequality theory contends that even in the face of ELDs, life-course trajectories can be shaped by resource mobilization, individual agency, and psychological resources (Ferraro et al., 2009). However, few studies seek to identify the life-course factors that support resilience (Ryff & Singer, 2009) against the negative effects of ELD on cognitive ability. We aim to identify factors allowing individuals to overcome the effects of ELD using a life-course perspective of cumulative (dis)advantage acknowledging how cognitive aging is influenced by one's characteristics throughout life.

Recent work has suggested that personality may be a source of "cognitive resilience" (Graham et al., 2021). Certain personality factors can be stable across longer periods of time, and to the extent to which late-life personality relates with personality throughout life, personality may affect health and health behaviors, and how individuals deal with stress and adversity throughout their lives, including stress associated with ELD. We consider two personality factors including conscientiousness and locus of control (LOC), which may potentially facilitate cognitive resilience and buffer the cumulative effects of ELDs on cognition later in life.

Conscientiousness refers to an individual's tendency to follow social norms for impulse control and ability to plan, be goal oriented, and delay gratification (Roberts et al., 2009). Conscientiousness is associated with better cognitive ability and slower cognitive decline (Curtis et al., 2015; Low et al., 2013; Luchetti et al., 2016). Conscientiousness also relates to better cognitive function even in the presence of neuropathologic burden (Graham et al., 2021), potentially due to more engagement in cognitively stimulating activities (Wilson et al., 2007). Conscientiousness may play a role in shaping one's health and health behaviors. Conscientiousness is related to better health including lower adiposity, favorable metabolic, cardiovascular, and inflammation biomarkers (Sutin et al., 2018), better health behaviors such as refraining from smoking and excessive alcohol consumption, better diet, exercise (Bogg & Roberts, 2004), and better management of chronic conditions (Hill & Roberts, 2011; Luchetti et al., 2016). Conscientiousness is also related to higher resilience and a better ability to cope with negative events and stress (Wilson et al., 2007) by using active and constructive responses to stressors (Flynn & Smith, 2007).

LOC is a personality trait indicating how strongly individuals feel they have control over their life situations (Rotter, 1966). Individuals with an internal LOC tend to believe that life circumstances are due to one's own choices and efforts whereas those with an external LOC believe life circumstances are due to influences outside of their control, including luck or chance (Rotter, 1966). Internal LOC is associated with better cognitive ability (Anderson et al., 2018; Wight et al., 2003), and changing from external to internal LOC was more beneficial for cognitive ability than changing to or remaining external (Anderson et al., 2018). An internal LOC has also been associated with better cognitive ability among men, but not women, with type 1 diabetes (Eng et al., 2020). Like conscientiousness, LOC shapes health and health behaviors and how one deal with stress and adversity. Internal LOC is associated with better physical and mental health and health behaviors (Kesavayuth et al., 2020) including better diet, less smoking, and more exercise (Cobb-Clark et al., 2014; Kesavayuth et al., 2020). LOC also influences how individuals cope with stress and approach problems. Specifically, internal LOC is linked to active problem-focused coping styles whereas external LOC may relate to resignation and avoidance coping (Reknes et al., 2019).

Existing studies suggest that both LOC and conscientiousness shape one's health status and how individuals cope with stress and manage health problems including chronic diseases (Cobb-Clark et al., 2014; Kesavayuth et al., 2020; Luchetti et al., 2016; Wilson et al., 2007). This is critical as chronic stress (Sandi, 2013), and diseases including hypertension and diabetes (Deckers et al., 2015; Papademetriou, 2005) are associated with lower levels of cognitive function. This may be due to LOC and conscientiousness both reducing the likelihood of developing health problems or experiencing stressors, or by LOC and conscientiousness buffering the negative effects of stressors and health conditions on the level of cognitive ability (Shanahan et al., 2014). Furthermore, personality characteristics may relate to actively seeking cognitively stimulating activities (Curtis et al., 2015).

Gender must also be considered given gender differences in LOC and conscientiousness. Women tend to have more external LOC, compared to men (Sherman et al., 1997). Associations between LOC and cognitive ability may also differ across gender (Eng et al., 2020). Gender differences in conscientiousness are less clear. Previous work has found that women score higher on certain aspects of conscientiousness, such as order or dutifulness (Costa et al., 2001; Feingold, 1994). However, these findings are not consistent and suggest that there are no gender differences at the level of the Big Five domains (Weisberg et al., 2011). Previous work examining specific traits that define the five

components of personality, including conscientiousness, documented no gender difference in order or dutifulness among U.S. adults, but there was among adults from other cultures (Costa et al., 2001). We may expect there to be gender differences in conscientiousness among older adults in Mexico. Differences exist in cognition as well, where Mexican men tend to have higher global cognition compared to women, potentially due to gender gaps in education (Díaz-Venegas et al., 2019).

