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### Permalink

<https://escholarship.org/uc/item/6rx132md>

### Journal

Journal of the American Medical Directors Association (JAMDA): long-term care: management, applied research and clinical issues, 23(10)

### Authors

Ankuda, Claire  
Perez-Benzo, Grace  
Osakwe, Zainab  
[et al.](#)

### Publication Date

2022-10-01

### DOI

10.1016/j.jamda.2022.06.014

Peer reviewed



# HHS Public Access

Author manuscript

*J Am Med Dir Assoc.* Author manuscript; available in PMC 2023 October 01.

Published in final edited form as:

*J Am Med Dir Assoc.* 2022 October ; 23(10): 1614–1620.e10. doi:10.1016/j.jamda.2022.06.014.

## Growth of Fee-for-Service Medicare Home-Based Medical Care Within Private Residences and Domiciliary Care Settings in the U.S., 2012–2019

Bian Liu, PhD<sup>a,\*</sup>, Christine S. Ritchie, MD, MSPH<sup>b</sup>, Claire K. Ankuda, MD<sup>c</sup>, Grace Perez-Benzo, MD<sup>c</sup>, Zainab Toteh Osakwe, PhD<sup>d</sup>, Jennifer M. Reckrey, MD<sup>c</sup>, Maggie R. Salinger, MD, MPP<sup>e</sup>, Bruce Leff, MD<sup>f</sup>, Katherine A. Ornstein, PhD<sup>c</sup>

<sup>a</sup>Department of Population Health Science and Policy, Icahn School of Medicine at Mount Sinai, New York, NY, USA

<sup>b</sup>Division of Palliative Care and Geriatric Medicine, Mongan Institute Center for Aging and Serious Illness, Massachusetts General Hospital, Boston, MA, USA

<sup>c</sup>Department of Geriatrics and Palliative Medicine, Icahn School of Medicine at Mount Sinai, New York, NY, USA

<sup>d</sup>College of Nursing and Public Health, Adelphi University, Garden City, NY, USA

<sup>e</sup>Department of General Internal Medicine, Massachusetts General Hospital, Boston, MA, USA

<sup>f</sup>Division of Geriatric Medicine and Gerontology, Johns Hopkins University School of Medicine, Baltimore, MD, USA

### Abstract

**Objectives:** Home-based medical care (HBMC) delivers physician or advanced practice provider–led medical services for patients in private residences and domiciliary settings (eg, assisted living facilities, group/boardings homes). We aimed to examine the time trends in HBMC utilization by care settings.

**Design:** Analyses of HBMC utilization at the national and state levels during the years 2012–2019.

**Setting and Participants:** With Medicare public use files, we calculated the state-level utilization rate of HBMC among fee-for-service (FFS) Medicare beneficiaries, measured by visits per 1000 FFS enrollees, in private residences and domiciliary settings, both separately and combined.

\*Address correspondence to Bian Liu, PhD, MS, One Gustave L. Levy Place, Box 1077, Department of Population Health Science and Policy, Icahn School of Medicine at Mount Sinai, New York, NY 10029, USA. [bian.liu@m Mountsinai.org](mailto:bian.liu@m Mountsinai.org) (B. Liu).

Author Contributions: B. Liu had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. Concept and design: K.A. Ornstein, C. S. Ritchie, B. Liu. Acquisition, analysis, or interpretation of data: All authors. Drafting of the manuscript: B. Liu. Critical revision of the manuscript for important intellectual content: All authors. Statistical analysis: B. Liu. Supervision: K.A. Ornstein, C. S. Ritchie.

The authors declare no conflicts of interest.

**Methods:** We assessed the trend of HBMC utilization over time via linear mixed models with random intercept for state, adjusting for the following state-level markers of HBMC supply and demand: number of HBMC providers, state ranking of total assisted living and residential care capacity, and the proportion of FFS beneficiaries with dementia, dual eligibility for Medicaid, receiving home health services, and Medicare Advantage.

