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Parental status in later life and parents' risk of cognitive impairment

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ABSTRACT

Parental status can influence parents' well-being in significant ways, but little research has examined its impact on older adults' cognitive health in the U.S. Using data from the National Health and Aging Trends Study (NHATS) 2011–2019, this study examines whether parental status is related to the risk of cognitive impairment among older adults in the U.S. We found that the presence of adult children (i.e., having at least one living adult child) was associated with a lower risk of cognitive impairment for older parents. Moreover, compared to childless older adults, older parents who had three and more children, who had adult daughter(s), and who had biological/adopted adult children displayed a significantly lower risk of cognitive impairment. This study highlights the importance of adult children as resources of support and caring that may benefit older parents' cognitive health. The findings can help to identify the most vulnerable subpopulations among aging adults so that medical workers and policy makers can design effective strategies to protect cognitive function for those "at risk" older adults.

1. Introduction

Parental status has been characterized as a normative life experience and a crucial role transition that has been shown to be a factor related to parental well-being (Bures et al., 2009; McLanahan & Adams, 1987; Umberson, Pudrovska, & Reczek, 2010; Zhang & Hayward, 2001). However, the demographic transition, with increasing longevity, declining fertility rates, and increasing remarriage and stepfamilies, all make parenting status more complex than a few decades ago, which requires researchers to reconsider its effects on parental well-being in the U.S. today (Carr & Utz, 2020; Nomaguchi & Milkie, 2020; Umberson, Pudrovska, & Reczek, 2010). Being a parent or not can significantly shape individuals' life context, and its impact on health can vary across parent's life span (Nomaguchi & Milkie,2020). Yet, the vast majority of research in this area has focused on how parenting minor children influences younger parents' psychological well-being (e.g., Nomaguchi, 2012). Empirical evidence on the effects of adult children on parental well-being in later life, especially on parents' cognitive health, is limited in the U.S.

Cognitive impairment has emerged as a major public health concern because of high prevalence rates, high health care costs, and the high burden they impose on patients and caregivers, both economically and emotionally (Alzheimer's Association, 2020; Ray & Davidson, 2014). Among primary dementia caregivers, over half take care of their parents, and over one-third of dementia caregivers are daughters (Alzheimer's Association, 2020). Childless older adults living with cognitive impairment are among the most unsupported and socially isolated populations, being more likely to experience loneliness, elder abuse, and inability to access formal care (Read & Grundy, 2017; Sundström et al., 2014; Xu et al., 2018). Although an increasing number of studies have examined how the onset or progression of cognitive impairment influences the relationship between older parents and children, little is known about how adult children can be a protective or risk factor affecting parents' risk of cognitive impairment.

This study explores the linkage between parental status in later life and parents' risk of cognitive impairment using longitudinal data from the National Health and Aging Trends Study (NHATS), 2011–2019. We focus on four measures of parental status in parents' later life: the presence of adult children, number of adult children, gender of adult children, and step-parenthood. The analysis addresses four major research questions: (1) Is having adult children related to a lower risk of cognitive impairment for older parents? (2) Do older parents who have more adult children show a lower risk of cognitive impairment? (3) Does the gender of adult children matter to older parents' cognitive health? (4) Do stepchildren benefit older stepparents' cognitive health? Considering potential selection effects that may shape both parenting trajectories and later life cognitive health, we adjust several confounding factors, including parents' education, marital status, and health

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conditions. We also examine the gender interaction to investigate whether the association between parental status and cognition may vary between older men and older women.

2. A life course perspective

The life course perspective has been widely applied in understanding how parental status links to parents' health outcomes (Koropeckyj-Cox et al., 2007; Nomaguchi & Milkie, 2020; Umberson, Pudrovska, & Reczek, 2010). First, the life course perspective emphasizes individual variations in different social contexts throughout the life span (Elder, 1995). Being a parent or not can significantly shape an adult's life contexts, determining changes in socioeconomic status, labor market participation, and marital quality that can, in turn, affect individuals' health outcomes in both the short and long term (Koropeckyj-Cox et al., 2007). Second, the notion of "linked lives" suggests the interconnectedness between parents and children (Bengtson et al., 2012; Elder, 1994). Parents' lives are mostly embedded in relationships with their children, suggesting that children's characteristics and lives have implications for parents' lives, and further influence trajectories of change in parents' well-being over time (Bengtson et al., 2012; Elder, 1995; Umberson, Pudrovska, & Reczek, 2010). Last, the life course perspective helps to locate people in a matrix of age-graded family relationships, which can provide insight to contextualize the effects of parenthood on older parents' well-being in later life. Prior studies mainly focused on parenting minor children and younger parents' well-being (e.g., Nomaguchi, 2012), which was less powerful in explaining how adult children influence older parents' lives. Therefore, it is important to consider the dynamics of parental status over the life course.

3. Mechanisms linking parental status and cognitive health

There are three major mechanisms that explain how and why parental status may link to parents' well-being: *the* support *model, the social control process,* and *the stress model. The* support *model* suggests that family members (i.e., spouse, children, relatives) often support individuals financially, instrumentally, informationally, and emotionally, which are potential protectors of well-being in later life (Liu et al., 2020; Nomaguchi & Milkie, 2020; Umberson, Pudrovska, & Reczek, 2010). First, adult children can support older parents by providing parents with economic resources, for instance, by improving household wealth and purchasing insurance, medical treatment, and care service (Knoester, 2003; Umberson et al., 2013). Second, children can satisfy parents' emotional needs by providing psychological support, which often increases parents' life satisfaction and can play the role of stress buffer by diminishing the negative effects of life strains (e.g., financial loss, death of spouse, health decline) on parents' well-being (Knoester, 2003; Umberson et al., 2013). Moreover, adult children are considered central figures in the social networks of their parents, providing social support and bridges to social services (Gibney et al., 2017). Children can enlarge parents' social network, build parents' social capital, and increase parents' daily communication, interaction, and social participation in their community (Gibney et al., 2017). Frequent social interaction and engagement have been proven by epidemiologists to be factors contributing to brain reserve or brain stimulation, allowing cognitive function to be maintained in old age (Fratiglioni & Wang, 2007; Gow et al., 2013; Kuiper et al., 2015).