Our objective is to assess whether personality factors, including LOC and conscientiousness, facilitate resilience against the effects of ELD on the level of cognition by gender among adults aged 50 and older in Mexico. We hypothesize that having a conscientious personality or an internal LOC will position individuals to avoid the negative effects of ELD. This may operate by reducing the prevalence of risk factors (poor health and stressors), buffering the effects of poor health and stress, and enhancing protective factors such as living a cognitively stimulating lifestyle. We hypothesize this effect will be greater for men than women because of the traditional gender norms among older adults in Mexico, where older women may have fewer opportunities to use personality resources to build cognitive resilience.

Method

Data

We used cross-sectional data from the 2015 Mexican Health and Aging Study (MHAS Mexican Health and Aging Study, 2015), a large, household-based, nationally representative cohort of older adults aged 50+. The MHAS cohort began in 2001 with a sample of approximately 15,000 including both rural and urban areas. At baseline, target households were houses with at least one resident aged 50+ as identified by the National Employment Survey (Encuesta Nacional de Empleo). Coresiding spouses were included in the MHAS, regardless of their age. Direct interviews were conducted with participants; however, proxy interviews, with an informant, were conducted if participants were unable to due to health or absence. Follow-up interviews have been conducted in 2003, 2012, 2015, and 2018. In the 2012 and 2018 waves, refresher cohorts of individuals born 1952–62 and 1963–68, respectively, were added to maintain representation of the Mexican population age 50+. The MHAS has a high response rate, ranging from 85% to 93% throughout waves. We focus on the 2015 MHAS because this is the only wave in which LOC and conscientiousness were assessed for the whole sample. We only included participants aged 50 and over who completed a direct interview, as personality questions were not asked of individuals requiring proxies. The MHAS is a sister study of the Health and Retirement Study in the United States and has been described in greater detail elsewhere (Wong et al., 2017).

Cognitive Ability

MHAS participants completed cognitive tasks covering multiple cognitive domains. Verbal Learning and Verbal Recall tests involved respondents being read an eight-word list and asked to recall as many words as he/she was able across three trials (Verbal Learning, range 0–24), and after a delay (Verbal Recall, range 0–8). Respondents completed a Visual Scanning task, where respondents were presented a visual stimulus and marked each occurrence of the stimulus in an array of stimuli (range 0–60). Respondents also named as many animals as possible in 1 minute to assess Verbal Fluency (range 0–60). Orientation involved respondents identifying the day, month, and year (range 0–3). Visuospatial Ability and Visual Memory were assessed by copying a geometric figure (Visuospatial Ability, range 0–6) and recalling it from memory (Visual Memory, range 0–6). MHAS cognitive tasks are described in greater detail elsewhere (Mejía-Arango et al., 2015; Mejia-Arango & Gutierrez, 2011). These seven cognitive tasks were used to construct a latent general cognitive ability factor.

Locus of Control

The MHAS assessed LOC using eight items adapted from Rotter (1966). Respondents reported whether they agree, somewhat agree, somewhat disagree, or disagree with statements: (1) there is no sense in planning for the future; (2) good things happen mostly due to luck; (3) one is responsible for one's own success; (4) one can do just about anything one puts one's mind to; (5) one's problems are due to bad luck; (6) one has little control over bad things; (7) one's misfortunes are results of own mistakes; and (8) one is responsible for own failures. For items reflecting internal LOC (numbers 3, 4, 7, and 8), respondents were given 3 points for each item with which they agree, 2 for each item with which they somewhat agree, 1 for each item with which they somewhat disagree, and 0 for each item with which they disagree. Items reflecting external LOC (numbers 1, 2, 5, and 6) were reverse coded. Scores across the eight items were summed and standardized to a mean of zero and variance of one with higher values reflecting a more internal LOC.

Conscientiousness

Conscientiousness was assessed using six items. Respondents were asked whether they are (1) organized; (2) responsible; (3) dedicated/hardworking; (4) careless; (5) thorough; and (6) disciplined. Response categories included "a lot," "some," "little," or "not at all." For items reflecting a conscientious personality (numbers 1, 2, 3, 5, and 6), respondents were given 3 points for each item they answered "a lot," 2 for each item they answered "some," 1 for each item they answered "little," and 0 for each item

they answered "not at all." Item number 4 (representing low conscientiousness) was reverse coded. Scores across the items were summed and standardized to a mean of zero and a variance of one with higher values representing a more conscientious personality.

