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Adult child educational attainment and older parents' psychosocial outcomes during the COVID-19 pandemic

Karla Renata Flores Romero¹, Yulin Yang¹, Sharon H. Green², Sirena Gutierrez¹, Erika Meza¹ and Jacqueline M. Torres^{1*}

Abstract

Background Older adults' psychosocial outcomes during the COVID-19 pandemic have been inequitable by socio-economic status (SES). However, studies have focused solely on own SES, ignoring emerging evidence of the relationship between adult child SES and late-life health. We evaluated whether adult child educational attainment – a core marker of SES – is associated with older parents' psychosocial outcomes during the pandemic.

Methods We used data from the Survey of Health, Aging, and Retirement in Europe (SHARE) 2004–2018 and the SHARE Corona Surveys (SCS) 2020 and 2021. We included 40,392 respondents ≥ 65 years who had pre-pandemic information on adult child educational attainment and self-reported psychosocial outcomes during the pandemic, including self-assessments of worsened psychosocial outcomes compared to the pre-pandemic period. We used generalized estimating equations with a Poisson distribution and a log link, adjusted for respondent and family-level characteristics, including respondents' own educational attainment.

Results Older adults whose adult children averaged levels of educational attainment at or above (vs. below) their country-specific mean had a lower prevalence of feeling nervous (Prevalence Ratio [PR]: 0.94, 95% Confidence Interval [CI]: 0.90, 0.97), sad or depressed (PR: 0.94, 95% CI: 0.91, 0.98), and having sleep problems (PR: 0.94, 95% CI: 0.90, 0.97) during the pandemic. Additionally, higher adult child educational attainment was associated with a lower risk of perceiving worsened feelings of nervousness (PR: 0.95, 95% CI: 0.90, 1.01) and worsened sleep problems (PR: 0.91, 95% CI: 0.82, 1.01) as compared to the pre-pandemic. In stratified models, protective associations were observed only in countries experiencing "high" levels of COVID-19 intensity at the time of the survey. All of these results are derived from adjusted models.

Conclusions Adult child SES may have "upward" spillover effects on the psychosocial wellbeing of older parents during periods of societal duress like the pandemic.

Keywords Socio-economic status, COVID-19 pandemic, Older adults, Mental health, Intergenerational influences

Introduction

Older adults faced myriad adverse experiences during COVID-19 pandemic including due to the direct threats of infection and disease as well as disruption to social life. These and other challenges contributed to poorer mental wellbeing among older adults [1–5]. Nevertheless, studies have indicated that the psychosocial

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consequences of the COVID-19 pandemic have been inequitable across socio-economic strata, with the poorest outcomes concentrated among older adults with lower levels of education and other markers of socio-economic disadvantage [1, 3, 6–11]. However, this research has taken an individualistic approach by exclusively focusing on the impact of *own* socio-economic status, ignoring growing evidence that the socio-economic status (SES) of one's family – and most notably, one's adult children – can influence late-life psychosocial and related health outcomes [12–22]. To our knowledge, no study has specifically examined the impact of adult children's SES on their parents' health outcomes during the pandemic.

Research from the pre-pandemic period provides evidence of a plausible relationship between adult child SES and pandemic-era health, including mental health [12, 13, 16]. For example, numerous pre-pandemic studies have demonstrated a protective relationship between adult child educational attainment and psychosocial well-being among older adults, including fewer depressive symptoms and greater social engagement [23–25]. These relationships may be explained by the fact that adult children with higher SES may provide critical economic and non-economic resources to older parents, including direct financial transfers or resource sharing (e.g. sharing a household) [22]. During the pandemic, adult child economic resources may have been used to help older adults overcome pandemic-related challenges [26], like accessing technology needed to maintain social connections with non-resident family and friends. Higher SES among adult children has also been linked to lower levels of stress and worry for older parents (e.g. via reduced financial strain, improved relationship quality, or the exchange of social and instrumental support) as well as greater life satisfaction and quality of life [25, 27, 28]; these factors may underlie relationships between higher adult child educational attainment and psychosocial outcomes for older parents during the pandemic.

Beyond the economic realm, studies using pre-pandemic data have suggested that higher adult child educational attainment may contribute to older parents' health care access and health behaviors, which may be relevant for pandemic-era outcomes. For example, studies have found that higher adult child educational attainment is associated with better management of chronic health conditions [29, 30] and a lower risk of adverse health behaviors (e.g. smoking) among older parents [20, 31]. These associations are often explained by the intergenerational transmission of knowledge and information about health risks as well as direct and indirect support in navigating the health care system (e.g. communicating with health care providers) [32,

33]. Specifically in the context of COVID-19, higher adult child SES could have yielded greater awareness of the risks associated with in-person contact for COVID-19 transmission amongst older parents. Research using SHARE data has shown the importance of close kin for the transmission of knowledge about COVID vaccination as well as instrumental support to help avoid the risk of infection [34]. Reduced risk of infection or reduced risk of adverse outcomes even in the presence of infection could have contributed to reduced worry and anxiety among older adults [35].

In the present study, we bridge recent literature on socio-economic inequalities in psychosocial outcomes among older adults during the COVID-19 pandemic with pre-pandemic literature on the “upward” intergenerational influences (i.e., the directional flow of influence from adult children to parents) of adult child SES on older parents' health. We evaluated whether older European adults' psychosocial outcomes during the COVID-19 pandemic were patterned by adult child educational attainment—a core maker of SES-independent of respondents' own lifecourse SES. We expected that higher adult child educational attainment would be associated with better psychosocial outcomes among older parents during the pandemic. We additionally expected that higher adult child educational attainment would be associated with a lower risk of older parents perceiving that their psychosocial outcomes had worsened compared to the pre-pandemic period. We secondarily evaluated associations between adult child educational attainment and older parents' frequency of contact with children, the prevalence of help with basic needs given to and received from children, and respondents' COVID-19-specific outcomes. These latter outcomes could serve as potential pathways of influence between adult child educational attainment and parents' psychosocial outcomes.

