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Children's gender and parents' long-term care arrangements: evidence from China

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ABSTRACT

There has been a puzzle in China that despite the increasingly ageing population in recent years, the demand for nursing homes continues to decline. This paper provides a new explanation of this puzzle from the perspective of children's gender composition. Using the gender of the firstborn child as an exogenous variable, we find that having a male firstborn child significantly reduces the willingness of parents to live in nursing homes for long-term care. Heterogeneity analysis indicates that parents with only one child and those living in rural areas or areas with a high number of scandals related to nursing homes are more likely to be negatively affected. Mechanism analysis reveals two channels for this effect: traditional beliefs and children's economic capabilities.

I. Introduction

Population ageing is a common trend faced by countries worldwide in development (Liang, Wang, and Lazear 2018).[1] Since the 21st century, China has experienced rapid population ageing (see Figure 1(a)), which has attracted many scholars' attention to China's long-term care (hereafter abbreviated as, LTC).[2] Several scholars have documented the positive relationship between the proportion of elderly people and the demand for formal LTC (Bonsang 2009; Fischer and Müller 2020; Pezzin, Kemper, and Reschovsky 1996). However, there has been a puzzle in China that despite the increasingly ageing population in recent years, the demand for formal care provided by nursing homes continues to decline. As shown in Figure 1(b), from 2013 to 2018, the vacancy rate of beds in China's nursing homes has sharply increased from 29.24% to 43.9%, and the proportion of people who live in nursing homes has decreased from 1.88% to 1.04%. This raises the question: What are the factors

inhibiting people's willingness to live in formal nursing homes in China?

Some scholars have provided explanations for this puzzle from the supply side, such as the low service quality of nursing homes or unreasonable pricing mechanisms in nursing homes (Chang, Yang, and Deguchi 2020; Feng et al. 2012; Shum et al. 2015). [3]From the demand side, considering the substitution relationship between formal care and informal care in China (Feng et al. 2012; Shum et al. 2015; Zhan, Feng, and Luo 2008), decreased nursing home utilization may be due to increased demand for home care. Furthermore, since sons have long been regarded as the main provider of home care for their parents, the increase in the gender ratio of children may lead parents to gradually prefer home care over institutional care. Therefore, this paper aims to provide a new explanation of this puzzle from the perspective of the gender composition of children.

Using individual-level data from the China Household Finance Survey (CHFS), we examine the effect of children's gender on parents' LTC

[1]A research report by the World Health Organization indicates that by 2050, the global proportion of people aged 60 and over is expected to double from 2015 levels. For more details see https://www.who.int/zh/news/item/30-09-2015-who-number-of-people-over-60-years-set-to-double-by-2050-major-societal-changes-required.

[2]See for example, Flaherty et al. (2007), Feng et al. (2011), Smith, Strauss, and Zhao (2014), Chang, Yang, and Deguchi (2020), Fang et al. (2020), and Chen and Fang (2021).

[3]During this period, the number of nursing home beds decreased and the number of disabled elderly people increased. Therefore, this puzzle cannot be explained by an increase in the number of available beds in nursing homes or an improvement in the health of elderly people.
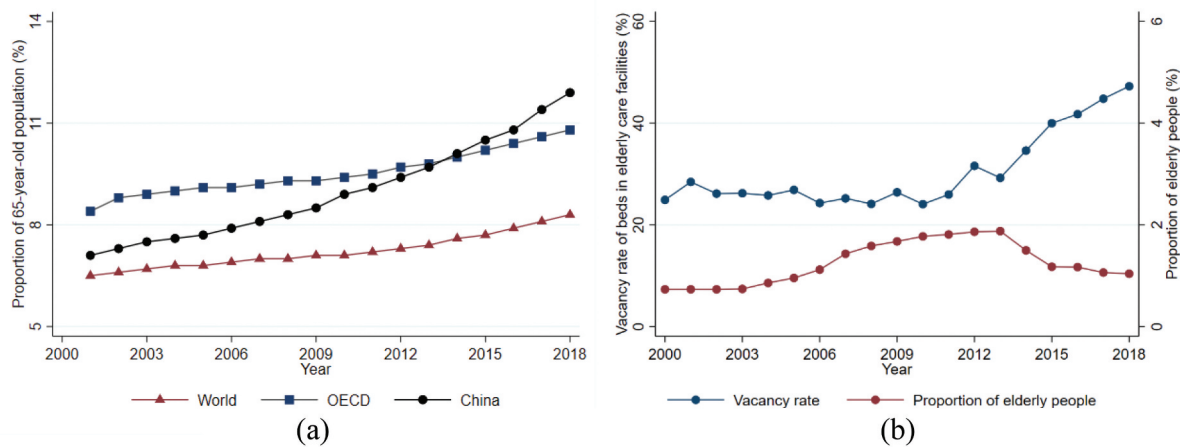
Figure 1. Population ageing trends and the puzzle of nursing home utilization in China. Panel (a) shows the trends of population ageing in China, OECD countries, and the world. The vertical axis represents the proportion of people over 65 years old. Data are obtained from the World Bank databases (see https://data.worldbank.org/) and the OECD databases (see https://data.oecd.org/). Panel (b) shows the trends of the bed vacancy rate and the proportion of elderly people living in nursing homes in China. The left vertical axis represents the bed vacancy rate in nursing homes, and the right vertical axis represents the proportion of elderly people living in nursing homes to the total population of elderly people. Data were obtained from the National Bureau of Statistics and the China Civil Affairs Statistical Yearbook.

arrangements. Specifically, we focus on how the gender of children affects parents' willingness to live in nursing homes. The main challenge in our empirical analysis is that the gender composition of children may be manipulated by parents for various reasons, both in developed and developing countries (Dahl and Moretti 2008; Ebenstein 2010; Ebenstein and Leung 2010). To address endogeneity concerns, we use the gender of the firstborn child as a proxy for children's gender, which has been widely used as an exogenous variable in previous studies on the effect of children's gender (e.g. Ebenstein 2010; Li and Wu 2011). Given that the Chinese government implemented its One-and-a-half Child Policy in 1984, reducing the likelihood of gender-selective abortions of firstborn children (Qian 2009), we restrict our sample to children born after 1984 to reinforce its exogeneity. Further, we test the exogeneity of this variable, showing that the gender of the firstborn child is not predicted by parental characteristics (e.g. gender, marital status, and cultural preferences) or family characteristics (e.g. number of houses owned, per capita income, and family size).

