Does Aging at Home Make Older Adults Healthy: Evidence from Medicaid Home and Community-Based Services

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September 2022

Abstract

The Medicaid Home and Community-Based Services (HCBS) subsidizes long-term care to satisfy the increasing desire to age at home among older adults. The HCBS program may improve health outcomes of this population by allowing them to age-in-place, but less quality and quantity of home-based care comparing to nursing home care could offset some of the potential benefits. We use plausibly exogenous policy expenditure across states over time linked with detailed health information from the restricted Health and Retirement Study (HRS) to identify the causal effects of HCBS on general health, physical health, and mental health of older adults. Overall, our findings suggest that HCBS is beneficial to health: a $1,000 increase in HCBS per older person improves health status by 6 percent, mitigates functional mobility limitations by 5 percent, and reduces negative psychological feelings by 10 percent. The positive effect on physical health is concentrated among people with limited financial resources, while the reducing impact on mental health is significant among the richer group. The HCBS program improves health outcomes mainly through three mechanisms: decreasing risk behavior on drinking, increasing healthcare use, and spending more time accompanying with family.

Keywords: Medicaid HCBS, Long-Term Care, Health, Aging

JEL classification: I12, I18, I30

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1 INTRODUCTION

The need for long-term care (LTC) in the United States has increased dramatically as its population ages (Kemper et al. 2005; Brown and Finkelstein 2008; National Center for Health Statistics 2009; Hagen 2013; Johnson 2017). To meet the elderly's increasing demand for LTC without raising the government's financial burden in covering the costly nursing home care services, Medicaid implemented the Home and Community-Based Services (HCBS) program in the mid-1980s, and expanded its coverage rapidly since the early 1990s (Kaye et al. 2009; Ng et al. 2010).[1] As people generally prefer to age in their own homes and communities, the HCBS program works by encouraging older people to delay entering nursing homes or rely less on nursing home care (Wilmoth and Chen 2003; Muramatsu et al. 2007; Miller 2011; Guo et al. 2015; Segelman et al. 2017; Aguila et al. 2020).

Despite its cost attractiveness, whether the expansion of HCBS improves health outcomes for the older population remains unclear. On the one hand, a large body of literature demonstrates that aging-in-place can improve health by creating senses of belonging and self-control of lives, reducing feelings of loneliness, and facilitating social relationships (Nair 2004; Oswald and Wahl 2004; Wiles 2005; Grabowski 2006; Rojo-Pérez et al. 2007; Stancliffe et al. 2009; Prieto-Flores et al. 2011; Sereny and Gu 2011). On the other hand, compared to nursing home care, there is typically less oversight of quality and quantity of home-based care (Kane et al. 2007; Dick et al. 2019), which may reduce health outcomes for the affected population. For example, there is evidence that the training and skills of HCBS staff are inadequate for particular groups, such as people with dementia, who are at risk of being inaccurately evaluated and given unsuitable care (Sands et al. 2008; Cherry 2012). Furthermore, older people who receive home-based care may have less contact with medical professionals than in a nursing home. In this case, some of their illnesses may go undiagnosed, even if their underlying health has deteriorated. Thus, the

[1] Many OECD countries have shifted resources toward providing more affordable home-based care to reduce the costs of providing long-term institutional care (Landers et al. 2016).

overall effect of Medicaid HCBS on the health of older people demands detailed investigation.

This paper examines eempirically how the HCBS program affects older Americans' health outcomes. Using the restricted data of the Health and Retirement Study (HRS) and detailed data on state-level policy spending from 1998 to 2014, we demonstrate how the HCBS benefits older people's health condition in three dimensions. First, we demonstrate that a $1,000 increase in HCBS expenditure per older person decreases the probability of reporting worse health status by 6 percent. The self-reported health improvement effect is more significant for older people with limited financial resources who are more likely to be enrolled in HCBS. Second, we evaluate how the HCBS program affects the older population on physical health. Our findings show that a $1,000 increase in HCBS expenditure is associated with a 5 percent decrease in the probability of individuals reporting mobility limitation. Third, our estimates also confirm that HCBS generosity improves mental health by reducing the probability of negative emotional feelings by 10 percent and increasing cognitive skills by 1 percent. The estimates above are robust across different specifications.

We further explore the mechanisms through which HCBS improves health outcomes of older adults. First, we find that HCBS leads to changes in risky behavior. An increase in HCBS generosity reduces the likelihood of drinking among older people by 2 percentage points (5 percent with a mean of 0.43). HCBS also decreases drinking intensity by 8 percentage points weekly (8 percent with a mean of 1) and 6 percentage points daily (12 percent with a mean of 0.5). These changes are nontrivial taking the fact that it is harder for older adults to change long-maintaining habits. Second, we show that the HCBS expansion is associated with an increase in healthcare use. HCBS increases the probability of using inpatient service by about 6 percent and the probability of regularly taking medication by 1 percent. Third, we provide suggestive evidence that HCBS significantly improves the chances of older people to interact with family members. Specifically, Liu and Zai (2022) show that HCBS generosity substantially increases informal caregiving to older

adults by their children and increases more incidents of co-residency with family members. In addition, we also find that HCBS improves the likelihood of older adults to be taken care of by either paid home aids or informal caregivers by about 38 percent. HCBS also increases the daily care provided to older peoply by 0.6 days (or hourly care by 3.9 hours) during the past month of the interview date.

This paper is related to several branches of the literature. First, the results are related to the research on how HCBS affects care arrangements and well-being of older people. A large part of this literature focuses on analyzing how HCBS affects home stay or home/community return, nursing home entry, length of nursing home stay, and use of hospitals (Miller et al. 1998; Alecxih et al. 2006; Radke et al. 2006; Muramatsu et al. 2007; Miller 2011; Guo et al. 2015; Wang et al. 2020). This line of work finds that the expansion of HCBS allows older people to stay at home/community longer and return to home after being discharged from nursing homes and hospitals. In addition, HCBS generosity decreases nursing home care use and the duration in nursing facilities. Another part of this literature shows that participants in HCBS are at a higher risk of hospitalization than nursing home residents (Sands et al. 2008; Wysocki et al. 2014; Konetzka et al. 2020). A few papers on analyzing health effects of HCBS find that HCBS generosity is associated with more patients of functional and cognitive impairment at home (Kane et al. 2013; Wang et al. 2020). To our best knowledge, this paper is the first to examine the extensive health effects of HCBS and hence contribute to the discussion of benefits of HCBS. We present a more convincing estimates by using the longitudinal HRS with a large representative sample of aging people in the United States linked with state-level demographic and economic variables that allow for identification assumption tests and detailed robustness checks.

Second, the findings in this paper are broadly connected to the literature that estimates the benefits of public policy on health. Studies of other Medicaid program find that the Affordable Care Act (ACA) expansion improves self-reported health and the psychological

health of low-income adults as well as infant health (Currie and Gruber 1996a;b; Finkelstein et al. 2012; McMorrow et al. 2017; Simon et al. 2017; Kuka 2020). Studies of Medicare show that Medicare benefits are associated with an improvement in self-reported health among older people (Khwaja 2006; Card et al. 2008). Studies of government welfare and nutrition programs also find improvement in self-reported health status (Bitler et al. 2005; Hoynes et al. 2011; Evans and Garthwaite 2014; Kuka 2020). Our findings echo this line of research and add to the conclusion that government policy can effectively enhance people's health conditions.

Third, the study is related to a smaller literature that evaluates the cost-effectiveness of HCBS. Many studies show that the HCBS program increases the overall Medicaid expenditure on LTC (Kemper 1988; Levine and Barry 2003; Grabowski 2006; Kane et al. 2013). Our findings provide evidence that HCBS could save Medicaid health care spending by improving health of older people. The potential savings from health improvement justifies the increasing investment in HCBS from the policy perspective.

The paper is organized as follows. Section 2 introduces the institutional background of HCBS. Section 3 describes the data, explains some key health outcomes, and presents summary statistics. Section 4 introduces the empirical model and potential threats to identification. Section 5 reports the effects of HCBS on a variety of health outcomes, explores mechanisms, presents robustness checks, and analyzes heterogeneous effects. Section 6 concludes.

2 MEDICAID HCBS

After its initial launch, LTC for older people funded by Medicaid was only available in institutional settings, such as in nursing homes. Because nursing home care is costly, Medicaid's LTC expenditure to expand significantly over the years. In an effort to contain the massive growth in LTC expenditure, and in the meanwhile, to satisfy older people's

expressed preferences for receiving LTC at home, Medicaid implemented the HCBS program in the early 1980s. The mission of HCBS is to provide LTC for older adults at home, and thus to improve their quality of life by allowing them to age in place. Since 1999, the program has expanded substantially, in response to court-ordered mandates of serving people with disabilities in home or community-based settings, as shown in Appendix Figure A1.[2] Our main working sample covers the period from 1998 to 2014, from the expansion of HCBS to the most recent year with policy information available. In section 4.1, we also use the pre-expansion period from 1992-1998 to test our identification assumptions.

Medicaid HCBS funds three major programs for older adults: a mandatory home health state plan, an optional personal care state plan, and optional aging waivers.[3] The state plans are available to every Medicaid-eligible person with limited resources and the aging waiver is only for Medicaid-eligible people aged 65 and above. (For most states, the Medicaid eligibility limit is around $2,313 per month in incomes and $2,000 in assets.)[4] Specifically, the home health state plan mainly covers in-home services provided by nurses and professionals; the personal care state plan provides additional services such as personal care and assistance with household activities at home, in the workplace, in foster care, and in an assisted living facility; the aging waiver focuses on services such as round-the-clock help and similar personal care services in the personal care state plan to assist older participants with difficulties in daily activities. Appendix Table A1 describes the services offered under each HCBS subprogram in detail. Notice that there are some overlap between these programs. For example, the home-based services such as personal care and help with household chores are covered in all

[2]Per Americans with Disabilities Act (ADA)'s community integration mandate, Supreme Court's Olmstead decision promotes HCBS to cover for people with disabilities.

[3]Medicaid HCBS also includes other state plan programs, such as Community First Choice, which provides supplementary services for people who prefer to stay at home; and Section 1915(i), which supports intellectually or developmentally disabled people. In 2018, about $62.5 billion was spent on waivers, accounting for 58 percent of total Medicaid expenditure; another $20.6 billion was spent on state plans, representing 23 percent of total Medicaid expenditure; while the Community First Choice program was much smaller, accounting for around 9 percent of total Medicaid expenditure.

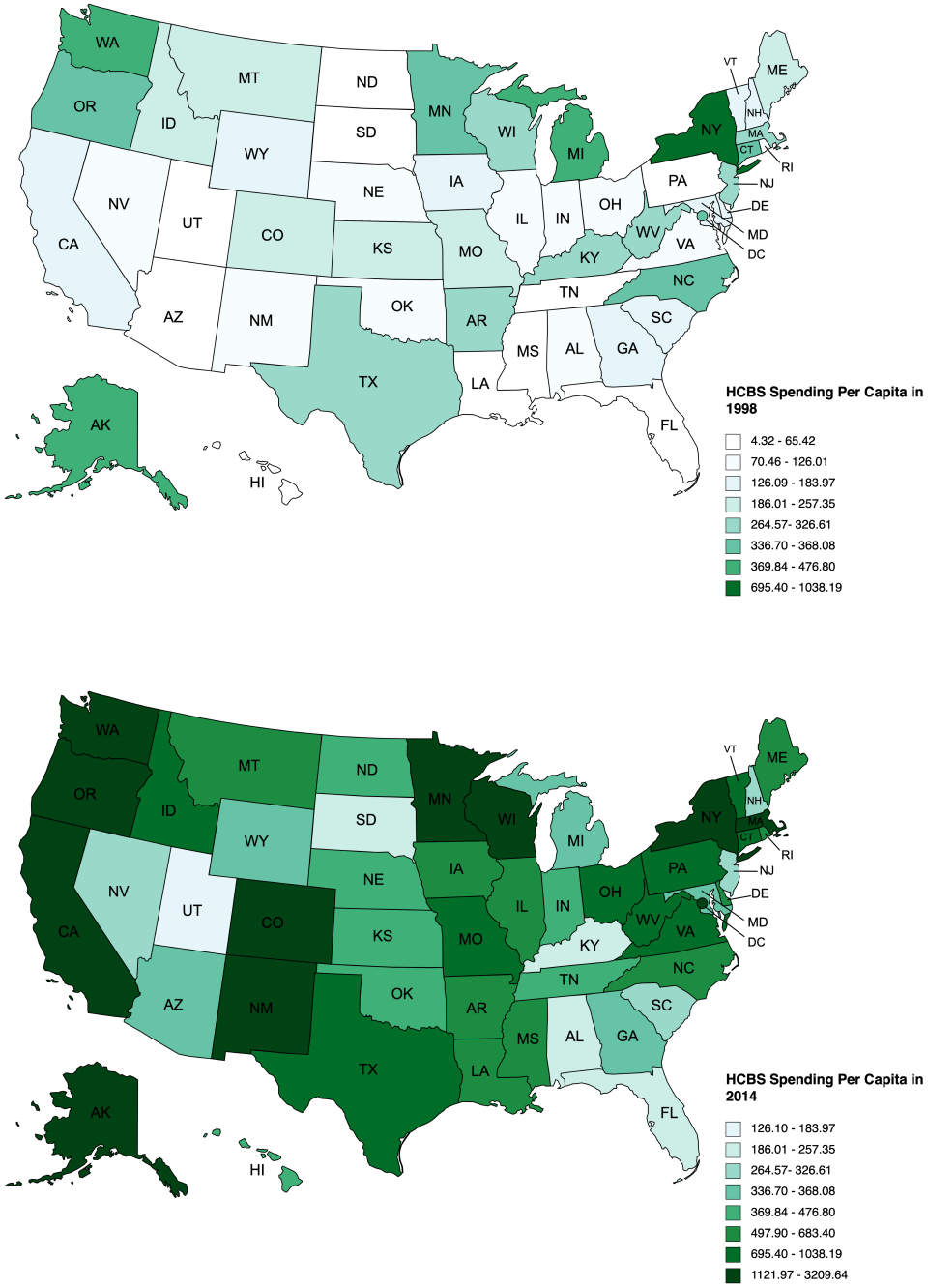
[4]For details about the eligibility rules in each state, see: https://www.medicaidplanningassistance.org/medicaid-eligibility/.

of the sub-programs of HCBS.