Finally, we evaluated whether associations between adult child educational attainment and older adults' psychosocial outcomes varied across both time and pandemic stage. Specifically, we expected that adult child educational attainment could have been more impactful for parents' outcomes during the earliest months of COVID-19, characterized by scarcity of resources to cope with the impacts of lockdown, including not only basic resources like food and toilets, but also essential mental and health support. We also considered that there could be heterogeneity based on the intensity of COVID-19, given that European countries experienced the pandemic differently at any given point in time and country-level pandemic intensity has been independently associated with population mental health [1, 4, 5].

Methods

Data

Data for this study comes from the Survey of Health, Ageing and Retirement in Europe (SHARE) [36] and the SHARE Corona Survey (SCS) [37, 38]. SHARE has collected data on adults ≥ 50 years of age and their spouses since 2004 with approximately biennial follow-ups through early 2020; 28 European countries and Israel have been included in SHARE. The SCS was conducted among SHARE panel members in wave 8 via computer-assisted telephone interviews (CATI) during the early months of the pandemic (June–August 2020) and one year later (June–August 2021).

We restricted the analytic sample to respondents ≥ 65 years in European countries (excluding Israel); we focused on adults ≥ 65 given that older adults were disproportionately impacted by the COVID-19 pandemic in terms of both morbidity and mortality as well as some adverse psychosocial sequelae (e.g. social isolation) [39, 40]. We followed a complete case analysis approach and further restricted the analytic sample to those who: 1) had at least one living child, 2) reported on their child characteristics at any of the pre-pandemic SHARE waves, and 3) had completed SHARE wave 8 (conducted between October 2019 and March 2020), from which we derived our pre-pandemic control variables, and 4) had complete data in either one or both SCS waves. After applying these inclusion criteria, we were left with an analytic pooled sample of 40,392 respondents (see eFig. 1).

Outcome measures

Psychosocial outcomes

At each of the two SCS waves, participants answered the following questions, which each had binary yes/no response options: *“In the last month, have you felt nervous, anxious, or on edge?”*, *“In the last month, have you been sad or depressed?”*, *“Have you had trouble sleeping recently?”* Respondents also reported on the frequency of feeling lonely; we grouped those who reported often or some of the time (vs. hardly ever or never).

During the first SCS wave, respondents were asked to rate whether each of the symptoms listed above (feeling nervous, feeling sad or depressed, having sleep problems, and feeling lonely) had worsened, improved, or stayed the same as compared to the pre-pandemic period. We contrasted those who perceived that their symptoms had worsened with those who reported perceiving that their symptoms had improved, stayed the same, or that they had not experienced that symptom. Worsened psychosocial outcomes over time (e.g. increases in depressive symptoms, increases in loneliness) as well as poorer sleep

over time have been associated with a greater risk of poor subsequent outcomes (e.g. stroke, dementia, mortality) [41–45].

Secondary outcomes

Contact with children was measured at each pandemic wave with the following question: *“Since the outbreak of Corona, how often did you have personal contact, that is, face to face with your own children from outside your home?”* We grouped those who responded daily, several times a week, or about once a week (vs. less often or never).

Support given to and received from children was measured with two questions at each wave: *“How often did your own children help you to obtain necessities, compared to before the outbreak of Corona? Less often, about the same, or more often?”* *“Compared to before the outbreak of Corona, how often did you help your own children to obtain necessities: less often, about the same, or more often?”* Wording for the latter two questions shifted slightly during the second SCS wave (see Supplemental Appendix for specific question wording). We grouped those who responded less often or about the same (vs. more often).

Respondents' COVID-19 experiences were captured with the following questions at each wave, which we evaluated as separate outcomes: *“Have you or anyone close to you been tested for the Corona virus and the result was positive, meaning that the person had the Covid disease? (Yes/No)”*, *“Have you or anyone close to you been hospitalized due to an infection from the Corona virus? (Yes/No)”*, *“Has anyone close to you died due to an infection from the Corona virus? (Yes/No)”*.

Adult child educational attainment

At the pre-pandemic SHARE waves, respondents reported the level of educational attainment for each of their children ≥ 16 years of age. Levels of educational attainment were standardized across SHARE countries using the International Standard Classification of Education (ISCED-1997) [46], with values that ranged from 0 (pre-primary education) to 6 (doctoral studies). For each respondent, we calculated a binary variable contrasting those who reported that their adult children had completed a mean level of ISCED-1997 classification at or above vs. below the mean level for all respondents residing in the same country, with means calculated based on the entire SHARE survey (i.e. before applying exclusion and inclusion criteria).

To evaluate the consistency of our results in sensitivity analyses, we created 1) a continuous measure of the average ISCED-1997 score (range: 0–6) that was not standardized to country-specific averages, 2) a categorical variable based on country-specific quartiles of average

adult child educational attainment, and 3) a binary indicator of mean levels of ISCED-1997 classification for adult children, comparing those at or above the mean level to those below the mean level for all respondents in the same country, based on baseline or first available ISCED-1997 classification values.

Confounders and effect modifiers

We followed modern epidemiologic principles of confounder selection [47, 48] and considered confounders to be measures that may have influenced adult-child educational attainment – which was generally established long before the pandemic – and older parents' psychosocial outcomes during the COVID-19 pandemic. These included respondent's age, sex, educational attainment, nativity, marital status, parents' level of educational attainment (for mother and father), spouse's age (if currently married/partnered, with an indicator variable for whether or not respondents had a current spouse/partner to retain the entire analytic sample), spouse's educational attainment (if currently married/partnered or formerly married/partnered, with an indicator variable for whether or not respondents had a current or former spouse/partner to retain the entire analytic sample), the total number of respondent's living children, the percentage of female children, and country fixed effects. All these measures were captured during pre-pandemic waves of data collection. We did not control for respondents' pre-pandemic health, given that this may have mediated the relationship between adult child educational attainment and psychosocial outcomes during the pandemic.

