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Childlessness and health in middle age and older adulthood: Evidence from Singapore ☆

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ABSTRACT

Health and well-being in mature adulthood are important concerns given the prevalence of individuals aging without children. We exploit two new instruments for childlessness—infertility and the number of childless siblings—and condition our analyses on a rich set of covariates including childhood health and financial status, to investigate the causal relationship between childlessness and health in middle age and older adulthood. Using a nationwide dataset of 1500 Singaporeans aged 50 and above, we show that OLS underestimates the negative effects of childlessness on health. We find that childlessness leads to higher likelihood of poorer self-reported health and mental distress. The results are robust to a battery of sensitivity analyses, including bounding the effects by relaxing the exclusion restrictions.

1. Introduction

The proportion of individuals aging without children is an increasing phenomenon worldwide. Nearly a quarter of women born in 1970–1974 in Germany and Spain are childless (Doepke et al., 2023). Meanwhile, 15.5 percent of women aged 50 and above are childless in Singapore (Ho et al., 2023), a number comparable to the 15 percent of childless women aged 55 and above in the United States (Valerio et al., 2021). As children have traditionally been a linchpin of support in old age, concerns have been raised about the health and well-being of those aging without children (McGarry, 2025). Nevertheless, the vast literature is quite mixed on whether the childless have better or worse health compared to parents in middle and older adulthood (Cwikel et al., 2006; Djundeva et al., 2018; Guo, 2014; Pertold-Gebicka, 2022; Stanca, 2012), possibly because past evidence tends to ignore potential selection

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into childlessness. For instance, there may be unobserved factors, such as childhood health, that drive both childlessness and health in mature adulthood, leading to omitted variable bias. In such a case, being childless does not necessarily *cause* poor health; instead, poor childhood health could both (i) lead to a lower probability of having children and (ii) result in adverse health outcomes in middle age and older adulthood. A few studies indeed find that the associations between childlessness and health change once socio-demographic factors are controlled for (Quashie et al., 2021; Zhang and Hayward, 2001), suggesting that the mixed results in past literature could potentially be due to unobserved confounders or selection effects.

To clearly identify the relationship between childlessness and health, an exogenous source of variation in childlessness status is needed. In this study, we exploit two new instrumental variables (IVs) for childlessness—infertility during reproductive years and the number of childless siblings—to explore the causal effects of childlessness on self-reported health and mental distress of middle aged and older adults. To this purpose, we recruited 1500 middle aged and older non-institutionalized Singaporeans (500 childless and 1000 parents) through random stratified sampling, and interviewed them on their fertility history, childhood and family background, socio-demographic characteristics, and health and mental well-being. Our rich dataset allows us to condition our analyses on childhood and youth characteristics including health at ages 0–16 and desire for children in one's 20s–30s, to account for some of the potential confounders discussed above. Specifically, we argue that our IVs are conditionally exogenous given the rich set of controls. Moreover, infertility and the number of childless siblings significantly increase the probability of being childless, indicative of relevant instruments. We further show that background characteristics of the respondents — such as gender, education, and childhood socioeconomic status — appear to be unrelated to the IVs. Furthermore, neither of the IVs correlate with chronic and non-chronic health conditions, suggesting that they are unlikely to directly affect human capital. Additionally, Sargan–Hansen J tests of overidentification cannot reject the null hypothesis that our overidentifying restrictions are valid. Thus, an indicator variable for infertility during one's reproductive years and the number of childless siblings are plausible instruments for childlessness. We relax the exclusion restrictions in robustness checks and bound the estimated effects.

To the best of our knowledge, this study is the first that explores the causal effects of childlessness on health and well-being in middle and late adulthood. A handful of studies have explored the causal link between the number of children and health in the United States, Europe, and developing countries (Bonsang and Skirbekk, 2022; Cáceres-Delpiano and Simonsen, 2012; Kruk and Reinhold, 2014; Priebe, 2020). These studies use twinning or sex composition of the first two children as IVs for the number of children, and thus, restrict their samples to parents with at least one child or two children, respectively. Such approach identifies the effect of having an additional child on health, conditional on reaching a certain parity.[1]

Bonsang and Skirbekk (2022) find that having three or more versus two children significantly reduces late-life cognitive functioning in European elderly, with IV estimates showing substantially larger negative effects than Ordinary Least Squares (OLS) estimates. Similarly, Cáceres-Delpiano and Simonsen (2012) demonstrate that fertility increases the likelihood of mothers suffering from high blood pressure and becoming obese, with IV estimates using multiple births revealing substantially larger adverse effects than OLS. Kruk and Reinhold (2014) find important non-linear effects and heterogeneity in fertility's impact on elderly depression. OLS showed no consistent relationship but IV estimates revealed that the transition from two to three children (but not from one to two children) leads to worse mental health. These studies suggest that decreased financial resources from having more children may be a contributor to lower health and well-being, particularly for the transition from two to three children or more. Conversely, Priebe (2020) provide contrasting evidence from developing countries, where OLS estimates suggested negative associations between family size and subjective well-being, but IV estimates revealed positive effects with complete sign reversal and much larger magnitudes. That study suggests that having a third child increases life satisfaction primarily through enhanced social connectedness.

Complementing the literature that identified the effect of having an additional child conditional on already being a parent (intensive fertility margin) in the Western or developing world, we are interested in the effect of childlessness per se (extensive fertility margin) in an Asian setting. Childlessness is very salient in our context given the centrality of children as a source of support to parents in old age in Singapore (Ho, 2022). For instance, the Maintenance of Parents Act allows Singaporean parents to sue children who fail to provide for them. This aligns with the prominent norms of filial piety across Asia, where parents still rely heavily on adult children for financial, instrumental, or emotional support (Guo and Zhang, 2020; Jayachandran, 2015). In the absence of offspring, the health and well-being of mature adults may be at risk due to a lack of support typically provided by adult children. Given its rapidly aging population and ultra-low fertility rates, Singapore provides a compelling setting to investigate the implications of childlessness on the health of middle aged and older adults.

The context underlying our research question extends well beyond Singapore given rising rates of childlessness worldwide (Doepke et al., 2023) and prevalent norms of familism across diverse regions. Cross-national evidence shows substantial reliance on family care across developed countries, with the majority of care recipients receiving help from family members even in countries with extensive formal care systems (Ho, 2025; McGarry, 2025). The pathways through which childlessness affects health — reduced intergenerational support and limited social connections — thus operate across diverse cultural and economic settings. Our focus on childlessness and health of middle-aged and older adults therefore addresses a globally relevant policy concern as societies worldwide navigate the intersection of declining fertility and population aging.