Figure 1 shows a large variation in HCBS spending per capita across states. There are several reasons to explain why each state spends HCBS funding differently. First, states have full discretion to determine the scope of services covered in aging waivers. For example, 85 percent waivers spend HCBS dollars on home-based services, 70 percent waivers cover nursing therapy services, 40 percent waivers include round-the-clock services, and 27 percent waivers provide mental health services. Second, states decide their own spending of each service covered under waivers. Figure 2 demonstrates the cross-state variation on the spending of each service in waivers per enrollee in 2014. For example, for home-based services, Oregon spent only $826 per participant, Florida spent $4,404 per enrollee, North Carolina spent $11,531 per person, and New Jersey spent $43,066 per participant in HCBS waivers. Third, states are allowed to set their own eligibility limits in incomes and assets in aging waivers. The majority of these waivers (79%) use the standard Medicaid eligibility cutoffs (300% SSI in incomes and $2,000 in assets). Some waivers set more restrictive requirements by setting the income limit to be below 100% SSI (5 percent), or 101% to 299% SSI (16%), and by setting the asset limit to be below $1,600 (4%) in 2018. Eight percent of waivers have more generous asset limit of $2,500-4,000 and 1 percent waivers do not have asset cutoffs.[5] Fourth, states have flexibility to allocate dollars in different programs of HCBS. Some states rely on traditional state plans to serve older people in need such as Missouri, Connecticut, North Carolina, Texas, and California, and some states allocate more resources on optional waivers to better target older people such as Oregon, Minnesota, Washington, and Wisconsin. Appendix Figures A2 to A7 plot the spending per capita for each program in detail over the period 1998-2014 in each state. In summary, the HCBS expenditure varies considerably across states and time. In section 4, we show that the variation of HCBS spending is uncorrelated with state-level current or lagged economic and demographic characteristics and it comes mainly from long-standing institutional features of those states.

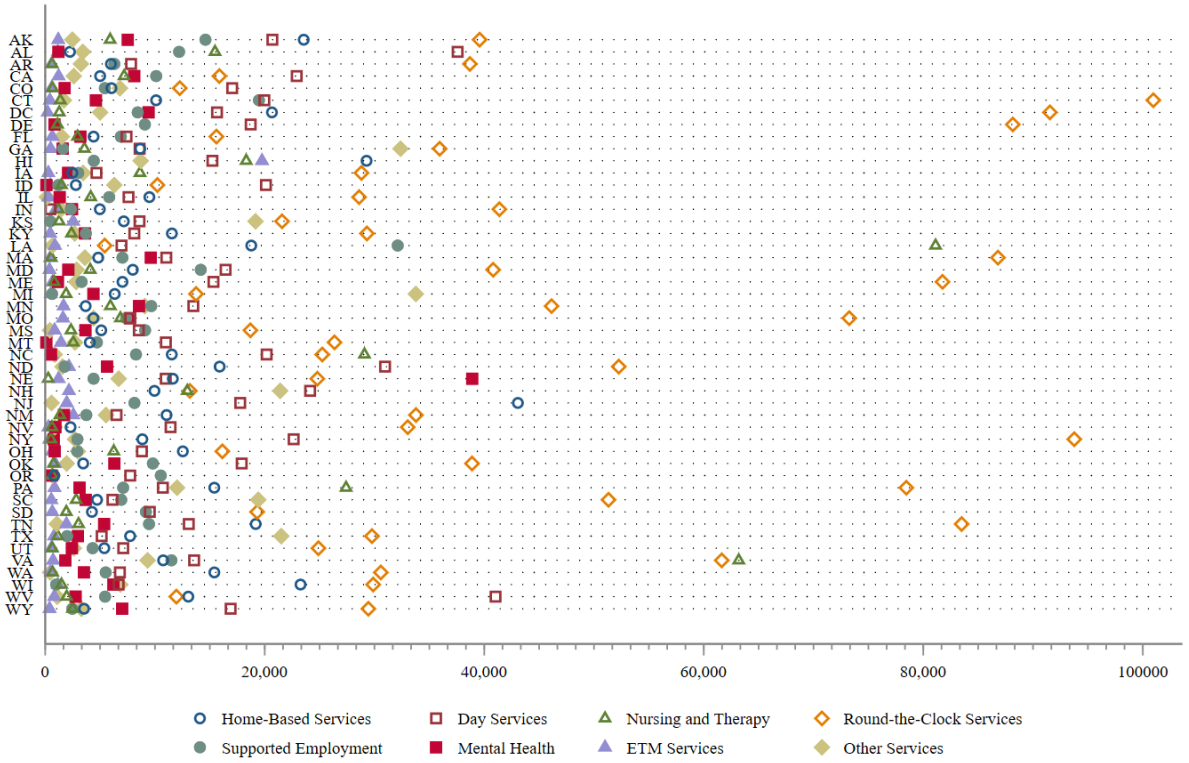
[5]See the Kasier Family Foundation Report on HCBS in 2018 for more details.

Figure 1: State Variation in HCBS Expenditures Per Older Person in 1998 and 2014



Notes: Bins represent the deciles of the distribution for the state's average HCBS spending for people aged over 65 in 1998 and 2014. The darker the color on the map, the higher the per capita HCBS spending in the state.

Figure 2: Variation in Spending per Enrollee for Each Service of Waivers in 2014



Notes: The plot displays the variation of spending per enrollee for each service covered under waivers across states. The x-axis is the dollars spent per participant in waivers. The y-axis is the abbreviation of each state.

3 DATA

Our first data source is the Medicaid HCBS policy information for older adults in 1996 to 2014 from the CMS.[6] It includes annual reports of expenditure and enrollment on home health state plans, personal care state plans, and aging waivers for older people.[7] HCBS expenditure per capita, our main independent variable, is calculated using the population aged 65 and older.

Our second data source is the Health and Retirement Study (HRS), a longitudinal dataset representative of Americans aged 51 and older which began in 1992 and surveys

[6] 2014 is the recent year that the CMS makes HCBS data publicly available.

[7] The annual expenditure data can be downloaded at https://www.medicaid.gov/. The enrollment report is collected by Kaiser Family Foundation and publicly available on its website.

every other year. The survey includes different cohorts due to new entrants of those who turned eligible during the survey period. The core cohort, the HRS cohort, has been followed and interviewed since 1992. Since 1993, the HRS has added the Study of Assets and Health Dynamics Among the Oldest Old (AHEAD) cohort born before 1924; the Children of the Depression Age (CODA) cohort born between 1924 and 1930; and the War Babies (WB) cohort born between 1942 and 1947. An additional Early Baby Boomers (EBB) cohort born between 1948 and 1953 was included to the HRS in 2004, and the Mid-Baby Boomers (MBB) cohort born between 1954 and 1959 was added in 2010. A detailed questionnaire that asks respondents about their demographic characteristics, health outcomes, employment status, financial situation, and intergenerational transfers is administered in person or via telephone.

We use the restricted-access HRS which includes the state of residence for each respondent, and merge it with the HCBS policy information in our first data source at the state level. We restrict the main sample to respondents who are over age 65, the eligibility age for the HCBS program. The resulting dataset includes approximately 21,400 unique individuals, and 98,000 observations from 1998 to 2014.[8]

We also supplement with other data to address possible threats to our identification assumption that the changes in HCBS within states are orthogonal to other state-level confounders that may affect health outcomes. First, we use economic information about state-level unemployment rates and employment rates from the Bureau of Labor Statistics (BLS) in 1999 to 2014. In addition, we extract information about GDP, personal income (PI), personal consumption expenditure (PCE) and detailed PCE from the Bureau of Economic Analysis (BEA) Regional Economic Accounts in 1998 and 2014. Second, we employ information from American Community Survey (ACS) about demographic characteristics such as education, poverty level, racial/ethnic percentage, and marriage rate at the state level in 2004 to 2014.[9] The population data in 1998 to 2014 is from Census

[8]We start from 1998 in that we use the average of policy spending in 1998 and 1997 as the treatment value in HRS survey year 1998. See section 4 for details.

[9]See Liu and Zai (2022) for detailed description of these variables.

Bureau. These state-level economic and demographic characteristics are utilized to test the plausible randomness of HCBS in section 4.

3.1 Key Variables

First, we use information about health status to estimate how HCBS affects the well-being of older people. The HRS asks respondents to self-report their general health status where 1 is for excellent, 2 for very good, 3 for good, 4 for fair, and 5 for poor. We create a subjective poor health indicator, which is one if self-reported health is fair or poor, and zero otherwise.[10] While the self-reported health is subjective and prone to recall errors, it is a good predictor of mortality (Idler and Benyamini 1997; DeSalvo et al. 2006; Kuka 2020). We also report estimates of an alternative health indicator in section 5.2.

Second, we use more objective measures about physical health conditions. The HRS has detailed information about functional limitations. Specifically, the mobility difficulty index refers to respondents having any problem in walking 1 block, walking several blocks, walking across a room, climbing 1 flight of stairs, and climbing several flights of stairs. In addition, the HRS provides indexes about physical limitations of Activities of Daily Living (ADLs) and instrumental activities of daily living (IADLs). The ADLs include items such as bathing, eating, dressing, getting in or out of bed, and walking across a room and the IADLs assess difficulties in using the phone, managing money, taking medications, shopping for groceries, and preparing hot meals. These mobility/ADL/IADL indexes all range from 0 to 5. For example, an index with a value of 5 means that an individual has difficulties with all of the functional limitations, while a value of zero means that the individual has no limitations at physical health. We create some dichotomous indicators which equal one if an individual has a certain amount of limitations and zero, otherwise. Section 5.2 reports our main estimates using the indicator with at least 2 items of limitations since majority of individuals report

[10]The same procedure is also employed in Dave et al. (2006) using the HRS, in Eibich (2015) using the German Socio-Economic Panel Study (SOEP), and in Kuka (2020) using the Survey of Income and Program Participation (SIPP).

less than 2 items of functional limitations.[11] The results on other indicators are also shown in section 5.2.[12]

Third, we further use information about mental and cognitive health. The HRS asks respondents about their mental health using the Center for Epidemiologic Studies Depression (CESD) score. The CESD score captures the number of negative sentiments a respondent experienced all or most of the time in the past two years, for instance, whether an individual was depressed, felt alone, felt sad, had restless sleep, felt everything was an effort, could not get going, felt unhappy, and did not enjoy life. The CESD scale has been validated to identify major depression in older adults in the research (Irwin et al. 1999). We create a depressed indicator, which is one if an individual reported at least 6 items of negative feelings and zero if the CESD score is below 5. We also show estimates of other depressed indicators in section 5.2. Besides, the cognition summary score calculates an individual's total scores on word recall and mental status tests, with values from 0 to 35. The word recall test, which is widely used to measure cognitive skills, asks respondents to listen to a list of words, and then to recall them immediately and with a delay (Bonsang et al. 2012; Mazzonna and Peracchi 2012). The mental status test assesses an individual's abilities on serial 7s, counting backwards from 20, naming objects, recalling dates, and naming the president or the vice-president. These cognitive tests are important tools to evaluate the mental health of older adults, as the aging process is strongly associated with a decline in the ability to perform cognitive tasks (Souchay et al. 2000; Anderson and Craik 2000; Prull et al. 2000; Dixon 2004; Hertzog et al. 2008).

3.2 Sample Statistics

Table 1 presents the summary statistics of our sample, HRS respondents who are aged 65 and older. About 58 percent of the sample is female since women in general live longer

[11] See section 3.2 for details on summary statistics.