We considered variation in associations by SCS wave, which corresponded to some of the earliest months of the pandemic (Wave 1) and the post-vaccination period (Wave 2). We also considered heterogeneity by the intensity of the COVID-19 pandemic since higher country-level COVID intensity has been associated with population mental health [1, 4, 5]. COVID-19 intensity was measured as the number of cases per 1,000 population averaged separately for each country during the three-month data collection period for the first SCS wave; data were obtained via Our World in Data, sourced from Johns Hopkins University [49]. We transformed this measure into a binary indicator of cases per 1000 population at or above vs. below the median across the countries included in our analyses. We focused our analysis on heterogeneity by COVID-19 intensity on the first SCS wave (June – August 2020); given the vast differences in the landscape of vaccination and treatment by the second SCS wave (June – August 2021), the meaning of “high” COVID-19 intensity may have varied substantially by this time. We replicated the same

procedure using the number of deaths per 1,000 population to assess the consistency of our results across measures of COVID intensity.

Analytic strategy

We used generalized estimating equations (GEE) with a Poisson distribution and a log link [50] to analyze the associations between adult child educational attainment and older parents' psychosocial outcomes, contact with children, support given to and received from children, and COVID-19 experiences, adjusting for all confounders described above. Our models were estimated using robust standard errors. We pooled data across both pandemic waves, which allowed for improved precision. The GEE models account for the non-independence of repeated observations of the same respondents over the two pandemic waves.

We used inverse probability weights to account for selective missingness from the analytic sample, with missingness driven by respondents either not having children, having children but lacking data on the exposure variable, or having children but with missing values on outcome variables (Appendix Fig. 1). To create the weights, we estimated a logistic regression model in which our outcome was a binary indicator of inclusion (vs. exclusion) from our analytic sample, conditional on respondents' demographic characteristics (i.e. age, sex, educational attainment, nativity, marital status, and country of origin). We generated predicted probabilities of inclusion from this model, which we used to calculate weights equal to the inverse of the probability of inclusion (i.e. $1/p_{\text{inclusion}}$) for those who were included in the analytic sample. We did not adjust or trim the weights in any way.

While our main models used pooled data from both pandemic waves to examine associations with our primary and secondary outcomes, we also conducted further analyses to examine whether the associations with our primary outcomes varied according to the sex/gender of the adult child and the respondent. This additional testing is motivated by prior evidence of heterogeneity in studies of adult child educational attainment and pre-pandemic health outcomes for older parents [14, 18, 20, 22]. We evaluated effect estimates and 95% confidence intervals in models that considered adult child education separately for daughters vs. sons. Additionally, we evaluated heterogeneity by parent sex/gender with stratified models, which allowed us to compare effect estimates and 95% confidence intervals.

We subsequently evaluated potential differences in associations with our primary outcomes across study waves and country-level COVID-19 intensity by comparing effect estimates and 95% confidence intervals in stratified models (i.e. for Wave 1 vs. Wave 2 and high vs. low

COVID intensity measures) and formally tested multiplicative interaction terms in pooled models e.g. evaluating the multiplicative interaction between study wave and adult child educational attainment in association with parents' outcomes.

In order to evaluate heterogeneity, we compared the sign and magnitude of effect estimates and the overlap in 95% confidence intervals across stratified models. When we additionally tested for interaction in pooled models, we also considered the effect estimates and *p*-values corresponding to multiplicative interaction terms.

Finally, we assessed the consistency of our findings from the main models which examined associations with our primary and secondary outcomes. This evaluation used both a continuous measure of the average ISCED-1997 score (range: 0–6) that was not standardized to country-specific averages as well as a categorical variable based on country-specific quartiles of average adult child educational attainment. Moreover, we confirmed the reliability of the outcomes from our main models related to primary outcomes through the application of baseline or first available ISCED-1997 classification values.

Results

Descriptive statistics

Respondents' characteristics are summarized for the first and second waves of the SCS in Table 1. In each wave, respondents had a median age of 74 (Interquartile Range [IQR]: 69–80) and 73 (IQR: 69–79), respectively, they were primarily female (57% and 58%), born in their country of residency (93%), and married (68%). Respondents had a median ISCED level of 3 (IQR: 2–4), roughly corresponding to lower secondary educational attainment. Respondents had a median of two (IQR 2–3) adult children with a median ISCED level of 4 (IQR: 3–5), corresponding to an upper secondary level of education.

Across the two SCS waves (Wave 1 and Wave 2), 29% and 32% of respondents reported feeling nervous, 26% and 31% reported feeling sad or depressed (hereafter "feeling depressed" for brevity), 28% and 32% reported having sleep problems, and 30% and 32% reported feeling lonely. In the first wave, one-fifth of respondents perceived that their feelings of nervousness had worsened as compared to before the COVID-19 outbreak, 16% perceived that their feelings of depression had worsened, 8% reported worsened sleep problems, and 13% felt worsened feelings of loneliness.

In addition, across SCS Wave 1 and Wave 2, 47% and 30% of respondents reported little or no in-person contact with their children, 67% and 38% received help more often from children to obtain basic necessities, and 18% and 10% reported helping their children more often obtain basic necessities. Finally, 6% and 36% reported a

positive COVID-19 test, 3% and 12% reported COVID-19-related hospitalization for themselves or someone close to them, and 2% and 8% reported that someone close to them had died of COVID-19.

