HHS Public Access

Author manuscript

J Appl Gerontol. Author manuscript; available in PMC 2022 March 01.

Published in final edited form as:

J Appl Gerontol. 2022 March ; 41(3): 638–649. doi:10.1177/07334648211048187.

HCBS Service Spending and Nursing Home Placement for Patients with Alzheimer's Disease and Related Dementias: Does Race Matter?

Di Yan, MS[1], **Sijiu Wang, PhD**[2], **Helena Temkin-Greener, PhD**[1], **Shubing Cai, PhD**[1]

[1]University of Rochester School of Medicine and Dentistry, Rochester, NY

[2]University of Chicago, Department of Public Health Sciences

Abstract

Objectives: We examined the extent to which home and community-based services (HCBS) spending affected the likelihood of nursing home (NH) placement among black and white HCBS users with Alzheimer's disease and related dementias (ADRD).

Methods: The study population included new HCBS users with ADRD between 2010–2013 (N=1,046,200).

Results: We found that a one hundred dollar increase in monthly HCBS spending was associated with a 0.3 percentage points decrease in the NH placement rate among Whites, but a 0.3 percentage points increase in the NH placement rate among Blacks. The overall NH placement rate was 68.2% and 56.7% for Whites and Blacks, respectively.

Discussion: A higher HCBS spending was associated with a decreased likelihood of NH placements for Whites but not for Blacks. It is important to understand how states' HCBS expansion efforts influence Blacks and Whites with ADRD so that resources can be tailored to communities with different race-mix.

Keywords

Medicaid home and community-based services; Racial difference; Nursing home placement; Alzheimer's disease and related dementias

Introduction:

An estimated 5.8 million Americans were diagnosed with Alzheimer's dementia in 2019 and their medical spending was more than $234 billion (Alzheimer's Association, 2019). Older adults with Alzheimer's disease and related dementias (ADRD) are more likely to require long-term services and supports (LTSS) than those without (J. Wang et al., 2020). They also have high care needs due to comorbidities, cognitive impairment, and limitations in activities of daily living (ADL) (Alzheimer's Association, 2019). In addition, they are

Corresponding author: Di Yan, Department of Public Health Sciences, University of Rochester School of Medicine and Dentistry, 265 Crittenden Blvd, Rochester, NY 14642, Tel: 585-622-6870, di_yan@URMC.Rochester.edu.

Conflicts of interest: No

likely to develop behavioral and psychological symptoms, such as depression, psychosis, agitation, aggression, apathy, sleep disturbances, and disinhibition that require caregivers' attention (Cen et al., 2018; Hessler et al., 2018; Rahman et al., 2013). Consequently, most of older adults with ADRD rely on unpaid caregivers such as relatives or friends to maintain living in the community (Alzheimer's Association, 2019). However, support from informal caregivers is often not sustainable due to the increasing need for supervision and personal care, as well as the increase in caregivers' emotional stress and depression associated with the disease progression (Porter et al., 2016). Thus, older adults with ADRD are more likely to be placed into nursing homes (NHs) compared with those without ADRD (Lepore et al., 2017).

Care for persons with ADRD may vary with race. The prevalence of ADRD is higher among Blacks: studies indicate that older Blacks are twice as likely to have ADRD as older Whites (Y. Chen et al., 2019; Masel & Peek, 2009; Weuve et al., 2018). More specifically, the estimated prevalence of ADRD in 2012 was 18–30% for Blacks and 11–13% for Whites (Zhu et al., 2019). Another study estimated that the incidence of ADRD was 26.6/1000 person-years for Blacks and 19.3/1000 person-years for Whites (Mayeda et al., 2016). Furthermore, Blacks with ADRD have a higher disease burden and require more intense care than Whites. Compared with their White counterparts, Blacks with ADRD are more likely to have comorbidities, a higher level of cognitive impairment, diabetes, vascular disease, and worse cognitive test performance (Barnes & Bennett, 2014; Peek et al., 2007; Schwartz et al., 2004). Thus, Blacks with ADRD may need more support to maintain living in the community. In addition, there are significant differences in socioeconomic status, with Blacks being generally more disadvantaged, more likely to rely on Medicaid, and more likely to reside in resource-deprived communities compared to Whites (American Psychological Association, 2013; Hayes et al., 2017; Lê Cook, 2007; Yue et al., 2018). Lastly, there are also significant differences in coping strategies and treatment preferences between Blacks and Whites (Chui & Gatz, 2005; Harris et al., 2020; Ward et al., 2013). For example, compared to Whites, Blacks are less likely to seek formal health services and tend to exhibit greater severity of symptoms at the time of presentation (Cahill et al., 2015; C. Chen & Zissimopoulos, 2018). Thus, the choice of LTSS for persons with ADRD could be quite different between Blacks and Whites.

In recent years, Medicaid has made significant efforts to shift LTSS from institutional care to home and community-based services (HCBS) for older adults who need LTSS (Eiken et al., 2018). Services provided under Medicaid HCBS, such as personal care, home health care, and daily living support services may alleviate the stress and burden on caregivers. Additionally, Medicaid HCBS may provide sustainable support for persons with intensive care needs to maintain their community living, thus delaying NH admissions (Agency for Healthcare Research and Quality, 2012; Kane et al., 2013; Sands et al., 2008). Indeed, some studies have examined the relationship between the state HCBS spending and NH placement among HCBS users and found that a higher state-level spending on HCBS was associated with a lower risk of NH placement (Greiner et al., 2014; Sands et al., 2012; Segelman, Intrator, et al., 2017; Tsuji et al., 1995). A recently published study confirmed this association, i.e., greater HCBS generosity being associated with lower risk of NH placement, among dually eligible older adults with ADRD (S. Wang et al., 2021).

Despite prior studies, many questions are left unanswered regarding the use of HCBS among individuals with ADRD. It is unknown whether the expansion of HCBS investment affects Blacks and Whites with ADRD equally regarding the likelihood of maintaining community living. For individuals who are enrolled in HCBS, there remain substantial variations in states' investment in HCBS (Y. M. Chen & Berkowitz, 2012; Ewen et al., 2017). Whether and how these variations, especially concerning the spending of HCBS, affect the likelihood of NH placement for Blacks and Whites with ADRD remains unclear.

To address this gap in knowledge, by using national Medicaid and Medicare claims data, this study examined the association between HCBS spending (measured as the average monthly Medicaid spending per HCBS user with ADRD) and the likelihood of NH placement among HCBS users with ADRD, and whether such associations varied with individual race.