The association between parenthood and parents' health also lies in *a process of social control* (Umberson, 1987). Specifically, parental role modeling of healthy eating, physical activity, and less risky health behaviors can benefit both children's and parents' health in both the short and long term (Umberson, 1987). In turn, adult children, especially daughters, often play the role of primary caregiver and as such monitor parents' health behaviors (Umberson, 1987; Umberson, Pudrovska, & Reczek, 2010). Good lifestyle behaviors, such as healthy eating, not smoking, good sleep quality, and regular exercise, have been well-recognized as determinants of better brain health for older adults (Kirk-Sanchez & McGough, 2014; Guitar et al., 2018; Sun et al., 2018). For example, scientists have found consistent evidence that exercise or physical activity is a robust intervention that improves memory performance and executive function and reduces brain aging (Guitar et al., 2018; Sun et al., 2018). The social control process may influence parents' health through both direct and indirect pathways. Directly, adult children can remind parents to eat healthily or avoid risk factors, help control their blood pressure, or provide interventions to help them recover from diseases (Umberson, 1987; Umberson, Pudrovska, & Reczek, 2010). Indirectly, the norms of a healthy lifestyle are likely to be internalized so that parents can actively control their own health (Umberson, 1987).

The stress model emphasizes that each relationship has its dark side, including relationships between parents and children (Carr & Utz, 2020; Umberson et al., 2013). Adult children may not only give parents support and care but also cause them worry, frustration, and stress, which explains why parenthood is often described as a "mixed bag" or a source of "ambivalence" (Bengtson et al., 2002; Musick et al., 2016; Ward et al., 2009). Stress associated with adult children can come from many sources, such as coresidence with adult children, negative interactions with adult children (e.g., breaking up with children, mistreatment or abuse from children), having stepchildren, and death of children (Carr & Utz, 2020; Pudrovska, 2009; Thomas & Umberson, 2018). These stressors can negatively impact older parents' well-being, and the consequences are likely to be more serious if older parents are unmarried or without support within family or broader social networks (Sundström et al., 2014).

Acute stress elevates the risk of cognitive impairment by evoking pathophysiological metabolic effects and adverse changes in stress hormones and certain brain regions (Henckens et al., 2009; Kuhlmann et al., 2005; Rothman & Mattson, 2010). Moreover, stressful events or chronic stressors can cause psychological distress (e.g., anxiety, depression) and increase the risk of multiple chronic diseases, such as hypertension, cardiovascular disease, stroke, diabetes, which have common links to the incidence of cognitive decline (Morley, 2017; Nagai et al., 2010; Ramirez-Moreno et al., 2020; Rothman & Mattson, 2010; Stampfer, 2006). For example, researchers found that the main causes of cardiovascular disease, including inflammation, oxidative stress, and atherosclerosis-induced brain hypoperfusion, contribute to Alzheimer's diseases and related dementia (Casserly & Topol, 2004). However, some studies suggest that mild stress related to relationship strain is likely to bolster cognitive function (Comijs et al., 2011; Thomas & Umberson, 2018). For example, the study by Thomas and Umberson (2018) indicates that higher levels of relationship strain with children can protect against fathers' cognitive decline because the strained relationship may be a mild stressor for fathers but not for mothers.

4. Empirical evidence

4.1. Having adult children vs. being childless in later life

About 6.6% of U.S. adults aged 55 and older have neither spouse nor biological children, and this proportion is projected to reach as high as 20% in future cohorts (Margolis & Verdery, 2017). Those older adults "aging alone" who lack a close kin tie are more likely to live with loneliness and social isolation, which may increase their risks of cognitive impairment (Dykstra & Wagner, 2007; Shankar et al., 2013). However, the association between parental status and parents' cognition is rarely examined in the U.S. Generally, current research focusing on childlessness and cognition is limited and mainly based on European data. For example, Sundström and coauthors (2014) used population-based, longitudinal data on older adults aged 65 and above in Sweden to examine how parental status is associated with the risk of dementia. This study suggests that not having children was associated with incident dementia. Widowed, older adults without children showed the highest risk of dementia (Sundström et al., 2014). Read and Grundy (2017) used nationally representative longitudinal data to examine the relationship between fertility history and cognition among men and women aged 50 and older in England. They found that for both men and women, there was a strong association between childlessness and cognitive impairment, even adjusting for the effects of socioeconomic status, health, and social engagement factors (Read & Grundy, 2017). Similarly, a recent study using data from the UK also found that having offspring was associated with better cognitive function, such as faster response time and fewer mistakes in visual memory tasks, among both men and women (Ning et al., 2020). Given this evidence, we expect that having adult children in later life is associated with a lower risk of cognitive impairment for older parents.

4.2. Number of children and parents' cognitive health

Having a great number of children (including any type of children) is likely to be both positive and negative for parental health. On the one hand, having more children may dissolve parents' economic resources and increase perceived demands and the feeling of ambivalence in parent-child relationships (McLanahan & Adams, 1987; Ward et al., 2009). On the other hand, more children may bring more support to older parents. Siblings can share the responsibility of caring, especially when some children are unavailable or unable to assist older parents (Bures et al., 2009). Regarding the association between number of children and parents' cognitive health, empirical evidence is limited and predominantly based on data from European countries. For example, Ning and coauthors' (2020) study in the UK found that although having offspring was associated with better cognitive health, parents with two or three children showed the largest differences compared to their childless counterparts, such as faster response time, more accurate visual memory, and significantly younger brain age (Ning et al., 2020). The authors attributed this association more to social factors than to biological processes, such as healthy lifestyle and children's support. Read and Grundy's (2017) study in England also found that compared to medium parity (2 children), older adults with low (0–1 child) and high parity (3+ children) showed poorer cognitive functioning. Although these two studies indicate an inverted U-shaped association between parity and cognitive functioning, the cutoff points for low and high parity are not quite the same, and they do not consider social parenthood (e.g., having adopted or stepchildren). Although little evidence shows the association between number of children and parents' cognition in the U.S., the present study tentatively expects that having more children is associated with a lower risk of cognitive impairment for older parents.