Associations with psychosocial outcomes during the COVID-19 pandemic

Respondents for whom average adult child educational attainment was at or above the country-specific mean had a 6% lower risk of reporting feeling nervous (95% Confidence Interval [CI]: 0.90, 0.97), a 6% lower risk of reporting feeling depressed (95% CI: 0.91, 0.98), a 6% lower risk of having sleep problems (95% CI: 0.90, 0.97) during the pandemic compared to respondents for whom average adult child educational attainment was below the country-specific mean (Fig. 1). Higher average adult child educational attainment was associated with a 3% lower risk of feeling lonely (95% CI: 0.94, 1.01), although the 95% CI crossed the null. Results were substantively similar when using the continuous and categorical measures of adult child educational attainment (Table 2). Similar substantial consistency was observed when using the mean levels of ISCED-1997 classification for adult children, comparing those at or above the mean level to those below the mean level for all respondents in the same country, based on baseline or first available ISCED-1997 classification values (Appendix Table 1).

There was no evidence of heterogeneous associations by SCS wave based on estimates presented in stratified models and *p*-values corresponding to multiplicative interaction terms in pooled models (Appendix Table 2). There was evidence of heterogeneity by COVID-19 intensity, measured as the number of cases per 1,000 population, based on both effect estimates in stratified models (Fig. 2) and the multiplicative interaction terms evaluated in pooled models (Appendix Table 3) for the outcomes of feeling nervous and feeling lonely. There was no evidence of heterogeneity in associations with feeling depressed or having sleep problems. Respondents in countries experiencing higher levels of COVID-19 intensity during the first SCS wave and with average adult child educational attainment at or above the country-specific mean had an 11% lower risk of reporting feeling nervous (95% CI: 0.83, 0.95), a 7% lower risk of feeling lonely (95% CI: 0.88, 1.00) compared to respondents for whom average adult child educational attainment was below the country-specific mean (Fig. 2). Conversely, there were no significant associations observed in countries with lower COVID-19 intensity (Fig. 2). Substantially similar outcomes were observed when using the number of deaths per 1,000 population as our COVID-19 intensity measure, instead of the number of cases per 1,000 population (Appendix Table 4).

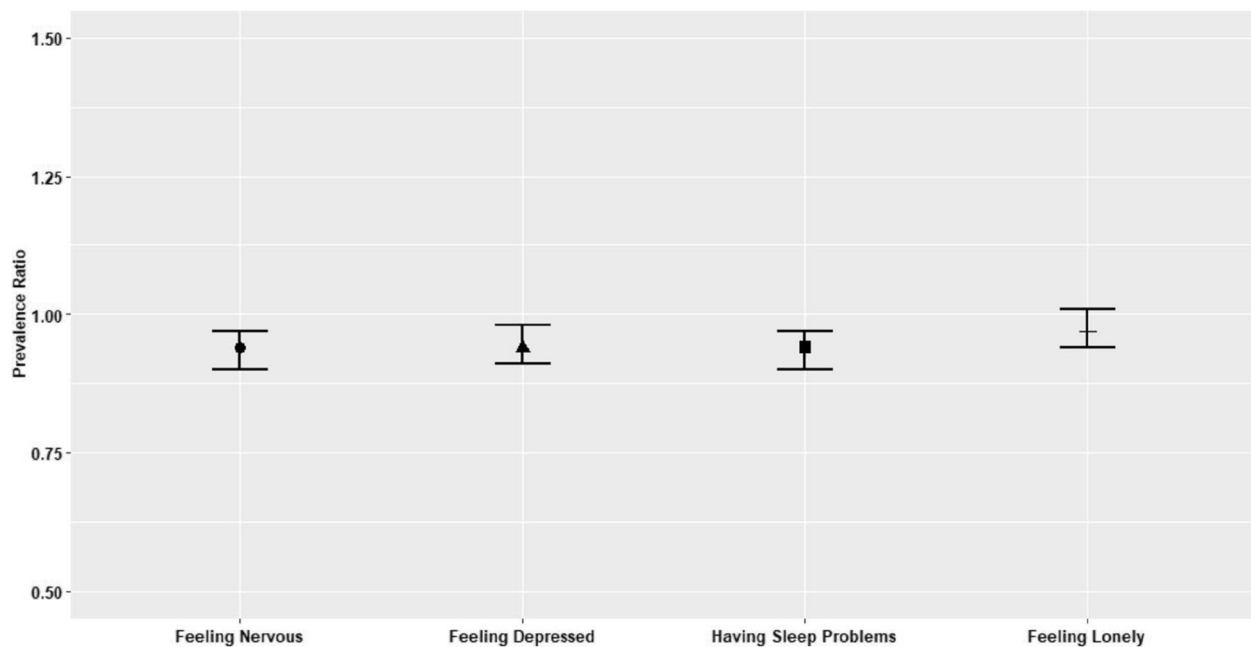


Fig. 1 Adult Child Educational Attainment and Older Parents' Psychosocial Outcomes During the COVID-19 Pandemic. Source: Pooled observations of respondents in the SHARE Corona Survey, Wave 1 and Wave 2, of the Survey on Health, Aging and Retirement in Europe (SHARE) ($N=40,392$). Notes: Exposure is a binary indicator of mean levels of ISCED-1997 classification for adult children, comparing those at or above the mean level to those below the mean level for all respondents in the same country. Controls include age, sex, educational attainment, nativity, country, marital status, parental education (mother and father), age of current spouse (if married/partnered) and educational attainment of current or former spouse, number of children and percentage of female children

There was no indication of heterogeneity by adult child sex/gender, as demonstrated by the overlapping 95% confidence intervals. However, when examining the educational attainment of adult daughters, we observed larger effect sizes: an 8% lower risk of reporting nervousness, a 5% lower risk of reporting depression, a 5% lower risk of experiencing sleep problems, and a 2% lower risk of feeling lonely (although the 95% CI for the outcome feeling lonely crossed the null). In contrast, for adult sons, the effect sizes were smaller: a 2% lower risk of reporting nervousness (which crossed the null), a 2% lower risk of reporting depression (also crossing the null), a 5% lower risk of experiencing sleep problems, and a 4% lower risk of feeling lonely (Appendix Table 5). While 95% confidence intervals overlapped for estimates stratified by parent sex, the magnitude of associations was larger for fathers (9% lower risk of reporting nervousness, 9% lower risk of reporting depression, 8% lower risk of experiencing sleep problems, and 9% lower risk of feeling lonely) compared to mothers (5% lower risk of reporting nervousness, 4% lower risk of reporting depression, 5% lower risk of experiencing sleep problems, and 0% lower risk of feeling lonely, although the 95% CI for the latter outcome crossed the null) (Appendix Table 6).