Early-Life Disadvantage

Several markers of ELD are included in the MHAS and asked when respondents first entered the study. Own education was assessed as years of formal education. Maternal education and paternal education were each categorized as no education, incomplete elementary, elementary, and beyond elementary education. Parental occupation was assessed as whether the respondent's guardian worked in agriculture, construction/manufacturing/mining, gardening/maintenance, childcare/domestic work, restaurant/store/hotel, office/professional, other/or did not work before age 10. Respondents received a six-question battery to measure early-life SES including whether, before age 10, they (1) had an in-home toilet; (2) often went to bed hungry; (3) wore shoes regularly; (4) respondent/sibling dropped out of school to support family; (5) had anyone sleep in the kitchen; and (6) the family received financial assistance. Last, we included contemporaneous height, assessed via self-report as an additional marker of ELD following prior work (Case & Paxson, 2008; Selvamani & Arokiasamy, 2021). We used self-reported height to construct gender-specific height tertiles. Self-reported height in the sample has been validated in prior studies (Avila-Funes & Gutierrez-Robledo, 2004).

Stress, Health, and Cognitive Stimulation

LOC and conscientiousness relate with health and how individuals manage stressors and health problems. Health factors included self-reported diabetes, hypertension, and spending a day or more in bed due to sickness/injury in the past year. Health behaviors included smoking (ever versus never smoker) and exercise (whether the respondent exercised or did hard physical work 3+ times a week on average over the past 2 years).

We included several variables to capture stressors. Depressive symptoms were measured through a nine-item version of the Center for Epidemiologic Studies—Depression (CES-D) scale (Radloff, 1977). We included self-rated financial situation and health, both classified as excellent/very good/good, fair, or poor. Food insecurity was assessed by asking respondents whether they had enough money to purchase food throughout the past 2 years. Those answering "no" answered whether they did not eat or ate less because there was not enough food in the last 2 years. Reporting either not having money to purchase food or not eating/eating less was considered food insecurity. Pain was assessed as reporting pain that limits daily activities.

Living in poor-quality housing was an additional stressor. Poor- versus high-quality housing was based on seven household characteristics from prior work aimed at capturing poverty in Mexico (CONEVAL, 2010): ceiling material (cardboard vs concrete, partition, brick, palm, shingles, wood, asbestos, or metal laminate); floor (mud vs wood, mosaic, or concrete); walls (asbestos/metal laminate/cardboard laminate vs partition, brick, stone, concrete, wood, or adobe); sanitary facility (bucket filled with water, no need for water, or not having a sanitary facility vs having a water connection); electricity (inferred by owning a refrigerator, television, washing machine, internet, or computer), plumbing (un-piped water from a lake, river, stream, or other piped water outside the home vs piped water inside the home or lot); and crowding (>2.5 persons per room). The number of indicators of poor housing quality was calculated as a measure of poor housing quality.

We constructed a measure of respondents' engagement in cognitive stimulation by calculating the number of cognitively stimulating activities (attending a training course, reading books/magazines/newspapers, doing puzzles, and playing games such as cards, dominos, or chess) that respondents did over the past year.

Demographic Controls

Demographic control variables included age, years of education, marital status (married/partnered, widowed, or other), urban dwelling (community with 100,000+ residents), wealth decile, and whether respondents were currently working.

Analytic Procedure

Analyses were based on three quantities: (1) observed late-life cognitive ability, (2) expected cognitive ability given ELD; and (3) difference between observed and expected cognitive ability. The last quantity captures resilience as those with high cognitive ability despite ELD will have large differences between observed cognitive ability and expected cognitive ability based on ELD. Differences between observed and expected scores given risk factors have been frequently used to quantify resilience, including resilience against adverse childhood experiences (Cahill et al., 2022), as they capture a mismatch between risk factors and cognitive ability (Bocancea et al., 2021).

Observed cognitive ability

Observed cognitive ability was calculated as a factor score from a one-factor model of cognitive ability in a confirmatory factor analysis with the general cognitive ability factor mean fixed to zero and variance fixed to one estimated using full-information maximum likelihood including all MHAS respondents aged 50+ who completed at least one of the seven cognitive tasks described earlier (n = 13,208). Factor scores were age-normed by regressing scores on

age in a linear regression model and calculating residuals, which were used as a measure of age-normed observed cognitive ability, showing a respondent's cognitive ability relative to others of the same age.

Expected cognitive ability ($\hat{y}$)

Expected cognitive ability given ELD was calculated by regressing age-normed observed cognitive ability on ELD markers in a linear regression model. Using model-estimated intercepts, ELD parameter estimates, and observed ELD characteristics, we calculated respondents' model-implied expected cognitive ability ($\hat{y}$) given ELD. These models included 9,533 respondents with all markers of ELD observed.

Difference between observed and expected ability

Our analytic procedure is shown in Figure 1, which provides a scatter plot of observed cognitive ability and expected cognitive ability given ELD. For simplicity, a random selection of a quarter of respondents is shown. We identified respondents in the lowest quartile of expected cognitive ability given ELD, those to the left of the dashed vertical line in Figure 1 as our analytic sample. Among those in the lowest quartile of expected cognitive ability given ELD, we used logistic regression to predict who had above-median observed cognitive ability, or those who were above the solid horizontal line in Figure 1. We consider those having above-median cognitive ability despite being in the lowest quartile of expected cognitive ability to be cognitively resilient.