4.3. Children's gender and parents' cognitive health

Prior research on gender differences within the family is most often about the adults; the influence of children's gender on parents' health has not been a major focus of the literature (Umberson, Pudrovska, & Reczek, 2010). However, consistent evidence shows that women are more likely to be the primary managers of family members' health care, and daughters are more likely than sons to be caregivers in the United States (Carr & Utz, 2020; Horowitz, 1985; Raley & Bianchi, 2006). As for older parents who had dementia or cognitive impairment, a growing number of their caregivers are adult daughters, who are more likely than adult sons to assimilate information or knowledge about subjects related to health care, such as medical insurance and social services, and to provide long-term caregiving to older parents (Alzheimer's Association, 2020). Most previous literature discusses how being a caregiver influences women's own health conditions, but little research provides evidence about whether women's caregiving can have an impact on the care receivers' (mostly older parents') health outcomes in the U.S. (Carr & Utz, 2020). It has been well-recognized that good quality of care promotes the care receivers' health through good diet, regular exercise, and monitored health behaviors (i.e., reduced smoking and drinking) (Umberson, 1987). Also, frequent visits or contact with children can increase interaction and communication, which potentially benefit older parent's cognitive functioning by maintaining and improving mental stimulation and brain reserves (Kuiper et al., 2015; Stern, 2012; Zahodne et al., 2019). Although there is little knowledge on how children's gender can make a difference in protecting or damaging older parents' cognitive health, based on the fact that adult daughters are often the primary caregivers in families, the present study expects that children's gender matters to older parents' cognition, and having adult daughters is associated with lower risk of cognitive impairment for older parents.

4.4. Stepchildren and stepparents

Parenthood can be both biological and social. There has been a significant increase in remarriage and stepfamilies in the past four decades in the U.S. Yet stepfamilies are incompletely institutionalized, and the legal status and obligations of stepparents and stepchildren are ambiguous (Cherlin, 1978; Stewart, 2005; Sherman et al., 2013; Umberson, Pudrovska, & Reczek, 2010). For example, Sherman et al. (2013) examined social relations and support networks among remarried wife dementia caregivers in later life. They found that stepchildren comprised the largest group in the negative networks, which were related to greater caregiver burden and depression. Thus, it is likely that having biological children, stepchildren, or both can affect parental well-being differently in parents' later life (Pezzin et al., 2013). However, previous studies on parental status and parents' health have often focused on biological parenthood only or simply neglected the differences between biological parenthood and step-parenthood (e.g., Modig et al., 2017; Nomaguchi, 2012; Sundström et al., 2014), which may obscure real vulnerabilities among subgroups of older adults. Moreover, stepparenting can happen at any time throughout parents' life span and influences both parents and children, yet most research on stepfamilies has emphasized the consequences for children's well-being rather than parents', and the vast majority of these studies have focused on parenting minor or adolescent stepchildren (e.g., Jensen & Harris, 2017). This evidence may not be applicable to explaining the effects of adult stepchildren on older parents' well-being.

Existing evidence on step-parenthood in later life is inconsistent with respect to how stepchildren influence stepparents' health outcomes. For example, using cross-sectional data from the National Survey of Families and Households (NSFH), Evenson and Simon (2005) reported that having adult stepchildren was associated with higher levels of distress, compared to being childless and having other types of children. Similarly, Pezzin and coauthors (2013) used longitudinal data from the Health and Retirement Study and found that parents with only stepchildren reported worse health outcomes than parents with only biological children. By contrast, Pudrovska's (2009) longitudinal analysis showed that having adult stepchildren is not related to the mental health of middle-aged and older parents. Bures and coauthors (2009) used HRS data from 1998 and also found that there were no differences in depression levels between childless people and parents, whether childlessness was defined biologically or socially. However, their parallel analysis using data from the NSFH 1987–1988 suggested that social childlessness (the absence of any living children) was related to higher depression but not biological childlessness (having no biological children but may have stepchildren). Admittedly, the inconsistent results are likely due to the differences in birth cohorts of two samples. In short, although little evidence indicates the association between stepchildren and stepparents' cognition in the U.S., the present study tentatively expects that step-parenthood may be related to older parents' cognitive health.

5. Variations by parent's gender

The linkage between parental status and cognition may vary by parent's gender, but current empirical evidence is limited (Ning et al., 2020; Read & Grundy, 2017; Umberson, Crosnoe, & Reczek, 2010). Read and Grundy (2017)'s study suggests that childless women show a faster cognitive decline than men over the study period. The study by Ning et al. (2020) demonstrates that compared to childless people, fathers with medium parity (i.e., two or three children) are more likely than mothers to have faster response time, more accurate visual memory, and younger brain age. However, high parity (i.e., more than 4 or 5 children) is associated with a higher risk of dementia for both fathers and mothers (Gemmill and Weiss 2020). Stepmothers are more likely to have stressful relationships with stepchildren, which may lead to a higher risk of health issues than stepfathers (Stewart, 2005; Umberson, Pudrovska, & Reczek, 2010). Moreover, the genders of parents and children may interact together to influence caregiving quality and cognitive health for older parents. Although evidence in terms of cognitive consequences is very limited, prior literature shows that children tend to provide care to the parents of the same gender, but daughters are more likely to care for both fathers and mothers than sons (Grigoryeva, 2017). In short, the gender dynamics in the linkage of parental status and parent's cognition has not been well-researched. We expect gender variations between older men and women and test gender interaction with each parental status variable in the analysis.

6. Data and methods

6.1. Data

The data for the present study were drawn from the National Health and Aging Trends Study (NHATS), 2011–2019, which is a nationally representative longitudinal sample of Medicare beneficiaries in the contiguous United States (Kasper & Freedman, 2020). Detailed information on older adults' cognitive functioning and health conditions was collected in addition to demographic and other contextual data. In 2011, 8,245 respondents aged 65 and older completed the initial interview (Wave 1, 71% response rate). Respondents have been reinterviewed annually to document changes over time. We deleted missing values in analytical variables (3.66%). We also excluded respondents who had only one child who was under 20 years old[1] (0.01%). Therefore, the final sample included 7,458 respondents (27,134 person-year records) who had complete data on cognitive measures and other key variables from 2011 to 2019.