Data and Methods

Data source.

The Medicaid Analytic eXtract (MAX) Personal Summary (PS) file and Other Therapy (OT) file were obtained for all eligible individuals in the U.S. between 2010 and 2012, and individuals in 28 states in 2013 (due to the availability of data at the time of data request). These data were then linked with the following 2009–2014 data at the individual level: Minimum Data Set (MDS) 2.0 & MDS 3.0, Medicare Master Beneficiary Summary File (MBSF), and Medicare Provider Analysis and Review (MedPAR). The MAX PS file contains summary information for each Medicaid enrollee during the year, including demographic and enrollment status (e.g. age, gender, race, and Medicare/Medicaid enrollment date) as well as service utilization and expenditure measures. The MAX OT file includes information on utilization (e.g. date of service) and expenditure for each type of HCBS (e.g. personal care services) used by an enrollee. The MDS contains information on individual health conditions, such as physical functioning and cognitive status, for all residents admitted to Medicaid and/or Medicare certified NHs. MBSF contains information on residents' demographics and chronic conditions (e.g. the diagnosis of ADRD) for Medicare beneficiaries. The MedPAR file contains information on hospitalization events.

Study population.

We included new fee-for-service (FFS) HCBS users with ADRD who were dually eligible for Medicare and Medicaid between February 2010 and December 2013. Medicare and Medicaid dually eligible FFS beneficiaries were identified using MBSF and MAX. We restricted our analysis to Medicare and Medicaid FFS enrollees so as to capture an individual's history of prior hospitalizations, which can be used as a proxy for health conditions. The diagnosis of ADRD was based on the MBSF chronic condition files. New HCBS users were defined as those who did not have HCBS episodes in the prior 30 days, based on the OT records. If a resident had multiple eligible episodes over the study period, we selected the first HCBS use. We further excluded individuals in counties with less than 100 HCBS users with ADRD, because one of the variables of interest, HCBS spending, was constructed for HCBS users with ADRD in a county, and such measurement may not be

reliable in counties with few eligible users. The final analytical sample included 1,046,200 individuals.

Measures.

The outcome variable was defined as whether an individual experienced any NH admission within one year after the onset of HCBS use. The identification of NH admission was based on the MDS. The main variables of interest included race and the HCBS spending. Race was dichotomized as White and Black, based on the MBSF. Similar to Gonçalves and colleages' study (Gonçalves et al., 2020), the HCBS spending was measured as the average monthly Medicaid spending on HCBS per FFS HCBS user with ADRD in a county, constructed from the MAX PS file. This HCBS spending measure captured variations in HCBS spending within a state, and was more relevant to the study population (i.e. population with ADRD) as HCBS can provide services to other populations.

To account for other individual factors that may contribute to NH placement, we included individual covariates, such as demographics (e.g. gender and age), the number of years since ADRD diagnosis at the time of HCBS use, history of prior health care utilization (i.e. hospitalization, NH utilization within 90 days prior to the identified HCBS use), end-of-life status(death within one year after onset of HCBS use), and individual chronic conditions, such as cardiovascular disease, mental illness, asthma, cancer, diabetes, and obesity.

Lastly, for those who were admitted into NHs, we obtained their physical functioning status and cognitive status at the time of admission. These two variables were constructed based on the MDS. Physical functioning status was measured by activities of daily living (ADL), a 28-point scale with a higher score indicating higher impairment (Carpenter et al., 2006). Cognitive impairment was measured based on the cognitive function scale (CFS, 4-level scale from 1 to 4, where 1 indicates no impairment and 4 indicates severe impairment) (Thomas et al., 2017).

Analysis.

All analyses were conducted at the individual level. We first compared the NH placement rates and individual characteristics for Blacks and Whites with ADRD. We then fitted a linear probability model (Wooldridge, 2010) with county and year fixed-effects and robust standard errors to examine the relationship between race, the HCBS spending, and the probability of NH placement among the HCBS users with ADRD, accounting for individual covariates. The county fixed effects account for state- and county-level time-invariant characteristics that may affect NH placement. We included the interactions between race and the HCBS spending in the model to examine whether and how the relationship between race and the probability of NH placement was modified by the HCBS spending. Lastly, we compared individual physical functioning status and cognitive status between Blacks and Whites who were admitted to NHs.

To test the robustness of the findings, we conducted four additional sensitivity analyses. First, we redefined the main outcome variable as any NH admission from community within one year after the onset of HCBS use (those who were admitted to a NH within 30 days of discharge of an inpatient stay were coded as 0). Second, we redefined the outcome variable

as whether an individual experience any NH admission, within one year after the onset of HCBS use, that ended up being a NH long stay (i.e. NH residents with at least 100 NH stay days) (CMS, 2019). Thirdly, we redefined the outcome variable as the high-impairment at NH admission (CFS ≥ 3 or ADL ≥ 17) (Segelman, Cai, et al., 2017) and conducted the analyses among those who have any NH admission in the study sample. Lastly, to explore the potential role of the community, we stratified the analysis by the Area Deprivation Index (ADI) (Kind & Buckingham, 2018), which captures the socio-economic status of a community. Based on the literature (Kind et al., 2014), we divided communities into most deprived (top 15%) versus all others, using the 2015 ADI, and repeated the analysis in each of the subgroups.

All analyses were performed using SAS 9.4 (SAS Institute Inc.) and STATA 15 (StataCorp LLC. College Station, TX.) This study has been reviewed and approved by the University of Rochester Research Subjects Review Board (STUDY00001025). All authors have no conflicts of interest.

Study Results:

Figure 1 presents the county-level Medicaid spending of HCBS among FFS users with ADRD in 2012. As illustrated in the figure, HCBS spending varied widely across counties – at the 25th percentile, median, and the 75th percentile, Medicaid spent $654, $827, $1,095 per ADRD user per month, respectively.

Table 1 compares the characteristics of Black versus White HCBS users with ADRD. Overall, 77.8% of HCBS users with ADRD were White, and 22.2% were Black. The average one-year NH placement rate was 65.7% during the study period (i.e. 2010–2013), and the NH placement rates for Whites and Blacks were 68.2% and 56.7% respectively (P<0.01). Compared with Blacks, Whites were older and with more mental illnesses, such as depression, anxiety disorders, bipolar disease, and major depressive affective disorders. In addition, at the onset of the HCBS use, Whites tended to have been diagnosed with ADRD for a longer period of time than Blacks (2.1 vs. 1.9 years, P<0.01). Moreover, compared with White HCBS users, Blacks were more likely (46.5% versus 44.5%, P<0.01) to live in a county with a lower level of HCBS spending (i.e., HCBS spending per user per month of less than $800), and less likely (31.8% versus 33.2%, P<0.01) to reside in counties with a higher level of HCBS spending (at least $1000 per user per month). On average, Blacks had lower spending on HCBS than Whites. The average yearly spending on HCBS among White and Black users with ADRD was $5,913 and $5,111 respectively (P<0.01).