Our analytic sample included 2,086 (939 men and 1,147 women) respondents in the lowest quartile of expected cognitive ability with independent variables. We first estimated logistic regression models including demographic controls (age centered at 50, age squared, rural/urban dwelling, education, marital status, wealth decile, and current work status) and personality factors (LOC and conscientiousness) for men and women in Models 1 and 3, respectively. These models tested our hypotheses that conscientiousness and internal LOC would relate to cognitive resilience. Next, we added stress, health, and cognitive stimulation to determine whether resilience operated through these factors (Models 2 and 4 for men and women, respectively). Last, we tested whether personality buffered the effects of health and stressors by testing interactions between personality factors and stressors/health. Models were stratified by gender because we observed a significant negative conscientiousness by female interactions ($\beta = -0.22$, $p < .05$) indicating weaker effects of conscientiousness for women in our models including demographic controls. All analyses were conducted using Stata 17 MP.

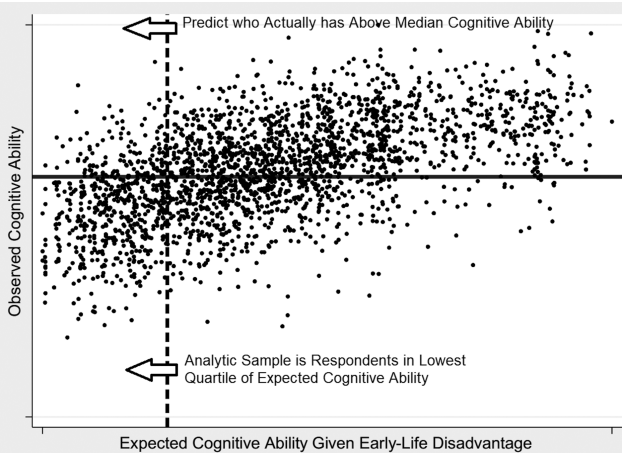

Figure 1. Diagram of analytic process. *Notes*: Random selection of 2,386 respondents is shown. "Observed Cognitive Ability" is a general cognitive ability factor score, which is age-normed. "Expected Cognitive Ability Given Early-Life Disadvantage" was estimated from a linear regression model regressing age-normed cognitive ability on early-life disadvantage markers. Observations to the left of the vertical dashed line represent those in the lowest quartile of expected cognitive ability. Observations above the horizontal solid line represent those with above-median observed cognitive ability.

Results

Characteristics of the Full Sample

We begin by presenting the basic demographic, cognitive, and early-life characteristics of the full sample (with observed ELD markers and cognitive ability) in Table 1. The overall sample had a mean age of 66.2 and was 56.3% female. Around half (46.9%) reported a mother with no education and 40.2% reported a father with no education. Slightly over half (51.3%) reported a parent working in agriculture. The sample had an average of 6.3 years of education.

Relationships Between Early-Life Disadvantage and Cognitive Ability

We now move to the results of the linear regression model in which age-normed observed cognitive ability was modeled using ELD markers. Parameter estimates and 95% confidence intervals (CIs) for ELD markers are shown in Figure 2. Among parental characteristics, having a mother or a father with more education was associated with higher cognitive ability. Compared to having a parent working in agriculture, having a parent working in construction/manufacturing/mining, gardening/maintenance, restaurant/store/hotel, or office/professional labor was associated with higher cognitive ability. Regarding a respondent's own characteristics, going to bed hungry ($p < .05$), not wearing shoes regularly ($p < .05$), having a family member sleep in the kitchen ($p < .001$), and having less education ($p < .001$) were related with lower cognitive ability. Compared to being in the lowest height tertile, being in the middle or highest height tertile was associated with better cognitive ability ($ps < .05$). Markers of ELD explained 28.7% of the variance in age-normed observed cognitive

Table 1. Demographic, Early-Life, and Cognitive Characteristics of Mexican Adults Age 50 and Over From the Mexican Health and Aging Study (n = 9,533)

	n	%
Basic demographics		
Age (mean, *SD*)	66.2	9.3
Female	5,365	56.3
Observed cognitive ability		
General cognitive ability (mean, *SD*)	0.1	0.7
Below median	4,312	45.2
Above median	5,221	54.8
Mother's education		
No education	4,470	46.9
Incomplete elementary	3,387	35.5
Elementary	1,146	12.0
Beyond elementary	530	5.6
Father's education		
No education	3,832	40.2
Incomplete elementary	3,656	38.4
Elementary	1,253	13.1
Beyond elementary	792	8.3
Parental occupation		
Agriculture	4,887	51.3
Construction/manufacturing/mining	1,500	15.7
Gardening/maintenance	919	9.6
Restaurant/store/hotel	715	7.5
Office/professional	369	3.9
Other/did not work/missing	1,143	12.0
SES measures (before age 10)		
No in-home toilet	6,304	66.1
Often went to bed hungry	2,677	28.1
Did not wear shoes regularly	1,898	19.9
Family member slept in kitchen	2,109	22.1
Self/sibling dropped out to support family	3,851	40.4
Family received financial assistance	961	10.1
Gender-specific height tertile		
Lowest tertile	2,298	24.1
Middle tertile	3,871	40.6
Highest tertile	3,364	35.3
Respondent educational attainment		
Years of education (mean, *SD*)	6.3	4.8

Notes: *SD* = standard deviation; SES = socioeconomic status.
Source: Authors' own calculation using data from the 2015 Mexican Health and Aging Study.

ability. Expected cognitive ability given early-life disadvantage correlated with observed cognitive ability at r = 0.54.

