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ORIGINAL ARTICLE

Advantages and disadvantages across the life course and health status in old age among women in Chile

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Abstract

Objectives Based on a life course perspective, we assessed the association between three types of social advantages and disadvantages accumulated across different life stages, with the number of self-reported chronic conditions among women aged 60 + in Chile, a Latin-American country with almost no reports on this matter.

Methods We used a population-representative longitudinal survey (Chile's Social Protection Survey) with information about childhood conditions, economic mobility across life, educational attainment, late adulthood labor-force trajectories, and later-life health, of 2627 women aged 60+. We then used sequence and Poisson regression analyses to assess the effect of life course (dis)advantages over the number of chronic conditions in old age.

Results Growing up in a poor household and experiencing downward economic mobility (especially among those with a non-poor childhood) increases the predicted number of chronic conditions in old age. By contrast, having a continuous and formal labor-force trajectory in late adulthood and higher educational attainment is associated with fewer chronic conditions later in life.

Conclusions Policy measures that seek to foster health prevention and health care among older women should consider how multiple exposures to social advantages/disadvantages during earlier stages of the life course could affect health in late life.

Keywords Life course · Old age · Chronic conditions · Women · Advantages and disadvantages · Longitudinal methods · Chile

Introduction

Health status expressed in old age derives from the accumulation of individuals' exposure to social advantages/disadvantages throughout different life stages (e.g., childhood, youth, adulthood), and across multiple domains such as work, family, education, or social networks (Chen et al. 2018; Dannefer 2003). Specifically, social advantages/disadvantages experienced by people across their lives, such as material conditions (e.g., nutrition, accommodation), psychosocial conditions (e.g., stress, discrimination), health behaviors risks (e.g., tobacco use, alimentary habits, drinking habits), or access to health care and health facilities, could affect subsequent health outcomes (Solar and Irwin 2010). This may be particularly relevant for women who are usually in a more vulnerable position due to

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personal and social factors (Levy and Widmer 2013). Recent research has indeed shown that socially disadvantaged women are at higher risk of facing different types of solid cancers (e.g., kidney, bladder, stomach, cervical, and liver), lymphoid/hematopoietic neoplasms (Hoebel et al. 2018), hypertension (Lucumi et al. 2017), depressive symptoms (Anand et al. 2018), disability (Landös et al. 2018), and heart disease (Díaz-Toro et al. 2018), than men in similar social conditions. Hence, identifying how specific social advantages/disadvantages influence health statuses at older age in women is relevant in order to better understand this phenomenon and to identify possible areas for public policy interventions.

Three different theoretical models have been used to explain the effects of social advantages/disadvantages on subsequent health statuses: the critical periods model, the social mobility model, and the risk accumulation model (Corna 2013). The critical periods model assumes that exposure to certain socioeconomic circumstances and life experiences in specific life course stages, for instance at birth and during early childhood, might be particularly harmful or favorable for individuals' health in later life (Kuh et al. 2003; Demakakos et al. 2018; van der Linden et al. 2018).

The social mobility model suggests that the effect of positive or negative early life socioeconomic conditions on older people's health can be counterbalanced by improved or worsened economic conditions in early-, mid-, and late adulthood (Ferraro et al. 2009). The main assumption of this second model is that socioeconomic status during early childhood does not necessarily determine the likelihood of confronting health vulnerabilities later on, but these conditions might be moderated by mid-life economic circumstances (Bartley and Plewis 2007; Brennan and Spencer 2014).

Unlike the critical periods and the social mobility models, the risk accumulation model does not emphasize the time windows during which individuals are exposed to adverse or positive experiences. Instead, it suggests that continued exposure to multiple life circumstances, accumulated as advantages and disadvantages over time in domains such as education and the labor market, determines whether an individual experiences or not subsequent health issues (Dannefer 2003; Singh et al. 2017; Cunningham et al. 2018).

Although several studies have described the effects of each of these theoretical models in health status in older women, most of them have described these associations in developed countries from Europe, Asia, or North America using multiple data sources (Cheval et al. 2018; Angelini et al. 2018; Surachman et al. 2018), with few reports in Latin-American countries. For example, a group of researches during the early 2000s performed a specific survey in older adults in seven cities from this region and they found associations between social determinants and health statuses among elderlies (Alvarado et al. 2008; Guerra et al. 2008; Monteverde et al. 2009). However, the data used were obtained at a single point in time and did not represent the population at the country level.

Also, most studies have described these associations using only one of the described theoretical models (Reiss 2013; Frenz et al. 2017). Indeed, to the best of our knowledge, there are only three studies that have tested these models simultaneously on health outcomes (Pudrovska and Anikputa 2014; Shuey and Willson 2014; Willson and Shuey 2016). Therefore, it is almost not known whether each of these theoretical models that describe social advantages/disadvantages—the critical periods, the social mobility, and the risk accumulation models—independently affects the overall health of old women, or not. Describing the role of each of these models may be relevant to recognize the relevance of multiple life course exposures in the overall health among elderly women.