**Results:** Total HBMC visits in the United States increased from 3,911,778 in 2012 to 5,524,939 in 2019. The median (interquartile range) state-level HBMC utilization rate per 1000 FFS population was 67.6 (34.1–151.3) visits overall, 17.3 (7.9–41.9) visits in private residences, and 47.7 (23.1–86.6) visits in domiciliary settings. The annual percentage increase of utilization rates was significant for all care settings in crude models (3%–8%), and remained significant for overall visits and visits in domiciliary settings (2%–4%), but not in private residences.

**Conclusions and Implications:** The national-level growth in HBMC from 2012–2019 was largely driven by a growth of HBMC occurring in domiciliary settings. To meet the needs of a growing aging population, future studies should focus efforts on policy and payment issues to address inequities in access to HBMC services for homebound older adults, and examine drivers of HBMC growth at regional and local levels.

## Keywords

Medicare; fee-for-service; home care services; assisted living facilities; aging

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A growing number of older Americans reside in community-based residential settings, including assisted living facilities, group homes, and boarding homes (referred to as domiciliary settings hereafter to distinguish this setting from both private homes and nursing homes). The number of domiciliary residences increased from 713,300 in 2012 to 918,700 in 2018.<sup>1,2</sup> In contrast, the number of nursing facility residences decreased from 1,367,500 in 2012 to 1,246,100 in 2019.<sup>3</sup> Although domiciliary settings are not someone's "home" in the same way a private residence would be due to lack of autonomy, from a clinical care perspective, they offer the latitude for involvement of home-based medical care (HBMC) in a way that nursing homes do not. Although most older adults who live in domiciliary settings generally do not require continuous on-site skilled care provided in settings like nursing homes, they often have complex care needs owing to a high burden of comorbidities, homebound status, functional limitations, and frailty.<sup>4,5</sup> For example, 93% of residents in domiciliary settings were 65 or older, 34% were diagnosed with dementia, and 61% needed assistance with 3 or more activities of daily living (ADLs), according to a 2018 national survey.<sup>1</sup>

For many older adults, especially those who are homebound, access to office-based primary care is challenging. This limitation can result in care gaps, unnecessary emergency department visits, and hospitalizations that in turn exacerbate the financial and care burden for patients and their caregivers, as well as the health care system.<sup>6</sup> HBMC provides an alternative solution to meet the complex medical needs of older adults where they live, including in domiciliary settings, while reducing health care expenditures. HBMC delivers physician or advanced practice provider–led interdisciplinary medical services in private residences and domiciliary settings. HBMC has demonstrated reductions in

hospital admissions, emergency department visits, hospital length of stay, and long-term care admissions.<sup>7-9</sup>

HBMC has expanded recently in the context of value-based care models, technological advancements (eg, remote monitoring, portable equipment), and a growing evidence base of improved patient outcomes.<sup>5,7,9-14</sup> However, not all individuals who might benefit from HBMC receive care. A recent study showed that the proportion of fee-for-service (FFS) Medicare beneficiaries who used HBMC increased slightly from 2.29% in 2011 to 2.56% in 2017, whereas the homebound population had a higher HBMC usage, only 11% of them received HBMC.<sup>5</sup> In addition, disparities in HBMC utilization exist, with more common utilization among those living in metropolitan areas and assisted living facilities.<sup>5</sup> Regional variation in HBMC access and availability of providers who deliver HBMC has also been reported.<sup>13,15</sup>

There are approximately 2 million older adults in the United States who are completely homebound and another 5.5 million who cannot leave their residence without assistance or difficulty.<sup>16</sup> Although HBMC delivery has expanded across the United States to meet the need of older Americans, including homebound adults, data describing state-level trends in the utilization of HBMC services over time are lacking. Moreover, time trends in HBMC utilization by care settings (private residences vs domiciliary) have not been examined. The goal of this study was to examine the growth of HBMC nationally and by state with a specific focus on the distinct trends of HBMC use in private residences vs domiciliary settings.

## Methods

### Study Design and Data Sources

We used several public use files (PUFs) from the Centers for Medicare and Medicaid Services (CMS) for Medicare FFS beneficiaries during the years 2012 to 2019.