Table 2 presents the findings from the main regression analysis. For ease of understanding, we also calculated the adjusted NH placement rates (i.e. accounting for individual-level characteristics) for White and Black users with ADRD in counties with different HCBS spending levels, as presented in Figure 2. Overall, Whites were more likely to be admitted to NHs than Blacks regardless of county's levels of HCBS spending. For example, Whites had a 5.64 percentage points higher likelihood of NH placement than Blacks (P<0.01) in a county with a median HCBS spending (i.e., $839 per HCBS user with ADRD per month) (Table 2). The results from the sensitivity analyses were consistent with the main findings

when we changed the definition of NH placement (shown in Appendix-Table 2 Model 1&2). We also found that Whites were more likely to be admitted to NHs than Blacks regardless of the community's deprivation level, but such racial difference appeared to be greater in the most deprived communities (P<0.01) (shown in Appendix-Table 3).

Furthermore, HCBS spending appeared to have different impacts on NH admission for White versus Black users: a higher level of HCBS spending was related to a reduced likelihood of NH placement for White users with ADRD, but an increased likelihood of NH placement for Black HCBS users with ADRD. Specifically, as presented in Table 2, a one hundred dollars increase in monthly HCBS spending was associated with a 0.35 percentage points (P<0.01) decrease in the likelihood of NH placement among Whites (i.e. the main effect of HCBS spending), but a 0.25 percentage points (P<0.01) increase in the likelihood of NH placement among Blacks (i.e. the effect of the interaction and the main effect of HCBS spending). Thus, as presented in Figure 2, with the increase in the HCBS spending, racial differences in the likelihood of NH placement became smaller. For example, when the county level average monthly HCBS spending increased from $600 to $1100 per user, the gap between Whites and Blacks in NH placement rate decreased from 5.27 to 4.97 percentage point (P<0.01). Full results from the regression were available in Appendix-Table 1.

Lastly, we compared physical and cognitive functioning status among Whites and Blacks when they were admitted into NHs (shown in Appendix-Table 4). In general, Blacks appeared to be more impaired in cognitive and physical functioning at the time of NH placement than Whites. For example, the average ADL scores for Whites and Blacks were 17.6 and 19.1 respectively (P<0.01), and 9.8% of Whites versus 13.7% of Blacks had severe cognitive function impairment at the time of NH admission (P<0.01). Furthermore, Blacks were more likely to have high impairment at NH admission than Whites (P<0.01). Higher HCBS spending was associated with a lower likelihood of high impairment at NH admission among Blacks but not among Whites (shown in Appendix-Table 2 Model 3).

Discussion

This study examined the relationship between Medicaid HCBS spending and the likelihood of NH placement among Medicare-Medicaid dual eligible HCBS users with ADRD, and how this relationship varied with individuals' race. We found that Black HCBS users with ADRD generally were less likely to be admitted into NHs than their White counterparts. Although a higher level of HCBS spending was related to a reduced probability of NH placement among Whites with ADRD. However, such relationship reversed for Blacks with ADRD.

Blacks and Whites with ADRD may have different needs for care and support. For example, Black HCBS users with ADRD were younger and had lower 1-year mortality, compared to their White counterparts. Blacks with ADRD were less likely to use NH care but were more physically and functionally impaired at the time of NH admission, suggesting that they were likely to use NH care at the later stage of the illness. Although we were not able to determine the exact reasons for these racial differences, studies have suggested that these

racial differences may be related to personal preferences, religious or cultural background, as well as their socio-economic status (Cai & Temkin-Greener, 2015; Gaugler et al., 2009; Segelman, Intrator, et al., 2017). For example, studies have suggested that Blacks were more likely to use family and unpaid caregiving to support their community living, and more likely to use home health care services (Fabius et al., 2019; Groger, 1997; Harris et al., 2020; Smedley et al., 2003). Thus, Blacks with ADRD also may be more likely to rely on family and unpaid caregiving rather than going to NHs. On the other hand, it is possible that Blacks may face systemic bias in NH admission, and thus the burden of care shifted to families and unpaid caregivers. For example, Blacks are more likely to reside in socio-economically deprived communities with fewer resources (Fabius et al., 2019), and limited access to NHs, and they may need to have longer travel times to access NHs than Whites (Howard et al., 2002; Wong et al., 2017). Indeed, we found racial differences in NH admissions were greater in socio-economically deprived communities.

Furthermore, we found that the likelihood of NH placement was related to HCBS spending, and such relationship varied with individual race. As expected, our findings suggested that a higher level of HCBS spending was related to a lower likelihood of NH placement among White users with ADRD. The higher level of spending may indicate more services available to older adults with ADRD in the community. Thus, older adults in counties with higher HCBS spending may be more likely supported by paid services and caregivers, often in conjunction with unpaid care, which may enable them to live in the community longer. This finding is consistent with the prior studies, which suggested that the availability of HCBS in the community may delay or prevent NH placement (Greiner et al., 2014; Sands et al., 2012; Toot et al., 2017; Tsuji et al., 1995).

In contrast, we observed an increased likelihood of NH placements with a higher level of HCBS spending among Blacks with ADRD. The effect sizes that we detected were moderate, however, the difference of NH placement between Blacks and Whites may influence a great number of HCBS users considering the high prevalence of ADRD among older adults. Although this study was not able to detect the underlying mechanism for this observation, several potential reasons may attribute to the different effects of HCBS spending on White versus Black users with ADRD. For example, the effect of HCBS spending on NH placement may be greater for those who lack family support – it has been shown that higher HCBS expenditures were associated with a lower risk of NHs admissions among older adults with few family caregiving resources compared to those with more family support (Muramatsu et al., 2007). Compared to Blacks, Whites usually obtain less support from their extended family members (Brown et al., 2002; Harris et al., 2020). Therefore, the spending of HCBS and more availability of support and services in the community may have a greater impact on Whites than Blacks, with respect to NH placement. In addition, as discussed above, Blacks are more likely to reside in communities with limited health care resources and may experience access barriers to formal care as well as delayed NH care (Harris-Kojetin et al., 2016; Luth & Prigerson, 2018). Communities with more generous HCBS services may be more abundant in other resources as well, and thus Blacks may have reduced barriers in access to NHs in these communities. We found that a higher HCBS spending was associated with a lower level of impairment at NH admission

among Blacks, which is consistent with the main findings that higher spending was related to a higher likelihood of NH admission among Blacks but not among Whites.