Associations with perceptions of worsened psychosocial outcomes

Respondents for whom average adult child educational attainment was at or above the country-specific mean had a 5% lower risk of perceiving worsened feelings of nervousness (95% CI: 0.90, 1.01) and a 9% lower risk of perceiving worsened sleep problems (95% CI: 0.82, 1.01), compared to those for whom average adult child educational attainment was below the country-specific mean. In contrast, there were no significant associations observed with the outcomes of perception of worsened feelings of depression and loneliness (Appendix Table 7). There was evidence of heterogeneity by country-level COVID intensity for perceived worsened feelings of nervousness and perceived worsened sleep problems. This evidence was observed through effect estimates in stratified models (Fig. 3) and the evaluation of multiplicative interaction terms in pooled models (Appendix Table 8). Respondents in countries experiencing higher levels of COVID-19 intensity during the first SCS wave and with average adult child educational attainment at or above the country-specific mean had an 8% lower risk of perceiving worsened feelings of nervousness (95% CI: 0.85, 1.00) compared to respondents for whom average adult child educational attainment was below the country-specific mean. Similarly, they also had

Table 1 Descriptive Characteristics, Adults 65 + Years in SHARE and SHARE Corona Survey Wave 1 and Wave 2

	Wave 1 (N=20,916)	Wave 2 (N=19,476)
Pre-COVID Socio-Demographic Characteristics		
Age, median (IQR)	74 (69–80)	73 (69–79)
Female, n (%)	11,959 (57.2)	11,267 (57.9)
Native-born, n (%)	19,409 (92.8)	18,057 (92.7)
Marital status, n (%)		
Married/partnered	14,198 (67.9)	13,332 (68.5)
Widowed	4,951 (23.7)	4,444 (22.8)
Divorced/separated	1,510 (7.2)	1,460 (7.5)
Single	257 (1.2)	240 (1.2)
Educational attainment (range: 0–6), median (IQR) ^a	3 (2–4)	3 (2–4)
Pre-COVID Parental Characteristics		
Average parental educational attainment, n (%) ^a		
Low (range: 0–3)	17,363 (83.0)	16,158 (83.0)
High (range: 4–6)	1,048 (5.0)	1,012 (5.2)
Parental level of education not available	2,505 (12.0)	2,306 (11.8)
Pre-COVID Spouse Characteristics		
Age of current spouse (if married/partnered), n (%)		
< 65	1,515 (7.2)	1,505 (7.7)
65–79	9,326 (44.6)	8,924 (45.8)
80+	2,733 (13.1)	2,349 (12.1)
Age of spouse not available	7,342 (35.1)	6,698 (34.4)
Spousal educational attainment, n (%)		
Low (range: 0–3)	13,234 (63.3)	12,270 (63.0)
High (range: 4–6)	4,357 (20.8)	4,279 (22.0)
Spousal level of education not available	3,325 (15.9)	2,927 (15.0)
Pre-COVID Child Characteristics		
Total number of children, median (IQR)	2 (2–3)	2 (2–3)
Female children, n (%)	10,301 (49.2)	9,596 (49.3)
Average educational attainment (range: 0–6), median (IQR) ^a	4 (3–5)	4 (3–5)
Outcomes and Experiences during COVID		
Covid Intensity		
Covid cases per 1,000 population, median (IQR)	143 (101–307)	-
Covid deaths per 1,000 population, median (IQR)	5.1 (3.2–19.3)	-
Psychosocial, n (%)		
Feeling nervous	6,008 (28.7)	6,254 (32.1)
Feeling depressed	5,460 (26.1)	5,992 (30.8)
Having sleep problems	5,914 (28.3)	6,318 (32.4)
Feeling lonely	6,274 (30.0)	6,268 (32.2)
Worsened feelings of nervousness	4,252 (20.3)	-
Worsened feelings of depression	3,405 (16.3)	-
Worsened sleep problems	1,608 (7.7)	-
Worsened feelings of loneliness	2,631 (12.6)	-
Family Relationships and Contact, n (%)		
Little or no contact with children	9,785 (46.8)	5,947 (30.5)
Received help from child to obtain necessities since the outbreak	4,994 (66.5)	7,312 (37.9)
Helped child to obtain necessities since the outbreak	249 (18.4)	1,875 (9.7)
Overall Covid Outcomes, n (%)		
Anyone tested positive for COVID-19	1,269 (6.1)	6,954 (35.7)
Anyone hospitalized due to COVID-19	630 (3.0)	2,306 (11.8)
Anyone died due to COVID-19	497 (2.4)	1,580 (8.1)

Source: Survey on Health, Aging and Retirement in Europe

^a Educational levels based on the International Standard Classification of Education (ISCED, 1997), with values that ranged from 0 (pre-primary education) to 6 (doctoral studies)

Table 2 Adult Child Educational Attainment and Older Parents’ Psychosocial Outcomes During the COVID-19 Pandemic

	Feeling Nervous		Feeling Depressed		Having Sleep Problems		Feeling Lonely	
	PR	95% CI	PR	95% CI	PR	95% CI	PR	95% CI
High Adult Child Educational Attainment ^a	0.94***	0.90—0.97	0.94***	0.91—0.98	0.94***	0.90—0.97	0.97	0.94—1.01
Continuous	0.96***	0.94—0.97	0.96***	0.95—0.98	0.96***	0.94—0.98	0.99*	0.97—1.00
Quartiles								
1 (Reference category)								
2	0.95**	0.90—0.99	0.97	0.93—1.02	0.96	0.92—1.01	0.98	0.93—1.02
3	0.94***	0.90—0.98	0.95**	0.91—0.99	0.95**	0.91—0.99	0.98	0.94—1.02
4	0.89***	0.84—0.94	0.91***	0.86—0.97	0.91***	0.86—0.97	0.96	0.91—1.02

Source: Pooled observations of respondents in the SHARE Corona Survey, wave 1 and wave 2, of the Survey on Health, Aging and Retirement in Europe (SHARE) (N=40,392).