The main goal of this study is to explore whether there is an association between social (dis)advantages during the life course with health outcomes among females aged 60 + in Chile. Specifically, we would like to explore whether each of the three proposed theoretical models is independently associated with subsequent health outcomes in this particular context.

Briefly, Chile is a relatively high-income Latin-American country (average per capita income equal to US$21,290), that has achieved universal health coverage (99.9%) in 2013, with a Gini coefficient of 0.55 and one of the highest life expectancies at birth among women in the Latin-American region, which has increased from 60 years old in 1960 to 82 years old in 2017. Chile has an epidemiological profile in which estimates suggest that non-communicable diseases account for 85% of all deaths among adults (WHO 2017). In this national context, exploring life course determinants of health among older adult women could provide new insights about the specific factors that influence health status in a population that has aged, and for whom social policies throughout life did not necessarily envisioned their current life expectancy and epidemiological profile.

In this study, we provide five non-competing hypotheses. First, based on the critical periods model, we expect that women who during childhood had parents occupied in manual positions, and those who characterize their childhood economic background as *poor*, will be more likely to confront chronic conditions in old age (*hypothesis 1*). Second, relying on the social mobility model, we expect that women who experienced upward economic mobility across life will be less likely to confront chronic conditions

in old age (*hypothesis 2.1*). However, this effect should be stronger for those with non-poor childhood economic background (*hypothesis 2.2*). Third, based on the risk accumulation model, we expect that women who reached college educational level, as well as those with continuous and formal labor-force trajectories in adulthood will be less likely to confront chronic conditions in old age (*hypothesis 3.1*). Yet, this latter association should be stronger for women with non-poor childhood economic background (*hypothesis 3.2*). Unlike previous research that has conceptualized mid-life job determinants as the exposure to certain work events and conditions at one time point, we look at long-term labor-force trajectories that capture multiple transitions throughout a significant period of a person's life.

Methods

Data and sample

To test these hypotheses, we used data from Chile's Social Protection Survey (*Encuesta de Protección Social*—EPS, for its acronym in Spanish). The EPS is a population-representative panel survey that collects information about socioeconomic status, educational attainment, family composition, employment status, and health conditions across life stages. This study is representative of all Chileans aged 18 or more and was conducted in 2002, 2004, 2006, 2009, and 2015 (see Supplementary Material [SM] page 1 for an in-depth explanation of the waves, response rates, refusal rates, and weighted factors of this survey). Each wave also includes a module on retrospective work histories, in which respondents must remember and organize their employment histories from 1980 until 2015, including periods of employment, unemployment, and inactivity (see SM page 3 for a further explanation). Out of the EPS's total sample, we used information for 2627 women who were aged about 60 or more, and who had valid information for the aspects being measured in our study—socioeconomic status, educational attainment, work histories during in adult life, and health status in older age. To assess potential sample selection bias or the loss of population representativeness caused by attrition and differential non-responses across survey rounds we also ran the main statistical models of this research weighted by an expansion factor (see Supplementary Table 1 in SM page 2 to observe weighted results). As reported, weighted and unweighted results remain highly stable.

The main outcome variable was defined as the total number of chronic conditions that patients reported to have experienced in the past. Respondents were asked whether a doctor had ever diagnosed them with: hypertension or high blood pressure, diabetes, cancer, asthma or pulmonary emphysema, heart problems, arthritis or arthrosis, renal disease, stroke, and psychiatric disease. We coded their responses as 1 if they had been diagnosed, and 0 if they had not. We created a summative indicator counting the number of chronic conditions people reported being diagnosed with. We also included obesity as a chronic condition considering as obese people with a body mass index (BMI) of 30 or higher. The final indicator could theoretically range from 0 (no chronic conditions ever diagnosed nor obese) to 10 (all chronic conditions diagnosed and obese).

Independent variables

To test *hypothesis 1*, people's socioeconomic conditions during their childhood was measured as their parents' occupation and childhood socioeconomic status (SES). Self-reported parents' occupations (coded using ISCO-88 codes) were collapsed into 'non-manual,' 'manual,' or 'farm,' for both parents. Also, the category 'military' was added to fathers, which did not appear among women due to their ineligibility to participate in Chilean armed forces. We also included the category 'not in employment,' which represents a significant share of mothers. Childhood SES was measured using the question: 'How would you define the economic situation in the household you grew up in?' The four possible response categories were recoded into 'poor' ('indigent' and 'poor') and 'non-poor' ('good' and 'very good').

To measure *hypotheses 2.1* and *2.2*, we used a single item that asked about people's perception of their current economic situation compared to the one in the household they grew up in. After being asked their childhood economic situation, they were asked: "In comparison to the previously defined situation, you would define your current situation as: 'much better', 'better', 'same', 'worse', or 'much worse.'" These were coded as upwardly mobile ('much better' or 'better'), downwardly mobile ('worse' or 'much worse'), and non-mobile ('same').