This study had several limitations. First, although we have controlled for a set of individual characteristics in the multivariable analyses, there may still be unobserved differences in individual characteristics (e.g. culture, preferences, access to institutional care, family caregivers, and social support) that confound the findings. Nonetheless, the main variable of interest – the HCBS spending was constructed at the county level. We excluded counties with fewer than 100 eligible individuals and controlled for county-level fixed effects in the analyses. Therefore, the potential unobserved individual level factors, such as preference, are not likely to change over time within a county, and thus are not likely to lead to a systematic bias in the relationship between HCBS spending and the likelihood of NH placement. Second, we measured HCBS spending as the average HCBS spending among HCBS users with ADRD in the county. Although this measure is based on utilization and is likely to be affected by individual needs/preference, we do not consider this influence to be large as this measure is constructed in counties with at least 100 eligible individuals. Third, our identification of ADRD is based on the Medicare data. Although it is possible that this may have resulted in the under-identification of individuals with ADRD (Amjad et al., 2018; Y. Chen et al., 2019), this was the best data source available to us. Lastly, the sample in this study was FFS beneficiaries and excluded Medicare Advantage enrollees. The results may not be generalized to the HCBS users covered by Medicare Advantage plans. Despite these limitations, to the best of our knowledge, this is the first study that used national data to examine racial differences in NH placement among HCBS users with ADRD, who have unique care needs and require different LTSS than those without ADRD. In addition, we constructed the measure of HCBS spending among HCBS users with ADRD, which could be more relevant to the care and services received by the population with ADRD.

Conclusions and Implications

A higher HCBS spending is associated with a reduced likelihood of NH admission among Whites with ADRD, but not among Blacks with ADRD. With states' policies to rebalance LTSS, it is crucial to understand how these efforts affect the ADRD population, the majority of whom need LTSS. Future studies may be needed to more clearly elucidate these different patterns of HCBS utilization between Blacks and Whites with ADRD so that resources can be reallocated or tailored to communities with different population mix, in order to provide the best-needed support to the ADRD population.

Acknowledgments

Funded by the National Institutes of Health (NIH) National Institute on Aging (HIA) R01AG052451; RF1AG063811

Approved by the University of Rochester Research Subjects Review Board, #STUDY00001025

Appendix

Appendix

Appendix-Table 1.

Racial Differences in NH Placement among HCBS users 2010–2013: Results from Multivariate Regression Analysis, Adjusting for Individual Characteristics and County Fixed Effects

	Coefficient (Robust Standard Error)
Race (Ref: White)	
Black	−0.0564*** (0.00638)
Average Monthly Spending on HCBS Centered ($100)	−0.00354*** (0.000913)
Black # Average Monthly Spending on HCBS Centered ($100)	0.00604*** (0.000927)
Sex= Female	−0.0404*** (0.00223)
Age when 1st HCBS use	0.0117*** (0.000746)
Age square	−0.0000289*** (0.00000482)
Years of ADRD Diagnosis at the 1st HCBS Use (Ref: Diagnosed after HCBS use)	
0 year ~ 1 year	0.0140*** (0.00197)
1 year ~ 2 year	0.0418*** (0.00214)
2 year ~ 3 year	0.0461*** (0.00226)
>3 years	0.0370*** (0.00225)
Any Hospital/NH admission 0–90 days Before HCBS use	0.353*** (0.00350)
Death within 365 days of HCBS use	0.0653*** (0.00274)
AMI	−0.0164*** (0.00161)
Chronic Kidney Disease	0.0127*** (0.00133)
Chronic Obstructive Pulmonary Disease	−0.00760*** (0.00192)
Heart Failure	0.0358*** (0.00206)
Diabetes	0.0122*** (0.00186)
Ischemic Heart Disease	−0.0259*** (0.00198)
Depression	0.0367*** (0.00200)
Osteoporosis	0.00878*** (0.00209)

	Coefficient (Robust Standard Error)
Rheumatoid Arthritis / Osteoarthritis	−0.0334*** (0.00297)
Stroke / Transient Ischemic Attack	0.0488*** (0.00151)
Asthma	−0.0460*** (0.00129)
Cancer	−0.0133*** (0.00135)
Anxiety Disorders	−0.00681*** (0.00124)
Bipolar	0.0422*** (0.00580)
Major Depressive Affective Disorder	0.0549*** (0.00233)
HIV/AIDS	−0.0241*** (0.00602)
Obesity	0.00138 (0.00137)
HCBS Year (Ref: 2010)	
2011	−0.0600*** (0.00333)
2012	−0.0562*** (0.00346)
2013	−0.0852*** (0.00457)
Constant	−0.279*** (0.0266)
Observations	1046200
No. of counties	1277

Linear Probability Model with county fixed effect and excluded counties with less than 100 HCBS users.
* $p < 0.10$,
** $p < 0.05$,
*** $p < 0.01$

Appendix

Appendix-Table 2.

Racial Differences in **Alternative Outcomes** among HCBS users 2010–2013: Results from Multivariate Regression Analysis, Adjusting for Individual Characteristics and County Fixed Effects

	Model 1 Coefficient (Robust Standard Error)	Model 2 Coefficient (Robust Standard Error)	Model 3 Coefficient (Robust Standard Error)
Outcome variable	NH Placement from Community	NH Placement Became Long-stayer	High Impairment at NH Admission
Race (Ref: White)			

	Model 1 Coefficient (Robust Standard Error)	Model 2 Coefficient (Robust Standard Error)	Model 3 Coefficient (Robust Standard Error)
Black	−0.00611** (0.00307)	−0.0594*** (0.00657)	0.0409*** (0.00255)
Average Monthly Spending on HCBS Centered ($100)	−0.00371*** (0.000820)	−0.00401*** (0.000685)	−0.000968 (0.00110)
Black # Average Monthly Spending on HCBS Centered ($100)	0.00236*** (0.000300)	0.00600*** (0.00103)	−0.00189*** (0.000325)
Observations	1046200	1046200	687002
No. of counties	1277	1277	1277

Linear Probability Model with county fixed effect and excluded counties with less than 100 HCBS users.