Descriptive Results

Supplementary Table 1 shows early-life characteristics of individuals by quartile of expected cognitive ability given ELD (calculated using results of the model shown in Figure 2). Not surprisingly, differences across quartiles of expected cognitive ability consistently reflected lower SES among those in lower quartiles of expected cognitive ability

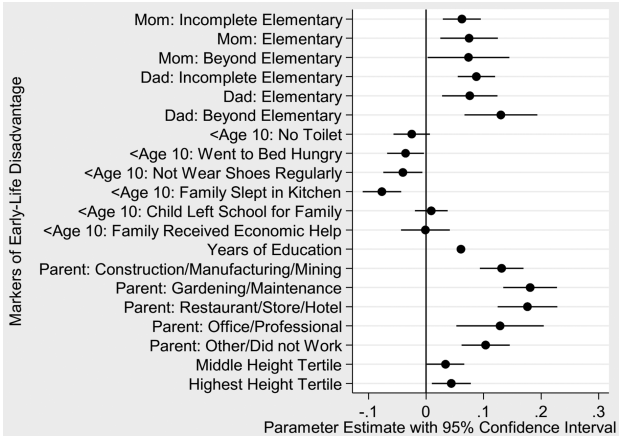

Figure 2. Parameter estimates and 95% confidence intervals from linear regression predicting age-normed observed cognitive ability among older Mexican adults using markers of early-life disadvantage (n = 9,533). *Notes*: Reference category for mother's and father's education is "No Education." Reference category for parental occupation is "Agricultural." Reference category for height tertile is "Lowest Tertile." Model R-squared is 0.2871. Model intercept is –0.48. *Source*: Authors' own calculation using data from the 2015 Mexican Health and Aging Study.

given ELD. Notably, respondents in the lowest quartile of expected cognitive ability had an average of around a year of education (1.1) whereas those in the highest quartile of expected ability had an average of 12.7 years. Despite being disadvantaged in the early-life markers, 23.8% of those in the lowest quartile of expected ability had observed cognitive ability above the median.

Table 2 focuses on our analytic sample, those in the lowest quartile of expected cognitive ability given ELD, and shows characteristics, stratified by gender and observed cognitive ability (below or above the median). Regardless of gender, respondents who had above-median observed cognitive ability had a more internal LOC and more conscientious personality. To evaluate the effect size of these differences, we calculated Cohen's d statistics comparing mean LOC and conscientiousness in groups with observed cognitive ability above versus below the median and found small to medium effect sizes (Cohen, 1988) regardless of gender. Cohen's d statistics for conscientiousness were 0.35 (95% CI: 0.21, 0.50) and 0.21 (95% CI: 0.07, 0.35) for men and women, respectively. Cohen's d statistics for LOC were 0.32 (95% CI: 0.18, 0.47) and 0.38 (95% CI: 0.24, 0.51) for men and women, respectively. Those with an above-median observed cognitive ability had better quality housing and engaged in more cognitively stimulating activities. Women with above-median cognitive ability were more likely to have smoked and less likely to experience food insecurity.

Regression Results

Table 3 provides results from logistic regressions predicting cognitive resilience (having above-median cognitive

Table 2. Personality, Demographic, Health, and Stress Characteristics by Gender and Observed Cognitive Ability Among Older Mexican Adults in the Lowest Quartile of Expected Cognitive Ability Given Early-Life Disadvantage (n = 2,086)