[12] More details on the construction of these measures can be found in Chien et al. (2015). Full results are available upon request.

than men. The average educational attainment of respondents is high school. On average, each individual has about two siblings. The majority of the respondents are white, and 13 percent are black. The average age of respondents is about 75 years. While 58 percent of the respondents are married or are living with a partner, approximately 30 percent have lost their spouse or partner in our older sample.

For health outcomes, on average, individuals assess their health status as good and report 1 to 2 items of limitations in mobility. The average ADL/IADl limitation index value is close to one, which indicates that an individual has one limitation of the activities of daily living. The average CESD depression score is 1.5 out of 8. The average cognition score is close to 21.

4 ESTIMATION

We estimate the health effects of HCBS among the older individuals with the following specification:

$$Y_{ist} = \delta HCBS_{s\bar{t}} + \alpha_i + \mu_t + \eta_s + \boldsymbol{X}'_{\boldsymbol{ist}}\boldsymbol{\beta} + \epsilon_{ist} \tag{1}$$

where Y_{ist} is a health outcome of an individual i in state s surveyed in year t. $HCBS_{s\bar{t}}$ is the average expenditure of Medicaid HCBS per older person in state s in year t and $t-1$. For example, the health outcome in survey year 2000 is regressed on HCBS expenditure averaged in 2000 and 1999. This policy construction takes that the HRS survey is conducted every two years into consideration. The individual fixed effect, α_i, controls for the unobservable factors that are time-invariant within individuals across time, such as protective health behavior like exercise, and preferences for health care providers. The year fixed effect, μ_t, controls for common shocks across states that could affect health outcomes. The state fixed effect, η_s, controls for unobserved time-invariant state characteristics, such as the political environment for promoting health and the basic infrastructure that facilitates entertainment activities among older people. X_{ist} is a set of time-varying demographic characteristics of

Table 1: Summary Statistics of the Sample

Variable	Mean	S.D.	Unique individuals	Obs.
Time-invariant demographics				
Female	0.58	0.49	21,421	98,116
Education	11.97	3.40	21,406	98,087
Siblings	2.31	2.23	21,199	97,776
Race/ethnicity				
White	0.83	0.37	21,409	98,091
Black/African	0.13	0.34	21,409	98,091
Other	0.03	0.18	21,409	98,091
Time-varying demographics				
Age	75.33	7.51	21,421	98,116
Marital status				
Married/partnered	0.58	0.49	21,420	98,060
Separated/divorced	0.09	0.28	21,420	98,060
Widowed	0.31	0.46	21,420	98,060
Never married	0.03	0.16	21,420	98,060
Heath variables				
Self-reported health	3.00	1.11	21,417	98,027
Mobility limitation	1.39	1.62	21,534	99,412
ADL limitation	0.51	1.16	21,409	98,040
IADL limitation	0.50	1.19	21,406	98,023
CESD scores	1.47	1.90	19,975	88,184
Cognition scores	21.28	5.39	19,951	87,999

Notes: The data used are from HRS 1998 to 2014 of individuals who are aged 65 and older. The definitions of these variables can be found in Appendix Table A2.

individuals, such as age, age squared, the number of living siblings, and marital status. The standard errors are clustered at the state level.

The coefficient of interest, δ, measures the health change of individuals exposed to HCBS generosity across years, conditional on controls. As suggested by (Callaway et al. 2021), we need two assumptions to interpret this coefficient as causal. First, we assume that states with higher HCBS expenditures in 1998 do not change differentially for non-HCBS-expansion-related reasons. That is, states with different HCBS expenditures in 1998 are on parallel trends. Second, we assume that each state gets the same treatment effect for an extra dollar spent, even if they don't pay the same amount initially. That is, we assume

homogenous treatment effects across states. With the continuous treatment variable, we testify our assumptions in 4.1. Then, we use the most demanding specification that includes individual fixed effects. The identifying variation of this specification employs variation within-individuals who experience HCBS expenditure change across years. This treatment change might come from their state's HCBS expenditure change or they move to states with different generosity of HCBS across years.

4.1 Threats to Identification

Our main identification assumption relies on that the variation of HCBS generosity within states over years is not correlated with other observable or unobservable confounders that might also affect health outcomes of interest. First, one might be concerned that states decide the HCBS expansion during the 1990s based on the health and socio-demographic characteristics of residents. For example, states could expand HCBS if health of older adults at home is worse or other related well-being factors are taken into consideration. One might also be worried that individuals changed health behavior in anticipation of the HCBS expansion. To test these possible concerns, we estimate the effect of pre-expansion of HCBS in 1998 on a range of health, socio-demographic, and health care use outcomes for individuals in 1992 to 1998 as follows (Bailey and Goodman-Bacon 2015; Goodman-Bacon 2018):

$$y_{ist} = \alpha + \beta_0 HCBS_s^{1998} + \beta_1 HCBS_s^{1998} \times (y - y^{1998}) + \xi_{st} \tag{2}$$

where y is a series of dependent variables to be tested against the HCBS spending per older person in 1998 when the program expansion began. We test for balance in levels ($H_0 : \beta_0 = 0$) in 1998 and in linear pre-1998 trends ($H_0 : \beta_1 = 0$) both.

Panel A of Table 2 tests whether the per capita HCBS generosity in 1998 is correlated with levels or trend in pre-expansion health outcomes. The results provide little evidence that the size of HCBS is determined by the general health status of state residents. Panel

B of Table 3 further explores the relationship between pre-expansion HCBS and health care use. Overall, there is no persuasive evidence that residents change health care pattern in anticipation of the HCBS expansion. These balance test results reassure that there is no systematic correlation between the HCBS expansion and health outcomes of interest. The findings further support that the variation of HCBS is more institutional feature driven than economic or social environment driven.

One might also be worried that HCBS generosity is correlated with the economic condition, which in turn impacts individual health. To address this issue, we construct a state-year panel from 1999 to 2014 using different sources of economic variables such as unemployment rate, employment rate, GDP per capita, personal income (PI) per capita, and personal consumption expenditure (PCE) per capita. These state economic measures are regressed on the HCBS spending controlling for state and year fixed effects. We allow flexible functional form of these economic variables and the results are reported in Table 4. For the first four columns, we use flexible functions of unemployment rate and employment rate. We then further add different income and consumption variables.

Overall, the results show that state-specific economic variables are not correlated with HCBS. The employment rate is positively related to HCBS and the unemployment rate is negatively related to HCBS, as we expect in columns 1 and 3. These relationships, however, are not statistically significant once we allow quadratic or cubic form and add in more economic controls such as income and expenditure. One might also worry that the HCBS size could be correlated with lagged economic conditions. For example, if states experienced high unemployment rates, the size of HCBS for older population could be decreased if state legislators are constrained by fiscal resources. Appendix Table A3 reports the results of lagged economic conditions on HCBS spending. As predicted in column 1, states with high unemployment rate in the last year have less HCBS spending and the estimate is statistically significant. When we further allow flexible unemployment rate format and add more state-level economic controls, the relationship between lagged economic factors and

Table 2: Balance Test: Relationship Between HCBS in 1998 and Pre-Expansion Characteristics in Levels and Trends

		Univariate		Multivariate	
Dependent Variable	Mean in 1998	Level ($HCBS_s^{1998}$)	Trend ($HCBS_s^{1998} \times Year$)	Level ($HCBS_s^{1998}$)	Trend ($HCBS_s^{1998} \times Year$)
	(1)	(2)	(3)	(4)	(5)
		Panel A: Health outcomes (1992-1998)			
Self-reported health status (0-5)	2.923	0.021	-0.002	1.269*	0.000
		(0.068)	(0.005)	(0.640)	(0.005)
Poor health status (0-1)	0.315	0.000	-0.003	-0.037	-0.004
		(0.028)	(0.002)	(0.237)	(0.003)
Mobility limitation (0-5)	1.015	0.016	-0.001	1.437	-0.013
		(0.062)	(0.008)	(0.958)	(0.009)
Mobility limiation (0-1)	0.264	0.006	-0.003	0.542*	-0.007**
		(0.017)	(0.003)	(0.272)	(0.003)
ADL limitation (0-5)	0.369	0.086***	0.010	1.547	0.011
		(0.029)	(0.007)	(1.144)	(0.008)
ADL limiation (0-1)	0.092	0.021**	0.002	0.525*	0.003
		(0.009)	(0.002)	(0.264)	(0.002)
IADL limitation (0-5)	0.327	0.050	-0.026**	1.267	0.006
		(0.035)	(0.012)	(1.890)	(0.014)
IADL limiation (0-1)	0.080	0.012	-0.006*	0.111	0.002
		(0.009)	(0.003)	(0.415)	(0.004)
Mental CESD (0-8)	1.617	0.050	-0.014	1.497	0.022
		(0.136)	(0.017)	(1.932)	(0.018)
Mental depression (0-1)	0.066	-0.002	-0.002*	0.138	-0.001
		(0.012)	(0.001)	(0.163)	(0.002)
Cognition (0-35)	22.160	-0.347	0.062	-15.375***	-0.025
		(0.279)	(0.089)	(3.039)	(0.091)

Notes: The data used are from HRS 1992 to 1998 of individuals who are aged 65 and older. The HCBS in 1998 is per capita spending of older population. The first column reports the mean of each dependent variable. Column 2 and 3 estimate the univariate relationship between HCBS in 1998 and health outcomes. Column 4 and 5 estimate the multivariate version controlling for state, year, and individual fixed effects. Column 2 and 4 report the estimates of level coefficients and columns 3 and 5 report the estimates of the trend coefficients of the model: $y_{ist} = \alpha + \beta_0 HCBS_s^{1998} + \beta_1 HCBS_s^{1998} \times (y - y^{1998}) + \xi_{st}$. Standard errors are clustered at the state level and shown in parentheses. *** p<0.01, ** p<0.05, * p<0.10.

HCBS generosity becomes nonexistent. Nonetheless, we check the sensitivity of our results after controlling for state-level factors in section 5.4.

Table 3: Balance Test: Continued

		Univariate		Multivariate	
Dependent Variable	Mean in 1998	Level ($HCBS_s^{1998}$)	Trend ($HCBS_s^{1998} \times Year$)	Level ($HCBS_s^{1998}$)	Trend ($HCBS_s^{1998} \times Year$)
	(1)	(2)	(3)	(4)	(5)
		Panel B: Health care use (1992-1998)			
Home health care	0.076	0.003	-0.001	-0.191	-0.002*
		(0.005)	(0.001)	(0.135)	(0.001)
Hospital stay	0.264	-0.004	-0.001	-0.324	-0.004
		(0.014)	(0.002)	(0.049)	(0.003)
Drugs	0.728	-0.010	-0.002	-0.306	-0.002
		(0.015)	(0.003)	(0.455)	(0.004)
Doctor visit	0.932	0.002	-0.004*	-0.121	-0.003
		(0.007)	(0.002)	(0.167)	(0.003)
Nurse home stay	0.033	0.007**	0.002**	0.094	-0.000
		(0.003)	(0.001)	(0.161)	(0.001)

Notes: The data used are from HRS 1992 to 1998 of individuals who are aged 65 and older. The HCBS in 1998 is per capita spending of older population. The first column reports the mean of each dependent variable. Column 2 and 3 estimate the univariate relationship between HCBS in 1998 and health outcomes. Column 4 and 5 estimate the multivariate version controlling for state, year, and individual fixed effects. Column 2 and 4 report the estimates of level coefficients and columns 3 and 5 report the estimates of the trend coefficients of the model: $y_{ist} = \alpha + \beta_0 HCBS_s^{1998} + \beta_1 HCBS_s^{1998} \times (y - y^{1998}) + \xi_{st}$. Standard errors are clustered at the state level and shown in parentheses. *** p<0.01, ** p<0.05, * p<0.10.

Another possible concern could be that the health change of older individuals might be driven by other contemporaneous social programs. We use the detailed consumer spending expenditure from Bureau Economic Analysis on health-related products to address this concern. Specifically, we explore the relationship between HCBS generosity and health care spending, net health insurance spending, and life insurance spending which are mostly relevant to health of the older population. Appendix Table A4 shows the estimates of the respective spending in each column. All specifications control for state-economic factors including unemployment/employment rate, income, and expenditure in each state. The relationships of HCBS with other health care spending, health insurance and life insurance spending are not obvious and statistically insignificant, which is assuring to our results.