'NH placement from community' was defined as those who were admitted to a NH and without any inpatient discharge within 30 days. 'NH placement became long-stayer' was defined as those NH residents with at least 100 NH stay days.

'High-impairment at NH admission' was defined as CFS≥3 or ADL≥17 at NH admission assessments.

Model 3 was conducted among new HCBS users with any NH admissions within one year of HCBS use.

Multivariate regression also includes other covariates in the main analysis - residents' demographic characteristics, for example, gender, age; residents' health conditions, for example, ADRD diagnosis years when the first HCBS use, any hospital or NH admission before HCBS use, death within one year; and residents' chronic conditions before HCBS use, for example, acute myocardial infarction, chronic kidney disease, etc.. Besides, year and county fixed effects were included.

* $p < 0.10$,
** $p < 0.05$,
*** $p < 0.01$

Appendix

Appendix-Table 3.

Racial Differences in NH Placement among HCBS users 2010–2013 Stratified by the Area Deprivation Index (ADI): Results from Multivariate Regression Analysis, Adjusting for Individual Characteristics and County Fixed Effects

	Top 15% Disadvantaged Coefficient (Robust Standard Error)	85% less Disadvantaged Coefficient (Robust Standard Error)
Race (Ref: White)		
Black	−0.0628*** (0.00724)	−0.0439*** (0.00681)
Average Monthly Spending on HCBS Centered ($100)	−0.00335*** (0.00114)	−0.00338*** (0.000840)
Black # Average Monthly Spending on HCBS Centered ($100)	0.00602*** (0.000887)	0.00564*** (0.00107)
Observations	270138	776062
No. of counties	1276	1277

Linear Probability Model with county fixed effect and excluded counties with less than 100 HCBS users.

Multivariate regression also includes other covariates in the main analysis - residents' demographic characteristics, for example, gender, age; residents' health conditions, for example, ADRD diagnosis years when the first HCBS use, any hospital or NH admission before HCBS use, death within one year; and residents' chronic conditions before HCBS use, for example, acute myocardial infarction, chronic kidney disease, etc.. Besides, year and county fixed effects were included.

We used the 2015 9-digit zip code Area Deprivation Index (ADI).

*$p < 0.10$,
**$p < 0.05$,
***$p < 0.01$

Appendix

Appendix-Table 4.

Health Condition at Nursing Home Admission

	White N (%)	Black N (%)	Total N (%)
	554,965 (80.78)	**132,037 (19.22)**	**687,002 (100.00)**
	%/Mean (SD)	**%/Mean (SD)**	**%/Mean (SD)**
CFS			
intact	31.02	25.36	29.93
mild	25.14	23.59	24.84
moderate	30.73	33.01	31.17
severe	9.76	13.71	10.52
missing	3.35	4.33	3.54
ADL (28 score)	17.56	19.12	17.86
SD	(6.12)	(6.38)	(6.22)

The difference among the two races groups of all variables were statistically significant at 0.01 level.

References

Agency for Healthcare Research and Quality. (2012). Long-Term Care for Older Adults: A Review of Home and Community-Based Services Versus Institutional Care. 12(81), 1–121. 10.1093/nar/gks1173

Alzheimer's Association. (2019). 2019 Alzheimer's disease facts and figures (Vol. 15, Issue 3). 10.1016/j.jalz.2019.01.010

American Psychological Association. (2013). Ethnic and racial minorities & socioeconomic status. Ethnic and Racial Minorities & ….

Amjad H, Roth DL, Sheehan OC, Lyketsos CG, Wolff JL, & Samus QM (2018). Underdiagnosis of Dementia: an Observational Study of Patterns in Diagnosis and Awareness in US Older Adults. Journal of General Internal Medicine, 33(7), 1131–1138. 10.1007/s11606-018-4377-y [PubMed: 29508259]

Barnes LL, & Bennett DA (2014). Alzheimer's disease in African Americans: Risk factors and challenges for the future. Health Affairs, 33(4), 580–586. 10.1377/hlthaff.2013.1353 [PubMed: 24711318]

Brown S, Cohon D, & Wheeler R (2002). African American extended families and kinship care: How relevant is the foster care model for kinship care? Children and Youth Services Review, 24(1–2), 53–77. 10.1016/S0190-7409(01)00168-2

Cahill S, Pierce M, Werner P, Darley A, & Bobersky A (2015). A Systematic Review of the Public's Knowledge and Understanding of Alzheimer's Disease and Dementia. In Alzheimer Disease and Associated Disorders. 10.1097/WAD.0000000000000102

Cai X, & Temkin-Greener H (2015). Nursing home admissions among medicaid HCBS enrollees: Evidence of racial/ethnic disparities or differences? Medical Care, 53(7), 566–573. 10.1097/MLR.0000000000000379 [PubMed: 26067880]

Carpenter GI, Hastie CL, Morris JN, Fries BE, & Ankri J (2006). Measuring change in activities of daily living in nursing home residents with moderate to severe cognitive impairment. BMC Geriatrics. 10.1186/1471-2318-6-7

Cen X, Li Y, Hasselberg M, Caprio T, Conwell Y, & Temkin-greener H (2018). Aggressive Behaviors Among Nursing Home Residents : Association With Dementia and Behavioral Health Disorders. Journal of the American Medical Directors Association, 19(12), 1104–1109.e4. 10.1016/j.jamda.2018.09.010 [PubMed: 30409493]

Chen C, & Zissimopoulos JM (2018). Racial and ethnic differences in trends in dementia prevalence and risk factors in the United States. Alzheimer's and Dementia: Translational Research and Clinical Interventions. 10.1016/j.trci.2018.08.009

Chen YM, & Berkowitz B (2012). Older adults home- and community-based care service use and residential transitions: A longitudinal study. BMC Geriatrics, 12(1), 1–12. 10.1186/1471-2318-12-44 [PubMed: 22214264]

Chen Y, Tysinger B, Crimmins E, & Zissimopoulos JM (2019). Analysis of dementia in the US population using Medicare claims: Insights from linked survey and administrative claims data. Alzheimer's and Dementia: Translational Research and Clinical Interventions, 5, 197–207. 10.1016/j.trci.2019.04.003 [PubMed: 31198838]