To explore *hypotheses 3.1* and *3.2*, we used two variables. First, the highest educational level achieved: 'primary education or less,' 'secondary education,' and 'college education.' Second, from the retrospective work histories module, we used different types of female labor-force trajectories. We focused in late adulthood labor-force trajectories (between ages 40 and 60) as women in Chile are more likely to be included in the labor market than in early adulthood, given the lower constraints from childrearing (Madero-Cabib et al. 2019a).

Concretely, types of labor-force trajectories between ages 40 and 60 were measured using sequence and cluster analysis (see SM page 4 for an in-depth explanation of how both statistical methods were used). First, we analyzed if

women were in paid work or not, and then, if they were, we analyzed if they were employees or self-employed, if they worked part- or full-time (30 h per week or less, or more than 30 weekly hours, respectively), and whether they contributed or not to their pension funds, an indicator of job formality in Chile. Based on these analyses, we identified nine types of labor-force trajectories, which were collapsed into six groups for analytical purposes (see SM page 4 for a further explanation of the original and collapsed solutions). The six labor-force trajectory types were labeled as: (1) 'out of the labor force' (38.6%), indicating women who remained continuously inactive or unemployed; (2) 'long-term attachment' (25%), about women employed with long-term, stable, and full-time jobs, who made uninterrupted pension contributions; (3) 'moving out early' (18.2%), women with the same work status as 'long-term attachment,' but who exited the labor market during their 50 s; (4) 'non-contributing' (10.1%), which gathers three small-size paths indicating full- or part-time employees or self-employed workers who did not contribute to a pension fund; (5) 'contributing' (5.3%), which clusters two small-size paths indicating part-time employees and full-time self-employed workers contributing to pension funds; and (6) 'residual type' (2.7%), in which no employment pattern could clearly be identified (see Fig. 1).

Covariates

We included age and current marital status ('partnered,' 'not partnered') as sociodemographic covariates. We also considered behavioral covariates for alcohol consumption (whether the person currently consumes alcohol or not), and an indicator of whether the person practiced any kind of physical activity or not. We also considered whether people had public or private insurance, which has been documented as a source of strong inequality in the Chilean health care system (Sapelli 2004).

Analysis

Given that our outcome of interest is a count variable (number of chronic conditions reported by respondents), to estimate the effect of 'critical periods,' 'social mobility,' and 'accumulated risks' variables over the predicted number of chronic conditions, we used Poisson regression models. We specifically estimated incidence rate ratios for each independent variable, that is, the multiplicative factor by which the expected count of chronic conditions changes when there is a one-unit change in an independent variable, holding all other variables constant.

We estimated separate statistical models for each one of our hypotheses, all of them adjusted by all of our covariates. Model 1 includes parents' occupation and childhood SES; model 2.1 tests the effect of social mobility and model 2.2 the effect of social mobility for different levels of childhood SES; model 3.1 considers the effect of the educational level achieved and the six labor-force trajectories types, and model 3.2 the variation of the effect of these six types across childhood SES levels; finally, model 4 considers all independent variables together. All statistical analyses in this study were performed in R (R Core Team 2018).

Results

Demographic characteristics of our sample are described in Table 1. Women were 65 years old in average and had a mean (standard deviation) of 2.22(1.6) chronic conditions, being the most common diagnoses hypertension or high blood pressure and arthritis or arthrosis. The majority of women had fathers who followed careers in manual or farm-related occupations, while most of their mothers were not employed. Most women reported growing up in non-poor households, and a significant share experienced upward mobility throughout their lives. Regarding our measure for labor-force trajectories types, most women followed either the 'out of the labor force' or the 'long-term attachment' trajectories, and another significant proportion of women was classified in the 'moving out early' trajectory type. More than half of the women reported an educational attainment of primary school or less. Most women reported not consuming alcohol or doing physical activity. Most women in our sample had public health insurance and were not partnered (which may indicate either to be widowed, divorced, or single).

Table 2 shows the average number of chronic conditions across all variables used in our statistical models. *p* values are shown for the effect of the variables over the average number of chronic conditions. Those women whose fathers worked in non-manual jobs had a lower average number of chronic conditions when compared to those with manual jobs, while mothers' occupation did not influence the number of women's average number of chronic conditions. Those who reported experimenting a non-poor childhood also had a statistically significant lower number of chronic conditions compared with those who report a poor childhood. With regard to social mobility, there are slightly significant differences between those who experienced upward, downward, or no mobility. Results also show that the '*long-term attachment*' trajectory shows the lowest number of chronic conditions when compared to all other labor-force trajectories, while those that followed an '*out of the labor force*' trajectory show the highest number of chronic conditions. Finally, there is an association between educational attainment and number and chronic conditions:

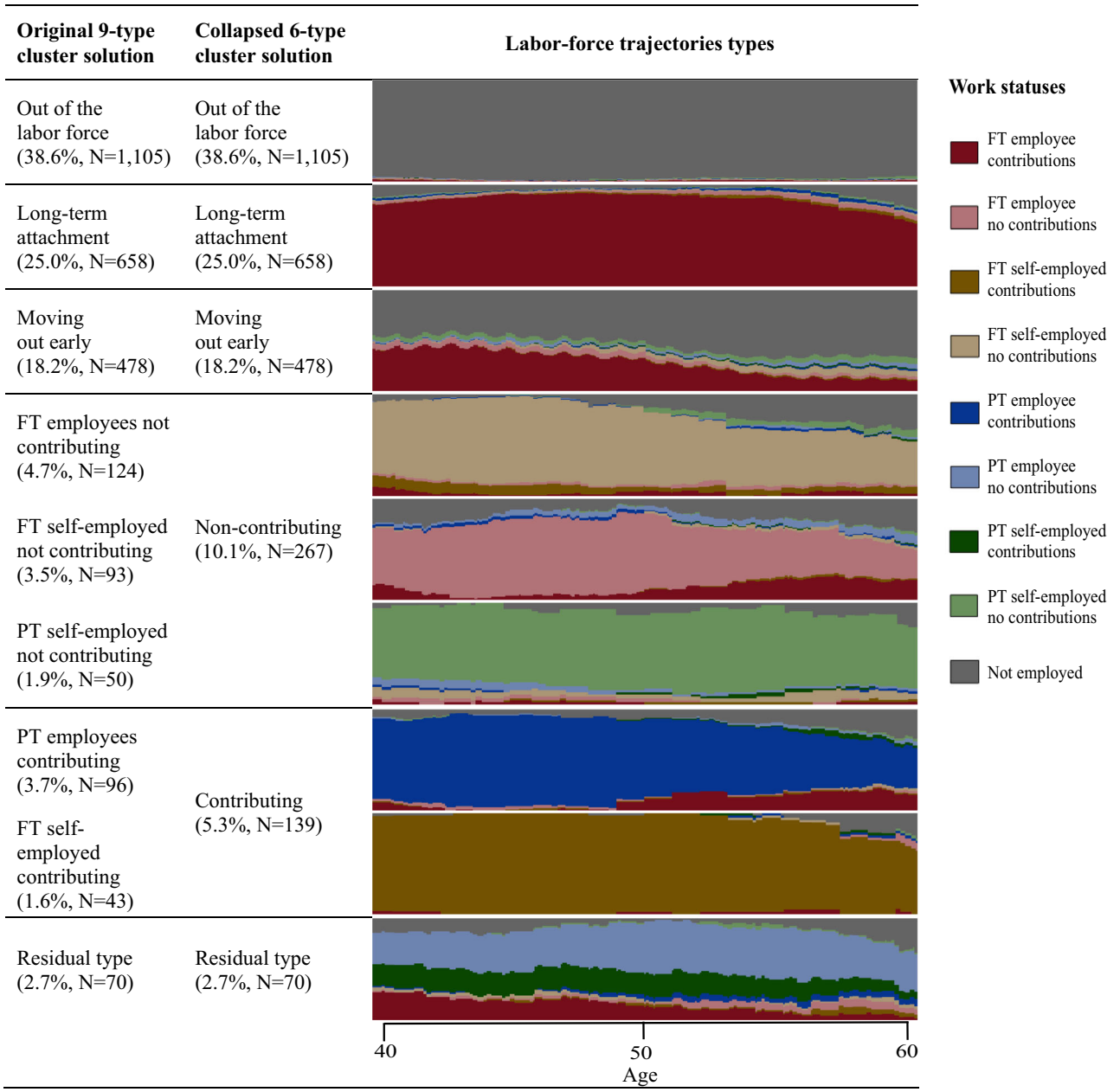

Fig. 1 Labor-force trajectories types of women between ages 40 and 60 in Chile. *Note*: 'FT' = Full-time; 'PT' = Part-time

Higher educational level is associated with lower number of reported chronic conditions.

In order to adjust for these variables and for other behavioral factors, we developed five different regression models (each one testing a different hypothesis) shown in Table 3 (see Supplementary Table 2 in SM page 7 to observe also control covariates' effects). Model 1 tests *hypothesis 1* on the association between parents' occupation and self-reported childhood SES, with the total number of chronic diseases. Parents' occupation does not predict the number of chronic diseases, whereas self-reported childhood SES shows a positive and significant effect over the number of chronic diseases: being poor in early stages of life increases the expected number of conditions during old age in 12.7% relative to reporting having a non-poor childhood (IRR = 1.127, $p < 0.01$).