Our baseline results show that the firstborn child being male rather than female significantly reduces parents' willingness to live in nursing homes, with a marginal effect of approximately −3.3%. Given that the sample mean of parents expressing a willingness to live in nursing homes is 12.6%, this effect decreases by 26.2% (= 3.3/12.6) when the firstborn child is male. Our heterogeneity analysis indicates that the gender of the first-born child has a larger impact for parents from one-child households or rural households, as well as those from areas with more institutional scandals. Our mechanism analysis suggests that this effect occurs through two underlying channels. First, the firstborn child being male means that parents are more likely to agree with the traditional concepts of raising sons for support in old age and filial piety, meaning that they have higher expectations of their sons to provide support in their later years. Second, the gender gap in economic capability means that adult men are more likely to find jobs and earn a higher income compared with adult women. Thus, when the firstborn child is male, parents have higher expectations of their children to provide support in old age, thereby reducing their willingness to live in nursing homes.

This paper complements the empirical literature on the effect of children's gender. Existing studies have documented the various effects of children's gender on parents, including their labour supply and wages (Lundberg and Rose 2002), marital status (Dahl and Moretti 2008), health conditions (Li and Wu 2011), social perceptions and family status (Edlund 1999; Gupta et al. 2003), and risk

preferences (Chew et al. 2018; Pogrebna, Oswald, and Haig 2018). In particular, our study is related to that of Guo and Zhang (2020), who investigate the effect of children's gender composition on filial piety and support of ageing parents. Different from previous studies, this paper is one of the first to provide causal evidence of the effect of children's gender on parents' LTC arrangements. More importantly, we demonstrate the heterogeneity of this effect and reveal the underlying mechanisms, thereby filling the literature gaps and providing useful policy implications.

This paper also contributes to the literature on determinants of preferred living arrangements in old age, examining the impact of personal and familial characteristics on LTC preferences. Mohd, Senadjki, and Mansor (2017) illustrate the effect of marital, educational, and work status on the living arrangements of elderly people. Fan, Fang, and Yang (2018) find that the poorer the health status of elderly parents, the greater the likelihood of them living with their children. For parents without social pension insurance, they may have to depend more on their children, raising the chances of living together (Engelhardt, Gruber, and Perry 2005). The work most relevant to the current paper is that of Oliveira (2016), who uses the incidence of firstborn twins as an instrument for fertility outcomes and shows that elderly Chinese parents with more children have a higher likelihood of living with an adult child. The present study sheds new light on a factor influencing elderly people's living arrangements – the gender composition of their children. Our evidence shows that having a firstborn male child significantly decreases parents' preference for nursing homes and increases their inclination to live with their adult children.

The rest of this paper is organized as follows. Section II introduces the background. Section III presents the data sources and empirical strategy. Section IV presents the baseline regression outcomes and robustness tests and investigates heterogeneity. Section V explores the underlying mechanisms via traditional norms and disparities in children's economic capacities. Section VI concludes with a summary and policy implications.

II. Background and research hypothesis

LTC system in China

With the acceleration of China's population ageing, the LTC system has received extensive attention. Confucian culture emphasizes the filial piety, which has led to China's elderly relying on home care for a long time (Gu, Dupre, and Liu 2007; Streib 1987; Zhan et al. 2011). Nonetheless, demographic shifts and socioeconomic changes are eroding this tradition, suggesting a shift from informal to formal LTC (Giles, Wang, and Zhao 2010). To stimulate the supply of formal care, in the mid-1990s, the Chinese government implemented reforms to decentralize the operation and financing of state welfare institutions (Feng et al. 2012). Since then, these institutions have shifted their financial base from reliance on public funding to more diversified revenue sources, including privately paying individuals.

Currently, China's LTC system consists of three parts: home care, institutional care, and community care. About 90% of the elderly receive home care from family members, about 3% live in nursing homes, and 7% rely on community-based care. In particular, nursing homes in China are divided into two types: private nursing homes and public nursing homes. The government subsidizes public nursing homes, thereby making their services cheap and accessible, especially in rural areas. However, the quality of care delivered by these public homes tends to be compromised due to obsolete infrastructure and a lack of professional nursing staff (Chu and Chi 2008; Feng et al. 2011, 2012). Conversely, private nursing homes offer a higher quality of service, but they are more expensive due to limited government financial support.[4]

Despite evidence from developed countries indicating both substitutes and complementarities between formal and informal care (Bolin,

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Lindgren, and Lundborg 2008; Houtven and Norton 2004; Kemp, Ball, and Perkins 2013), in China, formal and informal home care generally serve as substitutes (Feng et al. 2012; Shum et al. 2015; Zhan, Feng, and Luo 2008). Specifically, when elderly individuals opt for home care, it is primarily their children who assume responsibility for their living conditions, meals, activities, and health. Only when elderly individuals are suffering from a serious illness will the family seek support from a hospital or medical service centre. On the other hand, if the elderly choose formal care, they make nursing homes their primary residence where they receive life care and medical services. Under such circumstances, children only visit their parents during holidays and do not provide any other form of LTC.

Research hypothesis

The key research questions of this paper are whether the gender of the child will affect the parents' willingness to choose institutional LTC and through what specific channels this influence may be realized. Before adopting rigorous empirical methods to test the above questions, we first formulate a series of hypotheses based on related theories and conclusions of existing studies.

From the perspective of traditional culture, Chinese cultural norms have had a lasting and profound impact on parents' long-term care living arrangements, viewing sons as essential for both family lineage continuity and support for ageing parents (Gupta et al. 2003; Whyte and Xu 2003). In contrast, most daughters, once married, will live with their husbands' families and provide support to elderly in-laws. Thus, Chinese parents generally believe that sons are better equipped to care for them in old age, while daughters may be unable to fulfil this role. Meanwhile, 'filial piety' as another traditional norm is also closely related to elderly parents' living arrangements. As discussed by Becker and Murphy (1988), parents expect their children to support them in old age in return for investing in them, representing a type of LTC 'contract' enforced by the notion of filial piety. However, filial piety is closely associated with the children's gender. Compared with daughters, sons have a higher likelihood of being indoctrinated with the norm of filial piety (Guo and Zhang 2020). Therefore, when the first child is male, parents are more likely to instil traditional concepts in their children, thereby strengthening their agreements with traditional concepts in the process. This may lead to parents having higher expectations for home care provided by their sons, thereby reducing their willingness to live in a nursing home.