^a Exposure is a binary indicator of mean levels of ISCED-1997 classification for adult children, comparing those at or above the mean level to those below the mean level for all respondents in the same country. Controls include age, sex, educational attainment, nativity, country, marital status, parental education (mother and father), age of current spouse (if married/partnered) and educational attainment of current or former spouse, number of children and percentage of female children
 *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

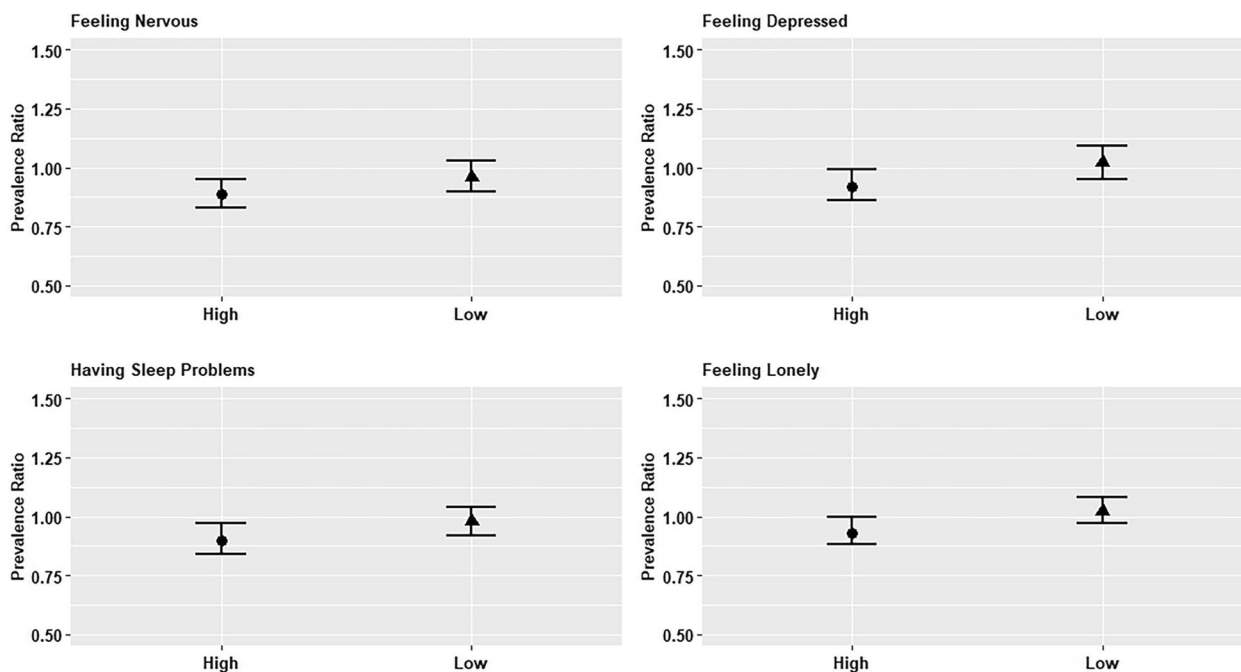


Fig. 2 . Adult Child Educational Attainment and Older Parents’ Psychosocial Outcomes, by COVID-19 Intensity. Source: SHARE Corona Survey Wave 1 of the Survey on Health, Aging and Retirement in Europe (SHARE) (N= 10,340 for high-country-level COVID-19 intensity and N= 10,576 for low-country-level COVID-19 intensity). Notes: Exposure is a binary indicator of mean levels of ISCED-1997 classification for adult children, comparing those at or above the mean level to those below the mean level for all respondents in the same country. Controls include age, sex, educational attainment, nativity, country, marital status, parental education (mother and father), age of current spouse (if married/partnered) and educational attainment of current or former spouse, number of children and percentage of female children

a 20% lower risk of perceiving worsened sleep problems (95% CI: 0.70, 0.93) compared to respondents for whom average adult child educational attainment was below the country-specific mean. Associations in countries with low COVID-19 intensity were generally null. Findings remained substantially consistent when using the number

of deaths per 1,000 population as our COVID-19 intensity measure (Appendix Table 9).

There was no evidence of heterogeneity by adult child sex, as indicated by the overlapping 95% confidence intervals (Appendix Table 10), however, there were differences in the magnitude of associations with certain