Our two-stage least squares (2SLS) strategy exploits infertility during reproductive years and the number of childless siblings as instruments, and captures a different Local Average Treatment Effect (LATE) than the one associated with twinning or gender composition of children as instruments. In the case of twinning or sex composition, the LATE captures the impact of having children

[1] A budding literature also seeks to estimate the effects of parenthood on mental health using an event study design (Ahammer et al., 2023; Shi and Shen, 2023). These studies focus on parents only and examine the trends in mental health outcomes before and after the birth of the first child (the "event").

on compliers with *higher* than initial desired fertility. For instance, parents who desired two children may end up with a third child either because of twinning at the second birth (unexpected increase in fertility) or due to wanting an additional child of the opposite gender when the first two were of the same gender (desired increase in fertility due to an exogenous reason). In contrast, in the case of infertility and childless siblings, the LATE captures the impact on compliers with *lower* than initial desired fertility. For example, parents who desired children may end up with no children due to difficulty in conceiving (unexpected decline in fertility) or intra-generational correlations in fertility (decline in fertility due to an exogenous reason).

A few studies have exploited infertility as an IV for the number of children to explore the effect of parenthood or family size on labor supply (Agüero and Marks, 2008, 2011; Bratti et al., 2020; Lundborg et al., 2017; Miller, 2011). Addison et al. (2020) further exploit siblings' fertility timing as IV to estimate the effects of one's own fertility timing on occupational mismatch and there is well-documented evidence on intra-generational correlations in fertility (Balbo and Barban, 2014; Lyngstad and Prskawetz, 2010; Raab et al., 2014). We discuss the relevance and validity of infertility and the number of childless siblings as IVs in the context of examining the effects of childlessness on health in mature adulthood while controlling for a rich set of childhood health and socio-economic characteristics below.

Our results show that the childless have worse health than parents in middle and older adulthood. Without accounting for endogeneity, the childless are 7 percentage points more likely to report poor health and 8.2 percentage points more likely to report mental distress from OLS estimation. 2SLS estimation confirms the sign of the effects but the marginal effects are much larger. From IV estimates, the childless are 46.1 percentage points more likely to report poor health and 45.6 percentage points more likely to report mental distress.[2] The negative effects of childlessness status on health and well-being of middle aged and older Singaporeans are robust to a battery of sensitivity analyses, including accounting for selection of unobservables à la Oster (2019) and relaxing the exclusion restrictions following Nevo and Rosen (2012).

The rest of the paper is organized as follows. Section 2 presents the data and descriptive statistics of childless individuals and parents. Section 3 introduces our empirical strategy and instrument validity checks. Section 4 discusses the health consequences of childlessness in middle and older adulthood, presents sensitivity analyses, and discusses potential mechanisms behind the results. Section 5 concludes.

2. Data and descriptive statistics

2.1. Survey data

We conducted a nationwide survey, Childless Aging in Singapore (CAS), comprising of 1500 Singaporeans and permanent residents aged 50 and above, with oversampling of childless individuals. The sample was randomly selected from a nationally representative listing of residential households with at least one member aged 50 and above. We recruited one individual aged 50+ per household, who was either childless (i.e., with no living children) or a parent.[3] In total, 1000 parents and 500 childless individuals aged above 50 were interviewed. The survey was conducted in 2022 through face-to-face interviews in respondent homes lasting approximately one hour.

Aside from the oversampling of childless individuals, our sample is quite representative of national averages. From Appendix Table A1, socio-demographic variables such as age, education, and being of Chinese ethnicity are comparable between our sample and those aged 50 and above from the 2020 Census (SingStat, 2021). While the proportion of those currently married is lower in our sample than in the census, this is predominantly driven by the higher proportion of never married childless individuals in our sample. When we focus on parents only, the proportion of currently married individuals stand at 73% in our sample, a number comparable to the 72% of currently married individuals in the census. For the sake of comparison, we also report statistics from two large-scale nationwide surveys of middle aged and older Singaporeans and permanent residents—the Singapore Life Panel (SLP) and the Retirement and Health Study (RHS), although we note that the two surveys are not exactly comparable to the CAS due to some differences in the target age groups (Ho et al., 2023; Ng et al., 2022; Vaithianathan et al., 2021).

Besides the fact that socio-demographic characteristics of the CAS sample align with that of the 2020 census for those aged 50 and above, our dataset is particularly suited to study our research question on the causal effects of childlessness on health and mental well-being of mature adults. First, the data contains rich information on fertility history, childhood and family background, socio-demographic characteristics, and health and mental well-being outcomes. Such detailed information enables us to not only control for additional confounders not controlled for in past literature but also to employ novel instruments for causal identification. Second, since the respondents are aged 50 and above, they are most likely to have completed their fertility decisions and are thus permanently childless (Baetschmann et al., 2016). Third, the high proportion of childless individuals surveyed enables us to have strong statistical power for analysis. Nevertheless, in sensitivity analyses, we also reweigh the childless in our sample to be comparable to those of the SLP, and show that our results are robust to such re-weighting.

[2] The 5–6 times larger estimates from 2SLS compared to OLS align with past literature on the effects of caesarean section on mental health, whereby Tonei (2019) finds 2SLS estimates to be six times larger than OLS estimates. As discussed above, prior fertility-health literature also shows similar patterns with IV estimates at least 6 times larger than OLS, and frequent sign reversals where OLS and IV point in opposite directions, suggesting systematic selection bias (Bonsang and Skirbekk, 2022; Cáceres-Delpiano and Simonsen, 2012; Kruk and Reinhold, 2014; Priebe, 2020).

[3] Respondents with step children were excluded from interview as they constitute a very small proportion ($\approx$3%) of individuals aged 50 and above in Singapore (Ho et al., 2023). If a household had multiple members above 50 years old including a childless member, the childless member was selected for interview. If a household had multiple childless members aged 50+, one childless member was randomly selected for interview. Finally, if a household had multiple members aged 50+ and no one was childless, one member was randomly selected for interview.

Table 1
Descriptive statistics for parents and childless individuals.