One may also challenge that our results might be driven by spending on an alternative

Table 4: Effect of State Economic Conditions on HCBS

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Unemployment rate	-19.815**	-36.451			-71.490	-79.548	-63.966	-80.971
	(8.442)	(49.515)			(56.412)	(59.791)	(59.326)	(64.207)
Unemployment rate^2		0.325			5.116	5.710	4.206	5.970
		(6.585)			(7.705)	(7.480)	(7.698)	(7.310)
Unemployment rate^3		0.051			-0.116	-0.132	-0.079	-0.144
		(0.303)			(0.341)	(0.323)	(0.330)	(0.294)
Employment rate			15.043*	-838	-1,026	-1,142	-1,072	-1,095
			(8.084)	(778)	(825)	(882)	(888)	(882)
Employment rate^2				14.551	17.879	19.801	18.594	19.040
				(12.896)	(13.767)	(14.701)	(14.744)	(14.655)
Employment rate^3				-0.082	-0.102	-0.112	-0.106	-0.108
				(0.071)	(0.077)	(0.082)	(0.081)	(0.081)
GDP per capita					-6,037			-3,375
					(5,418)			(7,897)
PI per capita						-0.012		-0.010
						(0.013)		(0.026)
PCE per capita							-0.010	0.004
							(0.035)	(0.053)
Observations	816	816	816	816	816	816	816	816
Adjusted R-squared	0.958	0.958	0.958	0.958	0.958	0.958	0.958	0.958

Notes: The data used are a state-year panel from 1999 to 2014. The unemployment and employment level is from BLS, the state population is from Census Bureau, the GDP, personal income (PI), personal consumption expenditure (PCE) is from the Bureau of Economic Analysis Regional Analysis Accounts. The dependent variable is per capita HCBS spending. Each cell reports estimates from a separate specification. All regressions include state, year fixed effects and weighted using the state population. Standard errors are clustered at the state level and shown in parentheses. *** p<0.01, ** p<0.05, * p<0.10.

setting, nursing homes, for the older population. This worry seems less implausible as we show in Liu and Zai (2022) that the spending on nursing homes is stable across years and does not drop significantly due to the increase in HCBS. In addition, we find neither the number of nursing homes nor the capacity of nursing homes such as nursing beds or occupancy rates is correlated with the HCBS expansion.

5 RESULTS

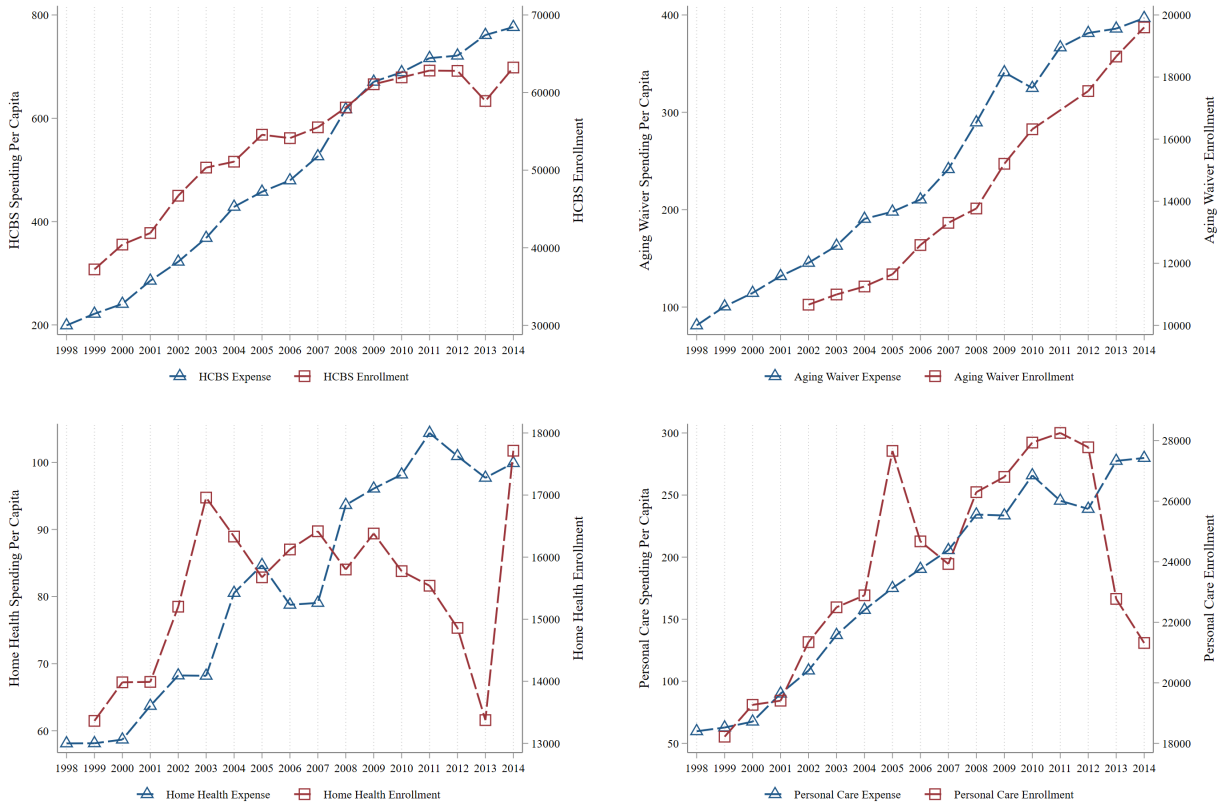
In this section, we show how much HCBS spending in total and spending of each program in HCBS (state plans and aging waivers) increase enrollment, respectively, as our first-stage results. Then, we estimate the effects of these programs on health outcomes among the older population.

5.1 HCBS Effect on Enrollment

Figure 3 depicts the pattern of the spending and enrollment for the HCBS in total as well as detailed sub-programs of HCBS using the raw data. The top-left plot shows that the HCBS expenditure per older people and its enrollment increased steadily over the period 1998-2014. Overall, the pattern for both spending and enrollment is similar for most years of the period although the enrollment in HCBS slightly dropped in 2013. The top-right plot demonstrates that the pattern of enrollment in the aging waiver is almost parallel with its increasing generosity despite a slightly decline of spending in 2010. The bottom-left plot exhibits the pattern for home health state plan on its spending and enrollment. The spending was increasing largely for years 1998-2014 except 2006 and 2012-2013 with a large decline. The enrollment increased in 1999-2003, declined in 2004-2005, started to increase in 2006-2007, kept decreasing in 2010-2013, had a big jump in 2014. The bottom-right plot shows that overall, the increasing trend of enrollment follows the increasing trend of spending for personal care state plan except that 2005 saw a spike in enrollment and 2013-2014 saw a big

plummet in enrollment. Overall, for most of the years in our working period, the spending of HCBS and its sub-programs positively correlates with its enrollment.

Figure 3: HCBS Spending and Enrollment 1998-2014



Notes: The data used are from CMS about enrollment in the HCBS programs. Each sub-plot shows the spending for a program and its enrollment over the period 1998-2014. The left y-axis corresponds to spending and the right y-axis corresponds to enrollment.

As discussed in the background section 2, states have discretion to allocate HCBS resources. To precisely estimate the first-stage effect of HCBS on enrollment, we regress the program spending on its enrollment controlling for the state and year fixed effects in a state-year panel from 1998-2014. Table 5 reports the estimates of HCBS on enrollment with different controls. Column 1 shows the simple estimate only with state and year fixed effects. Column 2 adds demographic variables at the state level such as poverty, education, percentage white, and percentage married. Column 3 further includes unemployment rate and employment rate to account for state-level economic conditions. Column 4 adds GDP

per capita, personal income per capita, and personal consumption per capita to further control for economic changes at the state level. Column 5 adds lagged economic conditions on unemployment rate, GDP, consumption as well as its quadratic and cubic forms to flexibly reflect any shocks of economic situation in each state. Overall, one dollar increase in HCBS spending per older person is significantly correlated with an increase in HCBS enrollment by 40 to 60, which is approximately 8 to 12 participants per 10,000 people. The estimates are robust with different demographic and flexible economic controls at the state level. Appendix Tables A5 to A7 further report the estimates of sub-programs of HCBS on enrollment, respectively: about 9 enrollment for aging waivers, 5 enrollment for home health state plan, and 24 enrollment for personal care state plan with a dollar increase in its spending.[13] Overall, we summarize that the number of participants in HCBS increases with its size of spending.

5.2 HCBS Effect on Health

Table 6 shows the health effect of HCBS from equation 1 with different outcomes. Specifically, a $1,000 increase in HCBS expenditure per older person is associated with a decrease of approximately 2 percentage points in the probability of reporting worse health (column 1). On an outcome mean of 0.33, the estimated effect size corresponds to a reduction of the probability reporting bad health status at 6 percent. Column 2 shows that the HCBS program is negatively associated with the probability of individuals reporting mobility limitations. The improvement in mobility health is about 2 percentage points with statistical significance, which is approximately 5 percent with a baseline mean at 0.37 with a $1,000 increase in HCBS generosity. The HCBS effect on ADL/IADL limitation is close to null and not statistically significant in columns 3 to 4. Column 5 reports that HCBS is beneficial to improve mental health. A $1,000 increase in HCBS per older person decreases the probability of individuals reporting negative emotional feelings by 1 percentage point (17 percent of

[13] One enrollee can participate in multiple sub-programs of HCBS.

Table 5: The Effect of HCBS Spending on Enrollment

	Dependent Variable: HCBS Enrollment				
	(1)	(2)	(3)	(4)	(5)
HCBS expenditure per older person	67.927	56.248*	60.045*	61.834*	43.312**
	(42.340)	(33.271)	(32.466)	(30.864)	(21.431)
Mean of dependent variable	53797	54634	54634	54634	57078
Observations	816	762	762	762	660
Adjusted R-squared	0.961	0.968	0.969	0.969	0.978
State + Year FE	Y	Y	Y	Y	Y
Demographics		Y	Y	Y	Y
Employment rate			Y	Y	Y
GDP and consumption				Y	Y
Lag economic conditions					Y

Notes: The data used are from CMS about enrollment in the HCBS programs from 1998 to 2014. Each cell reports estimates from a separate specification, weighted by state populations. Column 1 shows the simple estimate only with state and year fixed effects. Column 2 adds demographic variables at the state level such as poverty, education, percentage white, and percentage married. Column 3 further includes unemployment rate and employment rate to account for state-level economic conditions. Column 4 adds GDP per capita, personal income per capita, and personal consumption per capita to further control for economic changes at the state level. Column 5 adds lagged economic conditions on unemployment rate, GDP, consumption as well as its quadratic and cubic forms to flexibly reflect any shocks of economic situation in each state. The standard errors are clustered by state. *** $p<0.01$, ** $p<0.05$, * $p<0.10$.

outcome mean 0.06). The estimate on cognitive score in column 6 is positive but statistically insignificant. The HCBS increases the cognitive scores of old people by 0.2 points, which is approximately 1 percent increase with an average score of 21. Appendix Table A8 reports the effects of HCBS on health outcomes with other cutoffs. Some estimates lose statistical significance while the magnitudes are similar to our main estimates. We do not find any relationships between HCBS and other heatlh outcomes or morbidity events such as cancer, lung, heart, and strokes (Appendix Table A9).

Table 6: Results of HCBS on Health

	(1)	(2)	(3)	(4)	(5)	(6)
	Poor health	Mobility	ADL	IADL	Depression	Cognitive score
HCBS per capita ($1,000)	-0.018**	-0.018*	-0.000	0.001	-0.011**	0.233
	(0.008)	(0.009)	(0.011)	(0.013)	(0.005)	(0.180)
Mean of dependent variable	0.325	0.367	0.122	0.119	0.058	21.4
Number of individuals	18,200	18,183	18,196	18,194	16,676	16,658
Observations	94,637	94,600	94,657	94,643	84,747	84,567
Adjusted R-squared	0.488	0.515	0.455	0.471	0.323	0.676

Notes: The data used are from HRS 1998 to 2014 of individuals who are aged 65 and older. Each cell reports estimates using equation 1 for each dependent variable. Poor health is an indicator showing that an individual self-assesses his or her general health status as fair or poor. Mobility/ADL/IADL is an indicator of having at least 2 items of mobility/ADL/IADL limitations. Depression is an indicator of feeling at least 6 negative emotions. Cognitive score is continuous values from 0 to 35. The mean of HCBS expenditure per older person is around $500. All models control for state, year, individual fixed effects, and demographics of individuals such as age, age squared, marital status, and number of siblings of individuals. Standard errors are clustered at the state level. The detailed definition of these variables can be referred to Appendix Table A2. *** p<0.01, ** p<0.05, * p<0.10.

To explore the sub-programs of HCBS on health, we further report how state plans and aging waivers affect our outcomes in Table 7. Estimates in column 1 show that both aging waivers and state plans contribute to the increased probability of individuals reporting poor health. Estimates in column 2 find that the mitigating effect on mobility limitations comes from both programs and the effect from state plans is statistically significant. Columns 3 to 4 show that the HCBS program indeed does not correlate with ADL/IADL improvement. Column 5 reports that the reduced effect on depression is mainly from state plans, which

leads to about 1 percentage point decrease in negative emotional feelings. Column 6 shows that although the cognitive effect of total HCBS is close to null, the aging waivers contribute largely to an improvement in cognition among older individuals by around 0.5 points.