6.2. Measures (A full description of measures is in the Appendix)

6.2.1. Outcome variable: cognitive impairment

NHATS respondents completed a series of performance-based tests that measured their cognitive status. These cognitive tests evaluated three domains of cognitive functioning: memory, orientation, and executive function (Kasper & Freedman, 2020). We defined cognitive impairment in this study by having impairment in at least one cognition domain, while normal cognition by having impairment in no domain (Liu et al., 2019; MacNeil-Vroomen et al., 2020). For respondents who were unable to complete the cognitive tests (1.88% in raw data, 1.80% in final sample), cognitive impairment was measured by the proxy's report of a doctor's diagnosis of dementia or the proxy's responses to the Ascertain Dementia 8 (AD8) (Galvin et al., 2006; Kasper & Freedman, 2020). In these cases, the respondent was categorized as having cognitive impairment if the proxy reported that the respondent had been diagnosed with dementia or if the AD8 scores met the criteria for likely dementia.

6.2.2. Independent variables

Parents in the final sample are those who had at least one living adult child (age 20 or older), including biological/adopted children and stepchildren. Childlessness was defined by older adults who have no living adult child, including biological/adopted children and stepchildren.

Presence of adult children (time-varying) was coded as a dichotomous variable, where 0 = childlessness (reference) and 1 = having at least one living adult child.

Number of children (time-varying) was coded as a categorical variable, including having no living adult child (reference), one adult child, two children (at least one adult child), three children (at least one adult child), and four and more children (at least one adult child).

Children's gender (time-invariant) was coded into four categories, including having no living adult children (reference), having adult son (s) only, having adult daughter(s) only, and having both adult son(s) and adult daughter(s).

Step-parenthood (time-varying) was coded into four categories, including having no living adult children (reference), having biological/adopted children only, having stepchildren only, and having both biological/adopted and stepchildren.

6.2.3. Covariates

The analysis also considered the effects of covariates and confounding factors based on the respondent's demographic characteristics, including parents' gender, age, race/ethnicity, education, marital status, indicator of proxy-report, physical health factors (i.e., high blood pressure, heart disease, go walking for exercise, health condition at childhood), and ever lost a child.

6.3. Analytical strategy

To compare the risk of cognitive impairment across various parental status groups, we estimated discrete-time hazard models. Specifically, we created person-period record files and then used a logit model for the discrete-time event history analysis. A respondent contributed an observation for each wave at which they were interviewed, up to the onset of impairment or right censoring (i.e., loss to follow-up or death). The discrete-time hazard model is specified as:

$$\log\left(\frac{p_{ij}}{1-p_{ij}}\right) = \sum_{j=1}^{9} \alpha_j \boldsymbol{D}_{ij} + \beta_1 \boldsymbol{X}_i + \beta_2 \boldsymbol{Z}_{ij}$$

where p_{ij} indicates the probability of cognitive impairment for individual i at wave j; $\sum_{j=1}^{9} \alpha_j \boldsymbol{D}_{ij}$ represents the set of multiple intercepts from 2011 to 2019, one per period; $\boldsymbol{X}_i$ is a vector of time-invariant variables; $\boldsymbol{Z}_{ij}$ is a vector of time-varying variables; and β_1 *and* β_2 are corresponding coefficient vectors. We conducted four models to estimate the relationship between four parental status variables and risk of cognitive impairment, including presence of adult children (Model 1), number of children (Model 2), gender of children (Model 3), and step-parenthood (Model 4). We notice that, in Model 3, having son/daughter only can include one or more children but both son/daughter category must include at least two children so that the categories may conflate the number of children with the sex composition. The same issue applies to Model 4. Therefore, we did additional tests adjusting the effects of the number of children (centered to mean) in Model 3 and 4. The results are the same as what we reported in the article (the results are not shown but available upon request). All covariates were included in all four models. Analyses were weighted using the wave-specific weight. We used Stata 15 to estimate the models (StataCorp 2017).

[1] NHATS provides categorical age ranges of children. "Under 20" is the lowest category.

7. Results

Table 1 shows the descriptive statistics of unweighted frequencies and weighted proportions for all analyzed variables for the total sample. 9.84% of respondents reported having cognitive impairment versus 90.16% who reported normal cognition. Most respondents (91.16%) had at least one living adult child, while 8.84% of respondents were childless, without any living adult child. 11.05% of respondents had one adult child, 27.42% had two children (including at least one adult child), 23.53% had three, and 29.16% had four or more children. 58.34% of respondents had both son(s) and daughter(s), while 16.55% of respondents only had son(s), and 16.27% only had daughter(s). A majority of the respondents had biological/adopted children (77.88%), while 1.87% of respondents had stepchildren only, and 11.41% of respondents had both biological/adopted and stepchildren.

Table 2 presents estimated odds ratios of cognitive impairment for the four parental status variables from the discrete-time hazard models. Model 1 shows that compared with childless respondents, parents who had at least one living adult child showed a lower risk of cognitive impairment. Specifically, parents had 19% [(1–0.81) × 100%] lower odds of cognitive impairment than childless older adults (OR = 0.81, $p < 0.05$), adjusting for the effects of all covariates. Model 2 estimates the association between the number of children and the odds of cognitive impairment. The main results are that having any children have essentially the same effect on cognitive impairment as zero children, although parents who had three children and those who had four or more children showed statistically significant lower odds of cognitive impairment [22% (OR = 0.78, $p < 0.05$) and 19% (OR = 0.81, $p < 0.05$)]. Model 3 shows the relationships between children's gender and parents' risk of cognitive impairment. There is relatively clear evidence that the effect of having children regardless of gender is more protective to parents' cognition because the point estimates are really similar, and both show lower odds. Among these, parents who had daughter(s) only showed lower odds of cognitive impairment, compared to the childlessness, having son(s) only, and having both sons and daughters. Model 4 estimates whether having biological/adopted children versus stepchildren was related to a differential risk of cognitive impairment. Again, the main results suggest that any types of children have the same effect on parents' cognition as the estimates all show lower odds compared to having no child. However, parents who had biological/adopted children only and those who had both biological/adopted and stepchildren showed statistically lower odds of cognitive impairment (18% and 26%, respectively). We also tested interactions between parent's gender and each parental status variable. However, there is no significant gender difference found (results are not shown but available upon request).