	Parent		Childless		Difference
	Mean/Prop. (1)	S.D. (2)	Mean/Prop. (3)	S.D. (4)	p-value (5)
Outcome variables					
Poor self-reported health	0.347	0.476	0.422	0.494	0.005
Mental distress	0.095	0.293	0.150	0.358	0.002
Socio-demographics					
Female	0.583	0.493	0.593	0.492	0.723
Age in years	65.041	8.798	62.862	7.920	0.000
Primary or lower education	0.338	0.473	0.272	0.445	0.010
Secondary education	0.340	0.474	0.331	0.471	0.746
Junior college or higher	0.322	0.468	0.397	0.490	0.005
Currently married	0.734	0.442	0.218	0.413	0.000
Separated/Divorced	0.099	0.298	0.074	0.262	0.122
Widowed	0.165	0.371	0.039	0.194	0.000
Never married	0.002	0.045	0.669	0.471	0.000
Housing: ≤3room HDB	0.277	0.448	0.568	0.496	0.000
Housing: 4–5 room HDB	0.361	0.481	0.228	0.420	0.000
Housing: Private or other	0.362	0.481	0.204	0.403	0.000
Chinese	0.760	0.427	0.827	0.378	0.003
No. of siblings	5.167	2.929	4.465	2.688	0.000
Youth variables					
Poor health in childhood	0.080	0.272	0.086	0.281	0.692
Not financially well-off in childhood	0.859	0.349	0.854	0.354	0.809
Desire for children in 20–30s	0.825	0.380	0.420	0.494	0.000
Family genetics and dynamics					
Parent in poor health	0.404	0.491	0.407	0.492	0.897
Not close to parents/siblings in childhood	0.345	0.476	0.452	0.498	0.000
Instrumental variables					
Infertility	0.196	0.397	0.185	0.389	0.610
Failed pregnancy	0.128	0.334	0.123	0.329	0.798
Sought medical help	0.086	0.281	0.082	0.275	0.788
Diagnosed infertile	0.021	0.145	0.029	0.167	0.379
Physically not possible to conceive	0.060	0.238	0.072	0.259	0.377
No. of childless siblings	0.595	0.955	0.893	1.229	0.000
No. of observations	983		486		

Notes: Means or proportions and standard deviations are reported. HDB stands for housing development board, government subsidized flats where the majority of Singaporeans reside. The *p*-values of the differences in means or proportions from t-tests or proportion tests, respectively, are reported in Column (5).

2.2. Analytical sample

To get the analytic sample, we dropped 31 individuals with missing responses to any of the variables used in our analyses (≈2.07% of the sample), leaving us with 1469 individuals: 983 parents and 486 childless individuals. Table 1 presents descriptive statistics of the main outcomes, explanatory variables and IVs used in our analyses. On average, 58.6% of our sample are females and respondents are aged in their early to mid-60s. The childless display some expected differences in characteristics compared to parents. In particular, those without children tend to be younger, tend to have higher education, are less likely to be married, are more likely to live in a smaller house, more likely to be of Chinese ethnicity (as opposed to being of Malay, Indian or other ethnicity), and tend to have fewer siblings compared to parents ($p < .01$).

We additionally asked respondents about their childhood and family background (''Youth'') characteristics. These include an indicator variable that takes unity if the respondent reported having fair, poor, and very poor health when they were growing up (up to the age of 16), and zero otherwise. Around eight to nine percent of respondents reported having had fair, poor, or very poor health in childhood. We also construct an indicator variable that takes unity if the respondent reported that their family's financial condition was average, below average, or way below average when growing up. Approximately, 86% of respondents report having been financially average or not well-off. Finally, we asked respondents about the ideal number of children they desired when they were in their 20s and 30s. Around 82.5% of parents and 42% of childless individuals reported that they desired children when they were younger although many did not have a specific number that they desired. Unsurprisingly, childless individuals had a lower desire for children compared to parents in their 20s–30s, suggesting that there may be some selection into childlessness.

2.3. Health measures

Our primary outcomes of interest are poor self-reported health and mental distress. The self-reported health measure is based on the typical survey question ''How would you rate your current health status? Would you say your health status is…''. It categorizes general health status on a five-point scale, ranging from 1 = very good to 5 = very poor. Such self-rated health measure has been shown to be a very good predictor of other health outcomes, such as subsequent use of medical care or mortality (Idler and Benyamini, 1997). The distribution of the self-reported health for parents and childless individuals is presented in the top panel of Appendix Figure A1. We construct a binary indicator that takes unity if the respondent reported fair, poor, or very poor health. From Table 1, 42.2% of childless respondents reported fair, poor, or very poor self-reported health compared to 34.7% of parents. The difference between the two groups is statistically significantly different ($p < .01$).

To define mental distress, we use the 10-item Center for Epidemiological Studies-Depression (CES-D) scale, a well-validated scale that captures the frequency with which respondents report experiencing a series of depressive symptoms during the past one week (Bahal et al., 2023; McInerney et al., 2013; Radloff, 1977). The CES-D 10 scale was developed by Andresen and Malmgren (1994) to screen depression among older adults and has been well-validated (Fu et al., 2022), including among older Singaporeans (Lee and Chokkanathan, 2008) and in economic studies (Huang et al., 2013; Singhal, 2019; Wang et al., 2023) of middle-aged and older adults. The items include statements such as "I was happy" and "I felt lonely" (see Appendix Table A2 for all 10 statements). Respondents were asked to indicate how often they experienced each of these feelings and were scored on a 4-item scale: 0 = rarely or none of the time (less than 1 day), 1 = some or a little of the time (1–2 days), 2 = occasionally or a moderate amount of time (3–4 days), or 3 = all of the time (5–7 days). The scores to each statement were then summed to obtain an overall score (answers to positive statements are reverse coded), which ranges from 0 to 30. The distribution of the raw CES-D scores for parents and childless individuals is presented in Figure A1. An individual is said to suffer from mental distress if he/she has a score of 10 or greater, which aligns with the optimal cut-off used by earlier studies to define mental distress. From Table 1, 15% of childless individuals and 9.5% of parents experienced mental distress in the week prior to interview. The difference between the two groups is statistically significantly different at the 1% level.

3. Empirical strategy

3.1. Identification issues

Consider the following linear probability model:

$$\text{Poor Health}_i = \alpha_0 + \alpha_1 \text{Childless}_i + \boldsymbol{\alpha_2}'\mathbf{X}_i + u_i, \quad (1)$$

where Poor Health_i denotes poor self-reported health or mental distress of individual i. Childless_i is a binary indicator of childlessness status that takes unity if the individual is childless, and 0 otherwise; and $\mathbf{X}_i$ is a vector of covariates including the socio-demographics and youth variables described in Table 1 and Section 2.2.[4] Robust standard errors are estimated in all specifications to account for potential heteroscedasticity. We also account for multiple hypothesis testing using Anderson's sharpened q-values.