Chui HC, & Gatz M (2005). Cultural diversity in Alzheimer disease: The interface between biology, belief, and behavior. Alzheimer Disease and Associated Disorders. 10.1097/01.wad.0000190802.03717.20

Eiken S, Sredl K, Burwell B, & Amos A (2018). Medicaid Expenditures for Long-Term Services and Supports. In IBM Watson Health (Issue May). https://www.medicaid.gov/medicaid/ltss/downloads/reports-and-evaluations/ltssexpendituresffy2015final.pdf

Ewen HH, Washington TR, Emerson KG, Carswell AT, & Smith ML (2017). Variation in older adult characteristics by residence type and use of home- and community-based services. International Journal of Environmental Research and Public Health, 14(3). 10.3390/ijerph14030330

Fabius CD, Ogarek J, & Shireman TI (2019). Racial Disparities in Medicaid Home and Community-Based Service Utilization among White, Black, and Hispanic Adults with Multiple Sclerosis: Implications of State Policy. Journal of Racial and Ethnic Health Disparities, 6(6), 1200–1207. 10.1007/s40615-019-00621-9 [PubMed: 31359384]

Gaugler JE, Yu F, Krichbaum K, & Wyman JF (2009). Predictors of nursing home admission for persons with dementia. Medical Care, 47(2), 191–198. 10.1097/MLR.0b013e31818457ce [PubMed: 19169120]

Gonçalves J, Weaver F, & Konetzka RT (2020). Measuring State Medicaid Home Care Participation and Intensity Using Latent Variables. Journal of Applied Gerontology : The Official Journal of the Southern Gerontological Society, 39(7), 731–744. 10.1177/0733464818786396 [PubMed: 29978735]

Greiner MA, Qualls LG, Iwata I, White HK, Molony SL, Sullivan MT, Burke B, Schulman KA, & Setoguchi S (2014). Predicting nursing home placement among home- and community-based services program participants. The American Journal of Managed Care.

Groger L (1997). African American elders' long-term care preferences and choices. In Scripps Gerontology Center Publications.

Harris-Kojetin L, Sengupta M, & Park-Lee E (2016). Long-term care providers and services users in the United States: Data from the National Study of Long-Term Care Providers, 2013–2014. 3(38).

Harris J, Crumb L, Crowe A, & McKinney J (2020). African Americans' Perceptions of Mental Illness and Preferences for Treatment. Journal of Counselor Practice, 11(1), 1–33. 10.22229/afa1112020

Hayes SL, Riley P, Radley DC, & McCarthy D (2017). Reducing Racial and Ethnic Disparities in Access to Care: Has the Affordable Care Act Made a Difference? Issue Brief (Commonwealth Fund). 10.15868/socialsector.28158

Hessler JB, Schäufele M, Hendlmeier I, Junge MN, Leonhardt S, Weber J, & Bickel H (2018). Behavioural and psychological symptoms in general hospital patients with dementia, distress for nursing staff and complications in care: Results of the General Hospital Study. Epidemiology and Psychiatric Sciences. 10.1017/S2045796016001098

Howard DL, Sloane PD, Zimmerman S, Eckert JK, Walsh JF, Buie VC, Taylor PJ, & Koch GG (2002). Distribution of African Americans in residential care/assisted living and nursing homes: More evidence of racial disparity? American Journal of Public Health, 92(8), 1272–1277. 10.2105/AJPH.92.8.1272 [PubMed: 12144983]

Kane RL, Lum TY, Kane RA, Homyak P, Parashuram S, & Wysocki A (2013). Does Home- and Community-Based Care Affect Nursing Home Use? Journal of Aging & Social Policy, 25(2), 146–160. 10.1080/08959420.2013.766069 [PubMed: 23570508]

Kind AJH, & Buckingham WR (2018). Making Neighborhood-Disadvantage Metrics Accessible — The Neighborhood Atlas. New England Journal of Medicine. 10.1056/nejmp1802313

Kind AJH, Jencks S, Brock J, Yu M, Bartels C, Ehlenbach W, Greenberg C, & Smith M (2014). Neighborhood socioeconomic disadvantage and 30-day rehospitalization: A retrospective cohort study. Annals of Internal Medicine. 10.7326/M13-2946

Lê Cook B (2007). Effect of medicaid managed care on racial disparities in health care access. Health Services Research. 10.1111/j.1475-6773.2006.00611.x

Lepore M, Ferrell A, & Wiener JM (2017). Living Arrangements of People with Alzheimer's Disease and Related Dementias: Implications for Services and Supports. Research Summit on Dementia Care: Building Evidence for Services and Supports, October, 1–14.

Luth EA, & Prigerson HG (2018). Associations between race and dementia status and the quality of end-of-life care. Journal of Palliative Medicine, 21(7), 970–977. 10.1089/jpm.2017.0638 [PubMed: 29620949]

Masel MC, & Peek MK (2009). Ethnic Differences in Cognitive Function Over Time. Annals of Epidemiology. 10.1016/j.annepidem.2009.06.008

Mayeda ER, Glymour MM, Quesenberry CP, & Whitmer RA (2016). Inequalities in dementia incidence between six racial and ethnic groups over 14 years Elizabeth. Alzheimers Dement, 12(3), 216–224. 10.1016/j.jalz.2015.12.007 [PubMed: 26874595]

MDS 3 . 0 Quality Measures USER ' S MANUAL. (2019). In Centers for Medicare & Medicaid Services (Issue 0214077).

Muramatsu N, Yin H, Campbell RT, Hoyem RL, Jacob MA, & Ross CO (2007). Risk of nursing home admission among older Americans: Does states' spending on home- and community-based services matter? Journals of Gerontology - Series B Psychological Sciences and Social Sciences. 10.1093/geronb/62.3.S169

Peek ME, Cargill A, & Huang ES (2007). Diabetes health disparities: A systematic review of health care interventions. In Medical Care Research and Review. 10.1177/1077558707305409

Porter CN, Miller MC, Lane M, Cornman C, Sarsour K, & Kahle-Wrobleski K (2016). The influence of caregivers and behavioral and psychological symptoms on nursing home placement of persons with Alzheimer's disease: A matched case–control study. SAGE Open Medicine, 4, 205031211666187. 10.1177/2050312116661877

Rahman M, Grabowski DC, Intrator O, Cai S, & Mor V (2013). Serious mental illness and nursing home quality of care. Health Services Research, 48(4), 1279–1298. 10.1111/1475-6773.12023 [PubMed: 23278400]