Table 1
Descriptive statistics of person-period files (unweighted frequencies/means and weighted proportions), NHATS, 2011–2019, Total N of respondents = 7,458, Total N of person-periods = 27,134.

Variables	N/mean	%/SD	Variables	N/mean	%/SD
Cognitive health					
Normal cognition (ref)	23,653	90.16	Gender		
Cognitive impairment	3,481	9.84	Female (ref)	16,019	57.29
Parental status			Male	11,115	42.71
Childless (ref)	2,298	8.84	Age groups		
Having at least one child	24,836	91.16	65-69 (ref)	2,804	15.63
Number of children (ref: no child)			70–74	6,450	30.53
one child	3,202	11.05	75–79	6,539	24.29
two children	6,954	27.42	80–84	5,551	15.94
three children	6,149	23.53	85–89	3,685	9.34
four and more children	8,531	29.16	90+	2,105	4.28
Children's gender (ref: no child)					
all sons	4,278	16.55	Race/ethnicity		
all daughters	4,512	16.27	White (ref)	20,450	84.78
both sons and daughters	16,046	58.34	Black	4,879	7.08
Having bio or stepchildren (ref: no child)			Hispanics	1,160	5.09
bio children only	21,399	77.88	Others	645	3.06
stepchildren only	452	1.87	Education		
both bio and step	2,985	11.41	Less than high school (ref)	5,080	15.76
Parent's marital status			High school	9,344	34.56
Married (ref)	13,315	54.88	Some college	9,027	34.62
Cohabiting	540	2.49	College above	3,683	15.05
Divorce	3,377	12.41	Proxy report		
Widowed	8,930	26.72	No (ref)	26,645	98.51
Never married	972	3.49	Yes	489	1.49
Ever lost child			Health condition at childhood (1–5)	4.17	1.00
No (ref)	26,868	99.14	Heart disease		
Yes	266	0.86	No (ref)	21,145	79.01
			Yes	5,989	20.99
High blood pressure			Exercise (go walking)		
No (ref)	7,892	32.10	No (ref)	10,915	37.76
Yes	19,242	67.90	Yes	16,219	62.24

7.1. Sensitivity analysis

We conducted a sensitivity analysis to test the robustness of the results by excluding the left-censored observations (i.e., those with cognitive impairment at the baseline survey). Excluding the cases with cognitive impairment at baseline (n = 1,950) eliminated the influence of the baseline association between parental status variables and parents' cognition and focused on the incidence of cognitive impairment across waves. The results (shown in Table 3) show the same patterns, with the same direction of odds ratios as reported in Table 2, but some of the associations were not statistically significant, which was likely due to the reduced sample size. Notably, Model 1–3 in Table 3 demonstrates robust results, indicating that parents with at least one adult child showed 21% lower odds of cognitive impairment than the childless counterparts. Parents who had three children and who only had daughter(s) showed 26% and 30% lower risk of cognitive impairment, respectively.

8. Discussion

Parental status shapes one's life contexts in significant ways, and it can impact individuals' well-being throughout life spans. Yet, limited evidence shows the association between parental status and older adults' cognitive health, and research in this area is especially rare in the U.S. Using data from the National Health and Aging Trends Study (NHATS) 2011–2019, this study examines whether parental status is related to the risk of cognitive impairment among older adults in the U. S. We found that the presence of adult children (i.e., having at least one living adult child) was associated with a lower risk of cognitive impairment for older parents, and children's gender, number, and types do not change this main pattern. Moreover, compared to childless older adults, older parents who had three and more children, who had adult daughter(s), and who had biological/adopted adult children displayed a significantly lower risk of cognitive impairment. We believe that this study fills some gaps of knowledge in understanding the association between parental status and older adults' cognitive function in several aspects.

First, this study indicates that being childless in later life makes older adults more vulnerable to the risk of cognitive impairment than parents with living adult children. This finding is consistent with previous evidence of a health disadvantage among the childlessness (Koropeckyj-Cox et al., 2007; Modig et al., 2017; Pudrovska, 2009). Childless older adults are often regarded as the most unsupported and socially isolated population because they are more likely to experience loneliness, elder abuse, and inability to access formal care (Carr & Utz, 2020; Xu et al.,

Table 2
Adjusted odds ratios from discrete-time hazard models, parental status and cognitive impairment, NHATS 2011–2019, total N of respondents = 7,458, total N of person-periods = 27,134.