Our coefficient of interest is α_1, which captures the effect of childlessness status on health. However, OLS estimates of α_1 are likely to be biased due to the presence of unobserved variables in u_i, that may correlate with both the outcome variable, Poor Health_i, and the predictor of interest, Childless_i. For instance, consider a situation where poor childhood health or high desire for children are omitted from regression (1). Poor childhood health could imply a higher likelihood of remaining childless due to infertility issues (u_i is positively correlated with Childless_i), and also imply poorer health in middle and late adulthood (u_i is positively correlated with Poor Health_i). OLS would then overestimate α_1. Conversely, those who desire children may also anticipate poorer health in old age. They may thus be less likely to be childless (u_i is negatively correlated with Childless_i) and face a higher risk of poorer health in middle and late adulthood (u_i is positively correlated with $Poor\ Health_i$). In such case, OLS would underestimate α_1.

Our rich dataset helps mitigate such concerns regarding omitted variable bias by enabling us to control for a variety of socio-demographic and youth attributes—including health, socio-economic condition, and desire for children when young, which are usually not controlled for in prior literature due to data availability. We thus consider two empirical specifications, one that controls for socio-demographics and another that additionally controls for youth variables, as described in Table 1. Nevertheless, there may still be other unobserved factors such as personality traits that correlate with both Poor Health_i and Childless_i, and that we cannot control for. For example, those with more individualistic self-caring personalities or with higher intelligence may prefer to invest in themselves than in others, and thus be more likely to remain childless (u_i is positively correlated with Childless_i) and face a lower risk of poor health in mature adulthood (u_i is negatively correlated with Poor Health_i). Indeed, past literature has found that those with more independence or intelligence are more likely to be childless (Avison and Furnham, 2015; Kanazawa, 2014). There is also evidence that those with higher cognitive ability tend to have lower early mortality rates (Calvin et al., 2011). Thus, OLS could still underestimate α_1. To assess the causal effect of childlessness on the health of middle aged and older individuals, we therefore use an indicator of infertility during reproductive years and the number of childless siblings as IVs for childlessness, which condition on a rich set of covariates.

[4] Sensitivity analyses (i) using a more granular definitions of our covariates and (ii) additionally controlling for the education of the respondents' fathers as well as the respondents' occupation in their 30s and their work status yielded very similar results and inferences (available upon request).

Table 2
First-stage results: Associations between IVs and childlessness.

Dependent variable	Childless	
	(1)	(2)
Infertility	0.139***	0.149***
	(0.026)	(0.026)
	[0.001]	[0.001]
No. of childless siblings	0.018**	0.016**
	(0.008)	(0.008)
	[0.021]	[0.024]
Youth variables	No	Yes
Kleibergen–Paap Wald rk F-statistic	18.080	19.700
Kleibergen–Paap rk LM p-value	0.000	0.000
Dep. var mean	0.331	0.331
Observations	1469	1469

Notes: The above specifications control for socio-demographic characteristics—gender, age, education level, marital status, type of residence, race, and number of siblings. Youth variables include childhood health status, childhood socioeconomic status, and whether the individual had a desire for children when young. Anderson's sharpened q-values from the test of the two coefficients being equal to zero in all of the columns are reported in square brackets. Robust standard errors are given in parentheses.
*** p < .01, ** p < .05, * p < .10.

3.2. Instrumental variable strategy

The first and second-stage regressions of our 2SLS models are, respectively:

$$\text{Childless}_i = \beta_0 + \beta_1 \text{Infertility}_i + \beta_2 \text{Childless Siblings}_i + \boldsymbol{\beta_3}'\mathbf{X}_i + \varepsilon_i, \tag{2}$$

$$\text{Poor Health}_i = \alpha_0 + \alpha_1 \widehat{\text{Childless}}_i + \boldsymbol{\alpha_2}'\mathbf{X}_i + u_i. \tag{3}$$

$\widehat{\text{Childless}}_i$ is the predicted value of Childless_i from the first stage regression. Childlessness status is instrumented by two variables: (i) Infertility_i and (ii) $\text{Childless Siblings}_i$. Infertility_i is a binary variable that takes unity if individual i and/or his/her spouse faced difficulties in conceiving, and 0 otherwise. In particular, the infertility indicator takes unity if the respondent answered in the affirmative to any of the following questions: (a) "Was there ever a time when you and/or your spouse were trying to get pregnant but did not conceive within at least 12 months?" (b) "Have you and/or your spouse ever sought professional help/medical intervention for issues related to difficulties in conceiving?" (c) "Have you and/or your spouse ever been diagnosed by a doctor with infertility?", or the respondent answered negatively to (d) "As far as you know, when you were younger, was it physically possible for you or your spouse to have a baby?" We perform robustness checks on alternative definitions of infertility below. $\text{Childless Siblings}_i$ represent the number of childless siblings individual i has.

Relevance. We examine relevance here (strength of the instruments) and discuss validity (the exclusion restrictions) below. Infertility has been used as an instrument in past studies to examine the causal effects of parenthood or family size on labor supply (Agüero and Marks, 2008, 2011; Bratti et al., 2020; Lundborg et al., 2017; Miller, 2011). Specifically, infertility provides a natural experiment whereby nature bounds family size, irrespective of a person's background. It is, therefore, expected that infertility would be positively associated with childlessness. Additionally, there is well-documented evidence on positive intra-generational correlations in fertility, possibly due to common family genetics, background, or preferences (Addison et al., 2020; Balbo and Barban, 2014; Lyngstad and Prskawetz, 2010; Raab et al., 2014). Besides infertility during reproductive years, we thus leverage the number of childless siblings as a novel instrument to identify the causal effects of childlessness status on the health of middle aged and older adults.

First stage regressions of Eq. (2) indicate that the instruments are highly relevant to childlessness status. From Table 2, infertility increases the likelihood of being childless by 14 to 15 percentage points while an additional childless sibling is associated with a 1.6 to 1.9 percentage points increase in the probability of being childless. The Kleibergen–Paap Wald F-statistics—which in the case of a single endogenous regressor, is equivalent to a standard F-test with robust standard errors—is reasonably large at 18.4 to 20, suggesting that the instruments are not weak. The Kleibergen–Paap *rk* LM test also always strongly rejects the null hypothesis of underidentification, which provides greater confidence in the relevance of our instruments.