Model 2.1 test *hypothesis 2.1* on the association between having experienced economic mobility and the number of chronic conditions. Relative to having experienced upward mobility, those who experienced downward mobility show a 9.4% higher number of expected chronic diseases, but this is slightly significant (IRR = 1.094, $p < 0.1$). Nevertheless, as established in *hypothesis 2.2*, since socioeconomic mobility is relative to one person's original

Table 1 Descriptive statistics of older women in Chile

Variable	*N* (%)	*N* missing (%)	Variable	*N* (%)	*N* missing (%)
Age [mean (SD)]	64.66 (6.09)	0 (0)	*Social mobility*		
Chronic conditions			Upward mobility	1615 (61.48)	3 (0.11)
Hypertension or high blood pressure	1279 (63.44)	0 (0)	Downward mobility	427 (16.25)	
Diabetes	554 (27.48)		No mobility	582 (22.15)	
Cancer	152 (7.54)		*Labor-force trajectory types*		
Asthma or pulmonary emphysema	290 (14.41)		Long-term attachment	658 (25.05)	0 (0)
Heart problems	436 (21.76)		Moving out early	478 (18.20)	
Arthritis or arthrosis	905 (44.96)		Contributing	139 (5.29)	
Renal disease	213 (10.59)		Not contributing	267 (10.16)	
Stroke	43 (2.14)		Out of the labor force	1015 (38.64)	
Psychiatric disease	36 (1.79)		Residual	70 (2.66)	
Obesity	572 (28.33)		*Educational attainment*		
Number of chronic conditions [mean (SD)]	2.22 (1.595)	0 (0)	Primary or less	1338 (50.93)	6 (0.23)
Father's occupation			Secondary	1015 (38.64)	
Manual	982 (37.38)	408 (15.53)	College or more	268 (10.20)	
Military	30 (1.14)		*Alcohol consumption*		
Non-manual	507 (19.30)		No	2127 (80.97)	48 (1.83)
Farm	583 (22.19)		Yes	452 (17.21)	
Not in employment	117 (4.45)		*Physical activity*		
Mother's occupation			Yes	569 (21.66)	59 (2.25)
Manual	328 (12.49)	118 (4.49)	No	1999 (76.09)	
Non-manual	527 (20.06)		*Health insurance*		
Farm	59 (2.25)		Public	2350 (89.46)	122 (4.64)
Not in employment	1595 (60.72)		Private	155 (5.90)	
Childhood socioeconomic status			*Marital status*		
Non-poor	1395 (53.10)	3 (0.11)	Partnered	1308 (49.79)	4 (0.15)
Poor	1229 (46.78)		Not partnered (widowed, divorced or single)	1315 (50.06)	

N = 2627 (including all missing values). Information on health and socioeconomic status taken from last answered wave

socioeconomic position, we also estimated the effect of mobility conditioned by a person's childhood SES (model 2.2). To facilitate interpretation of these results, in Fig. 2, we show the average marginal effects of economic mobility over the predicted number of chronic conditions, by childhood SES. As seen, among those who grew up in a non-poor household, downward mobility increases the number of chronic conditions in 19.9% (IRR = 1.199, $p < 0.01$) relative to those who experienced upward or no mobility. In contrast, among those who grew up in a poor household, economic mobility seems to make no difference in the predicted number of chronic conditions. If anything, among the 'poor' group, no mobility has a slightly significant positive effect.

Model 3.1 tests *hypothesis 3.1* about the effect of six labor-force trajectories types and the respondent's current educational level. Relative to the 'long-term attachment' trajectory, those who follow a 'out of the labor force' trajectory have a 21.4% higher expected number of chronic conditions (IRR = 1.214, $p < 0.01$), while those classified in the 'non-contributing' (IRR = 1.222, $p < 0.01$), and the 'moving out early' (IRR = 1.115, $p < 0.01$) trajectories are also significantly more likely to confront more chronic diseases in old age. With regard to education, those who finished secondary school have an expected number of conditions 13.3% (IRR = 0.867, $p < 0.01$) lower than those who have only primary or less education. Having college education does not show a significant result. We also tested, based on *hypothesis 3.2*, whether the effect of the six labor-force trajectories types varied depending on people's childhood socioeconomic background (model 3.2.). To better understand the effects being estimated in

Table 2 Bivariate analysis—mean number of chronic conditions per variable among older women in Chile