	M1		M2		M3		M4	
	OR	SE	OR	SE	OR	SE	OR	SE
Having at least one adult child (ref: no child)	0.81*	(0.08)						
Number of children (ref: no child)								
one child			0.84	(0.09)				
two children			0.83	(0.09)				
three children			0.78*	(0.08)				
four or more children			0.81*	(0.08)				
Children's gender (ref: no child)								
son(s) only					0.84	(0.08)		
daughter(s) only					0.76*	(0.09)		
both son(s) and daughter(s)					0.82*	(0.08)		
Having bio or stepchildren (ref: no child)								
biological children only							0.82*	(0.08)
stepchildren only							0.72	(0.17)
both bio and stepchildren							0.74*	(0.09)
Male (ref: female)	1.32***	(0.08)	1.32***	(0.08)	1.32***	(0.08)	1.33***	(0.08)
Age group (ref: 65–69)								
70-74	1.38*	(0.17)	1.38*	(0.17)	1.38*	(0.17)	1.37*	(0.17)
75-79	2.22***	(0.20)	2.22***	(0.20)	2.22***	(0.20)	2.21***	(0.20)
80-84	3.46***	(0.34)	3.47***	(0.34)	3.46***	(0.34)	3.44***	(0.34)
85-89	5.33***	(0.65)	5.33***	(0.64)	5.34***	(0.65)	5.29***	(0.65)
90+	7.58***	(0.96)	7.55***	(0.95)	7.61***	(0.97)	7.53***	(0.96)
Race/ethnicity (ref: Non-Hispanic White)								
Non-Hispanic Black	1.73***	(0.11)	1.73***	(0.11)	1.73***	(0.11)	1.73***	(0.11)
Hispanic	2.07***	(0.20)	2.07***	(0.20)	2.06***	(0.20)	2.06***	(0.20)
Others	1.86**	(0.42)	1.86**	(0.42)	1.87**	(0.42)	1.86**	(0.42)
Proxy report (ref: self-report)	8.42***	(1.39)	8.42***	(1.39)	8.43***	(1.39)	8.41***	(1.39)
Education (ref: less than high school)								
High school	0.57***	(0.03)	0.57***	(0.03)	0.57***	(0.03)	0.57***	(0.03)
Some college	0.43***	(0.03)	0.43***	(0.03)	0.43***	(0.03)	0.43***	(0.03)
College above	0.32***	(0.03)	0.32***	(0.03)	0.32***	(0.03)	0.32***	(0.03)
Parent's marital status (ref: married)								
Cohabiting	0.89	(0.18)	0.89	(0.18)	0.89	(0.18)	0.89	(0.17)
Divorce	1.30***	(0.08)	1.30***	(0.08)	1.30***	(0.08)	1.29***	(0.08)
Widowed	1.24**	(0.08)	1.24**	(0.08)	1.24**	(0.08)	1.24**	(0.08)
Never married	1.12	(0.21)	1.12	(0.21)	1.12	(0.21)	1.11	(0.21)
Ever lost child (ref: No)	1.07	(0.31)	1.07	(0.31)	1.07	(0.31)	1.08	(0.31)
Health condition at childhood	0.91***	(0.02)	0.91***	(0.02)	0.91***	(0.02)	0.91***	(0.02)
High blood pressure (ref: No)	0.96	(0.05)	0.95	(0.05)	0.96	(0.05)	0.96	(0.05)
Heart disease (ref: No)	1.25***	(0.07)	1.25***	(0.07)	1.24***	(0.07)	1.25***	(0.07)
Exercise (ref: No)	0.83***	(0.04)	0.83***	(0.04)	0.83***	(0.04)	0.83***	(0.04)

Note: ***p < 0.001, **p < 0.01, *p < 0.05.

2018). Scientific evidence has demonstrated that loneliness and isolation significantly increase older people's risk of cognitive decline (Kuiper et al., 2015; Maharani et al., 2019). By contrast, the presence of adult children benefits older parents' cognitive functioning (Ning et al., 2020; Read & Grundy, 2017; Sundström et al., 2014). Although previous evidence was mainly based on European data, this study suggests that the same pattern is also found in the U.S. The cognitive advantage among older parents may be due to children's support and social control processes. Specifically, adult children can provide parents with social support by giving parents long-term help and assistance, taking care of finances, showing love and intimacy, and diminishing negative effects of life strains (e.g., death of spouse, health decline) (Carr & Utz, 2020; Knoester, 2003; Umberson et al., 2013). Frequent contact or visits and good communication or interaction with children are likely to increase parents' feeling of connectedness and reduce loneliness, which are factors contributing to brain reserve and stimulation, allowing cognitive function to be maintained in old age (Fratiglioni & Wang, 2007; Gow et al., 2013; Kuiper et al., 2015; Shankar et al., 2013). Moreover, adult children are often the primary caregivers for older parents and can help monitor parents' health behaviors. Empirical evidence indicates that engaging in healthy lifestyles, such as reducing smoking and drinking, diet, and physical exercise, can reduce parents' harmful exposure to cognitive decline at older ages (Bherer et al., 2013; Hayes et al., 2016; Swan & Lessov-Schlaggar, 2007).

Second, this study further indicates that having any number of children shows protective effects on older parents' cognition, although parents who have three and more adult children showed a significantly lower risk of cognitive impairment than the childless. This finding is partially consistent with some previous parity studies finding a J-shaped or U-shaped relationship between parity and parents' health problems, including the risk of cognitive impairment (Högnäs et al., 2017; Keenan & Grundy, 2019; Ning et al., 2020; Read & Grundy, 2017). These studies suggest that a medium parity (compared to childlessness and a very high parity) is likely to benefit parents' well-being the most. However, our findings indicate a greater number of adult children benefit older parents' cognition more. Having more adult children in later life usually means more support available to older parents, and adult children can share caregiving responsibility with siblings. Adult children are mostly nonresidential children and often have multiple roles as caregivers to both parents and their own children, making it likely that they are not always available or able to assist older parents (Bures et al., 2009). A greater number of children may reduce this unavailability of support to parents. Moreover, this finding could also result from a selection effect, if parents who were able to have more kids, both social and biological, were those who were healthier or who had better cognitive status (Kolk & Barclay, 2021). Such parents are more likely to be selected into parenthood and maintain a larger family network. We should also notice the differences in samples between the present study and previous parity

Table 3
Adjusted odds ratios from discrete-time hazard models excluding cognitive impairment cases at baseline, NHATS 2011–2019, total N of respondents = 5,508, total N of person-periods = 25,184.