Validity. For the IVs to be valid, they have to satisfy the exclusion restrictions and be orthogonal to u_i. In other words, the IVs must not be directly correlated with $PoorHealth_i$. We provide several pieces of evidence that point in that direction including balance checks on observables and unobservables, and argue that our instruments are exogenous conditional on our rich set of control variables including socio-demographics and youth variables.

While there is a well-known positive correlation between infertility and age, past literature suggests that background characteristics such as father's social status and lifestyle factors, for example, smoking are uncorrelated with infertility (Agüero and Marks, 2008, 2011; Bratti et al., 2020). We provide supplementary evidence to this literature and also show that the number of childless

Table 3
Instrument validity: Balance on background characteristics.

	Infertility (1)	No. of childless siblings (2)
Female	0.037	0.011
	(0.033)	(0.013)
Primary or lower education	−0.008	−0.003
	(0.030)	(0.011)
Secondary education	0.006	0.002
	(0.032)	(0.012)
Junior college or higher	0.002	0.001
	(0.031)	(0.012)
Chinese	−0.051*	0.014
	(0.030)	(0.010)
Never married	−0.204***	0.047***
	(0.021)	(0.012)
Currently married	0.150***	−0.041***
	(0.031)	(0.013)
Divorced/Separated	0.034*	0.003
	(0.021)	(0.008)
Widowed	0.020	−0.006
	(0.020)	(0.007)
No. of siblings	0.025	0.592***
	(0.194)	(0.066)
Poor health in childhood	0.076***	−0.000
	(0.022)	(0.007)
Financially not well-off in childhood	−0.019	−0.003
	(0.022)	(0.009)
Desire for children in 20s–30s	0.135***	−0.031***
	(0.029)	(0.012)
Any chronic condition	−0.062*	0.010
	(0.033)	(0.012)
Any non-chronic condition	−0.014	−0.003
	(0.019)	(0.007)
Parent in poor health	0.030	−0.005
	(0.033)	(0.012)
Not close to parents/siblings in childhood	0.052	0.028**
	(0.033)	(0.012)
Dep. var mean	0.193	0.694
No. of observations	1469	1469

Note: Estimates are from separate regressions of each background characteristic on each instrument that control for age fixed effects. "Any chronic condition" refers to diabetes, high blood pressure, cholesterol, kidney failure, respiratory problem, alzheimer, arthritis and osteoporosis. "Any non-chronic condition" refers to heart attack, heart failure, chest pain, and stroke. "Parent in poor health" includes premature death of either parent (died at 60 or earlier) or whether any living parent has an ADL/IADL limitation.
*** $p < .01$, ** $p < .05$, * $p < .10$.

siblings is not correlated with most pre-determined background characteristics. To do so, we follow Agüero and Marks (2011) and regress the instruments on background traits, while controlling for age fixed effects. From Table 3, characteristics such as gender, education and childhood socioeconomic status do not seem to correlate with the IVs. Conversely, as expected, poor childhood health positively correlates with infertility. Desire for children is positively associated with infertility—possibly, because those who desire and thus attempt to have children may be better aware of their infertility—and negatively associated with the number of childless siblings, which is consistent with intra-generational correlation in fertility preferences. The total number of siblings is also positively associated with the number of childless siblings. We control for poor childhood health, desire for children when young, and the total number of siblings in our analyses.

A potential concern is that our instruments may directly impact self-reported health and mental distress among middle aged and older adults. For instance, those who are infertile and underwent in-vitro fertilization (IVF) treatment may be more depressed due to the toll that such treatment exercises on one's body. Nevertheless, using an event study design, Lundborg et al. (2017) finds no evidence that women undergoing IVF treatment are more likely to get depressed, suggesting that fertility treatment per se does not impact mental well-being. Moreover, as neither of the IVs correlate with education or chronic and non-chronic conditions at the 5% level (see Table 3), it is unlikely that they directly affect human capital in mature adulthood.[5]

[5] Any chronic condition is marginally negatively correlated with infertility ($p < .10$). Such correlation, if valid, would imply that our 2SLS estimates are attenuated, and thus provide lower bound estimates. See Appendix Tables A3 and A4 for robustness checks without age fixed effects and for tests of differences in means.

Table 4
Impact of childlessness on health outcomes.

Dependent variable	Poor Self-Reported Health				Mental Distress			
	OLS		2SLS		OLS		2SLS	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Childless	0.053	0.071*	0.611***	0.461**	0.069**	0.082***	0.531***	0.456***
	(0.042)	(0.042)	(0.229)	(0.213)	(0.031)	(0.032)	(0.179)	(0.165)
	[0.057]	[0.043]	[0.020]	[0.021]	[0.021]	[0.020]	[0.020]	[0.020]
Youth variables	No	Yes	No	Yes	No	Yes	No	Yes
Overid p-val.	–	–	0.452	0.243	–	–	0.748	0.958
Dep. var mean	0.372	0.372	0.372	0.372	0.113	0.113	0.113	0.113
Observations	1469	1469	1469	1469	1469	1469	1469	1469

Notes: "Poor Self-Reported Health" takes unity if the individual reports self-reported health as fair/moderate, poor, or very poor, and 0 otherwise. "Mental Distress" takes unity if the CES-D score of an individual is greater than or equal to 10, and 0 otherwise. The above specifications control for socio-demographic characteristics—gender, age, education level, marital status, type of residence, race, and number of siblings. "Youth variables" include childhood health status, childhood socioeconomic status, and whether the individual had a desire for children in youth. Anderson's sharpened q-values from the test of "Childless" coefficient being equal to zero in all of the columns are reported in square brackets. *P*-values from Sargan–Hansen tests that the overidentifying restrictions valid are reported. Robust standard errors in parentheses.
*** p < .01, ** p < .05, * p < .10.

There may nevertheless be unobserved lineal characteristics such as genetics or family dynamics that correlate both with our instruments and health in adulthood. Besides controlling for socio-demographics and youth variables in our analyses, we perform sensitivity analyses that control for additional proxies of family genetics or dynamics below. Specifically, we control for parental health (death of parents at the age of 60 or earlier or parents having limitations in performing activities of daily living (ADL) / instrumental ADL) and emotional proximity to close family members (could confide in father or mother in childhood, parents had good relationship in childhood, close relationship to siblings in childhood) and find the results to be robust to such controls.