Sands LP, Xu H, Thomas J, Paul S, Craig BA, Rosenman M, Doebbeling CC, & Weiner M (2012). Volume of Home- and Community-Based Services and time to nursing-Home Placement. Medicare and Medicaid Research Review. 10.5600/mmrr.002.03.a03

Sands LP, Xu H, Weiner M, Rosenman MB, Craig BA, & Thomas J (2008). Comparison of resource utilization for medicaid dementia patients using nursing homes versus home and community based waivers for long-term care. Medical Care, 46(4), 449–453. 10.1097/MLR.0b013e3181621eae [PubMed: 18362827]

Schwartz BS, Glass TA, Bolla KI, Stewart WF, Glass G, Rasmussen M, Bressler J, Shi W, & Bandeen-Roche K (2004). Disparities in cognitive functioning by race/ethnicity in the Baltimore Memory Study. Environmental Health Perspectives, 112(3), 314–320. 10.1289/ehp.6727 [PubMed: 14998746]

Segelman M, Cai X, Van Reenen C, Temkin-Greener H, & Pruchno R (2017). Transitioning from community-based to institutional long-term care: Comparing 1915(c) Waiver and PACE Enrollees. Gerontologist, 57(2), 300–308. 10.1093/geront/gnv106 [PubMed: 26286645]

Segelman M, Intrator O, Li Y, Mukamel D, Veazie P, & Temkin-Greener H (2017). HCBS Spending and Nursing Home Admissions for 1915(c) Waiver Enrollees. Journal of Aging & Social Policy, 29(5), 395–412. 10.1080/08959420.2017.1319714 [PubMed: 28414576]

Smedley BD, Stith AY, & Nelson AR (2003). Unequal Treatment: Confronting Racial and Ethnic Disparities in Health Care (with CD). In Unequal Treatment: Confronting Racial and Ethnic Disparities in Health Care (with CD). 10.17226/12875

Thomas KS, Dosa D, Wysocki A, & Mor V (2017). The Minimum Data Set 3.0 Cognitive Function Scale. Medical Care. 10.1097/MLR.0000000000000334

Toot S, Swinson T, Devine M, Challis D, & Orrell M (2017). Causes of nursing home placement for older people with dementia: A systematic review and meta-analysis. In International Psychogeriatrics. 10.1017/S1041610216001654

Tsuji I, Whalen S, & Finucane TE (1995). Predictors of Nursing Home Placement in Community Based Long term Care. Journal of the American Geriatrics Society. 10.1111/j.1532-5415.1995.tb07046.x

Wang J, Caprio TV, Simning A, Shang J, Conwell Y, Yu F, & Li Y (2020). Association Between Home Health Services and Facility Admission in Older Adults With and Without Alzheimer's Disease. Journal of the American Medical Directors Association, 21(5), 627–633.e9. 10.1016/j.jamda.2019.11.002 [PubMed: 31879184]

Wang S, Yan D, Temkin Greener H, & Cai S (2021). Nursing home admissions for persons with dementia: Role of home and community-based services. Health Services Research, 1–11. 10.1111/1475-6773.13715 [PubMed: 33388053]

Ward EC, Wiltshire JC, Detry MA, & Brown RL (2013). African American men and women's attitude toward mental illness, perceptions of stigma, and preferred coping behaviors. Nursing Research, 62(3), 185–194. 10.1097/NNR.0b013e31827bf533 [PubMed: 23328705]

Weuve J, Barnes LL, Mendes De Leon CF, Rajan KB, Beck T, Aggarwal NT, Hebert LE, Bennett DA, Wilson RS, & Evans DA (2018). Cognitive Aging in Black and White Americans: Cognition, Cognitive Decline, and Incidence of Alzheimer Disease Dementia. Epidemiology, 29(1), 151–159. 10.1097/EDE.0000000000000747 [PubMed: 28863046]

Wong MS, Grande DT, Mitra N, Radhakrishnan A, Branas CC, Ward KR, & Pollack CE (2017). Racial Differences in Geographic Access to Medical Care as Measured by Patient Report and Geographic Information Systems. Medical Care, 55(9), 817–822. 10.1097/MLR.0000000000000774 [PubMed: 28731892]

Wooldridge JM (2010). Econometric Analysis of Cross Section and Panel Data : Chapter 15 Binary Response Models (Second Edi).

Yue D, Rasmussen PW, & Ponce NA (2018). Racial/Ethnic Differential Effects of Medicaid Expansion on Health Care Access. Health Services Research. 10.1111/1475-6773.12834

Zhu Y, Chen Y, Crimmins EM, & Zissimopoulos JM (2019). Sex, Race and Age Differences in Prevalence of Alzheimer'S Disease and Related Dementia in Medicare Claims and Survey Data. Alzheimer's & Dementia, 15, P467–P467. 10.1016/j.jalz.2019.06.1122

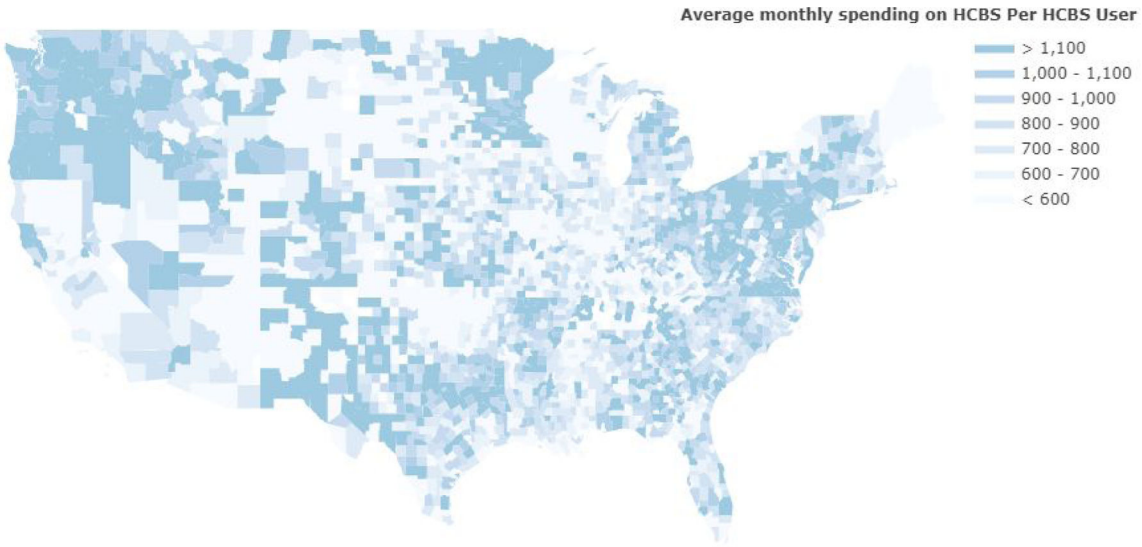

Figure 1. Distribution of HCBS Spending throughout the U.S. in 2012

Figure shows the county-level Medicaid spending of HCBS among fee-for-service (FFS) users with ADRD in 2012. HCBS spending was measured as the average monthly spending on HCBS among FFS HCBS users with ADRD.