Table 7: Results of Aging Waivers and State Plans on Health

	(1)	(2)	(3)	(4)	(5)	(6)
	Poor health	Mobility	ADL	IADL	Depression	Cognitive score
Aging waiver per person ($1,000)	-0.026	-0.018	-0.005	-0.000	-0.006	0.467**
	(0.017)	(0.015)	(0.017)	(0.017)	(0.005)	(0.174)
State plan per person ($1,000)	-0.015	-0.018**	0.002	0.001	-0.013**	0.139
	(0.009)	(0.009)	(0.010)	(0.013)	(0.005)	(0.158)
Mean of dependent variable	0.325	0.367	0.122	0.119	0.058	21.4
Number of individuals	18,200	18,183	18,196	18,194	16,676	16,658
Observations	94,637	94,600	94,657	94,643	84,747	84,567
Adjusted R-squared	0.488	0.515	0.455	0.471	0.323	0.676

Notes: The data used are from HRS 1998 to 2014 of individuals who are aged 65 and older. Each cell reports estimates using equation 1 for each dependent variable. Poor health is an indicator showing that an individual self-assesses his or her general health status as fair or poor. Mobility/ADL/IADL is an indicator of having at least 2 items of mobility/ADL/IADL limitations. Depression is an indicator of feeling at least 6 negative emotions. Cognitive score is continuous values from 0 to 35. The mean of aging waiver expenditure per older person is around $200. The mean of state plan expenditure per person is around $300. All models control for state, year, individual fixed effects, and demographics of individuals such as age, age squared, marital status, and number of siblings of individuals. Standard errors are clustered at the state level. The detailed definition of these variables can be referred to Appendix Table A2. *** p<0.01, ** p<0.05, * p<0.10.

5.3 Mechanisms

We explore three channels through which HCBS might improve health outcomes: risky behaviors, healthcare use, and family companionship. First, we show how HCBS affects risky behaviors of older people such as drinking and smoking. Table 8 reports the estimates of HCBS on different behavioral outcomes in the baseline model. Specifically, HCBS significantly reduces the probability of picking up drinking. An increase in HCBS generosity leads to approximately 2 percentage points decrease in drinking. Moreover, HCBS reduces drinking intensity. With more generous HCBS policy, individuals reduce

drinking days per week by about 8 percentage points and the number of drinks per day by about 6 percentage points while the estimates are statistically insignificant. We do not find that HCBS affects other health behaviors such as smoking and being obese.

Table 8: Results of HCBS on Risky Behavior

	(1)	(2)	(3)	(4)	(5)	(6)
	Drink	Drink days	Drink number per day	Smoke	Smoke number	Obesity
HCBS per capita ($1,000)	-0.021**	-0.075	-0.060	-0.000	0.004	0.006
	(0.009)	(0.050)	(0.037)	(0.000)	(0.007)	(0.008)
Mean of dependent variable	0.435	1.007	0.501	0.566	0.091	0.241
Number of individuals	18,203	18,195	18,185	18,049	18,140	18,204
Observations	94,709	94,531	94,502	93,891	94,115	94,726
Adjusted R-squared	0.658	0.711	0.608	0.988	0.772	0.692

Notes: The data used are from HRS 1998 to 2014 of individuals who are aged 65 and older. Each cell reports estimates using equation 1 for each dependent variable. The mean of HCBS expenditure per older person is around $500. All models control for state, year, individual fixed effects, and demographics of individuals such as age, age squared, marital status, and number of siblings of individuals. Standard errors are clustered at the state level. The detailed definition of these variables can be referred to Appendix Table A2. *** p<0.01, ** p<0.05, * p<0.10.

Second, we demonstrate that HCBS increases healthcare use among older people. Appendix Table A10 reports the correlation between HCBS spending and different healthcare use. The findings show that HCBS is significantly correlated with increased use of inpatient service and medication. More generous HCBS is associated with about 2 percentage points increase in inpatient service (6 percent with a mean of 0.33) and 1 percentage point increase in medication take (1 percent with a mean of 0.87). In addition, HCBS increases the times to visit a hospital and doctor. The coefficients are not statistically significant, though.

Third, we explore whether family members play a role in health improvement by HCBS. As shown in Liu and Zai (2022), HCBS not only increases the probability of older adults getting care from their children but also increases the chances of family members living together with older adults, which can potentially improve mental health and overall health with increasing time spent with family members. Appendix Table A11 further

reports the correlation between HCBS and helpers (informal and formal) received by older adults. Informal care accounts for the majority of help (70 percent). An increase in HCBS spending is positively associated with the number of available helpers ever helped in the previous two years by 4 percentage points and with helpers helped in the last month by 4 percentage points. In addition, HCBS increases the likelihood to receive paid help by about 3 percentage points and is associated with intensive care provided to older adults: increased days got help (0.4 days) and increased hours got help (2.4 hours) in the last month with statistical insignificance.

5.4 Robustness

In this section, we report a series of robustness checks of our estimates of HCBS on health outcomes. First, one might be concerned that our main estimates could be driven by omitted socio-economic status of older people. Since the socio-economic status determines the eligibility for HCBS and also affects health, we do not include any proxies in our main specification. Another possible concern about our results might come from the correlation between state-level characteristics and HCBS spending as discussed in section 4.1. Even though the results in Table 4 show no evidence on such relationship, one might still be interested in how our health results change when we further control for some state-level demographic such as percentage of people with high school education, percentage female, birth rate, fertility rate, and unemployment rate. Appendix Table A12 shows that overall, our main estimates are robust across these specifications with different controls. The estimate on mobility limitation outcome become statistically insignificant in the model with both income and state-level covariates while the main estimate is still within the confidence interval.

Second, as discussed in section 4, our identification variation comes from HCBS policy change over years within states. However, one may be concerned about the endogenous variation coming from individuals who move in our study period. Individuals could have

incentives to move to states with more generous HCBS if they are more self-aware of their health or they value health more than others. Appendix Table A13 shows that the main health estimates do not change much when removing the moving observations.

Third, one might be concerned about the sensitivity of our results with sample restrictions. In the main regressions, we use the sample of individuals age 65 and above, who are potentially eligible for HCBS. However, one might argue that people who potentially benefit these in-home services of HCBS should be older. Appendix Table A14 shows the results limiting the sample to individuals who are at least 70. The sample size shrinks about 30 percent. The magnitude of the estimates is similar to that in the main results while some lose the statistical significance with larger standard errors due to a smaller sample. However, the coefficient on cognitive score becomes statistically significant, which suggests that HCBS can potentially improve cognition among older population.

5.5 Heterogeneity Analysis

The overall results show that the HCBS program seems effective to improve self-reported health status, mitigate functional mobility limitations, and reduce negative emotions on older individuals who are potential beneficiaries of the program. However, the estimates on the whole sample might mask some null effects on groups who are less likely to be impacted or some stronger positive effects on minorities who are targeted by HCBS. We further explore the heterogeneous effects of HCBS by demographics: income, education, and race/ethnicity.

Panel A of Table 9 shows the estimates of HCBS on health by income using the baseline specification. We index individuals with annual earnings below the mean as the low-income group.[14] As discussed in section 2 , one has to be either resources limited or medically needy to be eligible for Medicaid HCBS thus individuals with low income are more likely to be treated. Column 1 shows that the effect on improving self-assessed health status is close to null and statistically insignificant for high-income individuals. The size of the effect on

[14]Results are indifferent when we use other measurement such as pensions and annuities. In addition, results are robust when we use income level cutoff, such as $2,000.

Table 9: Heterogeneous Effects of HCBS on Health

	(1) Poor health	(2) Mobility	(3) ADL	(4) IADL	(5) Depression	(6) Cognitive score
			Panel A: By Income			
HCBS per capita ($1,000)	-0.032	-0.044***	-0.012	-0.035**	-0.011*	0.562**
	(0.021)	(0.012)	(0.015)	(0.014)	(0.006)	(0.210)
HCBS × low income	0.014	0.026***	0.012*	0.036***	-0.000	-0.333***
	(0.016)	(0.009)	(0.007)	(0.006)	(0.004)	(0.095)
Observations	94,637	94,600	94,657	94,643	84,747	84,567
			Panel B: By Education			
HCBS per capita ($1,000)	-0.012	-0.033**	-0.032***	-0.037**	-0.009	0.417**
	(0.012)	(0.014)	(0.008)	(0.014)	(0.006)	(0.168)
HCBS × low education	-0.010	0.026**	0.052***	0.063***	-0.004	-0.315**
	(0.013)	(0.013)	(0.015)	(0.019)	(0.007)	(0.134)
Observations	94,616	94,579	94,636	94,622	84,726	84,546
			Panel C: By Race			
HCBS per capita ($1,000)	-0.012	-0.016*	-0.008	-0.006	-0.007*	0.293
	(0.011)	(0.009)	(0.009)	(0.013)	(0.004)	(0.181)
HCBS × black	-0.044**	-0.012	0.053***	0.052**	-0.028***	-0.428*
	(0.017)	(0.011)	(0.017)	(0.020)	(0.010)	(0.252)
Observations	94,617	94,580	94,637	94,623	84,735	84,555

Notes: The data used are from HRS 1998 to 2014 of individuals who are aged 65 and older. Each cell reports estimates using equation 1 for each dependent variable. Poor health is an indicator showing that an individual self-assesses his or her general health status as fair or poor. Mobility/ADL/IADL is an indicator of having at least 2 items of mobility/ADL/IADL limitations. Depression is an indicator of feeling at least 6 negative emotions. Cognitive score is continuous values from 0 to 35. The mean of HCBS expenditure per older person is around $500. Low income indicates individuals with less than mean income; low education indicates those who have less than high school education years; and black indicates people who are black. All models control for state, year, individual fixed effects, and demographics of individuals such as age, age squared, marital status, and number of siblings of individuals. Standard errors are clustered at the state level. The detailed definition of these variables can be referred to Appendix Table A2. *** p<0.01, ** p<0.05, * p<0.10.

low-income individuals is similar to that estimated in Table 6. Column 2 reports that HCBS mitigates mobility limitations for both groups. High-income individuals seem to benefit more from the program by 4 percentage points less likely reporting worse mobility limitations. The differences between low and high income groups are positive and statistically significant. Columns 3 to 4 show significant estimates of HCBS on reducing ADL/IADL limitations by income while the main estimates are indifferent from zero shown in Table 6. Similar to the effect on mobility limitation, HCBS benefits both groups on improving ADL/IADL limitations and the benefit is larger for high-income individuals. This pattern applies on depression (column 5) and cognition (column 6) as well.

Panel B of Table 9 shows the heterogeneous estimates of HCBS on health by education, where the low-education group includes individuals with less than high school education. The patter by education is similar to that by income in Panel A except that the mitigation effects of HCBS on ADL/IADL limitations are much larger for high-income individuals and the differences between groups are positive and statistically significant. Panel C of Table 9 reports the estimates of HCBS by race/ethnicity. Uniquely, HCBS signigicantly improves general health for black people and has no effect on white people. In addition, both groups seem to be more responsive to HCBS on relieving depression and the estimates are statistically significant.

How to understand the different patterns of heterogeneous effects of HCBS? First, these estimates corroborate that HCBS is good for people who are most likely to receive the health care covered by the program. Specifically, individuals with limited resources are more likely to be treated by more generous HCBS funding. The health care provided at home for these individuals is more likely to improve their physical and self-assessed health status. The estimates are close to the treatment on the treated (TOT) effects. Second, the mental health estimates suggest other important health improving evidence on the intent-to-treat (ITT) group. High-income individuals might not be immediately qualified for HCBS. However, they can also be treated by the HCBS program. On the one hand, they are exposed to the

uncertainty of health deterioration and risk of high medical expenditure which make them potentially be treated in the future. The HCBS functions as a safety-net program for these high income individuals and reduces the uncertainty and stress of becoming indigent once the health shock is realized. They might feel less pessimistic and spend more time learning policy details by searching more or watching more news on these public insurance programs. We do not have information on such behavior to test this evidence. On the other hand, high-income individuals might be influenced by peers or close contacts who are treated by HCBS to exercise more or just increase frequency of mobility. The mental health could be improved directly from interacting with their less-depressed peers or from knowing that they could also be covered sometime in the future. Their cognitive skills could be incentivized by learning the policy details of HCBS from peers.

6 CONCLUSION

In this paper, we explore how Medicaid HCBS affects health outcomes among people aged 65 and older. First, we find that a $1,000 increase in HCBS spending per capita increases its enrollment by about 1 percent. Then, we show that HCBS is beneficial for health of older people aging in place. The HCBS program significantly increases the probability of individuals to self-report better health, mitigates the likelihood to experience mobility limitations, and improves mental health. These health effects are reasonable comparing to the first-stage enrollment effect of HCBS. In addition, we find that the health benefits are larger for older people with limited resources who are more likely to be covered by HCBS. We also present three potential mechanisms through which HCBS is beneficial to healt of older adults: decreasing risk behavior on drinking, increasing healthcare use such as doctor visits and inpatient use, and spending more time with family members by living together and receiving more informal care.