The utilization of HBMC services was obtained from the Medicare Provider Utilization and Payment Data: Physician and Other Supplier PUF.<sup>17</sup> This provider PUF summarized reimbursable services delivered by providers (eg, physicians, physician assistants, and nurse practitioners) to Medicare FFS beneficiaries. Provided services were coded using the Healthcare Common Procedure Coding System (HCPCS) codes, and individual providers were distinguished by their National Provider Identifier (NPI). The total number of individual services provided per HCPCS code and the total number of beneficiaries per HCPCS code were both summarized at the NPI level. Data for providers with fewer than 11 beneficiaries for individual HCPCS codes were suppressed in the provider PUF to protect patient privacy. We extracted HBMC visits in private residences (HCPCS 99341-50) and domiciliary settings (HCPCS 99324-28 and 99334-37). Consistent with prior studies, we excluded services delivered by podiatrists.<sup>13,15</sup>

### Outcome Variables

The primary outcome of interest was HBMC utilization rate measured by visits per 1000 Medicare FFS enrollees. We used the sum of the HBMC visits per individual providers

located within the same state as the numerator, and used the counts of state-level Medicare FFS enrollees obtained from the enrollment PUF as the denominator.<sup>18</sup> We also considered 2 additional secondary measures of HBMC utilization based on patient volume [persons served and new patients, which were based on nonunique patient counts and CMS's definition of what constitutes new patients (see details in the Supplemental Information)].

### Exposure Variable

We used calendar year, treated as a continuous variable, to investigate changes in HBMC utilization rate over time between 2012 and 2019.

### Covariates

We included the following concurrent state-level factors to represent both the supply and demand side of HBMC services that can potentially confound the overall HBMC utilization trend. Supply-level factors included availability of HBMC providers as well as availability of long-term services and supports (LTSS). Demand-level factors included the prevalence of Alzheimer disease and related dementia (ADRD), the proportions receiving home health, percentage of dual-eligible enrollees, and Medicare Advantage (MA) penetration, all of which were obtained from the 2012 to 2019 chronic disease PUF.<sup>19</sup>

We approximated the availability of HBMC providers by summing the total number of unique providers delivering HBMC services within each state, and dividing this sum by the state-level FFS population count. We used the LTSS State Scorecard rankings of assisted living and residential care units per 1000 older adults to account for state-level supply of LTSS.<sup>20</sup>

To capture the demand-side influences, we measured state-level proportions of FFS Medicare beneficiaries diagnosed with ADRD (ADRD%) as well as the proportions receiving home health (home-health-use%), because both are positively correlated with HBMC need.<sup>5,12,19</sup> Like state-level ADRD% and home-health-use%, the proportion of dual-eligible FFS beneficiaries (dual-eligible%) was measured to indicate HBMC need. This is because dual-eligibles account for a disproportionate share of health care spending (ie, they account for 20% of Medicare enrollees but 34% of spending; and 15% of Medicaid enrollees but 32% of spending),<sup>21</sup> and because they tend to have more ADL dependencies.<sup>1,21</sup> But unlike ADRD% and home-health-use%, the dual-eligible% would also affect demand for HBMC via LTSS availability, because LTSS is a Medicaid-covered benefit for dual-eligibles.<sup>22-24</sup> Lastly, we also included the proportion of Medicare beneficiaries who were enrolled in MA plans (MA%) to capture potential reductions in demand for FFS-funded HBMCs.

### Statistical Analysis

Trends in HBMC utilization rates (eg, visits per 1000 FFS population) over time were assessed first using descriptive summaries over the 8-year period and across years. To better capture national trend while accounting for state-level variations, we used linear mixed models with random intercept for state, both with and without adjusting for state-level indicators of HBMC supply and demand that could potentially confound the

observed trends. Separate models were conducted for HBMC visits in private residences, in domiciliary settings, and in both settings combined. All models used the natural log-transformed HBMC utilization rate as the response variable to account for its skewed distribution. We also assessed the crude time trends of visits per 1000 FFS population for individual states using simple linear regression models without adjusting for any covariates. All analyses were conducted using SAS (v9.4) and R (V4.0.2).