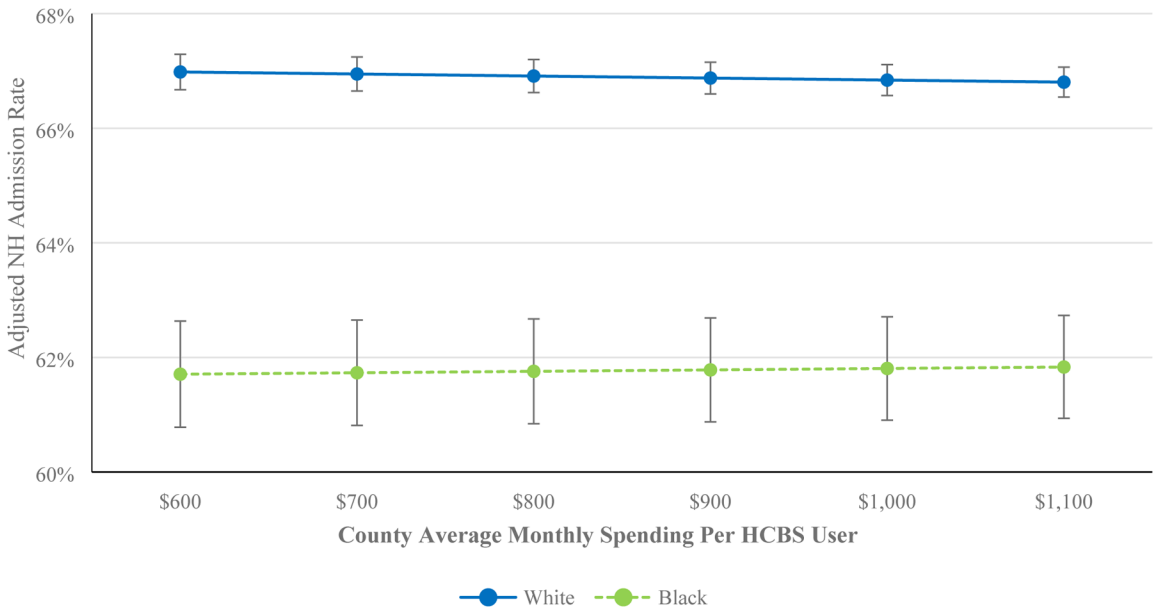

Figure 2. Adjusted NH Admission Rate among Newly HCBS Users by Race

The NH admission rates were adjusted at means of all other covariates based on the multivariate regression.

Table 1.

Demographic Characteristics of HCBS Users by Races

	White N (%)	Black N (%)	Total N (%)
	813,466	**232,734**	**1,046,200**
	(77.75%)	**(22.25%)**	**(100.00%)**
	%/Mean (SD)	**%/Mean (SD)**	**%/Mean (SD)**
Any Nursing Home Placement Within 1 Year	68.22	56.73	65.67
County Average Monthly Spending on HCBS	44.56	46.46	44.98
< $800 Per User			
[$800, $1000) Per User	23.66	20.37	22.93
>= $1000 Per User	31.79	33.17	32.09
Years of ADRD Diagnosis at the 1st HCBS Use	27.06	33.17	28.42
Diagnosed after HCBS use			
0 year ~ 1 year	17.57	16.48	17.33
1 year ~ 2 year	10.88	9.49	10.57
2 year ~ 3 year	9.06	7.92	8.81
>= 3 year	35.43	32.94	34.88
Age When 1St HCBS Use	78.58	75.68	77.93
	(12.87)	(13.19)	(12.99)
Spending on HCBS within 1 year	5912.64	5111.29	5741.47
	(15433.40)	(12246.23)	(14813.22)
Female	69.53	65.55	68.64
Any Hospital/NH Admission 0–90 Days Before HCBS Use	52.08	46.43	50.82
Death within 365 days of HCBS use	29.26	22.05	27.66
Acute Myocardial Infarction (AMI)	8.41	6.64	8.02
Chronic Kidney Disease	38.79	46.85	40.58
Chronic Obstructive Pulmonary Disease	46.12	37.49	44.20
Heart Failure	54.73	55.67	54.94
Diabetes	49.41	61.01	51.99
Ischemic Heart Disease	66.24	64.35	65.82
Depression	67.57	50.76	63.83
Osteoporosis	34.21	17.19	30.43
Rheumatoid Arthritis / Osteoarthritis	66.01	61.36	64.98
Stroke / Transient Ischemic Attack	35.01	39.80	36.07
Asthma	18.19	18.35	18.22
Cancer	14.72	14.27	14.62
Anxiety Disorders	39.42	23.40	35.86
Bipolar	13.90	10.01	13.03
Major Depressive Affective Disorder	57.76	40.44	53.91
HIV/AIDS	0.54	2.13	0.89
Obesity	17.21	20.24	17.88

The differences among the two race groups of all variables were statistically significant at 0.01 level.

Table 2.

Racial Differences in NH Placement among HCBS users 2010–2013: Results from Multivariate Regression Analysis, Adjusting for Individual Characteristics and Facility Effects

	Coefficient (Robust Standard Error)
Race (Ref: White)	
Black	−0.0564*** (0.00638)
Average Monthly Spending on HCBS Centered ($100)	−0.00354*** (0.000913)
Black # Average Monthly Spending on HCBS Centered ($100)	0.00604*** (0.000927)

Multivariate regression also includes residents' demographic characteristics, for example, gender, age; residents' health conditions, for example, ADRD diagnosis years when the first HCBS use, any hospital or NH admission before HCBS use, death within one year; and residents' chronic conditions before HCBS use, for example, acute myocardial infarction, chronic kidney disease, etc.. Besides, year and county fixed effects were included. Full models are shown in the Appendix-Table 1.

* P < 0.10,

** P < 0.05,

*** P < 0.01