From the perspective of practical factors, the quality of long-term care is also closely related to the economic capability of children when parents rely on them for old-age support. Thus, differences in children's economic capabilities may shape parents' long-term care preferences. Many studies have documented differences between males and females in terms of economic capability (Le Barbanchon, Roland, and Alexandra 2021). Alesina, Giuliano, and Nunn (2013) provide cross-national evidence that in traditional agricultural societies, given their innate physical advantages, men are more economically valuable than women, resulting in parents preferring sons over daughters. Despite advances in productivity and the gradual replacement of labour-intensive production modes, a considerable wage gap between males and females persists (Ashenfelter and Hannan 1986). In China, gender inequality is pervasive in both urban and rural labour markets (Chi and Li 2008; Iwasaki and Ma 2020). Under the influence of traditional norms, women may opt for easier and lower-paying jobs to better care for their children and families. Many even transition into full-time homemakers, taking the main responsibility of caring at home. Therefore, if males are more economically capable, parents with sons rather than daughters may have a higher expectation of living with their children for support in old age, reducing their willingness to live in nursing homes.

Based on the above discussions, we formulate the core hypothesis:

H1: compared with parents whose firstborn child is a daughter, parents whose firstborn child is a son will significantly reduce their willingness to live in nursing homes.

The gender of children may have an impact through two specific channels:

H2: the firstborn child being male may strengthen parents' identification with traditional cultural norms, which makes parents follow traditional concepts and prefer family care for the elderly, thereby reducing their willingness to live in nursing homes.

H3: adult men may have stronger economic capabilities than adult women, which makes parents have higher expectations for boys to provide family support for the elderly, thereby reducing their willingness to live in nursing homes.

Stylized facts

To initially test these hypotheses, we provide preliminary stylized facts. Based on the 2015 1% National Population Sample Survey conducted by the National Bureau of Statistics, we obtain the male-to-female sex ratio of the population aged 25–55 years in each province of China.[5] As shown in Figure 2(a), the proportion of people residing in nursing homes across various provinces is

negatively correlated with the ratio of male to female children. Furthermore, using census data depicted in Figure 2(b), we illustrate an upward trend in the sex ratio of old-age individuals' children in China from 2000 to 2020. Combining graphical evidence in Figure 2, we find that as the gender ratio of children increases, the parents' demand for nursing homes decreases. Taking these facts together, we can provide a more comprehensive and intuitive explanation for this puzzle. In the next section, we use individual-level data to examine the effect of children's gender on parents' LTC arrangements.

III. Data and empirical strategy

Data

The data used in the baseline regression and mechanism analysis are drawn from the CHFS.[6] Since 2011, the survey has been conducted five times nationwide (in 2011, 2013, 2015, 2017, and

(a)   (b)
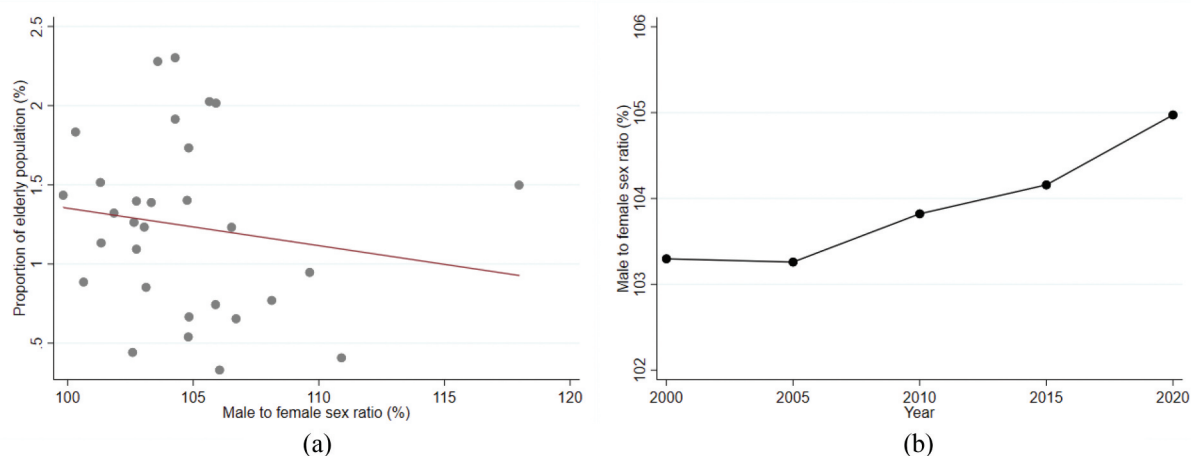
Figure 2. The proportion of elderly people living in nursing homes and the gender ratio of children. Panel (a) shows the correlation between the sex ratio and the proportion of elderly people living in nursing homes at the provincial level in 2015. The horizontal axis represents the sex ratio of men and women aged 25–55 years in 2015, and the vertical axis represents the proportion of elderly people living in nursing facilities to the total elderly population. Variables are obtained from the National Bureau of Statistics and the China Civil Affairs Statistical Yearbook. Panel (b) shows the trends in the sex ratio of children from 2000 to 2020. The vertical axis represents the sex ratio of men and women aged 25–55 years. Data are obtained from the censuses in different years (i.e. 2000, 2010, 2020) and the 1% National Population Sample Survey (the 'mini-census') (i.e. 2005, 2015).

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[5]The ages of children of parents aged 65 years and over are roughly in this range. Therefore, this indicator reflects the sex ratio of children of people aged 65 years or over in 2015.

[6]The CHFS is a nationally conducted by the Survey and Research Center for China Household Finance and is aimed at collecting relevant information on household finance at the micro level. The main topics include basic household characteristics, income, and consumption, employment and payment habits, housing assets and financial wealth, traditional beliefs and retirement choices, and other relevant information. The survey does not cover Xinjiang, Tibet, Hong Kong, Macao, or Taiwan.

Table 1. Descriptive statistics.