To further mitigate concerns about potential correlations between the IVs and unobservable health characteristics, we follow the approach by Tonei (2019) and use the residuals obtained from a regression of each of the IVs on socio-demographics and youth variables. Specifically, we regress the residuals on a proxy for unobservable characteristics of health, an indicator of whether the respondent ever smoked, which is a common correlate of health (OECD, 2010). From Appendix Table A5, there are no significant associations between the residuals and the proxy for unobserved characteristics, suggesting that remaining variations in the IVs are orthogonal to health unobservables.

Finally, we report Sargan–Hansen J-tests of overidentification from 2SLS estimation. Across all specifications, we cannot reject the null hypothesis that the overidentifying restrictions are valid, which gives us greater confidence in our IVs.

4. Results

4.1. Main results

Table 4 reports results from OLS Eq. (1) and 2SLS Eq. (3) for the outcomes of poor self-reported health and mental distress. We find that the childless have higher likelihoods of poor self-reported health and mental distress compared to parents across all specifications. Specifically, from columns (1) and (5), when we only control for socio-demographic characteristics in OLS regressions, we find that being childless is associated with a 5.3 and 6.9 percentage points increase in the likelihood of poor health and mental distress, respectively. The former association is not statistically significant while the latter association is statistically significant at the 5% level. From columns (2) and (6), when we additionally control for youth variables, we find that the magnitudes of the respective effects increase to 7.1 and 8.2 percentage points and the statistical significance also increases to 10% and 1%, respectively.

Turning to the second stage of the 2SLS results, we find that childlessness status increases the probability of poor self-reported health by 46.1 to 61.1 percentage points. Meanwhile, being childless increases the probability of being mentally distressed by 45.6 to 53.1 percentage points. The higher effects under 2SLS suggest that OLS underestimates the effects of being childless on the likelihood of poor self-reported health and mental distress. As discussed in Section 3, this could possibly be driven by unobserved characteristics such as having an individualistic self-caring personality or higher intelligence that simultaneously drives up the likelihood of remaining childless and drives down the risk of poor health in middle and older adulthood. These results are robust to a battery of sensitivity analyses discussed below.

4.2. Sensitivity analyses

4.2.1. Robustness checks

Ever married individuals only. The results remain statistically and economically significant when restricting the analysis to ever-married individuals. Childlessness continues to increase the likelihood of poor self-reported health and mental distress within this subsample (Table 5). The persistence of large, significant effects among the ever-married demonstrates that our findings reflect childlessness effects beyond simple partnership status. While marriage and childbearing are closely linked in Singapore, the health

Table 5
Impact of childlessness on health outcomes: Ever married individuals only.

Dependent variable	Poor Self-Reported Health				Mental Distress			
	OLS		2SLS		OLS		2SLS	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Childless	0.061	0.069	0.618***	0.484**	0.062**	0.071**	0.327**	0.262*
	(0.043)	(0.043)	(0.229)	(0.215)	(0.032)	(0.032)	(0.160)	(0.151)
	[0.084]	[0.084]	[0.059]	[0.073]	[0.073]	[0.073]	[0.073]	[0.084]
Youth variables	No	Yes	No	Yes	No	Yes	No	Yes
KP LM statistic	–	–	29.674	32.350	–	–	29.674	32.350
KP Wald F statistic	–	–	16.370	17.658	–	–	16.370	17.658
Overid p-val.	–	–	0.485	0.273	–	–	0.940	0.786
Dep. var mean	0.353	0.353	0.353	0.353	0.103	0.103	0.103	0.103
Observations	1142	1142	1142	1142	1142	1142	1142	1142

Notes: "Poor Self-Reported Health" takes unity if the individual reports self-reported health as fair/moderate, poor, or very poor, and 0 otherwise. "Mental Distress" takes unity if the CES-D score of an individual is greater than or equal to 10, and 0 otherwise. The above specifications control for socio-demographic characteristics—gender, age, education level, marital status (currently married versus widowed versus separated), type of residence, race, and number of siblings. "Youth variables" include childhood health status, childhood socioeconomic status, and whether the individual had a desire for children in youth. Anderson's sharpened q-values from the test of "Childless" coefficient being equal to zero in all of the columns are reported in square brackets. P-values from Sargan–Hansen tests that the overidentifying restrictions valid are reported. Robust standard errors in parentheses. *** p < .01, ** p < .05, * p < .10.

consequences of childlessness operate independently of marital status, as evidenced by the robustness of estimates in this more homogeneous population.

Family genetics and dynamics. Our above argument is that conditional on the rich set of demographic and socio-economic characteristics, including childhood health and the total number of siblings, infertility and the number of childless siblings make plausible instruments for childlessness. To further mitigate concerns that common family genetics or dynamics may simultaneously correlate with the IVs and health in mature adulthood, we perform sensitivity analyses where we control for parental health and emotional proximity to immediate family members, as described in Section 3. As can be seen from Appendix Tables A6 and A7, the results are robust to such controls.

Alternative specifications. As our main outcome variables are discrete, it is a somewhat open ended question whether we should rely on the linear model or on a non-linear model (Angrist and Pischke, 2009). Therefore, we re-estimate the empirical models using a probit specification and maximum likelihood estimation. The marginal effects from such models are reported in Appendix Table A8. The results and inferences are very similar to those reported in Table 4. Additionally, we present results from analyses using self-reported health and CES-D score as continuous outcomes in Appendix Table A9. The results are qualitatively similar to those in Table 4. Once again, we find that being childless leads to poorer self-reported health and mental distress, and that the magnitudes are larger from 2SLS than from OLS estimation.

Alternative samples. As individuals with adopted children may differ from those with biological children—for instance, in the strength of reliance on adult children for old age support, we drop 21 individuals with adopted children from the sample. From Appendix Table A10, the impacts of childlessness on health are very similar to those in Table 4. Additionally, we oversample the childless in our survey, which has the advantage of improving statistical power but the disadvantage of making the proportion of childless individuals non-nationally representative. We thus re-weight the childless in our sample using the proportion of childless in the large scale nationwide SLP. This takes into account the fact that 11 percent of men and 15 percent of women are childless (Ho et al., 2023). We derive the sample weights for parents and childless individuals by dividing the SLP proportion by CAS proportion separately for men and women. The results using the sample weights are given in Table A11. The adverse impact of childlessness on self-reported health and mental distress continue to be robust, albeit with some (expected) loss of statistical power.