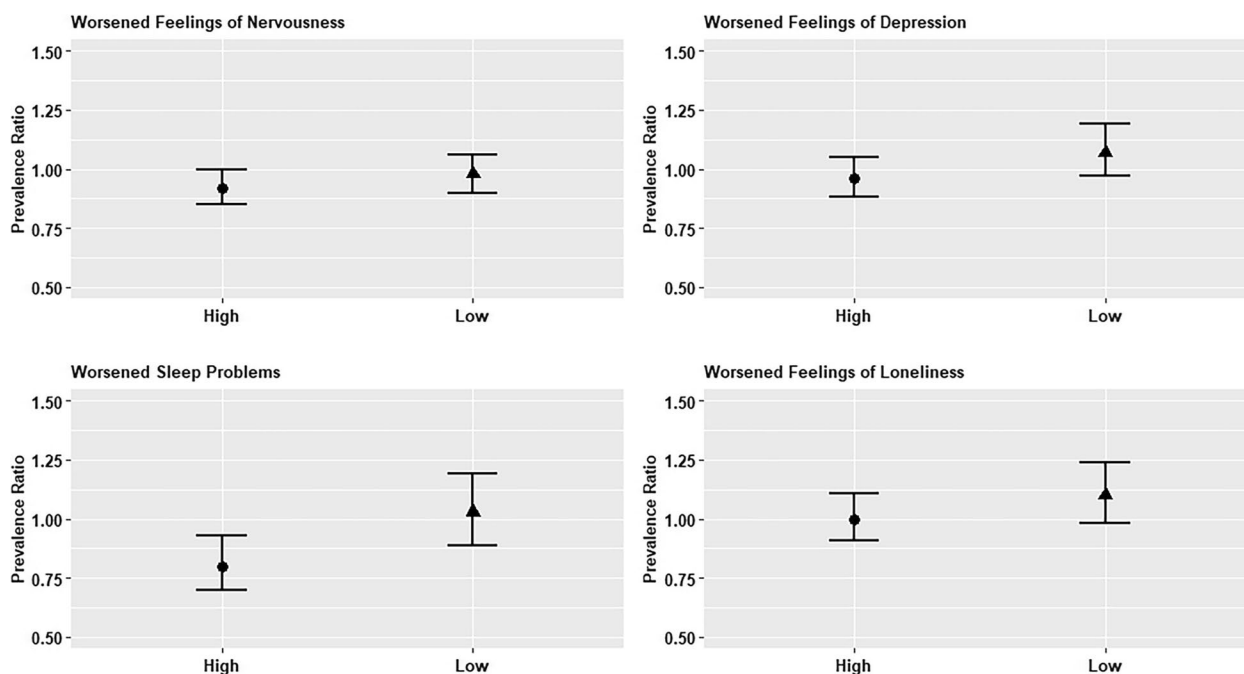


Fig. 3 Adult Child Educational Attainment and Older Parents’ Psychosocial Outcomes Compared to the Pre-Pandemic Period, by COVID-19 Intensity. Source: SHARE Corona Survey Wave 1 of the Survey on Health, Aging and Retirement in Europe (SHARE) (N= 10,340 for high-country-level COVID-19 intensity and N= 10,576 for low-country-level COVID-19 intensity). Notes: Exposure is a binary indicator of mean levels of ISCED-1997 classification for adult children, comparing those at or above the mean level to those below the mean level for all respondents in the same country. Controls include age, sex, educational attainment, nativity, country, marital status, parental education (mother and father), age of current spouse (if married/partnered) and educational attainment of current or former spouse, number of children and percentage of female children

outcomes. Specifically, the associations with perceiving worsened feelings of nervousness was larger for daughters compared to sons, while the association with perceiving worsened feelings of sadness or depression (hereafter worsened feelings of depression for brevity) was larger for sons compared to daughters and in the opposite direction of what was initially hypothesized. Associations with the other outcomes were null. While 95% confidence intervals overlapped throughout, associations between higher adult child educational attainment and perceiving worsened feelings of nervousness and perceiving worsened sleep problems were stronger for fathers compared to mothers. Conversely, associations with perceiving worsened feelings of loneliness were stronger for mothers compared to fathers and in the opposite direction of what was hypothesized (Appendix Table 11). Associations with perceiving worsened feelings of depression were null.

Associations with potential family and COVID-related mechanisms

Average adult child educational attainment at or above the country-level mean was associated with a 7% higher risk of having little or no in-person contact with children (95% CI: 1.04, 1.10) compared to average adult child educational attainment below the country-level mean

(Appendix Table 12). Associations with either receiving help from or giving help to children to obtain necessities were generally null.

Higher average adult child educational attainment was associated with a 10% higher risk of testing positive for COVID-19 or having someone close that tested positive (95% CI: 1.06, 1.15) compared to average adult child educational attainment below the country mean, but not with having been hospitalized, knowing someone close that had been hospitalized with COVID-19, or having someone close that died of COVID-19 (Appendix Table 13). All results were substantively similar when using binary, continuous, and categorical measures of adult child educational attainment (Appendix Tables 14 and 15).

Discussion

In our research focusing on older European adults in a population-based study, we found that higher adult child educational attainment – a core marker of socio-economic status – was associated with a lower risk of poor psychosocial outcomes during the COVID-19 pandemic, including feeling nervous, feeling depressed, and having sleep problems. This study extends growing evidence based on pre-pandemic data demonstrating the importance of adult child socio-economic status for older

parents' health [14–17, 27], but is the first to focus on parents' outcomes during the COVID-19 pandemic.

Additionally, we found that higher adult child educational attainment was associated with a lower risk of respondents reporting that their feelings of nervousness and sleep problems had worsened as compared to the pre-pandemic period. We also found strong associations between high adult child educational attainment and respondents' risk of poor psychosocial outcomes, including perceptions of worsened feelings of nervousness and worsened sleep problems compared to the pre-pandemic period in countries experiencing a higher number of COVID-19 cases and deaths during the survey period (in models focused on the first SCS wave only). These findings could suggest that adult child socio-economic resources may be most important for older parents' wellbeing during periods of societal and health-related duress. However, we did not find evidence of heterogeneity by SCS wave, which may suggest that the specific pandemic-related country-level circumstances may have been a more important modifier than a broad time frame.