The findings of this study have several policy implications. First, the results are

informative for the development of long-term care policy. During the 2020 pandemic, CMS changed the implementation rules for the aging waiver program. States were permitted to loosen quality requirements for home health care providers in order to ensure that services would continue to be provided to HCBS clients. In addition, some states increased pay rates in order to attract more providers and to compensate providers for the increased risk of entering homes during the pandemic. Understanding the detailed effects of the program on health outcomes is essential, as the federal government is planning for the eventual return to regular operations after the public health emergency ends. The results of this study can inform policy debates about what share of home health services should be covered, and about what types of care are more efficient in improving the quality of life of older people aging in place. Moreover, strategies aimed at better coordinating the incentives of home care providers, patients, family caregivers, and social workers can further increase the efficiency of care delivery. Second, the benefits of HCBS shown in the paper justifies the $400 billion expansion of the American Jobs Plan to increase HCBS coverage by the Biden Administration at the end of March 2021.

Third, improving the quality of care provided by home health agencies is a leading priority of CMS while reducing costs by shifting resources to home- or community-based settings. While each state HCBS program has minimum requirements for the certification of service providers that are guided by the federal government, these requirements vary across states. In addition, states are responsible for surveying and monitoring home health agencies to ensure that they are providing a high standard of care. However, with so many individuals being served by thousands of agencies, it is difficult to monitor their activities, and to ensure that all patients are treated fairly. The findings in this paper provide direct evidence on health effects of HCBS, which can be discussed in depth, and be used to create better quality indicators to regulate home health care providers.

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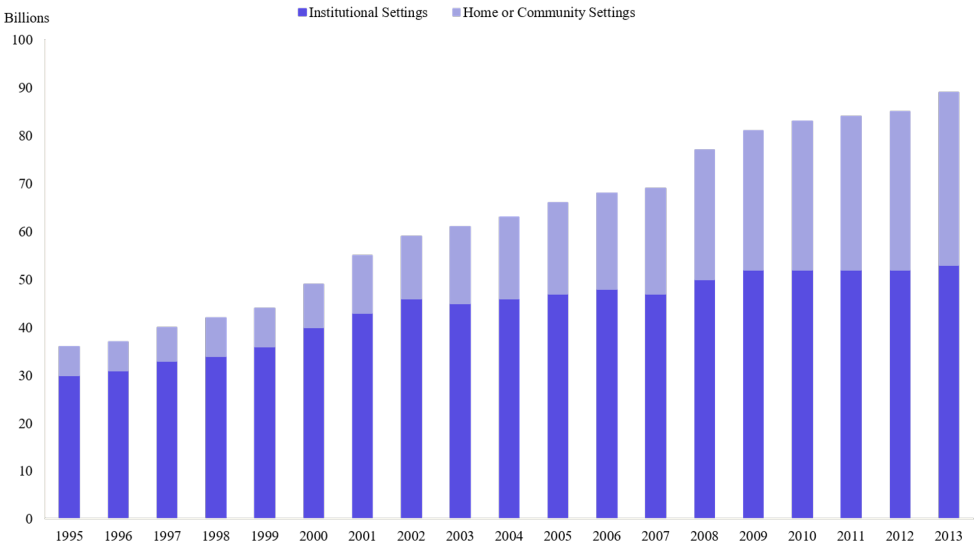
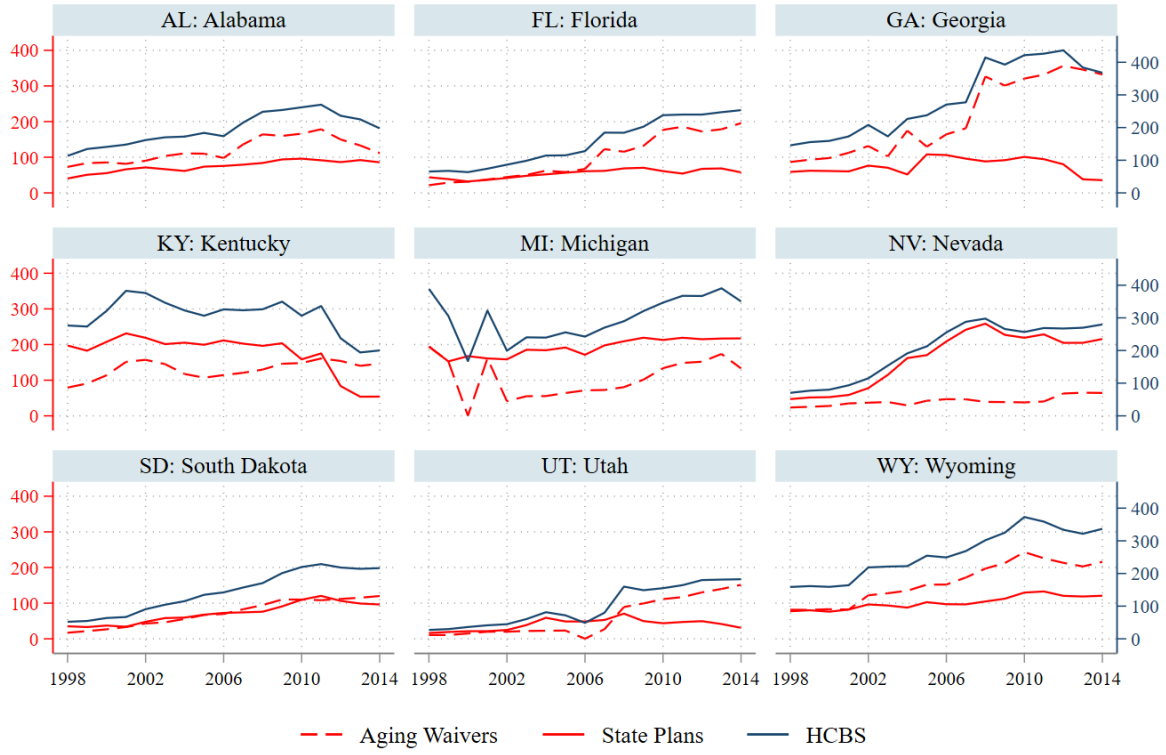
Figure A1: Medicaid LTC Spending by Service Settings



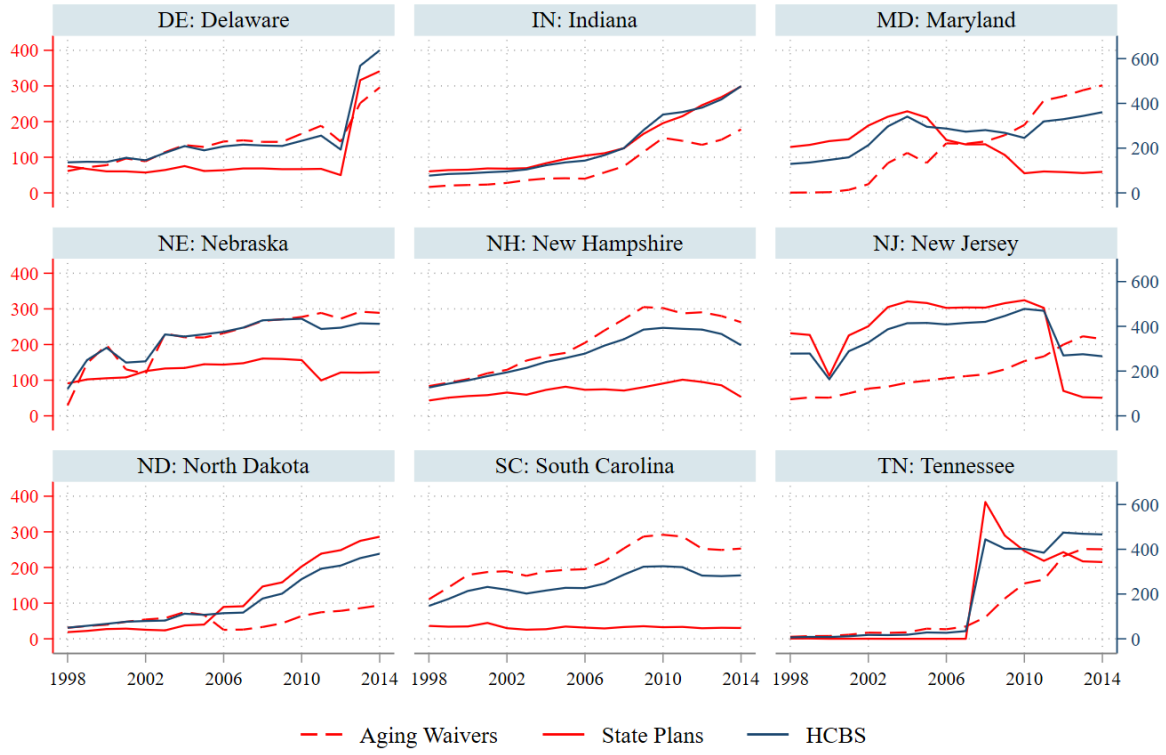
Notes: The graph shows Medicaid LTC spending by service settings, i.e., institutional settings and home or community-based settings, between 1995 and 2013. While spending on institutional settings dominated for much of this period, spending on home or community-based settings rose dramatically in later years. The data source is annual CMS 64 forms

Figure A2: Medicaid HCBS Spending for Older People by Program



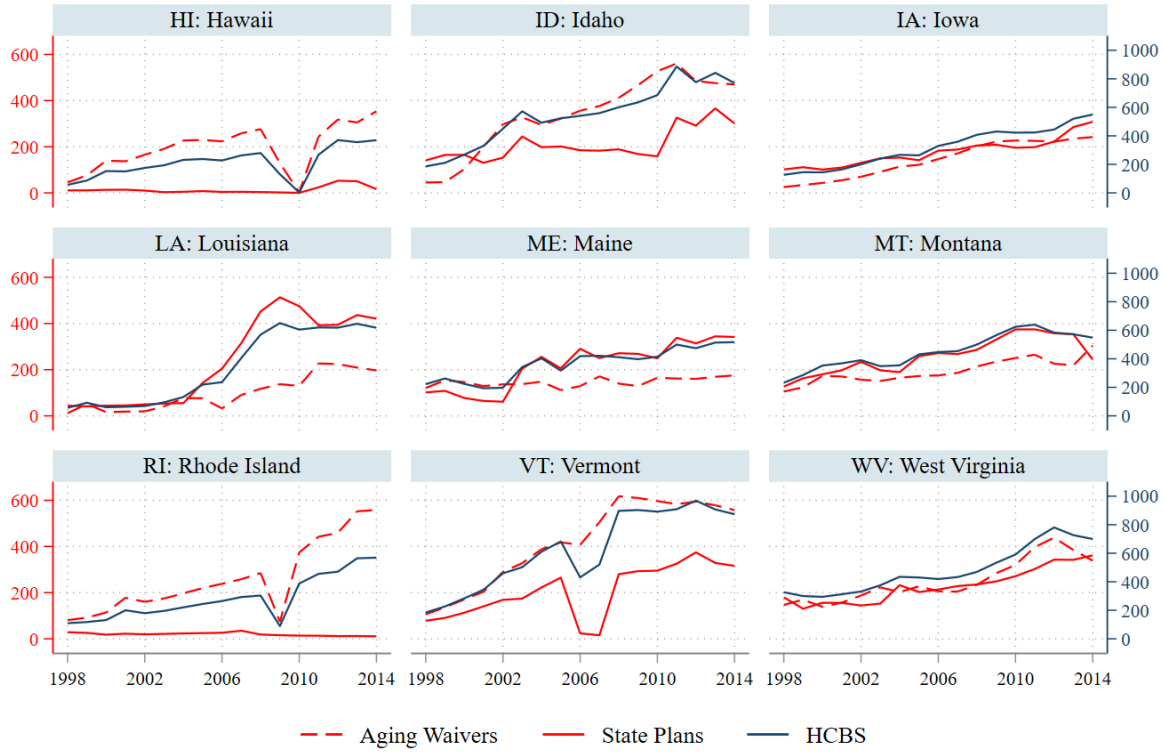
Notes: The graph shows Medicaid HCBS spending for older people by program: aging waivers, state plans of personal care and home health plans. The left y-axis is for each sub-program and the right y-axis is for the total HCBS spending per capita. The data source is annual CMS report for policy expenditure.

Figure A3: Medicaid HCBS Spending for Older People by Program



Notes: The graph shows Medicaid HCBS spending for older people by program: aging waivers, state plans of personal care and home health plans. The left y-axis is for each sub-program and the right y-axis is for the total HCBS spending per capita. The data source is annual CMS report for policy expenditure.