Variable	Mean (SD)	$Pr > F$	Variable	Mean (SD)	$Pr > F$
Father's occupation		0.004	*Educational attainment*		< 0.001
Manual	2.26 (1.618)		Primary or less	2.51 (1.602)	
Military	1.54 (1.201)		Secondary	2.00 (1.560)	
Non-manual	2.03 (1.611)		College or more	1.76 (1.445)	
Farm	2.33 (1.552)		*Alcohol consumption*		0.005
Not in employment	2.29 (1.526)		No	2.27 (1.624)	
Mother's occupation		0.368	Yes	2.01 (1.436)	
Manual	2.26 (1.618)		*Physical activity*		0.006
Non-manual	2.03 (1.611)		No	2.27 (1.604)	
Farm	2.33 (1.552)		Yes	2.04 (1.546)	
Not in employment	2.29 (1.526)		*Health insurance*		0.000
Childhood socioeconomic status		< 0.001	Private	1.38 (1.222)	
Non-poor	2.04 (1.527)		Public	2.28 (1.601)	
Poor	2.45 (1.649)		*Marital status*		0.179
Social mobility		0.051	No partnered	2.17 (1.622)	
Upward mobility	2.21 (1.579)		Partnered	2.27 (1.564)	
No mobility	2.39 (1.711)				
Downward mobility	2.11 (1.540)				
Labor-force trajectory types		< 0.001			
Long-term attachment	1.84 (1.466)				
Moving out early	2.18 (1.589)				
Contributing	2.25 (1.750)				
Not contributing	2.39 (1.742)				
Out of the labor force	2.47 (1.574)				
Residual	2.29 (1.620)				

$N = 2019$. The column $Pr > F$ shows the p value for the effect of the classification variables on the number of chronic conditions based on the F value obtained from an analysis of variance and covariance (ANOVA). Information on health and socioeconomic status taken from last answered wave

the models, we show in Fig. 3 the average marginal effects of labor-force trajectory types over the predicted number of chronic conditions, by childhood SES. Model 3.2 shows that, only among the 'non-poor' group, relative to being in a 'long-term attachment' trajectory, there are detrimental effects of following a 'moving out early' trajectory (IRR = 1.193, $p < 0.05$), 'non-contributing' trajectory (IRR = 1.253, $p < 0.05$), or 'out of the labor force' trajectory (IRR = 1.307, $p < 0.01$). In other words, specifically among the 'non-poor' group, we observe the protective effect of following the 'long-term attachment' trajectory over the predicted number of chronic conditions. By contrast, since among the 'poor' group there are not positive interaction effects between childhood SES and labor-force trajectories, we can thus conclude that the protective health effect of following a 'long-term attachment' trajectory is overshadowed by growing in a poor household.

Finally, model 4 tests our five hypotheses concurrently. Even though there are some changes in the coefficients, results show that the effects of childhood SES remain significant and positive and the effects of labor-force trajectories and education barely change, being the most significant change the level of significance in the coefficient of the 'moving out early' trajectory.

Discussion and conclusion

Using a population-representative longitudinal survey of Chilean adults, and based on three life course models—critical periods, social mobility, and risk accumulation models—in this study we analyzed five research hypotheses on the health effects of the exposure to social advantages/disadvantages throughout different life stages, among a group of older women in Chile. Results indicate that the three theoretical models—the critical periods, the social

Table 3 Poisson regression models (incidence rate ratios) on older women in Chile

	Model 1		Model 2.1		Model 2.2		Model 3.1		Model 3.2		Model 4	
Age	1.022***	[1.02,1.03]	1.023***	[1.02,1.03]	1.022***	[1.02,1.03]	1.020***	[1.02,1.03]	1.020***	[1.02,1.03]	1.020***	[1.02,1.03]
Father's occupation (ref = manual)												
Military	0.739	[0.55,1.00]									0.769	[0.57,1.04]
Non-manual	0.965	[0.89,1.05]									0.971	[0.89,1.05]
Farm	0.999	[0.93,1.07]									0.967	[0.90,1.04]
Not in the labor market	0.990	[1.00,1.00]									0.956	[1.00,1.00]
Mother's occupation (ref = manual)												
Non-manual	0.978	[0.88,1.09]									0.999	[0.90,1.11]
Farm	0.937	[0.75,1.17]									0.926	[0.74,1.15]
Not in the labor market	1.001	[0.91,1.10]									1.003	[0.91,1.10]
Childhood SES (ref = non-poor)												
Poor	1.127***	[1.06,1.20]			1.164***	[1.07,1.26]			1.255***	[1.10,1.43]	1.131**	[1.04,1.23]
Social mobility (ref = upward)												
Downward			1.094*	[1.01,1.18]	1.199***	[1.09,1.32]			1.161***	[1.06,1.27]	1.179**	[1.07,1.30]
No mobility			0.958	[0.89,1.03]	0.967	[0.87,1.07]			1.009	[0.93,1.09]	0.972	[1.07,1.30]
*Social mobility * childhood SES*												
Downward * poor					0.885	[0.72,1.09]					0.864	[0.70,1.07]
No mobility * poor					1.159	[0.99,1.36]					1.111	[0.95,1.30]
Labor-force trajectories types (ref = long-term attachment)												
Moving out early							1.155**	[1.05,1.27]	1.193**	[1.06,1.35]	1.148**	[1.04,1.26]
Contributing							1.162*	[1.01,1.34]	1.133	[0.93,1.39]	1.165*	[1.01,1.34]
Non-contributing							1.222***	[1.09,1.37]	1.253**	[1.06,1.48]	1.208***	[1.08,1.35]
Out of the labor force							1.214***	[1.12,1.32]	1.307***	[1.17,1.46]	1.213***	[1.12,1.32]
Residual							1.161	[0.95,1.41]	1.282	[0.99,1.66]	1.169	[0.96,1.42]
Education (ref = primary or less)												
Secondary							0.867***	[0.81,0.93]	0.889***	[0.83,0.95]	0.894**	[0.84,0.96]
College or more							0.894	[0.79,1.01]	0.934	[0.83,1.06]	0.931	[0.82,1.05]
*Childhood SES * labor-force trajectories types*												
Poor * moving out early									0.923	[0.77,1.10]		
Poor * contributing									1.046	[0.79,1.38]		
Poor * non-contributing									0.920	[0.74,1.16]		
Poor * out of the labor force									0.851*	[0.73,1.00]		