Moreover, we found that higher adult child educational attainment was associated with *less* in-person contact with children across the pandemic waves and a *higher* risk of reporting COVID-19 infection among oneself and/or someone close (e.g. a family member or friend). These findings have little precedent in the pre-pandemic literature, although one prior study found evidence of an association between higher adult daughter educational attainment and more frequent child contact for older parents in South Korea [22]. Our findings may have been driven by pandemic-specific circumstances. For example, it may have been the case that higher SES adult children may have been less likely to co-reside with older parents, which would have limited opportunities for contact during a time of pandemic-related physical distancing. In addition, higher SES children may have been more likely to have received information about the risks of in-person contact for COVID-19 transmission among older parents. Recent research suggests that family members played a pivotal role in supporting COVID-related prevention behaviors among older adults in the SHARE survey [34]. However, this could also be an artifact of greater testing resources among higher SES families or higher risk in some occupations that require higher levels of education (e.g. medical professionals) during the early pandemic period. Future research may further pinpoint the mechanisms underlying these results.

There was evidence of differences in the magnitude of association for older mothers and fathers, although patterns varied by outcomes and confidence intervals overlapped. Prior (i.e. pre-pandemic) studies have been

extremely mixed in this regard. For example, some studies have found greater health returns to adult child education for mothers [14, 19] while others have reported associations for fathers only [18], while others have reported no evidence of heterogeneity [25, 51]. Limited evidence of heterogeneity may point to the consistent importance of adult child educational attainment for older mother and fathers in this context. Finally, we found little systematic evidence of heterogeneity in associations by adult child sex. There is no consensus in the pre-pandemic literature on the topic of heterogeneous associations between the SES of adult daughters vs. sons and the outcomes of older parents; prior studies in the European context have found mixed evidence of heterogeneity in associations by child sex/gender, including evidence of no differences [18, 20, 25].

Limitations

We acknowledge important study limitations, including residual confounding due to respondents' long-standing economic and health conditions, including psychosocial wellbeing, that may have preceded the educational trajectories of their adult children and may have influenced both adult child educational attainment and pandemic outcomes. While respondents did report on health and economic circumstances in pre-COVID SHARE study waves, adult child educational attainment had generally been established for those in our analytic sample by their SHARE baseline wave, meaning that even respondents' baseline health and economic measures would have likely been influenced by adult child educational attainment, and should not be included as confounders. Specifically: 1) only 9% of respondents who had the same number of adult children changed exposure status on the binary adult child educational attainment at some point across SHARE study waves, and 2) the estimated average of respondent's average ages of adult children at their baseline waves was 38. Both points (1 and 2) reflect the fact that adult child educational attainment was largely 'set' by study baseline. The ideal study design would collect such data from mid-life adults as their children are completing their educational trajectories to better account for confounding due to parents' characteristics.

In addition, there is no consensus on the best metric of adult child educational attainment in the presence of multiple children. We have focused on average attainment, but welcome further research that may explore further differences across the many possible specifications of adult child educational attainment in families with more than one child, such as the maximum, the minimum, the attainment of the oldest child, the youngest child, or the difference in schooling between children.

While we offered two ways of measuring COVID intensity, we acknowledge that there are multiple alternative metrics, including those that reflect within-country variation or those modeled as linear or non-linear terms; other relevant measures might be related to government-level pandemic policies (e.g. related to physical distancing) or economic policies [1, 4, 5]. Our intention was not to evaluate a comprehensive set of pandemic-related measures in our analyses, but rather to offer up a set of tests to see whether our main associations of interest (i.e. between adult child educational attainment and pandemic outcomes) were to some extent context-dependent.

Additionally, there may be measurement error in exposure and outcome variables. We note that measurement error in parents' reports of the educational attainment of their adult children could be differential with respect to correlates of parental mental wellbeing (e.g. cognitive impairment). Furthermore, while educational attainment may be an important driver of contemporaneous SES, more proximate dimensions of adult child SES – including current income and wealth [52] – were not available. We also note we could not evaluate heterogeneity by adult child co-residence or consider whether patterns might be explained by co-residence dynamics [53], since the co-residence status of specific adult children was not evaluated during the pandemic waves. Finally, we note that these findings may not be generalizable across global settings with distinct social, economic, and health-related resources available during the pandemic, different average levels of intergenerational educational attainment, and distinct patterns of resource transmission between parents and their adult children.

Conclusion

In this population-based study of older European adults, adult child educational attainment measured before the pandemic was associated with older parents' psychosocial outcomes during the pandemic. Associations between adult child educational attainment and parents' psychosocial outcomes and perceptions of worsened psychosocial outcomes (vs. the pre-pandemic period) were found in countries experiencing higher COVID-19. Higher adult child educational attainment was also associated with other parental outcomes during the pandemic, albeit in unexpected ways: a lower risk of in-person contact with adult children and a higher risk of experience with COVID-19 infection. This is the first study, to our knowledge, to empirically consider the role of adult child educational attainment in shaping older parents' outcomes during the COVID-19 pandemic. Our findings suggest that adult child educational attainment is associated with the psychosocial wellbeing of older parents, particularly during periods of societal duress.

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12889-024-19425-6>.

Supplementary Material 1.

Supplementary Material 2.

Acknowledgements

Not applicable.

Authors' contributions

Jacqueline M. Torres and Karla Renata Flores Romero contributed to the study conception and design. Jacqueline M. Torres and Karla Renata Flores Romero analyzed the data. Yulin Yang performed the code review. The first draft of the manuscript was written by Karla Renata Flores and Jacqueline M. Torres and all authors commented on previous versions of the manuscript. All authors read and approved the final version of the manuscript.

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Availability of data and materials

The datasets used in this study are publicly available through the official website of The Survey of Health, Ageing, and Retirement in Europe (SHARE): <https://share-eric.eu/data/data-access>. We can provide our analyses code upon request to facilitate replication of our findings.

Declarations

Ethics approval and consent to participate

This study is a secondary analysis of publicly available and deidentified data. These analyses were determined to be exempt under UCSF Institutional Review Board #21–35802. Consent to participate was obtained from all participants as part of the original SHARE study. The present study is a secondary analysis of publicly available SHARE data.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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