Alternative definitions of infertility. As described in Section 3, a respondent is identified as someone who had infertility problems based on four different questions related to difficulty in conceiving. In Appendix Table A12, we combine three of these four questions at a time to construct four different measures of infertility. The results are once again robust and similar to those reported in Table 4. Moreover, as those who desired to have children may be better aware of their infertility, we conduct sensitivity analyses by limiting the sample to those who desired children when young. The results reported in Appendix Table A13 are robust. Similarly, because never married individuals may not be aware of their infertility, most did not answer the questions on infertility. To mitigate such issue, we control for an indicator that takes unity if the answers to the infertility questions are missing (Appendix Table A14). The inferences once again indicate that childlessness is associated with higher likelihoods of poor health.

4.2.2. Bounding the effects of childlessness

Accounting for selection on unobservables using selection on observables. We follow Oster (2019) to bound the effects of childlessness on health using selection on observed variables as a guide to selection on unobserved variables in the OLS model (1). This technique builds on the observation that omitted variable bias is often considered to be limited if a coefficient is stable when observed

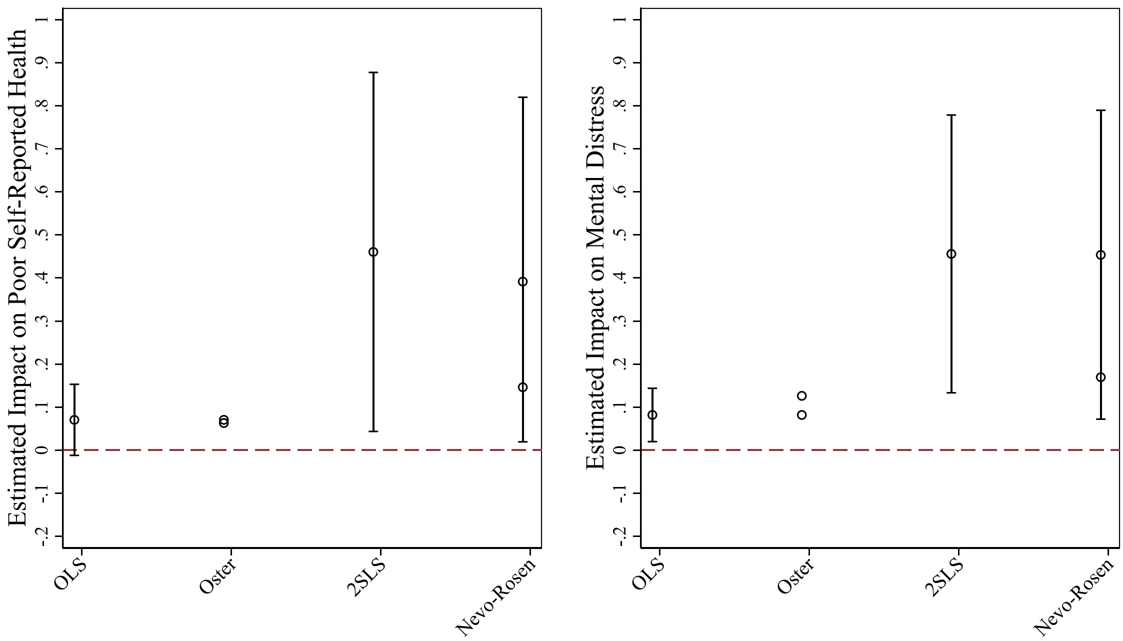

Fig. 1. Bounding the effects of childlessness on health.
Note: An individual is defined to have 'poor self-reported health' if he/she reported fair/moderate, poor or very poor health. An individual is defined to be suffer from mental distress if the CES-D score is 10 or higher. 95% confidence intervals are reported for OLS 2SLS, and NR bounds.

covariates are added in a regression. To derive the bias-adjusted treatment effect, we adopt the following recommended assumptions from Oster (2019): (a) there is equal selection on observables and unobservables, and (b) the attainable R^2 in a regression with a full set of (observable and unobservable) covariates, R_{max}, is equal to 1.3 times the estimated R^2 from a regression with observable covariates only, $\hat{R}_{OLS}$, as per specification (1). The identified set then lies between the OLS estimate from (1), $\hat{\alpha}_1^{OLS}$, and the bias-adjusted estimate, $\alpha_1^* = \hat{\alpha}_1^{OLS} - \left[\hat{\alpha}_1^0 - \hat{\alpha}_1^{OLS}\right] \frac{R_{max} - \hat{R}_{OLS}}{\hat{R}_{OLS} - \hat{R}_0}$, where $\hat{\alpha}_1^0$ and $\hat{R}_0$ are, respectively, the estimated treatment effect and R^2 from a regression of health on childlessness status without any controls. Fig. 1 plots OLS estimates as well as the bounds à la (Oster, 2019). From the figure, the identified sets of α_1 are fairly tight and are consistent with our inference that being childless is associated with poorer health.

Relaxing the exclusion restriction. For the IVs to be valid in the 2SLS model (2)–(3), they have to satisfy the exclusion restrictions and be orthogonal to u_i conditional on $\mathbf{X}_i$. As discussed in Section 3, our IVs do not correlate with most pre-determined background characteristics, and we also control for rich socio-demographic and youth variables in our analyses. Nevertheless, we perform one additional robustness check and relax the assumption of orthogonality to estimate bounds on the effects of being childless on health for more compelling evidence. Specifically, we follow the method proposed by Nevo and Rosen (2012), which allows the IVs to correlate with the error term in the second stage regression. Under the relatively weak assumptions that (a) the correlation between each IV and u_i has the same sign as the correlation between the endogenous regressor and u_i and (b) each IV is less endogenous than the endogenous regressor, we can derive informative bounds for the causal effects of childlessness on health based on set identification.

In our context, we argue that $\text{Childless}_\text{i}$ is negatively correlated with u_i because there may exist unobserved traits such as self-caring individuality that simultaneously drives up the probability of being childless and drives down the likelihood of poor health. This is consistent with the downward bias from OLS estimates compared to 2SLS estimates in Table 4. We now turn to the two above assumptions. For assumption (a), we posit that $\text{Infertility}_\text{i}$ positively correlates with u_i, that is, those who are infertile, may be less healthy in general. For this IV to satisfy assumption (a), we thus re-specify the instrument as $-\text{Infertility}_\text{i}$ such that there is also a negative correlation between $-\text{Infertility}_\text{i}$ and u_i. Conversely, we conjecture that $\text{Childless Siblings}_i$ negatively correlates with u_i, possibly because those with more childless siblings may take better care of themselves such that they are less likely to have poor health. For instance, Kim et al. (2024) find that childless individuals are more likely to take care of older parents than non-childless individuals. Thus, those with more childless siblings may face lower caregiving burdens and thus better health (Do et al., 2015). This satisfies assumption (a).