Figure A4: Medicaid HCBS Spending for Older People by Program

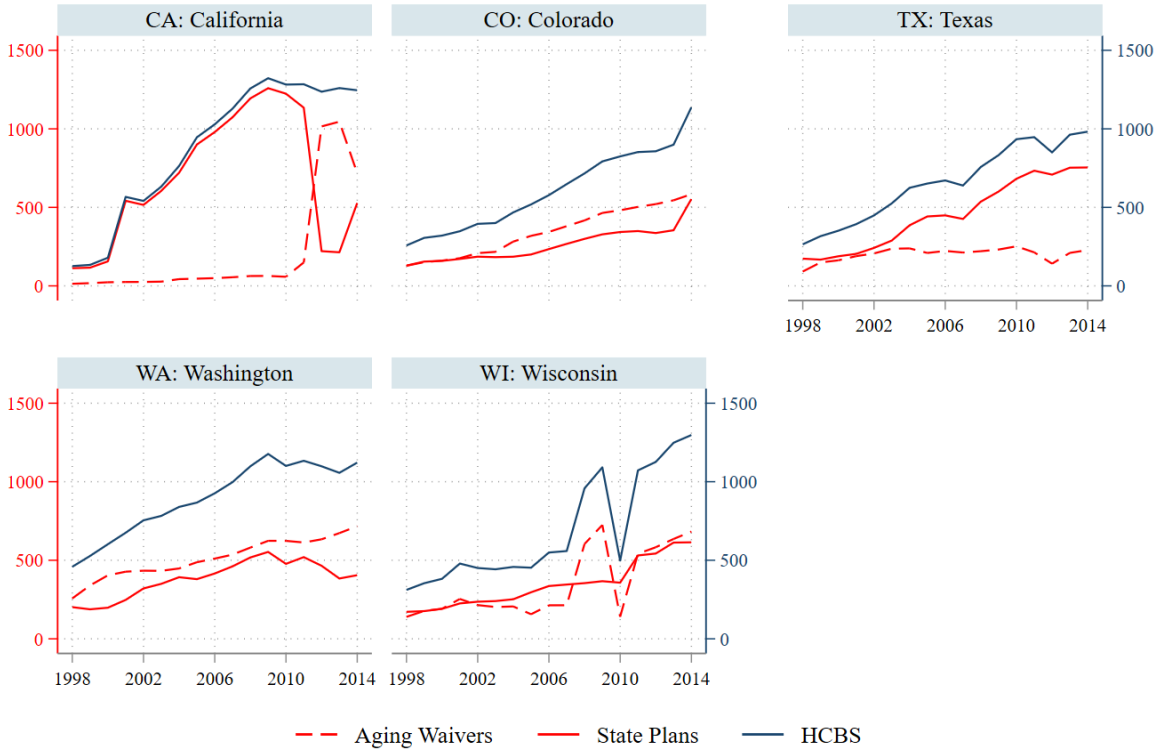


Notes: The graph shows Medicaid HCBS spending for older people by program: aging waivers, state plans of personal care and home health plans. The left y-axis is for each sub-program and the right y-axis is for the total HCBS spending per capita. The data source is annual CMS report for policy expenditure.

Figure A5: Medicaid HCBS Spending for Older People by Program

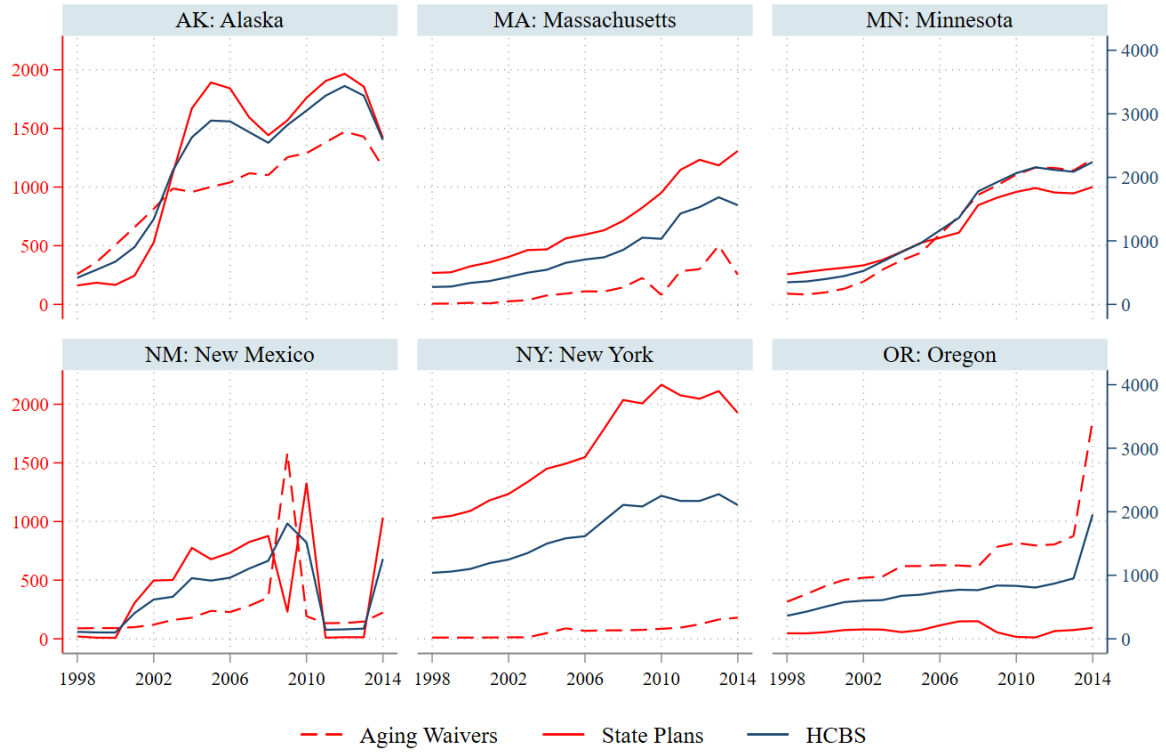
Notes: The graph shows Medicaid HCBS spending for older people by program: aging waivers, state plans of personal care and home health plans. The left y-axis is for each sub-program and the right y-axis is for the total HCBS spending per capita. The data source is annual CMS report for policy expenditure.

Figure A6: Medicaid HCBS Spending for Older People by Program



Notes: The graph shows Medicaid HCBS spending for older people by program: aging waivers, state plans of personal care and home health plans. The left y-axis is for each sub-program and the right y-axis is for the total HCBS spending per capita. The data source is annual CMS report for policy expenditure.

Figure A7: Medicaid HCBS Spending for Older People by Program



Notes: The graph shows Medicaid HCBS spending for older people by program: aging waivers, state plans of personal care and home health plans. The left y-axis is for each sub-program and the right y-axis is for the total HCBS spending per capita. The data source is annual CMS report for policy expenditure.

Table A1: Medicaid HCBS Programs

Home Health State Plan (every resident is eligible)
Nursing services
Home health aide services
Medical supplies, equipment and appliances
Optional therapy services like physical, occupational and speech pathology therapy
Personal Care State Plan (every resident is eligible)
Assistance with self-care (e.g., bathing, dressing)
Household activities (e.g., preparing meals)
Cueing or monitoring
Injections by nurses
Work sites, foster care or assisted living facilities
Aging Waivers (people age 65+)
Round-the-clock services (in-home residential rehabilitation)
Home-based services like personal care, assistance with household chores, and respite care
Day services (day rehabilitation and adult day care services)
Case management services

Notes: The table shows in detail the services covered under each Medicaid HCBS authority. Mandatory home health state plans mainly cover home-based aide services and professional services for all Medicaid-qualified participants. Personal care state plans mainly provide assistance to eligible people with ADL and IADL limitations. Aging waivers provide intensive round-the-clock services, as well as assistance to individuals with ADL and IADL limitations. The information is adjusted from the annual Kaiser Family Foundation Waiver Program Survey.

Table A2: Definitions of Variables

Variable	Definition
Heath variables	
Self-reported health	Respondent's self-reported general health status, one for excellent, two for very good, three for good, four for fair, and five for poor.
Mobility difficulty	Index of mobility difficulties ranging from 0 to 5, indicating respondents having any problem in walking 1 block, walking several blocks, walking across a room, climbing 1 flight of stairs, and climbing several flights of stairs
ADL difficulty	Index of difficulties in Activities of Daily Living (ADL) ranging from zero to five, indicating whether respondents are having any difficulties in bathing, eating, getting dressed, getting in/out of bed, and walking across a room
IADL difficulty	Index of difficulties in Instrumental Activities of Daily Living (IADL) ranging from zero to five, indicating whether respondents having any difficulties in using the phone, managing money, taking medications, shopping for groceries, and preparing hot meals
Depression scores	Index of mental health ranging from zero to eight based on the score on the Center for Epidemiological Studies Depression (CESD) scale, which represents the sum of five negative indicators minus two positive indicators. The negative indicators measure sentiments all or most of the time: depression, everything is an effort, restless sleep, feeling alone, sad, and cannot get going. The positive indicators measure whether respondents feel happy and enjoy life
Cognition scores	The total cognition score is the sum of the total word recall and mental status test scores ranging from zero to 35. The word recall index sums the immediate and delayed word recall test scores. The mental status index includes the scores for serial 7's, counting backwards from 20, naming objects, recalling dates, and naming the president/vice-president
Cancer diagnosis	Dichotomous indicator of whether respondents have ever been diagnosed with a cancer or a malignant tumor of any kind
Lung diagnosis	Dichotomous indicator of whether respondents have ever been had a lung-related disease
Heart diagnosis	Dichotomous indicator of whether respondents have ever been told by a doctor that they have had a heart attack, coronary heart disease, angina, congestive heart failure, or other heart problems
Stroke	Dichotomous indicator of whether respondents have ever had a stroke
Smoke now	Dichotomous indicator of whether respondents were smoking at the time of being surveyed
Smoke ever	Dichotomous indicator of whether respondents have ever smoked
Drink ever	Dichotomous indicator of whether respondents have ever drank alcohol
Drink days	The number of days per week respondents have had any alcohol to drink in the last three months, for example, beer, wine, or any drink containing liquor
Drink number	The number of drinks per day respondents have consumed in the last three months on the days they have been drinking

Table A3: Effect of Lagged State Economic Conditions on HCBS

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Unemployment rate lag 1	-32.093**	-22.273							-25.561
	(12.755)	(64.547)							(51.984)
Unemployment rate lag 1^2		-2.339							-1.210
		(9.436)							(7.689)
Unemployment rate lag 1^3		0.131							0.086
		(0.386)							(0.333)
Unemployment rate lag 2			-29.028	-47.526					-95.720
			(18.049)	(72.417)					(83.220)
Unemployment rate lag 2^2				3.088					11.088
				(10.269)					(11.517)
Unemployment rate lag 2^3				-0.147					-0.441
				(0.423)					(0.445)
Employment rate lag 1					13.761	-1,084			-1,350
					(10.654)	(1,046)			(973)
Employment rate lag 1^2						18.843			21.319
						(17.244)			(16.216)
Employment rate lag 1^3						-0.107			-0.112
						(0.095)			(0.090)
Employment rate lag 2							10.705	-241.748	-18.742
							(10.606)	(1,273)	(1,090)
Employment rate lag 2^2								5.969	2.870
								(20.352)	(17.386)
Employment rate lag 2^3								-0.042	-0.029
								(0.108)	(0.093)
Observations	765	765	714	714	765	765	714	714	714
Adjusted R-squared	0.961	0.961	0.965	0.965	0.960	0.960	0.964	0.965	0.966

Notes: The data used are a state-year panel from 1999 to 2014. The unemployment and employment level is from BLS, the state population is from Census Bureau, the GDP, personal income (PI), personal consumption expenditure (PCE) is from the Bureau of Economic Analysis Regional Analysis Accounts. The dependent variable is per capita HCBS spending. Each cell reports estimates from a separate specification. The last column includes lagged income controls such as GDP per capita, PI per capita, and PCE per capita. All regressions include state, year fixed effects and weighted using the state population. Standard errors are clustered at the state level and shown in parentheses. *** p<0.01, ** p<0.05, * p<0.10.

Table A4: Effect of HCBS on Other Spending

	(1)	(2)	(3)
	Health care per capita	Net health insurance per capita	Life insurance per capita
HCBS per capita ($1,000)	-0.001	-0.001	0.001
	(0.005)	(0.001)	(0.001)
Observations	816	816	816
Adjusted R-squared	0.997	0.973	0.953
Mean Y	471.9	40.28	24.15
Mean HCBS	498.98	498.98	498.98

Notes: The data used are a state-year panel from 1999 to 2014. The health care, net health insurance, and life insurance spending is from the Bureau of Economic Analysis Regional Analysis Accounts. All regressions include state, year fixed effects and weighted using the state population. Standard errors are clustered at the state level and shown in parentheses. *** p<0.01, ** p<0.05, * p<0.10.

Table A5: The Effect of Aging Waiver Spending on Enrollment

	Dependent Variable: Aging Waiver Enrollment				
	(1)	(2)	(3)	(4)	(5)
Expenditure per older person	8.099	8.170	8.267	9.580	13.038*
	(10.745)	(9.132)	(8.973)	(8.684)	(7.249)
Mean of dependent variable	14163	14113	14113	14113	14113
Observations	576	573	573	573	573
Adjusted R-squared	0.822	0.837	0.837	0.845	0.858
State + Year FE	Y	Y	Y	Y	Y
Demographics		Y	Y	Y	Y
Employment rate			Y	Y	Y
GDP and consumption				Y	Y
Lag economic conditions					Y

Notes: The data used are from CMS about enrollment in the HCBS programs from 1998 to 2014. Each cell reports estimates from a separate specification, weighted by state populations. Column 1 shows the simple estimate only with state and year fixed effects. Column 2 adds demographic variables at the state level such as poverty, education, percentage white, and percentage married. Column 3 further includes unemployment rate and employment rate to account for state-level economic conditions. Column 4 adds GDP per capita, personal income per capita, and personal consumption per capita to further control for economic changes at the state level. Column 5 adds lagged economic conditions on unemployment rate, GDP, consumption as well as its quadratic and cubic forms to flexibly reflect any shocks of economic situation in each state. The standard errors are clustered by state. *** p<0.01, ** p<0.05, * p<0.10.