Variable	Mean	SD	Min.	Max.	Obs.
Willingness to live in nursing homes	0.126	0.332	0	1	8,861
Willingness to home care	0.758	0.428	0	1	8,861
Willingness to live with children	0.368	0.482	0	1	5,948
Living with the first child in old age	0.231	0.421	0	1	5,876
Raising sons for support in old age	0.574	0.494	0	1	8,861
Filial piety (five-point scale)	4.110	1.250	1	5	8,861
Primary caregiving responsibility on children	0.355	0.478	0	1	8,861
Firstborn child (male = 1)	0.529	0.499	0	1	8,861
Employment (employed = 1)	0.555	0.497	0	1	4,264
Income (logarithm)	4.885	5.019	0	11.918	3,762

2019). The survey is based on 40,011 households comprising 127,012 individuals distributed across 29 provinces in China. The CHFS data provide the unique variables needed for our empirical analysis, including respondents' family member information, willingness to live in nursing homes, and attitude towards traditional concepts, enabling us to examine the effect of children's gender on ageing parents' living arrangements and explore the mechanisms underlying this effect. Additionally, the CHFS provides rich information on individual and family characteristics, providing useful variables for our heterogeneity analysis.

We select a sample of 8,861 individuals who have children and who have provided their views on LTC arrangements in the survey, while respondents without children are not included.[7] The main outcome variable is a dummy variable, which equals one if the individual plans to live in nursing homes, and zero otherwise.[8] Our explanatory variable is the gender of the first child, which equals one if the individual's firstborn child is male, and zero otherwise. The individual-level and household-level control variables used in the empirical analysis are also drawn from the 2015 CHFS database. Descriptive statistics of the main outcome variables are reported in Table 1.

Empirical specification

To examine the effect of children's gender, we establish the following regression model:

$$y_{ihp} = \alpha + \beta first\_male_i + \gamma X_i' + \rho \Psi_h' + \lambda_p + \varepsilon_{ihp} \tag{1}$$

where y_{ihp} is the dependent variable representing the outcome variables of interest; $first\_male_i$ is a dummy variable, representing whether the first-born child is a male; the coefficient β captures the gender effect; X_i' is the set of individual-level control variables: age, gender, health, marital status, financial situations, and family concepts (views on the importance of family); Ψ_h' is the set of household-level control variables: number of dwellings, annual per capita household income (logarithm), family size, and number of children; λ_p represents the prefecture fixed effects, controlling for the impact of prefecture-level characteristics that do not change over time; and ε_{ihp} is the residual term.

We use the logit model in the baseline regression, in which the dependent variable is binary. In the mechanism analysis, for ordinal dependent variables (such as the degree of adherence to filial piety), we use an ordered logit model in the regression. For continuous dependent variables (such as income level), we employ ordinary least squares (OLS) regressions. All regression outcomes report robust standard errors.

Endogeneity concerns

The main empirical challenge in our approach is that the gender composition of children is not necessarily random (Ebenstein 2010; Qian 2009), which may cause an endogeneity issue when exploring the effect of children's gender. First, the long-standing traditional agriculture system in China means that many Chinese parents perceive boys as having greater economic value because of their inherent labour advantages (Qian 2008), which

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[7]To ensure a more balanced gender ratio among the sample of first-born children, we delete samples where the number of children included in the dataset is not equal to the actual number of children born to the parents and remove the ten prefectures with the highest sex ratios from the sample.
[8]This information comes from the question, 'In what form do you want to live for your elderly life?' In the 2015 survey, the answer choices are: (a) home care, (b) institutional care, or (c) community care. We set the variable at 1 if parents chose (b), and 0 otherwise.

may lead to gender selection at birth. Second, the One Child Policy (hereafter abbreviated as, OCP) implemented in 1979 is likely to have intensified the traditional preference for sons, given the strict limitation on the number of children.

Following previous studies, we employ the gender of the firstborn child as a proxy for the gender composition of children. For example, Ebenstein (2010) shows that the sex ratio of firstborn children is close to the natural rate. In addition, since 1984, China has implemented a more flexible One-and -a-half Child Policy in rural areas, permitting households to have a second child if the first is a girl (Qian 2009). Under this policy, most parents focus more on the gender of their second rather than the first child. Therefore, we restrict the sample to the first children born after 1984 to enhance the exogeneity of the key independent variable.[9]

Besides the gender of the first child, the presence of sons, the number of sons, and the proportion of sons to the total number of children can also serve as proxies for children's gender composition. Thus, we further conduct the exogeneity test by separately regressing these proxies on a series of individual and household characteristic variables. Table 2 reports the estimation results. Columns (1) to (3) display other proxy variables significantly correlated with specific characteristics, whereas Column (4) shows no significant correlation between the first child's gender and these variables. Therefore, unless there are overlooked variables with no significant correlation to any included variables (which is unlikely), the estimates are not expected to be biased. Overall, the exogeneity of the gender of the first child is credible.

Control variables selection

Although the gender of the first child is a good exogenous variable, we are still concerned that many other factors may lead to biased estimates. Therefore, based on the existing literature on factors affecting LTC arrangements (Engelhardt, Gruber, and Perry 2005; Fan, Fang, and Yang 2018; Mohd, Senadjki, and Mansor 2017; Oliveira 2016), we control for a range of individual characteristics, household characteristics, and prefecture fixed effects in our baseline equation. Specifically, in terms of individual characteristics, we control for age, gender, health, marital status, financial situations, and family concepts. Regarding household characteristics, we control for the number of dwellings, annual per capita household income (logarithm), family size, and number of children. Considering that the

Table 2. Exogeneity test.