Nevo and Rosen (2012) show that under assumption (a), the effect of childlessness on health would be bounded by the 2SLS and OLS estimates. If the assumption (b) additionally holds, then we can obtain tighter bounds that lie between 2SLS and Nevo–Rosen (NR) estimates, $\hat{\alpha}_1^{NR}$, a 2SLS estimator that employs $NR = \sigma_{\text{Childless}}\text{IV}_\text{i} - \sigma_{\text{IV}}\text{Childless}$ as an instrument; σ_{var} denotes the standard deviation of $var = \{\text{Childless}, \text{IV}\}$ and $\text{IV} = \{-\text{Infertility}_\text{i}, \text{Childless Siblings}_i\}$. In the case of multiple instruments, the bounds may be computed for each instrument such that they will lie between $\hat{\alpha}_1^{NR}$ and the 2SLS estimate for one of the IVs. Nevertheless, Nevo and Rosen (2012) note that the bounds may differ from 2SLS estimate when the correlations in (a) are conditional on covariates. The NR bounds for the impact of childlessness on health using $-\text{Infertility}_i$ as IV are shown in Fig. 1. As can be seen from the figure, the bounds provide strong support that being childless is associated with higher likelihoods of poor health and mental distress.[6]

4.3. Potential mechanisms

There are several potential mechanisms through which childlessness may negatively impact health. First, hormonal changes associated with giving birth (in the case of women) may lead to direct changes in health in old age. In such case, we should observe that the effects of childlessness differ between men and women. From Appendix Table A15, we do not find any gender difference, suggesting that hormonal changes are unlikely to be the main driver of our results. Second, the act of raising children may make parents more active and thus physically healthier compared to those without children. We look at prevalence of chronic diseases such as high blood pressure, cancer, cholesterol, non-chronic diseases such as heart attack and stroke, difficulty in performing any Instrumental Activity of Daily Living (IADL) such as using telephone, walking to places of work, going for shopping, preparing meals, performing household chores, taking own medicine, and handling money. We do not find any direct effect of childlessness on these physical health outcomes (Appendix Table A16), suggesting that this channel is also unlikely in our context.

Third, those who have children may be less lonely and thus less likely to be in poor health compared to those without children. From Appendix Table A17, while we do not find any evidence that the childless have poorer social network, there is evidence that they have poorer relations and fewer activities with the younger generation. Fourth, a lack of contemporaneous or expected future support in old age may also drive our results. As discussed earlier, children are an important source of support in many countries (Guo and Zhang, 2020; Ho, 2022; Jayachandran, 2015; McGarry, 2025). From Table A17, we indeed find that those without children expect lower support in the future, both in terms of financial and instrumental help. Thus, it is possible that the childless may lack the interaction with the younger generation and the expected support that goes with it.

5. Discussion and conclusion

This study contributes to the growing literature on the consequences of childlessness. It represents a first attempt to identify the causal effect of childlessness on the health of middle-aged and older individuals in an Asian setting. To do so, we interview 1500 randomly selected Singaporeans aged 50 and above, and collect rich information on their fertility history, childhood and family background, and socio-demographic characteristics. We show that OLS underestimates the associations between childlessness status and poor health, possibly due to negative selection, whereby an unobserved attribute—such as, for example, having an individualistic self-caring personality or higher intelligence—increases the probability of being childless but also decreases the probability of being in poor health (Avison and Furnham, 2015; Calvin et al., 2011; Kanazawa, 2014).

We present evidence that supports the use of two novel instruments for childlessness, infertility during reproductive years and the number of childless siblings. First, both IVs are highly correlated with childlessness status. Second, we show that our IVs are unrelated to background traits such as gender, education, and childhood socioeconomic status. Third, our rich dataset allows us to control for potential confounders such as poor health in childhood, desire for children when young, and total number of siblings. Estimates from 2SLS suggest that being childless leads to a greater likelihood of poor self-reported health and mental distress. The results are robust to a battery of sensitivity analyses, including bounding the effects of childlessness using selection on observables à la Oster (2019) and relaxing the exclusion restrictions following Nevo and Rosen (2012).

Our findings contrast with results from past literature that has examined the effect of having an additional child on health in Western countries, by exploiting twinning or sex composition of the first two children as IVs (Bonsang and Skirbekk, 2022; Cáceres-Delpiano and Simonsen, 2012; Kruk and Reinhold, 2014). Such literature generally finds that an additional child leads to worse late life cognition or well-being. As discussed above, the LATE identified in our context comes from compliers who experience lower than desired fertility while past literature identifies a LATE from compliers who experience higher than desired fertility. We are thus identifying effects for a different subpopulation. Additionally, our setting is one where children are highly valued for old age support. Our results are more consistent with Priebe (2020) who finds that an additional child is associated with better subjective well-being and satisfaction in developing countries. This is possibly due to the fact that older parents also tend to be more reliant on adult children in developing economies. Nevertheless, that study focuses on the intensive margin of fertility for women of reproductive ages in developing countries while we focus on the extensive margin of fertility among middle aged and older individuals in a relatively rich Asian setting.

The inferences from this study are important for a number of reasons. First, aging without children is an increasingly salient phenomenon worldwide, with childlessness rates among middle aged and older individuals being greater than 20% in countries such as Spain and Germany (Doepke et al., 2023). Second, children are still an important form of support to parents globally, with cross-national evidence showing family members serve 76% of care recipients even in countries with extensive formal care systems (McGarry, 2025). Lack of children may thus be associated with lower support from and interactions with the younger generation as well as higher demands on the childless to care for their own parents (Kim et al., 2024). Third, poor health and

[6] To be conservative, we do not plot the bounds for the impact of childlessness on health using $\text{Childless Siblings}_i$ as IV because its lower bound lies above the upper bound shown in Fig. 1, suggesting even stronger effects of childlessness status on the likelihood of poor health. Results are available upon request.

depression in old age can be very severe conditions that limit one's everyday life and the ability to take care of oneself, thus imposing high costs on the individual and society (Schiele and Schmitz, 2023). In light of the increasing prevalence of those aging without children, our findings imply that policymakers may need to factor in the higher demands for both physical and mental health services in planning for the future.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary material related to this article can be found online at https://doi.org/10.1016/j.euroecorev.2026.105279.

Data availability

Data will be made available on request.

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