	Men					Women				
	Below-Median Observed Ability (n = 684)		Above-Median Observed Ability (n = 255)			Below-Median Observed Ability (n = 880)		Above-Median Observed Ability (n = 267)		
	Mean	*SD*	Mean	*SD*	*p*	Mean	*SD*	Mean	*SD*	*p*
Personality										
Internal locus of control	−0.5	0.9	−0.2	1.0	***	−0.4	0.9	0.0	1.0	***
Conscientiousness	−0.4	1.1	0.0	0.9	***	−0.2	1.1	0.0	1.0	**
Demographics										
Age	70.1	9.6	73.2	7.9	***	68.5	9.5	71.4	9.1	***
Urban (n, %)	221	32.3	100	39.2	*	375	42.6	140	52.4	**
Years of education	1.2	1.4	1.5	1.4	**	1.0	1.3	1.4	1.4	***
Married/partnered (n, %)	539	78.8	186	72.9		470	53.4	130	48.7	
Widowed (n, %)	91	13.3	44	17.3		277	31.5	99	37.1	
Div/sep/nev (n, %)	54	7.9	25	9.8		133	15.1	38	14.2	
Wealth decile	3.8	2.7	4.2	2.7		3.9	2.8	4.1	2.9	
Currently working (n, %)	376	55.0	128	50.2		164	18.6	48	18.0	
Health, stress, and cognitive stimulation										
Depressive symptoms	3.4	2.5	3.3	2.5		4.4	2.7	3.9	2.9	
Good or better self-rated health (n, %)	201	29.4	68	26.7		187	21.3	65	24.3	
Fair self-rated health (n, %)	373	54.5	132	51.8		494	56.1	144	53.9	
Poor self-rated health (n, %)	110	16.1	55	21.6		199	22.6	58	21.7	
Good or better self-rated financial (n, %)	100	14.6	30	11.8		140	15.9	29	10.9	
Fair self-rated financial (n, %)	492	71.9	190	74.5		618	70.2	198	74.2	
Poor self-rated financial (n, %)	92	13.5	35	13.7		122	13.9	40	15.0	
Diabetes (n, %)	164	24.0	52	20.4		305	34.7	79	29.6	
Hypertension (n, %)	362	52.9	147	57.6		626	71.1	189	70.8	
Exercise (n, %)	307	44.9	107	42.0		250	28.4	80	30.0	
Ever smoked (n, %)	428	62.6	175	68.6		138	15.7	70	26.2	***
Food insecurity (n, %)	265	38.7	95	37.3		374	42.5	93	34.8	*
Sick in bed a day or more (n, %)	143	20.9	43	16.9		277	31.5	70	26.2	
Pain (n, %)	120	17.5	44	17.3		252	28.6	69	25.8	
Poor housing quality	0.7	0.9	0.5	0.8	***	0.7	0.9	0.4	0.7	***
Cognitive stimulation	0.6	0.7	0.9	0.8	***	0.6	0.7	0.9	0.9	***

Notes: Column labeled "*p*" indicates whether differences in variables are significant between those above- and below-median observed cognitive ability. Expected cognitive ability given early-life disadvantage is estimated from a linear regression of age-normed observed cognitive ability on early-life markers of disadvantage (parental education, parental occupation, socioeconomic status measures before age 10, height, and respondent education). "Median observed cognitive ability" is calculated from the full MHAS sample, not the analytic sample included in this table (those in the lowest quartile of expected cognitive ability). MHAS = Mexican Health and Aging Study; *SD* = standard deviation.

*p < .05. **p < .01.***p < .001.

Source: Authors' own calculation using data from the 2015 Mexican Health and Aging Study.

ability) among those in the lowest quartile of expected cognitive ability given ELD. Focusing on men, Model 1 included LOC and conscientiousness, along with demographic variables. Both a more internal LOC (β = 0.32, p < .001) and conscientious personality (β = 0.39, p < .001) were associated with cognitive resilience. Model 2 added stressors, health factors, and cognitive stimulation to evaluate whether cognitive resilience was conveyed through the prevalence of stressors and poor health or engaging in cognitively stimulating activities. Even after adjustment for these variables, a more internal LOC (β = 0.32, p < .001) and conscientious personality (β = 0.38, p < .001) were associated with cognitive resilience among men, with coefficients changed only slightly by the added variables in Model 2.

Shifting attention to women, in Model 3, both a more internal LOC (β = 0.44, p < .001) and conscientious personality (β = 0.17, p < .05) related to cognitive resilience. When stressors, health factors, and cognitive stimulation were added in Model 4, a more internal LOC (β = 0.39, p < .001) and conscientiousness (β = 0.15, p < .05) remained significantly related with cognitive resilience.

Table 3. Logistic Regression Predicting Having Above-Median Observed Cognitive Ability Among Older Mexican Adults in the Lowest Quartile of Expected Cognitive Ability Given Early-Life Disadvantage (n = 2,086)