Variable	Presence of sons (1)	Number of sons (2)	Proportion of sons (3)	Gender of firstborn child (4)	Obs. (5)
Gender	0.023	0.022	0.011	0.008	8,861
	(0.044)	(0.034)	(0.047)	(0.043)	
Marriage	0.292**	0.252**	0.090	−0.020	8,861
	(0.138)	(0.113)	(0.158)	(0.137)	
Pension insurance	−0.169***	−0.168***	−0.047	−0.027	8,861
	(0.055)	(0.041)	(0.057)	(0.052)	
Health condition	−0.014	−0.072***	0.040	0.054	8,861
	(0.040)	(0.031)	(0.043)	(0.039)	
Family perceptions	0.054	0.020	−0.022	−0.042	8,861
	(0.050)	(0.039)	(0.054)	(0.049)	
Number of houses	−0.012	0.005	−0.004	−0.009	8,861
	(0.017)	(0.016)	(0.017)	(0.016)	
Household income per capita (log)	−0.179***	−0.227***	0.043	0.059	8,861
	(0.044)	(0.036)	(0.047)	(0.044)	
Family size	0.354***	0.365***	0.046*	−0.035	8,861
	(0.026)	(0.023)	(0.027)	(0.027)	

Dummy variables using logit regression: gender (male = 1), marriage (married = 1), pension insurance (owing = 1). Ordered variables using ordered logit regression: health condition and family perceptions. Continuous variables using ordinary least squares regression: number of houses owned, household income per capita (logarithm) and family size. Robust standard errors are in parentheses. ***, **, and * denote significance at the 0.01, 0.05, and 0.1 levels, respectively.

[9]Gender selection in China is rooted in traditional agriculture, with rural areas being the most affected. By reducing gender selection in rural families, the One-and-a-half Child Policy has significantly alleviated this issue nationwide. By limiting the sample to children born after this policy was implemented, the exogeneity of the first child's gender is further enhanced.

factor education is incorporated in the heterogeneity analysis, we include it as an additional control variable in the robustness checks. Furthermore, we also control for three other variables that may cause estimation bias in our robustness checks, including traditional concepts, the firstborn child's proximity, and marital status.

Finally, variations in cultural and economic development across different regions may influence both the provision and quality of LTC services, as well as the parental demand for them. Therefore, we also control for prefecture fixed effects to mitigate potential bias caused by these unobserved factors.

IV. Empirical results

Baseline estimates

We examine the effect of children's gender on parents' willingness to live in nursing homes. The results of the baseline regression are reported in Table 3, with Columns (1) to (4) illustrating the logit model regression results. Column (1) reports the baseline estimates with no control variables. Further, to effectively identify causal effects, three classes of control variables – individual characteristics, family characteristics, and prefecture fixed effects – are gradually added to the regression equation. The results are shown in Columns (2) to (4). Using the results reported in Column (4) as the baseline results and a significance level of 1%, we find that compared with the firstborn child being female, the firstborn child being male significantly reduces parents' willingness to live in

formal nursing homes, which supports our research hypothesis *H1*.

To facilitate interpretation, we further calculate the marginal effect based on the logit regression results in Column (4). The average willingness of parents to live in nursing homes is 12.6% (see Table 1), while the marginal effect of the firstborn child's gender is −3.3%, as shown in Column (5) of Table 3. This indicates that if the firstborn child is male, the willingness of parents to live in nursing homes declines from 12.6% to 9.3% (a relative decrease of 26.2% = 3.3/12.6). The OLS estimation result shown in Column (6) also suggests that parents whose firstborn child is male are significantly less willing to live in formal LTC institutions. Notably, this is close to the marginal effect estimation coefficient reported in Column (5).

Robustness checks

To ensure the robustness of our results, we conduct a series of empirical tests, including introducing additional control variables, selecting samples, replacing the proxy variable, and using alternative dependent variables. The estimated results are reported in Tables 4 and 5.

Additional controls. Although we have controlled the primary individual and family traits relevant to elderly living arrangements, there are endogeneity concerns resulting from omitted variables. Therefore, we introduce a series of other control variables to test the robustness of the results. The likelihood of parents accepting formal elder care, alongside the potential presence of gender bias, is predominantly shaped by their

Table 3. Baseline results.

Dependent variable	Willingness to live in nursing homes					
	Logit				Marginal effect	OLS
	(1)	(2)	(3)	(4)	(5)	(6)
First_male	−0.179***	−0.197***	−0.312***	−0.326***	−0.033***	−0.034***
	(0.064)	(0.065)	(0.066)	(0.070)	(0.007)	(0.007)
Individual controls		Yes	Yes	Yes	Yes	Yes
Family controls			Yes	Yes	Yes	Yes
Prefecture FE				Yes	Yes	Yes
Observations	8,861	8,861	8,861	8,861	8,861	8,861
Residual R^2	0.0012	0.0110	0.0465	0.0889		0.0642

Individual control variables mainly include age, gender, marital status, health condition, family perception, and social insurance. Family control variables mainly include the number of houses owned, per capita income, family size, and number of children. Robust standard errors are in parentheses. ***, **, and * denote significance at the 0.01, 0.05, and 0.1 levels, respectively.

Table 4. Robustness checks: additional control variables.

| Dependent variable | Willingness to live in nursing homes | | | | |
	(1)	(2)	(3)	(4)	(5)
First_male	−0.295***	−0.310***	−0.323***	−0.354***	−0.292***
	(0.070)	(0.070)	(0.070)	(0.074)	(0.071)
Education	0.255***				0.262***
	(0.037)				(0.040)
Traditional beliefs		−0.622***			−0.514***
		(0.130)			(0.145)
First_live			0.187*		0.196*
			(0.098)		(0.118)
First_married				−0.326**	−0.215
				(0.132)	(0.134)
Controls	Yes	Yes	Yes	Yes	Yes
Prefecture FE	Yes	Yes	Yes	Yes	Yes
Observations	8,855	8,861	8,665	8,014	7,965
Residual R^2	0.0959	0.0920	0.0880	0.0936	0.1066

Control variables include age, gender, marital status, health condition, family perception, social insurance, the number of houses owned, per capita income, family size, and number of children. Robust standard errors are in parentheses. ***, **, and * denote significance at the 0.01, 0.05, and 0.1 levels, respectively.