## Results

### Descriptive Summary of Overall HBMC Utilization

The total HBMC visits increased from 3,911,778 in 2012 to 5,524,939 in 2019 at the national level (Table 1), of which the proportion of visits in domiciliary settings increased from 53% in 2012 to 65% in 2019. Summarizing state-level HBMC utilization rates during the 8-year period yielded the median [interquartile range (IQR)] level of HBMC utilization rate per 1000 FFS population to be 67.6 (IQR 34.1–151.3) visits overall, 17.3 (IQR 7.9–41.9) visits in private residences, and 47.7 (IQR 23.1–86.6) visits in domiciliary settings (Table 1). At the national level, HBMC utilization rate in domiciliary settings was approximately 2 to 3 times that in private residences. Delivery of HBMC services at the individual provider level was similar between the private residences and domiciliary settings. The median level of visits per provider was 120 (IQR 46–343) in private residences, and was 131 (IQR 52–337) in domiciliary settings (Table 1). At the national level, the median number of providers who delivered HBMC was 2.9 (IQR 1.6–4.5) providers per 10,000 FFS population (Table 1).

We found similar relative distributions of HBMC utilization patterns between private residences and domiciliary settings as measured by persons served and new patients, as shown in Supplementary Table 1.

### Descriptive Summary of HBMC Utilization Trends Over Time

From 2012 to 2019, HBMC visits per 1000 FFS population increased for all care settings (Figure 1). The median level of utilization rate per 1000 FFS population increased from 51.6 (IQR 27.3–112.7) visits in 2012 to 90.5 (IQR 42.3–176.5) visits in 2019 overall, from 13.9 (IQR 5.8–33.5) to 22.1 (IQR 9.4–42.1) visits in private residences, and from 37.9 (IQR 18.9–58.8) to 60.4 (IQR 31.7–106.8) visits in domiciliary settings.

HBMC utilization rates varied across states, as illustrated by the utilization in 2019 (Figure 2). The top 3 states with high HBMC utilization measured by visits per 1000 FFS population were Florida, Michigan, and North Carolina for the overall visits; Nevada, Michigan, and Illinois for visits in private residences; and Florida, North Carolina, and Minnesota for visits in domiciliary settings. In contrast, the states with lowest HBMC utilization measured by visits per 1000 FFS population were Alaska, Vermont, and South Dakota for the overall visits; South Dakota, North Dakota, and Alaska for visits in private residences; and Vermont, Alaska, and South Dakota for visits in domiciliary settings.

We found a similar increase in HBMC utilization measured by patient volume (Supplementary Figures 1 and 2). The distribution of covariates during 2012 to 2019 are

shown in Supplementary Figure 3. The median number of providers who delivered HBMC per 10,000 FFS population increased from 2.3 (IQR 1.4–3.2) providers in 2012 to 3.7 (IQR 1.8–5.5) providers in 2019. This measure of provider capacity as well as other covariates also varied across states (Supplementary Figure 4).

### Modeled HBMC Utilization Trends Over Time

At the national level, results from the unadjusted models indicated a significant increase of HBMC utilization rate across all care settings (Figure 3). The magnitude of the increase was the highest for visits in domiciliary settings, where the annual increase was 8.4% (95% CI 7.3%–9.4%). Using the average national FFS population size over the study period (33,447,194) and the geometric means of visits in domiciliary settings (41.8 visits per 1000 FFS population), the annual percentage increases on the relative scale can be approximated to an increase of 116,805 (95% CI 101,893–131,856) visits in domiciliary settings on the absolute scale. In private residences, the magnitude of the annual increase was 3.0% (95% CI 1.0%–5.2%), equivalent to an increase of 16,785 (95% CI 5369–28,437) visits. In combined private residences and domiciliary settings, the annual increase was 6.0% (95% CI 5.1%–7.0%), equivalent to an increase of 133,047 (95% CI 111,775–154,538) visits.