	Men (n = 939)				Women (n = 1,147)			
	Model 1		Model 2		Model 3		Model 4	
Personality	β	Seβ	β	Seβ	β	Seβ	β	Seβ
Internal locus of control	0.32***	(0.08)	0.32***	(0.09)	0.44***	(0.08)	0.39***	(0.08)
Conscientiousness	0.39***	(0.08)	0.38***	(0.09)	0.17*	(0.07)	0.15*	(0.08)
Demographics								
Age	0.20***	(0.04)	0.22***	(0.04)	0.09**	(0.03)	0.10**	(0.03)
Age squared	−0.00***	(0.00)	−0.00***	(0.00)	−0.00	(0.00)	−0.00	(0.00)
Urban	0.25	(0.17)	0.07	(0.18)	0.43**	(0.15)	0.24	(0.16)
Years of education	0.21***	(0.05)	0.19***	(0.06)	0.29***	(0.06)	0.24***	(0.06)
Widowed (ref: married/partnered)	0.20	(0.22)	0.28	(0.24)	0.01	(0.17)	0.01	(0.18)
Div/sep/nev (ref: married/partnered)	0.23	(0.28)	0.40	(0.29)	−0.22	(0.23)	−0.34	(0.24)
Wealth decile	0.02	(0.03)	0.02	(0.03)	0.02	(0.03)	0.02	(0.03)
Currently working	0.04	(0.17)	0.06	(0.18)	0.26	(0.20)	0.18	(0.21)
Health, stress, and cognitive stimulation								
Depressive symptoms			−0.02	(0.04)			−0.05	(0.03)
Fair self-rated health (ref: good or better)			0.02	(0.19)			−0.21	(0.20)
Poor self-rated health (ref: good or better)			0.58*	(0.26)			−0.21	(0.26)
Fair self-rated financial (ref: good or better)			0.40	(0.25)			0.71**	(0.25)
Poor self-rated financial (ref: good or better)			0.40	(0.34)			1.12***	(0.32)
Hypertension			−0.05	(0.17)			−0.16	(0.18)
Diabetes			−0.43*	(0.20)			−0.22	(0.17)
Exercise			−0.02	(0.18)			0.05	(0.17)
Ever smoker			0.33	(0.17)			0.66***	(0.19)
Food insecurity			0.17	(0.18)			−0.22	(0.17)
Sick in bed a day or more			−0.27	(0.21)			−0.18	(0.18)
Pain			−0.06	(0.23)			0.09	(0.19)
Poor housing quality			−0.29**	(0.11)			−0.24*	(0.11)
Cognitive stimulation			0.37***	(0.10)			0.52***	(0.10)
Model fit								
X^2 (df)	104.4(10)***		144.1(24)***		100.0(10)***		169.31(24)***	
Pseudo r^2	0.095		0.131		0.080		0.136	

Notes: Age is centered at age 50. Expected cognitive ability given early-life disadvantage was estimated from a linear regression of age-normed observed cognitive ability on early-life markers of disadvantage (parental education, parental occupation, socioeconomic status measures before age 10, height, and respondent education).

*p < .05. **p < .01. ***p < .001.

Source: Authors' own calculation using data from the 2015 Mexican Health and Aging Study.

In further analyses (results not shown), we used Karlson, Holm, and Breen (KHB) mediation tests to decompose the total effects of independent variables (LOC and conscientiousness) on dependent variables (having above-median cognitive ability), into direct (unexplained by mediators: stressors, health factors, and cognitive stimulation) and indirect (explained by mediators) components. This allows us to test whether mediation effects are statistically significant while controlling for demographic covariates. The KHB method has been described in greater detail elsewhere (Kohler et al., 2011). The only mediation effect that reached statistical significance was the mediation effect of LOC on cognitive resilience through proposed mediators for women. Quantitatively, 3.9% and 13.5% of the effect of LOC on cognitive resilience were mediated through hypothesized mediators for men and women, respectively. Regarding conscientiousness, 8.0% and 20.0% of the effect of conscientiousness on cognitive resilience were mediated through proposed mediators for men and women, respectively. This suggests that most of the association between personality and cognitive resilience was not explained by proposed mediators.

Next, we tested interactions between stress, health, cognitive stimulation, and education variables and personality. These were estimated in logistic regression models where having above-median cognitive ability was the outcome estimated separately by gender and personality characteristics. Results are shown in Supplementary Table 2. Interactions between stress and health variables and personality tested whether personality buffered effects of

stressors and poor health whereas interactions between education and cognitive stimulation variables and personality evaluated whether personality affected the extent to which respondents may turn education and cognitive stimulating activities into cognitive resilience. We did not find any significant interactions between stress, health, cognitive stimulation, and education variables and personality.

Sensitivity Analyses

Although we hypothesized that internal LOC promotes cognitive resilience, there is potential reverse causality as individuals experiencing cognitive decline may feel less control over environments (Halse et al., 2021). Thus, we re-estimated logistic regressions predicting having above-median cognitive ability among those in the lowest quartile of expected cognitive ability given ELD using *lagged* LOC from the 2001 MHAS and demographic controls. We could not evaluate lagged conscientiousness as it was not assessed before 2015. This sensitivity analysis was based on a smaller sample as only respondents in the study since 2001 could be included (648 men and 879 women). Results are shown in Supplementary Table 3. Lagged internal LOC related with cognitive resilience in models including demographic factors for men ($\beta = 0.25$, $p < .01$) and women ($\beta = 0.18$, $p < .05$) supporting our hypothesis that LOC promotes cognition and cognitive resilience.