Table 5. Robustness checks: replacement of samples and variables.

| Dependent variable | Willingness to live in nursing homes | | Willingness to home care | Willingness to live with children | Living with the first child in old age |
	Excl. Beijing and Shanghai (1)	Alternative proxy (2)	Alternative outcome (3)	Alternative outcome (4)	Alternative outcome (5)
First_male	−0.257***		0.258***	0.137**	1.686***
	(0.071)		(0.054)	(0.063)	(0.103)
Proportion of sons		−0.042***			
		(0.009)			
Controls	Yes	Yes	Yes	Yes	Yes
Prefecture/County FE	Yes	Yes	Yes	Yes	Yes
Observations	8,256	8,861	8,861	5,948	5,675
Residual R^2	0.0795	0.0647	0.0758	0.1327	0.4086

Control variables include age, gender, marital status, health condition, family perception, social insurance, the number of houses owned, per capita income, family size, and number of children. Robust standard errors are in parentheses. ***, **, and * denote significance at the 0.01, 0.05, and 0.1 levels, respectively.

cognitive viewpoints. We control for parents' educational level and agreement with traditional beliefs[10] to address potential endogeneity concerns. Beyond personal traits, the geographical closeness and marital status of offspring also impact the parents' elder care. Traditionally, parents often live with their son and daughter-in-law, benefiting from the care they provide. We control for the distance of the firstborn child to their parents, using the variable of whether the firstborn child lives in the same county as the parents as the proxy, and their marital status. Simultaneously, we incorporate four additional control variables into the analysis. The results, which are detailed in Table 4, remain robust across all tests.

Sample selection. Using the full samples in the benchmark regression may lead to biased estimates because of the peculiarities of some samples. For example, given their higher public service quality and per capita income, Beijing and Shanghai may have a more sophisticated formal LTC service system; thus, parents in these cities may tend to prefer nursing homes when planning for old age. Therefore, Beijing and Shanghai may differ from other cities in the sample, leading to potential bias when using the full sample for regression. To mitigate this bias, we exclude Beijing and Shanghai from the sample and re-estimate the equation. The results are reported in Column (1) of Table 5. Children's gender continues to have a significant

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[10]We construct the traditional concept index utilizing Principal Component Analysis (PCA) based on the three variables- the traditional concepts of raising sons for support in old age and filial piety, as well as the belief that children bear primary responsibility for elderly care – which are subsequently employed in the mechanism analysis.

Table 6. Heterogeneity analysis.

Dependent variable	Willingness to live in nursing homes			
	Number of children		One-Child Policy	
	One	Multiple	Before OCP	After OCP
	(1)	(2)	(3)	(4)
First_male	−0.348***	−0.271	−0.123	−0.234***
	(0.077)	(0.195)	(0.138)	(0.062)
Controls	Yes	Yes	Yes	Yes
Prefecture FE	Yes	Yes	Yes	Yes
Observations	5,717	1,956	1,896	10,952
Residual R^2	0.0664	0.1301	0.0989	0.0821

The dependent variable is the willingness to live in nursing homes. Control variables include age, gender, marital status, health condition, family perception, social insurance, the number of houses owned, per capita income, family size, and number of children. Robust standard errors are in parentheses. ***, **, and * denote significance at the 0.01, 0.05, and 0.1 levels, respectively.

negative effect on parents' willingness to live in nursing homes, and the estimated coefficient (−0.257) is slightly lower than the baseline coefficient (−0.326).

Alternative proxy. In the baseline regression, the firstborn child's gender serves as a proxy for children's gender composition, addressing potential endogeneity issues. However, the responsibility for the elderly does not lie exclusively with the firstborn child in Chinese traditional culture. In families with many children, the responsibility for the care of elderly parents is distributed among siblings. Notably, parents may depend on their sons for support in old age, even if they are not the eldest. The preference for sons for support in old age depends not only on having sons but also on the number of sons. Therefore, the proportion of sons among all children better captures this concept. The results reported in Column (2) of Table 4 show that the higher the proportion of sons, the lower the parents' willingness to live in nursing homes, which is consistent with the baseline estimates.

Alternative outcomes. Our analysis indicates that having a firstborn male heightens parents' expectations for familial old-age support and home living, reducing their preference for institutionalized care. In Column (3) of Table 5, we replace the outcome with a dummy variable, which equals one if the parents plan to live at home in their old age and zero otherwise. We find that the firstborn child

being male significantly increases parents' willingness to choose home care. We further examine, using the 2013 CHFS data,[11] whether parents who rejected institutionalized care would prefer residing with their children in their later years rather than living independently if their eldest child is male. The results displayed in Column (4) of Table 5 support our hypothesis. Additionally, we use data from the 2016 China Family Panel Studies (CFPS) to investigate actual elderly living arrangements for parents over 65 years of age.[12] We construct a dummy variable, which equals one if the parents live with their firstborn adult child and zero otherwise. As shown in Column (5) of Table 5, the firstborn child being male significantly increases the likelihood of elderly parents living with their children. Combining these results, we show that a male firstborn considerably diminishes parents' inclination for institutionalized care and enhances their propensity to co-reside with their adult children.

Heterogeneous effects

The prior analysis examines the average effect of children's gender on parents' institutional preferences. In this section, we further examine heterogeneity in this effect across individual, familial, and regional dimensions. The results are reported in Tables 6 and 7.

Number of children. The number of children is closely related to the sharing of responsibilities for

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[11]The 2013 CHFS options for parental preferences for elderly care are (a) institutional care, (b) home care, or (c) children care; in 2015 questionnaire the options for this question changed to (a) home care, (b) institutional care, or (c) community care.
[12]The CFPS is a national large-scale, multidisciplinary, social survey project that focuses on the economic and noneconomic welfare of Chinese residents, including basic family and individual characteristics, economic activities, educational achievements, population migration, health, and intergenerational contacts. The CFPS sample covers 25 provinces, municipalities, and autonomous regions. We draw data from the individual characteristics of the 2016 CFPS.

Table 7. Heterogeneity analysis.

Dependent variable	Willingness to live in nursing homes					
	Education level		Location		Aged care scandals	
	Low (1)	High (2)	Rural (3)	Urban (4)	Low (5)	High (6)
First_male	−0.325***	−0.299***	−0.704***	−0.214**	−0.217*	−0.405***
	(0.114)	(0.093)	(0.227)	(0.075)	(0.112)	(0.099)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Prefecture FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,277	3,844	1,297	6,487	3,896	3,962
Residual R²	0.1026	0.0764	0.1292	0.0807	0.0889	0.0867

The dependent variable is the willingness to live in nursing homes. Control variables include age, gender, marital status, health condition, family perception, social insurance, the number of houses owned, per capita income, family size, and number of children. Robust standard errors are in parentheses. ***, **, and * denote significance at the 0.01, 0.05, and 0.1 levels, respectively.

the support of parents in old age. In one-child families, where the responsibility for LTC rests entirely on a single child, the effect of the firstborn child's gender may be pronounced. Parents whose only child is male may naturally perceive their son as the primary caregiver, while parents whose only child is female may be more inclined to consider alternative options such as nursing homes. However, in families with multiple children, in which care responsibilities can be shared, this pattern is less evident. We re-estimate our equation after dividing the sample into one-child and multi-child families. The results in Columns (1) and (2) of Table 6 show that in one-child families, the first-born child being male reduces parents' willingness to live in nursing homes, while this effect is non-significant in multi-child families. Furthermore, acknowledging that the OCP markedly influences the number of offspring, we examine the variances in the impact of the firstborn child's gender pre and post the policy's enforcement, segmenting the sample based on their birth years. The results reported in Columns (3) and (4) of Table 6 indicate that the policy has reinforced the effect of children's gender.