	M1		M2		M3		M4	
	OR	SE	OR	SE	OR	SE	OR	SE
Having at least one child (ref: no child)	0.79*	(0.09)						
Number of children (ref: no child)								
one child			0.86	(0.12)				
two children			0.79	(0.10)				
three children			0.74*	(0.10)				
four or more children			0.79	(0.10)				
Children's gender (ref: no child)								
son(s) only					0.84	(0.12)		
daughter(s) only					0.70*	(0.10)		
both son(s) and daughter(s)					0.80	(0.10)		
Having bio or stepchildren (ref: no child)								
biological children only							0.79	(0.09)
stepchildren only							0.87	(0.24)
both bio and stepchildren							0.76	(0.12)
Male (ref: female)	1.28**	(0.10)	1.28**	(0.10)	1.28**	(0.10)	1.28**	(0.10)
Age group (ref: 65–69)								
70-74	1.10	(0.22)	1.10	(0.22)	1.10	(0.22)	1.10	(0.22)
75-79	1.82***	(0.27)	1.83***	(0.27)	1.82***	(0.27)	1.82***	(0.27)
80-84	2.86***	(0.45)	2.86***	(0.44)	2.85***	(0.45)	2.86***	(0.44)
85-89	4.11***	(0.71)	4.10***	(0.71)	4.12***	(0.72)	4.12***	(0.71)
90+	5.74***	(1.09)	5.68***	(1.08)	5.76***	(1.09)	5.75***	(1.09)
Race/ethnicity (ref: Non-Hispanic White)								
Non-Hispanic Black	1.73***	(0.16)	1.72***	(0.16)	1.73***	(0.16)	1.73***	(0.16)
Hispanic	2.01***	(0.28)	2.00***	(0.28)	2.00***	(0.28)	2.01***	(0.28)
Others	1.35	(0.28)	1.34	(0.28)	1.37	(0.29)	1.35	(0.28)
Proxy report (ref: self-report)	12.28***	(3.00)	12.32***	(3.03)	12.28***	(3.00)	12.27***	(2.99)
Education (ref: less than high school)								
High school	0.67***	(0.05)	0.67***	(0.05)	0.67***	(0.05)	0.67***	(0.05)
Some college	0.52***	(0.05)	0.52***	(0.05)	0.52***	(0.05)	0.52***	(0.05)
College above	0.37***	(0.04)	0.37***	(0.04)	0.37***	(0.04)	0.37***	(0.04)
Parent's marital status (ref: married)								
Cohabiting	1.00	(0.22)	0.99	(0.22)	0.99	(0.22)	0.98	(0.21)
Divorce	1.37***	(0.11)	1.36***	(0.11)	1.37***	(0.11)	1.36***	(0.11)
Widowed	1.22*	(0.10)	1.22*	(0.10)	1.22*	(0.10)	1.22*	(0.10)
Never married	0.97	(0.20)	0.97	(0.20)	0.97	(0.20)	0.97	(0.21)
Ever lost child (ref: No)	1.09	(0.31)	1.09	(0.31)	1.10	(0.31)	1.10	(0.31)
Health condition at childhood	0.93**	(0.02)	0.93**	(0.02)	0.93**	(0.02)	0.93**	(0.02)
High blood pressure (ref: No)	1.06	(0.08)	1.05	(0.08)	1.06	(0.08)	1.06	(0.08)
Heart disease (ref: No)	1.24**	(0.10)	1.24**	(0.10)	1.23*	(0.10)	1.24**	(0.10)
Exercise (ref: No)	0.85**	(0.05)	0.85**	(0.05)	0.85**	(0.05)	0.85**	(0.05)

Note: ***p < 0.001, **p < 0.01, *p < 0.05, + p < 0.01.

studies, for example, we included both biological and social parents and focused on the aging population above 65 years old and those who had adult children. Moreover, our point estimates show really similar patterns between having one or two children and having three or more children, which remind us that we should not simply interpret it as "the more, the better." Future studies can use larger samples and better measures to examine the robustness of this result.

Another important finding of this study is the positive effects of having adult daughter(s) on parent's cognitive health. Previous research studying gender differences within the family often focused on parents' gender rather than children's gender, and evidence is rare with respect to how children's gender influences parents' cognitive ability in later life. However, what has been well-recognized is that caregiving, like other types of domestic labor, is often regarded as women's work (Carr & Utz, 2020). Women are more likely to be the primary managers of family members' health care, and daughters are more likely than sons to provide care to their older parents, especially parents with cognitive impairment (Alzheimer's Association, 2020; Horowitz, 1985; Raley & Bianchi, 2006). Moreover, women often play the role of "kin keeper," connecting family members and extended social networks. Having at least one daughter increases the chances that an older parent has telephone communication and visits from his/her children, while having only sons or all sons seems to be "no substitute for daughters" (Raley & Bianchi, 2006). Therefore, frequent contact, communication, and good caregiving are possible explanations for the association between having daughters and parents' lower risk of cognitive impairment. However, it is not clear why parents with both sons and daughters did not show a significantly lower risk of cognitive impairment than the childless. In future studies, it would be worth exploring how the gender composition of sibships influences gendered caregiving to parents and further affects parents' cognition in later life.

Last, step-parenthood and its impact on parents' cognitive health has rarely been examined in prior literature. This study suggests that compared to childlessness, having only stepchildren did not statistically benefit parents' cognitive health, but the presence of biological/adopted children does, which is consistent with prior evidence showing the health disadvantage among parents with stepchildren only (Pezzin et al., 2013). Step-parenthood may increase parents' psychological distress (e.g., worry, stress, anxiety), which is often caused by relationship strain with stepchildren or conflict with a remarried spouse (Stewart, 2005; Ward et al., 2009). Cherlin (1978) argued that stepfamilies are incompletely institutionalized because of their ambiguous boundaries and a lack of clarity of obligation or expectation. It is likely that adult stepchildren feel less obligated to take care of their stepparents, especially for cognitively impaired parents who need long-term, intensive care. Less contact/communication and support from stepchildren as well as psychological distress associated with step-parenthood may increase parents' social isolation and further trigger the onset or progression of cognitive impairment. However, this finding should be interpreted carefully because our sample includes a very small number of step-parents who have stepchildren only (1.87%). The direction of the coefficient (OR = 0.72, p > 0.05) is also consistent with other categories, so the lack of significance is probably due to the small sample size rather than substantive difference. Indeed, some studies have argued that the negative consequences of step-parenthood decline over time (Stewart, 2005). Compared to step-parenthood in early or mid-life, older step-parents and adult stepchildren may have more resilience and benefit from a longer time for relationship adjustment (Stewart, 2005; Umberson, Pudrovska, & Reczek, 2010).

This study is not without limitations. First, there are likely selection effects in the analysis. For example, remarried families are more likely to have stepchildren, and never married people are more likely to be childless. Therefore, the final sample may exclude more disadvantaged subpopulations with respect to both the marital dissolution and parental status. Moreover, people with better cognitive status are more likely to be selected into parenthood or into parenting more children (Kolk & Barclay, 2021). Considering the association between childlessness and mortality, older adults who are childless are more likely to be lost to follow-up (Modig et al., 2017). Thus, the childless older adults in the final sample were likely to be the “survivors” with the resilience to deal with the negative impact of being childless, and the analysis may be conservative in evaluating the association between parental status and cognition. Second, this study did not find any significant gender differences among the older adults, although previous literature suggests that parenthood may impact men and women differently. Future research can use different datasets to examine whether parental status in later life shows gender variations in its effects on cognitive health. Third, because the measures of cognitive impairment are from performance-based cognitive tests and proxy reports rather than clinical diagnoses, the issue of potential misclassification cannot be ignored. Fourth, the NHATS only provides a derived variable for stepchildren, without information on other types of children (e.g., foster), and is unable to distinguish between biological and adopted children. Last, the pathways to childlessness in later life can be very diverse (Dykstra & Wagner, 2007). For example, there are differences between the voluntarily and involuntarily childless, and between the lifelong childless and those who have outlived children, which lead to various experiences among non-parents. Our final sample included a very small sample size of parents who experienced the death of children that may lead to no effect on the main results. Future studies can use more detailed measures to describe different pathways to childlessness and how they influence older adults’ cognitive health.