As shown in Figure 3, after adjusting for the aforementioned state-level covariates, the modeled annual increase in HBMC utilization rate remained significant for HBMC in domiciliary settings (4.0%; 95% CI 2.4%–5.5%), as well as in combined private residences and domiciliary settings (1.9%; 95% CI 0.5%–3.2%), but not significant for visits in private residences (2.1%; 95% CI –4.9% to 0.7%). The variance in visits explained by calendar year and the covariates together was 76%, 58%, and 64% for overall visits, visits in private residences, and in domiciliary settings, respectively.

Similar time trends were observed when the HBMC utilization rate was measured by persons served, and time trends of HBMC utilization rate measured by new patients were no longer significant in the adjusted models for any care settings (Supplementary Figure 5).

The crude annual changes of overall HBMC visits (without adjusting for covariates) varied considerably across states (Supplementary Figure 6 to 8). A statistically significant ( $P < .05$ ) positive growth of HBMC visit rate was found in 67% ( $n = 34$ ) of the states for overall visits, 37% ( $n = 19$ ) for visits in private residences, and 82% ( $n = 42$ ) for visits in domiciliary settings. Some states also experienced a significant ( $P < .05$ ) negative growth, namely in 4 states (Alaska, Vermont, New Mexico, and Michigan) for overall visits, 6 states (South Dakota, Alaska, Vermont, Michigan, Ohio, and Illinois) and the District of Columbia for visits in private residences, and 2 states (Alaska and New Mexico) for visits in domiciliary settings. The state ranking in the magnitude of annual changes in HBMC visits varied depending on whether a relative or an absolute scale was used (Supplementary Figures 6–8). For example, Wyoming ranked the highest in the annual percentage change of HBMC visits in domiciliary settings (a 40.7% increase, equivalent to an increase of 192 visits), whereas Florida ranked the highest in terms of annual increase in the absolute number of visits (a 7.5% increase, equivalent to an increase of 36,221 visits, Supplementary Figure 8).



## Discussion

We provide the first empirical evidence showing different patterns of HBMC utilization over time in private residences vs domiciliary settings. The growth in HBMC from 2012 to 2019 was largely driven by changes in its use across domiciliary settings, rather than private residences. The observed patterns are likely driven by multiple factors, including an aging population, increased utilization of assisted living facilities, expansion of the HBMC provider workforce, and broader availability of subsidies for HBMC, all of which are also tied to state policies and finances, as well as the growing recognition of HBMC's value proposition.<sup>5,7,9–15,25</sup>

In analyzing the national trend of HBMC utilization rate, we were able to adjust for 6 key variables that can affect the supply and demand of HBMC services. These factors helped to explain a reasonable portion of the variations in HBMC served in domiciliary settings better than in private homes. In addition, the increasing trend of HBMC in domiciliary settings persisted even after the covariate adjustment. These discrepancies suggest that HBMC provided in private residences and domiciliary settings may be impacted by different underlying factors. For example, a key driver may be that practices are incentivized to focus HBMC delivery efforts on domiciliary settings, where they can serve a higher concentration of patients in a single setting, compared with private home settings. This explanation is consistent with a previous study based on patient-level data indicating a higher HBMC utilization among homebound population living in assisted living facilities.<sup>5</sup> It is also aligned with the result from the current analysis showing that the growth of HBMC utilization in domiciliary settings was stronger in utilization measured by the service and patient served compared with that measured by new patients. Patients who reside in private residences may also differ from domiciliary dwellers in terms of their health status, socioeconomic, and family caregiving situations. Moreover, geographic locations of both the patients and providers may play a role. Our studies and others have indicated that there is large spatial distribution of HBMC providers, and older adults in rural areas tended to use less HBMC, when providers were more than 15 or 30 miles away.<sup>13,15</sup> The unexplained variance (24% to 42%) in HBMC utilization in our adjusted models suggest that additional factors, such as individual socioeconomic status and caregiver support, should be considered in future studies to better explore the drivers of trends in HBMC delivered in private residences and in domiciliary settings. In addition, patient-level data as opposed to state-level data aggregated from the provider level are needed to understand inequities in access to HBMC services for homebound older adults.