Education level. Parents with higher levels of education tend to be less swayed by traditional concepts, resulting in diminished expectations of care from sons and a greater preference for independence, as partly evidenced by the robustness check results. However, this effect may continue to lessen as education levels rise. For parents who have reached a certain level of education, practical considerations, such as their children's financial capability, still hold importance when planning for elderly care arrangements despite their reduced susceptibility to traditional viewpoints. The results in Columns (1) and (2) of Table 7 show the heterogeneity of the effect of the firstborn child's gender by education level. We categorize parents with a senior high school degree or higher into the high-education group and those with a secondary school degree or lower into the low-education group. We observe that the coefficients obtained from the two groups are very similar.

Urban and rural households. In rural households, children's gender may have a more pronounced effect on LTC arrangements for three reasons. First, in rural families characterized by lower incomes and agricultural livelihoods, ageing parents tend to rely on their sons for financial support because of the physical advantages of males for agricultural production. This will lead parents to naturally expect sons to care for them in old age. Second, limited access to information in rural areas means that parents are more likely to be influenced by traditional culture. In contrast, urban households have various income sources, and parents are more likely to be exposed to modern concepts. Third, although nursing homes are more accessible in rural areas, the infrastructure and service quality of nursing homes are far inferior to those in urban areas.[13] In contrast, the service quality of public nursing homes and the proportion of private nursing homes in urban areas are both

[13]Specifically, in terms of differences in accessibility, according to data from the National Bureau of Statistics, in 2015, the number of beds in nursing homes per 10,000 people in rural areas was 244, while the number of beds in urban areas was 163. However, in terms of infrastructure and service quality, according to data from the Statistical Yearbook of the Ministry of Civil Affairs of China, in 2015, the average number of beds per nursing home in rural areas is only about half that in urban areas (115 vs. 204). The number of nursing staff per nursing home in rural areas was only half that in urban areas (7 vs. 17). Among them, the number of professional and skilled staff per nursing home in rural areas was only one-third that in urban areas (4 vs. 12).

higher. Under such conditions, for some parents in urban areas, formal care provided by nursing homes can become an alternative to home care, but for parents in rural areas, home care provided by their sons may be a better choice. Therefore, we divide the sample into rural and urban families and re-estimate the Equation. Columns (3) and (4) of Table 7 reveal a notably high negative impact on rural families, with a coefficient of −0.704. In contrast, urban families experience a less substantial effect, with a coefficient of −0.214.

Reputation of local nursing homes. When making future living arrangements, parents tend to be risk averse because of their anticipated vulnerability in old age. Thus, the social reputation of nursing homes plays a crucial role in local residents' demand for institutional care. We expect that in regions with a higher prevalence of scandals related to nursing homes, parents may be more reliant on their children for care, and their children's gender will have a greater effect on their living arrangements. To test this hypothesis, we collect data on negative events related to nursing homes in 2015 from The Database of TV News Information Teaching and Research (TVMVDB) and the China Digital Library newspaper database.[14] We aggregate the number of negative events at the provincial level and use this as an indicator to measure the social reputation of nursing homes. We divide our sample into low-scandal and high-scandal regions based on the median value of this indicator. The estimates obtained from the subsamples are reported in Columns (5) and (6) of Table 7, showing no effect of child gender on parents' willingness to live in nursing homes in low-scandal regions but a significant negative effect in high-scandal regions, with the estimated coefficient exceeding the baseline results.

V. Underlying mechanisms

The analysis above reveals the effect of child gender on parents' living arrangements in old age and the heterogeneity of this effect across various individual, familial, and regional characteristics. The

Table 8. Underlying mechanism: traditional beliefs.

Dependent variable	Raising sons for support in old age (1)	Filial piety (2)	Primary caregiving responsibility on children (3)
First_male	0.171***	0.075*	0.290***
	(0.047)	(0.043)	(0.050)
Controls	Yes	Yes	Yes
Prefecture FE	Yes	Yes	Yes
Sample of parents	Yes	Yes	Yes
Observations	8,861	8,861	8,861
Residual R^2	0.0814	0.0243	0.0970

Dependent variables are whether parents believe in: Column (1): raising sons for support in old age; Column (2): filial piety (five-point scale, with a higher score indicating greater agreement); Column (3): responsibility for LTC lies with children. Control variables include age, gender, marital status, health condition, family perception, social insurance, the number of houses owned, per capita income, family size, and number of children. Robust standard errors are in parentheses. ***, **, and * denote significance at the 0.01, 0.05, and 0.1 levels, respectively.

critical question remaining is why having a male firstborn child significantly reduces parents' willingness to live in nursing homes. This section presents the empirical tests conducted to explore underlying mechanisms such as traditional beliefs and children's economic capacities.

Traditional beliefs

As previously mentioned, deeply rooted traditional beliefs in China, such as raising sons for support in old age and filial piety, are closely related to elderly parents' living arrangements. According to hypothesis *H2*, having a male first-born child will strengthen parents' identification with traditional cultural norms, which makes parents follow traditional concepts and prefer family care for the elderly and reduce their willingness to choose institutional care for the elderly. We empirically test this hypothesis and present the results in Table 8.

We evaluate parents' adherence to the traditional concepts of raising sons for support in old age and filial piety. The results displayed in Columns (1) and (2) indicate that the firstborn child being male significantly increases parents' endorsement of these ideas, aligning with our theoretical analysis. Additionally, we examine parents' views on the allocations of LTC responsibilities.