Table 3 (continued)

	Model 1	Model 2.1	Model 2.2	Model 3.1	Model 3.2	Model 4
Poor * residual					0.795 [0.53,1.18]	
N	2019					

Confidence intervals in brackets. In gray, statistically significant effects highlighted. All models include alcohol consumption, whether the person does physical activity or not, whether they have private or public insurance, and their marital status as controls. Models with all control variables are shown in Supplementary Table 2 in SM page 7. 'Childhood SES' = Childhood socioeconomic status

***$p < 0.01$; **$p < 0.05$; *$p < 0.1$

mobility, and the risk accumulation models—are independently and concurrently associated with health outcomes of women in old age. In other words, socioeconomic circumstances in early childhood, economic mobility, as well as educational achievements and labor-force trajectories in late adulthood are associated separately and simultaneously with health status in older women in Chile. To our knowledge this is the first study to report these findings in Latin-America.

Specifically, first we showed that childhood economic status was associated with worse health outcomes. This finding is consistent with previous research about the associations between exposure to prenatal or early childhood stressors, such as poverty, maternal nutrition, maternal chronic diseases, smoking, pollutants, and a higher risk for chronic conditions such as hypertension, diabetes mellitus and others (Havranek et al. 2015). Therefore, our study contributes to strengthening the association between lower childhood SES and health status in the elderly at a population level.

Our results also support the social mobility model, showing that worsening economic conditions across life are associated with worse health status in women during old age. Although several studies have described low SES in adulthood as detrimental for health outcomes (Dorner and Stein 2013; Kolahi et al. 2018; McDaniel et al. 2019), this study also shows that becoming poor is per-se a predictor of worse health status in women during old age. Moreover, most literature that has addressed the effect of economic mobility has focused mainly on mental health and physical ability outcomes, leaving chronic conditions aside. Thus, our study contributes to close this knowledge gap.

Regarding the risk accumulation model, our study also supports an independent association between continued exposure to life advantages, such as completing secondary education and working continuously as formal full-time employee during adulthood, and being healthier in old age among this population of women. Although we did not find that having a higher education diploma was health protective, this could be explained by sampling constrains, considering that the higher-educated group was only a small proportion of the total number of subjects. Consistent with what we found, prior cross-national literature has described that lower educational attainment is associated with several health conditions among women in Europe, including heart problems, hypertension, hand/arm pain, diabetes, obesity, depression, breathing problems, headaches, and cancer, although these associations differ among countries (McNamara et al. 2017). On the other hand, the association between being out of the labor force continuously during adulthood and having a worse health in old age might be explained because people in Chile, given the liberal state orientation of the country, are heavily reliant