Discussion

Our results suggest that individuals with a more internal LOC or conscientious personality were more likely to break the link between ELD and diminished cognitive ability. This is consistent with prior studies finding internal LOC (Anderson et al., 2018; Eng et al., 2020; Wight et al., 2003) and conscientiousness (Curtis et al., 2015; Low et al., 2013; Luchetti et al., 2016; Wilson et al., 2007) to be related with better cognitive outcomes. Our results also agree with studies finding conscientiousness to be related to cognitive resilience (Graham et al., 2021). However, our findings extend prior research by studying resilience specific to ELD. Our findings also inform resilience despite ELD in Mexico, which has a rapidly aging population in which many older adults faced socioeconomic disadvantages, such as limited access to education, in childhood (Wong & Palloni, 2009). Our results suggest a small to medium effect of personality on cognitive resilience.

Although internal LOC and conscientiousness conveyed cognitive resilience against ELD regardless of gender, the effects of conscientiousness were smaller among women suggesting that men may reap larger returns from conscientiousness than women. This may be attributed to structural factors. For instance, especially among older cohorts, there is a more traditional division of gender roles in Mexico (Seedat et al., 2009), with women being less likely to participate in the formal labor sector than men (Bureau of Labor Statistics, 2013). Among older couple dyads, wives may also have less influence over shared decisions than husbands (Saenz & Rote, 2019). As a result, women may face social barriers in translating a conscientious personality into building cognitive reserve through economic opportunity.

We hypothesized that personality may convey cognitive resilience by reducing the prevalence of risk factors (poor health and stressors) and enhancing protective factors (living a cognitively stimulating lifestyle). However, both an internal LOC and conscientious personality were associated with cognitive resilience even when controlling for health, stress, and cognitive stimulation among men and women. Mediation analyses also suggested no significant mediation except in the case of proposed mediators only partially mediating the association between LOC and cognitive resilience for women with the majority (86.5%) of the association being unexplained by mediators. We also hypothesized that LOC and conscientiousness may buffer the effects of health and stress on cognitive function through effective management of health problems and stress coping. Our analyses found little support for this hypothesis as interactions between personality factors and health/stress variables were nonsignificant.

Given that neither of these hypotheses were supported, what may ultimately explain the cognitive resilience associated with an internal LOC or conscientious personality? First, stress, health, and cognitive stimulation processes may be involved but relevant aspects might not be captured using our measures. Although we included several stressors, other researchers have hypothesized that in the context of LOC, feeling little control over one's situation may be a stressor itself (Wight et al., 2003). Second, our measure of cognitive stimulation is crude and does not capture the myriad of ways in which individuals with an internal LOC or conscientious personality may build cognitive reserve throughout life such as engaging in cognitively complex work activities (Andel et al., 2015).

There are limitations to our study. First, measures of personality were based only on late life. Although conscientiousness and LOC can be relatively stable over time, they have the potential to change across the life course (Anderson et al., 2018; Bazana & Stelmack, 2004). Future research should examine personality across the life course, as early or midlife personality may be most relevant to the development of health behaviors, chronic conditions, and development of cognitive reserve. Second, although we found associations between internal LOC reported 14 years before our measures of cognition and cognitive resilience, reverse causality may potentially be influencing our findings. Individuals experiencing cognitive decline or dementia may start to feel less control over their lives as they begin to rely on others for their daily activities (Halse et al., 2021). We were unable to evaluate lagged measures of conscientiousness to evaluate reverse causality and higher cognitive ability may support the maintenance of conscientiousness

(Curtis et al., 2015). Third, future work should evaluate longitudinal cognitive change and whether it is predicted by personality factors as future waves of MHAS data become available. Last, the development of personality is a complex process involving both genetic and early-life environmental influences (Dahmann & Anger, 2014; Weinschenk et al., 2022; Willems et al., 2019). Future studies should use more exhaustive measures of early-life environments, including parental personality, to gain more insights into the effects of early-life environments on both personality and cognition. Our study has strengths including the large nationally representative MHAS sample, assessment of cognitive ability across cognitive domains, and detailed information on ELD.

This research has implications for interventions. Personality may serve to identify individuals at risk for poor cognition later in life. Our results suggest that cognitive training to shift individuals to a more internal LOC may be effective and beneficial for cognition (Wolinsky et al., 2010), particularly among those who experienced ELD. This may allow these individuals to be more resilient to cognitive decline, despite experienced disadvantages. To the extent that LOC and conscientiousness may be plastic, these personality characteristics may be important points of intervention among adults from young adulthood to late life when disadvantage in childhood can no longer be intervened. These potential interventions may be important in Mexico and other low- and middle-income countries, which have rapidly aging populations and growing numbers of older adults with cognitive decline and dementia (Prince et al., 2015).

Supplementary Material

Supplementary data are available at *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences* online.

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Conflict of Interest

None declared.

Data Availability

Data files and documentation are public use and available at www.MHASweb.org.

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