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[14]We consider scandals as negative events for which nursing homes are primarily responsible, such as elder abuse by staff or fires occurring because of poor facility management. Notably, in some provinces, no negative nursing home events occurred in 2015. This does not necessarily imply that they have a better reputation; rather, it may be attributable to fewer nursing homes and lower industry development in these areas. To better test our assumptions, we exclude provinces with no negative events in 2015 (Guizhou, Qinghai, Inner Mongolia, Ningxia, Hainan, and Gansu).

Table 9. Underlying mechanism: traditional beliefs.

Dependent variable	Willingness to live in nursing homes	Raising sons for support in old age	Filial piety	Primary caregiving responsibility on children
	(1)	(2)	(3)	(4)
Child×Son	−0.352***	0.238***	0.088*	0.299***
	(0.075)	(0.057)	(0.052)	(0.064)
Controls	Yes	Yes	Yes	Yes
Prefecture FE	Yes	Yes	Yes	Yes
Sample of parents	Yes	Yes	Yes	Yes
Observations	6,475	6,399	6,456	6,439
Residual R^2	0.0647	0.0683	0.0218	0.0836

The sample includes parents who have either no children or only one child. The variable $Child_i$ (whether having a child) has been included as a control variable. Control variables include age, gender, marital status, health condition, family perception, social insurance, the number of houses owned, per capita income, and family size. Robust standard errors are in parentheses. ***, **, and * denote significance at the 0.01, 0.05, and 0.1 levels, respectively.

The results in Column (3) show that having a male firstborn child significantly enhances parents' belief that their children, rather than themselves or the government, are primarily responsible for providing LTC. This indicates that the firstborn child being male reinforces parents' adherence to traditional beliefs, leading them to favour family-based care. Consequently, when the first child is male, parents are less willing to live in nursing homes.

Further, we employ a new framework to compare parental preferences across three groups: married couples without children, married couples with one girl, and married couples with one boy.[15] Estimation results reported in Table 9 show that, having a male child does significantly strengthen parents' identification with traditional beliefs related to LTC, thereby reducing their willingness to live in a nursing home. These estimates are consistent with those obtained using the gender of the firstborn child as the explanatory variable, which enhances our analysis of the traditional beliefs channel.

Children's economic capabilities

Differences in children's economic capabilities may also shape parents' long-term care preferences. Accord%ing to hypothesis *H3*, if males are more economically capable, parents with sons rather than daughters may have a higher expectation of living with their children for support in old age, reducing their willingness to live in nursing homes.

To assess the above hypothesis, based on China's legal working age of 16 years, we first divide the sample into children under 16 years and those aged 16 years or older. Given that the difference in economic ability between males and females will only appear after working age, we expect that when the age of children is below 16 years (the legal working

Table 10. Underlying mechanism: economic capability of children.

	Age of children			
	Willingness to live in nursing homes		Employment	Income (log)
Dependent variable	≥ 16 years	< 16 years	≥ 16 years	≥ 16 years
	(1)	(2)	(3)	(4)
First_male	−0.252***	−0.178	0.353***	0.555***
	(0.082)	(0.128)	(0.102)	(0.198)
Controls	Yes	Yes	Yes	Yes
Prefecture FE	Yes	Yes	Yes	Yes
Sample of parents	Yes	Yes		
Sample of first child			Yes	Yes
Observations	5,582	2,519	2,443	2,178
Residual R^2	0.0904	0.0721	0.2309	0.2789

Control variables in Columns (1) and (2) include age, gender, marital status, health condition, family perception, social insurance, the number of houses owned, per capita income, family size, and number of children, while in Columns (3) and (4) include firstborn child's age, marital status, education level, the number of houses owned, and per capita income. Robust standard errors are in parentheses. ***, **, and * denote significance at the 0.01, 0.05, and 0.1 levels, respectively.

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[15]We estimate the following specification.

$$y_{ihp} = a + \beta_0 child_i \times son_i + \beta_1 child_i + \gamma X_i' + \rho \Psi_h' + \lambda_p + \varepsilon_{ihp}.$$

where $child_i$ is a dummy variable, representing whether the parent i has a child; son_i is also a dummy variable, representing whether the child is a male; the coefficient β_0 captures the gender effect after controlling for the effect of having a child. Other variables remain the same as the baseline regression.

age), the gender composition of children will not affect parents' living arrangements in old age. In Table 10, Column (1) reveals that parents with children 16 or older are less inclined to reside in nursing facilities if the firstborn is male. Conversely, as shown in Column (2), the gender of the firstborn child has no significant effect with children below 16 years.

Further, we focus on the sample of firstborn children over the age of 16 years and directly examine whether disparities in economic capability between males and females appear once they have reached the legal working age. The results in Columns (3) and (4) of Table 10 reveal a considerable gender gap in both employment status and income. Compared with female firstborn children, male firstborn children at the legal working age are more likely to be employed and have a higher income. Combining these results, we verify the hypothesis that the difference in economic ability between genders is an important channel through which children's gender composition affects parents' LTC arrangements.

VI. Conclusions and discussion

This paper investigates the effect of children's gender on parents' LTC living arrangements. We find that the firstborn child being male significantly reduces parents' willingness to live in nursing homes. The results are sufficiently robust to perform a series of empirical tests. The results are heterogeneous, with the effect being stronger for parents with only one child, and those living in rural households or in areas with numerous nursing home scandals. The mechanism analysis reveals that the firstborn child being male negatively affects parents' willingness to live in nursing homes through two channels: first, the firstborn child being male strengthens the parents' agreements with traditional concepts, leading them to have higher expectations of their children to provide LTC; second, given that adult men have a greater economic capacity compared with adult women, when the firstborn child is male, parents have a greater expectation that their children will provide LTC in old age, thus reducing their willingness to live in nursing homes.

Our conclusions give rise to crucial policy implications for governments in China. First, our results reveal that traditional beliefs play an important role in making LTC arrangements for parents. The government needs to alter people's perceptions of traditional concepts. This may assist parents in adjusting their expectations for home care, particularly from sons, and promote their acceptance of nursing homes. Second, considering the difficulty of changing parents' dependence on home care in the short term, we propose that the government encourages and guides nursing homes to change their service strategies to complement home care, which may help improve their utilization. Third, the government needs to reduce the scandals of nursing homes by strengthening its regulatory supervision and prioritizing education and training initiatives to grow a professionalized LTC workforce.

Disclosure statement

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