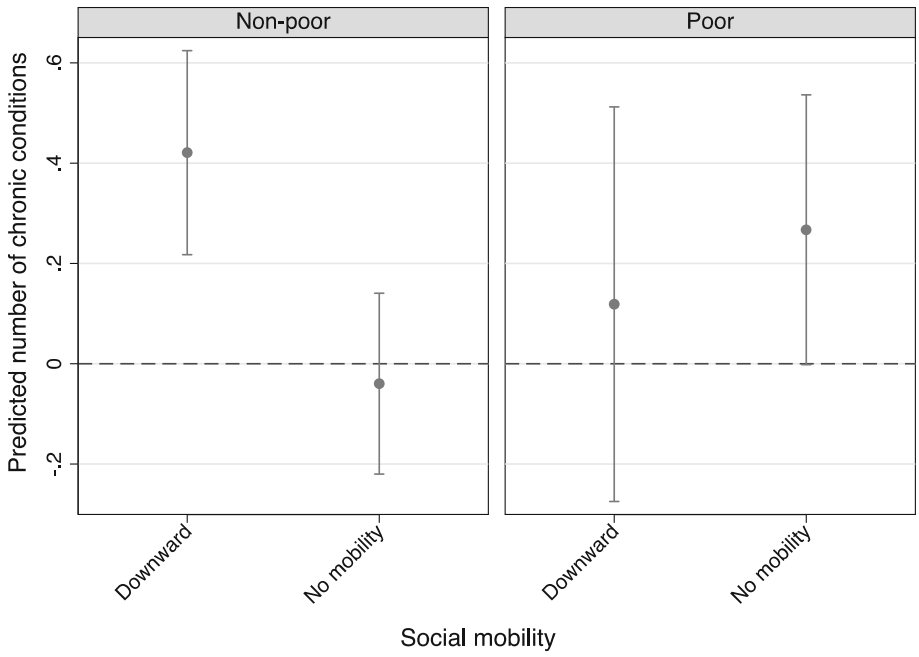

Fig. 2 Average marginal effects of economic mobility over the predicted number of chronic conditions, by childhood socioeconomic status, on older women in Chile. *Note*: Reference social mobility = 'Upward'

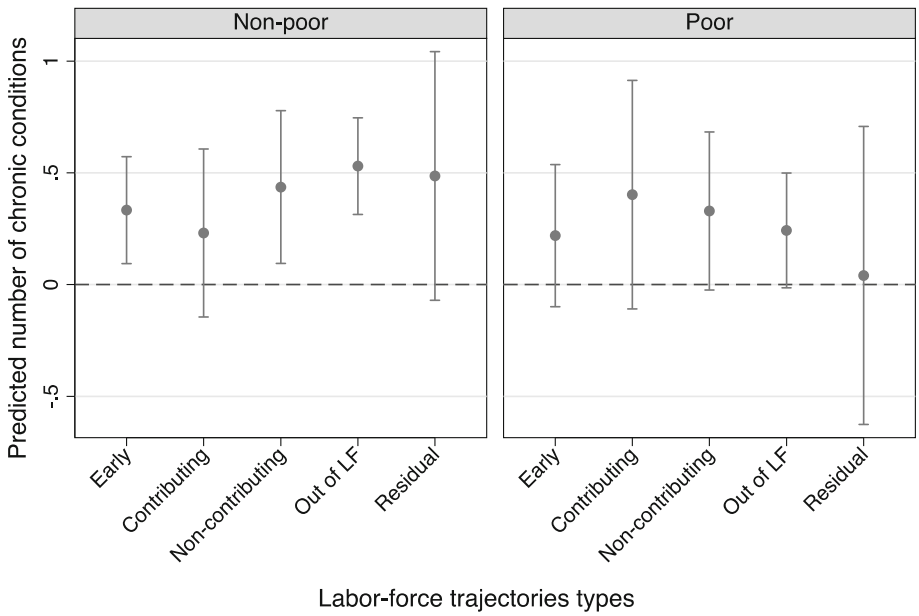

Fig. 3 Average marginal effects of labor-force trajectory types over the predicted number of chronic conditions, by childhood socioeconomic status, on older women in Chile. *Note*: Reference trajectory = 'long-term attachment'. 'Early' = Moving out early. 'Out of LF' = Out of the labor force

on the labor market and the privatized pension system to meet financial and health needs in late life (Madero-Cabib et al. 2019b). Therefore, staying long periods out of the labor market, might be a major cause in this country of confronting serious economic issues, and therefore be deprived of adequate health coverage in old age. However, we highlight the fact that there are certain contextual-level conditions which make women particularly more likely to be excluded during long life periods from the labor market (or at least excluded from participating in formal conditions) in this country: Chile has a male-breadwinner culture which generates stark differences in men's and women's labor-force participation rates, gender pay gap, gender occupational segregation, and overt gender discrimination at work (Madero-Cabib et al. 2019a).

This study has several limitations. First, measures of childhood SES and economic mobility are self-reported, limiting the accuracy of our data. Second, other types of life course factors not evaluated in this research, such as residential trajectories, marital and parenthood trajectories, or life-long health habits, could also influence individuals' health outcomes during late adulthood. Third, the use of a composite outcome might alter the strength of the reported associations given that the direction of the associations

between the life course variables and each of the health conditions included might not be the same for each of them.

Our results have important salience for public policies that aim to promote healthy lives among older women in the frame of a rapidly increasing elderly population. We suggest that policy measures that seek to foster health prevention and health care among older persons should not focus on understanding only traditional health determinants (e.g., financial access to health prevention and care), and either only during old age. Instead, these public policies should consider how multiple exposures to social advantages and disadvantages during previous stages of the life course could affect health in late life. Future research should explore whether other dimensions of life, such as housing, transportation, diet, cultural values and others, which are experienced by individuals throughout life, are also associated with health outcomes in the elderly. We expect that the results and discussion held in this manuscript could promote discussion and reflection at the public policy level and on how to enhance healthy life among an aging population.

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Compliance with ethical standards

Ethical statement We, the authors of this manuscript, certify that we do not have any actual or potential conflict on ethical standards, financial and non-financial interests and compensations, ethical approvals, personal relationships with people or organizations, which could inappropriately influence, or be perceived to influence, our work.

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