9. Conclusion

People are living longer today, and the parenthood experience is becoming more complex in the U.S. Though adult children are the most important figures in parents’ social connection and essential caregivers for older parents, their influence on parents’ cognitive health has not been fully understood. This is one of the first studies focusing on the connection between parental status in later life and its impact on parents’ cognitive health. The study adopts a life course perspective by identifying comprehensive measures of parental status, including not only the presence of children but also the number of children, children’s gender, and the presence of stepchildren. The results suggest that being childless is a potential risk factor for older adults’ cognitive impairment, while having more children, especially having daughter(s) and biological children, are possible protective factors for older parents’ cognitive health. This study highlights the importance of adult children as resources of support and caring that can bolster older parents’ cognitive health. The findings can help to identify the most vulnerable subpopulations among aging adults so that social workers, medical practitioners, and policy makers can design effective interventions and strategies to protect cognitive functioning for those “at risk” older adults.

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Ethical statement

The Authors declare no conflicts of interest. This paper only involves secondary data analysis and there are no ethical concerns to report.

Credit author statement

Yan Zhang: Conceptualization, Methodology, Software, and Writing–Original draft preparation. Jason Fletcher: Supervision and Writing–Reviewing.

Declaration of competing interest

The Authors declare no conflict of interest.

Appendix

Full Description of Data and Measures

Outcome Variable: Cognitive Impairment

NHATS respondents completed a series of performance-based tests that measured their cognitive status. These cognitive tests evaluated three domains of cognitive functioning: memory (immediate and delayed 10-word recall, scale: 0–20, cutoff $\leq$3), orientation (reporting the date, month, year, and day of the week; naming the president and vice president, scale: 0–8, cutoff $\leq$3), and executive function (clock drawing test, scale: 0–5, cutoff $\leq$1) (Kasper & Freedman, 2020). The cutoff points were defined as 1.5 standard deviations (SD) below the mean (Galvin et al., 2006; Kasper & Freedman, 2020). The NHATS defined two types of cognitive impairment by the cutoff points: probable dementia, defined by scores below the cutoff in at least two cognition domains, and possible dementia (mild cognitive impairment), defined by scores below the cutoff in one cognition domain. Following previous literature, we defined cognitive impairment in this study by combining probable and possible dementia, which means having impairment in at least one cognition domain, while normal cognition means having impairment in no domain (Liu et al., 2019; MacNeil-Vroomen et al., 2020).

For respondents who were unable to complete the cognitive tests (1.88% in raw data, 1.80% in final sample), cognitive impairment was measured by the proxy’s report of a doctor’s diagnosis of dementia or the proxy’s responses to the Ascertain Dementia 8 (AD8), which is an 8-item measure for assessing early memory loss, temporal orientation, judgment, and function (Galvin et al., 2006; Kasper & Freedman, 2020). In these cases, the respondent was categorized as having cognitive impairment if the proxy reported that the respondent had been diagnosed with dementia or if the AD8 scores met the criteria for likely dementia (scores $\geq$2).

Independent Variables

We used four variables to measure respondents’ parental status in later life, including presence of adult children, number of adult children, gender of adult children, and step-parenthood. These four independent variables were derived from items in the Children and Sibling (CS) section in the Sample Person (SP) file and the Other Person (OP) file. In the Other Person (OP) file, NHATS provided categorical age ranges of other persons, including biological/adopted children and stepchildren. We excluded parents who had only one child and the only child was under 20 years old. Therefore, parents in the final sample are those who had at least one living adult child (age 20 or older), including biological/adopted children and stepchildren. The childlessness was defined by older adults who have no living adult child, including biological/adopted children and stepchildren.

Presence of adult children (time-varying) was coded as a dichotomous variable, where 0 = childlessness (reference) and 1 = having at least one living adult child.

Number of children (time-varying) was coded as a categorical variable, including having no living adult child (reference), one adult child, two children (at least one adult child), three children (at least one adult child), and four and more children (at least one adult child).

Children's gender (time-invariant) was coded into four categories, including having no living adult children (reference), having adult son (s) only, having adult daughter(s) only, and having both adult son(s) and adult daughter(s).

Step-parenthood (time-varying) was coded into four categories, including having no living adult children (reference), having biological/adopted children only, having stepchildren only, and having both biological/adopted and stepchildren. Because NHATS does not distinguish between biological and adopted children, these two types of children have to be categorized in one group.

Covariates

The analysis also considered the effects of confounding factors based on the respondent's demographic characteristics. Specifically, *gender* was a dichotomous variable, coded as either female (reference) or male. *Age* was categorized into six groups: 65–69 (reference), 70–74, 75–79, 80–84, 85–89, and 90 and older. *Race/ethnicity* was self-reported and included four categories: non-Hispanic white (reference), non-Hispanic black, Hispanic, and other. *Education* included four categories: less than high school (reference), high school degree or equivalent, some college, and college graduate. *Marital status* was coded into five groups: married (reference), cohabiting, divorced, widowed, and never married. *Proxy-report* indicated whether cognitive status was reported by a proxy (0 = self-report, 1 = proxy-report). Health related factors include three binary variables (0 = No, 1 = Yes): high blood pressure, heart disease, and go walking for exercise. We also controlled for health condition at childhood (from 1 = poor to 5 = excellent), and ever lost a child (measured by child deceased since prior interview starting in wave 2). *Age, marital status, proxy-report, ever lost a child, and health related factors* were measured as time-varying covariates; *gender, race/ethnicity,* and *education* were time-invariant based on wave 1 data.

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