Table A6: The Effect of Home Health Spending on Enrollment

	Dependent Variable: Home Health State Plan Enrollment				
	(1)	(2)	(3)	(4)	(5)
Expenditure per older person	50.730	44.111	26.647	28.481	7.719
	(31.148)	(28.445)	(21.256)	(18.318)	(13.763)
Mean of dependent variable	15463	15595	15595	15595	15892
Observations	814	760	760	760	658
Adjusted R-squared	0.905	0.909	0.917	0.920	0.959
State + Year FE	Y	Y	Y	Y	Y
Demographics		Y	Y	Y	Y
Employment rate			Y	Y	Y
GDP and consumption				Y	Y
Lag economic conditions					Y

Notes: The data used are from CMS about enrollment in the HCBS programs from 1998 to 2014. Each cell reports estimates from a separate specification, weighted by state populations. Column 1 shows the simple estimate only with state and year fixed effects. Column 2 adds demographic variables at the state level such as poverty, education, percentage white, and percentage married. Column 3 further includes unemployment rate and employment rate to account for state-level economic conditions. Column 4 adds GDP per capita, personal income per capita, and personal consumption per capita to further control for economic changes at the state level. Column 5 adds lagged economic conditions on unemployment rate, GDP, consumption as well as its quadratic and cubic forms to flexibly reflect any shocks of economic situation in each state. The standard errors are clustered by state. *** p<0.01, ** p<0.05, * p<0.10.

Table A7: The Effect of Personal Care Spending on Enrollment

	Dependent Variable: Personal Care State Plan Enrollment				
	(1)	(2)	(3)	(4)	(5)
Expenditure per older person	63.613*	60.696**	66.974**	71.414***	60.957***
	(34.402)	(28.281)	(26.486)	(20.488)	(16.316)
Mean of dependent variable	23945	24256	24256	24256	25004
Observations	524	493	493	493	434
Adjusted R-squared	0.916	0.933	0.944	0.944	0.963
State + Year FE	Y	Y	Y	Y	Y
Demographics		Y	Y	Y	Y
Employment rate			Y	Y	Y
GDP and consumption				Y	Y
Lag economic conditions					Y

Notes: The data used are from CMS about enrollment in the HCBS programs from 1998 to 2014. Each cell reports estimates from a separate specification, weighted by state populations. Column 1 shows the simple estimate only with state and year fixed effects. Column 2 adds demographic variables at the state level such as poverty, education, percentage white, and percentage married. Column 3 further includes unemployment rate and employment rate to account for state-level economic conditions. Column 4 adds GDP per capita, personal income per capita, and personal consumption per capita to further control for economic changes at the state level. Column 5 adds lagged economic conditions on unemployment rate, GDP, consumption as well as its quadratic and cubic forms to flexibly reflect any shocks of economic situation in each state. The standard errors are clustered by state. *** p<0.01, ** p<0.05, * p<0.10.

Table A8: The Effects of HCBS on Health With Other Cutoffs

	(1)	(2)	(3)
	Panel A: Health		
	Poor	Main	
HCBS per capita ($1,000)	-0.007	-0.018**	
	(0.007)	(0.008)	
Mean	0.101	0.325	
	Panel B: Mobility limitation		
	≤ 1	Main	≤ 3
HCBS per capita ($1,000)	-0.006	-0.018*	-0.015
	(0.010)	(0.009)	(0.010)
Mean	0.567	0.367	0.235
	Panel C: ADL limitation		
	≤ 1	Main	≤ 3
HCBS per capita ($1,000)	0.000	0.000	0.007
	(0.013)	(0.011)	(0.010)
Mean	0.219	0.122	0.078
	Panel D: IADL limitation		
	≤ 1	Main	≤ 3
HCBS per capita ($1,000)	-0.005	0.006	0.005
	(0.014)	(0.011)	(0.007)
Mean	0.139	0.069	0.035
	Panel E: Depression		
	≤ 5	Main	≤ 7
HCBS per capita ($1,000)	-0.011	-0.011**	-0.007*
	(0.009)	(0.005)	(0.004)
Mean	0.095	0.058	0.030

Notes: The data used are from HRS 1998 to 2014 of individuals who are aged 65 and older. Each cell reports estimates using equation 1 for each health outcome with different cutoffs. The mean of HCBS expenditure per older person is around $500. All models control for state, year, individual fixed effects, and demographics of individuals such as age, age squared, marital status, and number of siblings of individuals. Standard errors are clustered at the state level. *** p<0.01, ** p<0.05, * p<0.10.

Table A9: Results of HCBS on Other Health Outcomes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Gross	Fine ability	Large muscle	Cancer	Lung	Heart	Stroke
HCBS per capita ($1,000)	-0.009	0.01	-0.003	0.004	-0.011	-0.004	-0.002
	(0.007)	(0.009)	(0.011)	(0.012)	(0.009)	(0.009)	(0.008)
Mean	0.194	0.069	0.444	0.195	0.148	0.381	0.123
Number of individuals	18,196	18,196	18,193	18,196	18,198	18,198	18201
Observations	94,661	94,655	94,618	94,640	94,640	94,613	94645
Adjusted R-squared	0.490	0.371	0.454	0.602	0.426	0.412	0.452

Notes: The data used are from HRS 1998 to 2014 of individuals who are aged 65 and older. Each cell reports estimates using equation 1 for each dependent variable. Gross motor skills limitation of column 1 includes items of walking one block, walking across a room, climbing one flight of stairs, getting in or out of bed, and bathing activities. Fine motor skills limitation of column 2 includes items of picking up a dime, eating, and dressing activities. Large muscle limitation of column 3 includes items of sitting for 2 hrs, getting up from a chair, stooping, kneeling or crouching, and pushing or pulling large objects activities. Columns 4 to 7 are dichotomous dependent variables indicating whether individuals have been diagnosed with cancer, lung, heart disease, and stroke. The mean of HCBS expenditure per older person is around $500. All models control for state, year, individual fixed effects, and demographics of individuals such as age, age squared, marital status, and number of siblings of individuals. Standard errors are clustered at the state level. *** p<0.01, ** p<0.05, * p<0.10.

Table A10: Correlation Between HCBS Spending and Healthcare Use

	(1)	(2)	(3)	(4)	(5)
	Inpatient Service	Medication	Hospital Stays	Nights at Hospitals	Doctor Visits
HCBS ($1,000)	0.016*	0.013**	0.022	0.151	0.213
	(0.009)	(0.006)	(0.021)	(0.134)	(0.427)
Mean	0.33	0.87	0.60	3.03	11.30
Observations	97,738	97,972	97,439	96,886	92,350

Notes: The data used are from HRS 1998 to 2014 of individuals who are aged 65 and older. Each cell reports estimates on dependent variables of healthcare use. Inpatient service means whether a respondent has ever visited a hospital in the previous two years. Medication use indicates whether a respond regularly takes medications in the past two years. Hospital stays and nights is the number of hospital use and doctor visits is number of visiting a doctor in the previous two years. The mean of each dependent variable is summarized in the mean row. All models control for state and year fixed effects. The standard errors are clustered at the state level. *** p<0.01, ** p<0.05, * p<0.10.

Table A11: Correlation Between HCBS Spending and Helper Use

	(1)	(2)	(3)	(4)	(5)
	Number of Helpers	Helpers Last Month	Days Helped	Hours Helped	Paid Helpers
HCBS ($1,000)	0.040*	0.040*	0.405	2.373	0.027
	(0.024)	(0.020)	(0.347)	(2.557)	(0.032)
Mean	0.34	0.31	5.24	27.37	0.26
Observations	87,336	87,293	87,209	86,204	16,196

Notes: The data used are from HRS 1998 to 2014 of individuals who are aged 65 and older. Each cell reports estimates on dependent variables of helpers. Column 1 shows the number of helpers ever helped in the last two years; column 2, the number of helpers helped in the last month; column 3, total days got helped last month; column 4, total hours got helped last month; column 5, total number of helped paid to help last month. The mean of each dependent variable is summarized in the mean row. All models control for state and year fixed effects. The standard errors are clustered at the state level. *** p<0.01, ** p<0.05, * p<0.10.

Table A12: Robustness Effects of HCBS With Different Controls

	(1)	(2)	(3)
	Panel A Outcome: Poor health		
HCBS dollars per capita ($1,000)	-0.018**	-0.018**	-0.015*
	(0.010)	(0.013)	(0.009)
	(0.008)	(0.008)	(0.009)
Mean	0.325	0.325	0.325
Observations	94,637	94,637	94,637
	Panel B Outcome: Mobility limitation		
HCBS dollars per capita ($1,000)	-0.018*	-0.018*	-0.008
	(0.009)	(0.009)	(0.008)
Mean	0.367	0.367	0.367
Observations	94,600	94,600	94,600
	Panel C Outcome: Depression		
HCBS dollars per capita ($1,000)	-0.011**	-0.011**	-0.011**
	(0.005)	(0.005)	(0.005)
Mean	0.058	0.058	0.058
Observations	84,747	84,747	84,747
Income controls		Y	Y
State controls			Y

Notes: The data used are from HRS 1998 to 2014 of individuals who are aged 65 and older. Each column reports an estimate corresponding to a specification. Column 1 is the baseline specification with state, year, individual fixed effects, and individual demographic controls.. Column 2 adds income controls such as earnings, pensions, and annuities. Column 3 adds state level controls such as percentage high school education, percentage female, birth rate, fertility rate, and unemployment rate. *** p<0.01, ** p<0.05, * p<0.10.

Table A13: Results of HCBS on Health Without Moving Sample

	(1)	(2)	(3)	(4)	(5)	(6)
	Poor health	Mobility	ADL	IADL	Depression	Cognitive score
HCBS per capita ($1,000)	-0.017**	-0.020**	0.001	0.001	-0.009*	0.214
	(0.008)	(0.008)	(0.010)	(0.011)	(0.005)	(0.168)
Mean of dependent variable	0.328	0.367	0.123	0.119	0.059	21.35
Number of individuals	16,889	16,873	16,885	16,883	15,433	15,416
Observations	86,557	86,514	86,568	86,557	77,461	77,294
Adjusted R-squared	0.49	0.516	0.46	0.476	0.324	0.678

Notes: The data used are from HRS 1998 to 2014 of individuals who are aged 65 and older without individuals who move over years. Each cell reports estimates using equation 1 for each dependent variable. Poor health is an indicator showing that an individual self-assesses his or her general health status as fair or poor. Mobility/ADL/IADL is an indicator of having at least 2 items of mobility/ADL/IADL limitations. Depression is an indicator of feeling at least 6 negative emotions. Cognitive score is continuous values from 0 to 35. The mean of HCBS expenditure per older person is around $500. All models control for state, year, individual fixed effects, and demographics of individuals such as age, age squared, marital status, and number of siblings of individuals. Standard errors are clustered at the state level. The detailed definition of these variables can be referred to Appendix Table A2. *** p<0.01, ** p<0.05, * p<0.10.

Table A14: Results of HCBS on Health With Sample 70+

	(1)	(2)	(3)	(4)	(5)	(6)
	Poor health	Mobility	ADL	IADL	Depression	Cognitive score
HCBS per capita ($1,000)	-0.018	-0.020*	-0.004	-0.002	-0.013**	0.287*
	(0.012)	(0.011)	(0.016)	(0.016)	(0.006)	(0.169)
Mean of dependent variable	0.345	0.403	0.143	0.146	0.0583	20.72
Number of individuals	14,711	14,693	14,707	14,706	13,313	13,316
Observations	68,778	68,737	68,792	68,782	60,589	60,598
Adjusted R-squared	0.470	0.513	0.455	0.479	0.315	0.672

Notes: The data used are from HRS 1998 to 2014 of individuals who are aged 70 and older. Each cell reports estimates using equation 1 for each dependent variable. Poor health is an indicator showing that an individual self-assesses his or her general health status as fair or poor. Mobility/ADL/IADL is an indicator of having at least 2 items of mobility/ADL/IADL limitations. Depression is an indicator of feeling at least 6 negative emotions. Cognitive score is continuous values from 0 to 35. The mean of HCBS expenditure per older person is around $500. All models control for state, year, individual fixed effects, and demographics of individuals such as age, age squared, marital status, and number of siblings of individuals. Standard errors are clustered at the state level. The detailed definition of these variables can be referred to Appendix Table A2. *** p<0.01, ** p<0.05, * p<0.10.