We also observed that the time trends in HBMC utilization without adjusting for covariates varied widely among states. Given the significant variation in the 6 state-level covariates, it is unsurprising to see varied utilization patterns across states. In general, most of the states experienced an increased HBMC utilization. States that experienced a negative growth tended to rank low in their HBMC utilization levels (eg, Alaska, Vermont, and South Dakota), with the exception of Michigan and Illinois, which had one of the highest HBMC visit rates in private settings in 2019 despite the decrease. How specific state-level factors contribute to the observed patterns warrant in-depth investigation in future studies with detailed local-focused data.



This study has several limitations. First, our results are limited to Medicare FFS beneficiaries, as we are not capturing HBMC use in the growing population of individuals who have MA. Second, the reliance on HCPCS codes to define HBMC services does not reflect the content or quality of the services. The “domiciliary” billing code includes different community-based residential settings, not just assisted living facilities, and it is unclear how settings on the spectrum of residential care are being classified by billing clinicians. Beneficiaries in assisted living facilities may differ from those in other type of congregate/shared community-settings, such as boarding home, custodial care services, or group homes. In addition, the regulation and management policies differ widely not only by state-level factors but also by types of settings (eg, size, cost, staffing), which could in turn affect how HBMC is used and provided.<sup>11</sup> Finally, although we were able to adjust for multiple covariates, additional factors unaccounted for can affect HBMC utilization.

## Conclusion and Implications

HBMC plays an important role in providing medical care for older adults in private residences and domiciliary settings that should be further examined as we consider how to best meet the long-term care needs of older adults. To meet the needs of a growing aging population, future studies should examine the quality and outcomes of HBMC delivered across different settings to different populations. Research should focus efforts on policy and payment issues to address inequities in access to HBMC services for homebound older adults who could most benefit from this form of care, and examine drivers of HBMC growth at regional and local levels, including specific state-level regulations and workforce supply. As the U.S. health care system looks to reduce institutional care and associated costs while improving the patient experience, the intersection between HBMC and residential care, including integration of HBMC into the current care delivery ecosystem to the older population, warrants further exploration.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

## Acknowledgments

The study was supported by the National Institute on Aging (P01 AG066605 and P30AG028741). The funding organization had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.

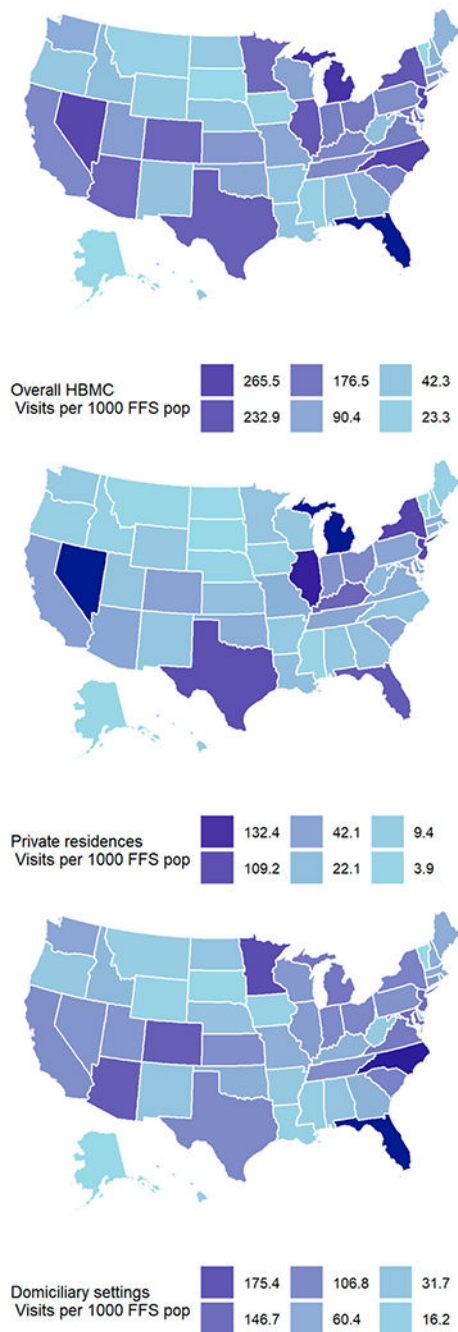
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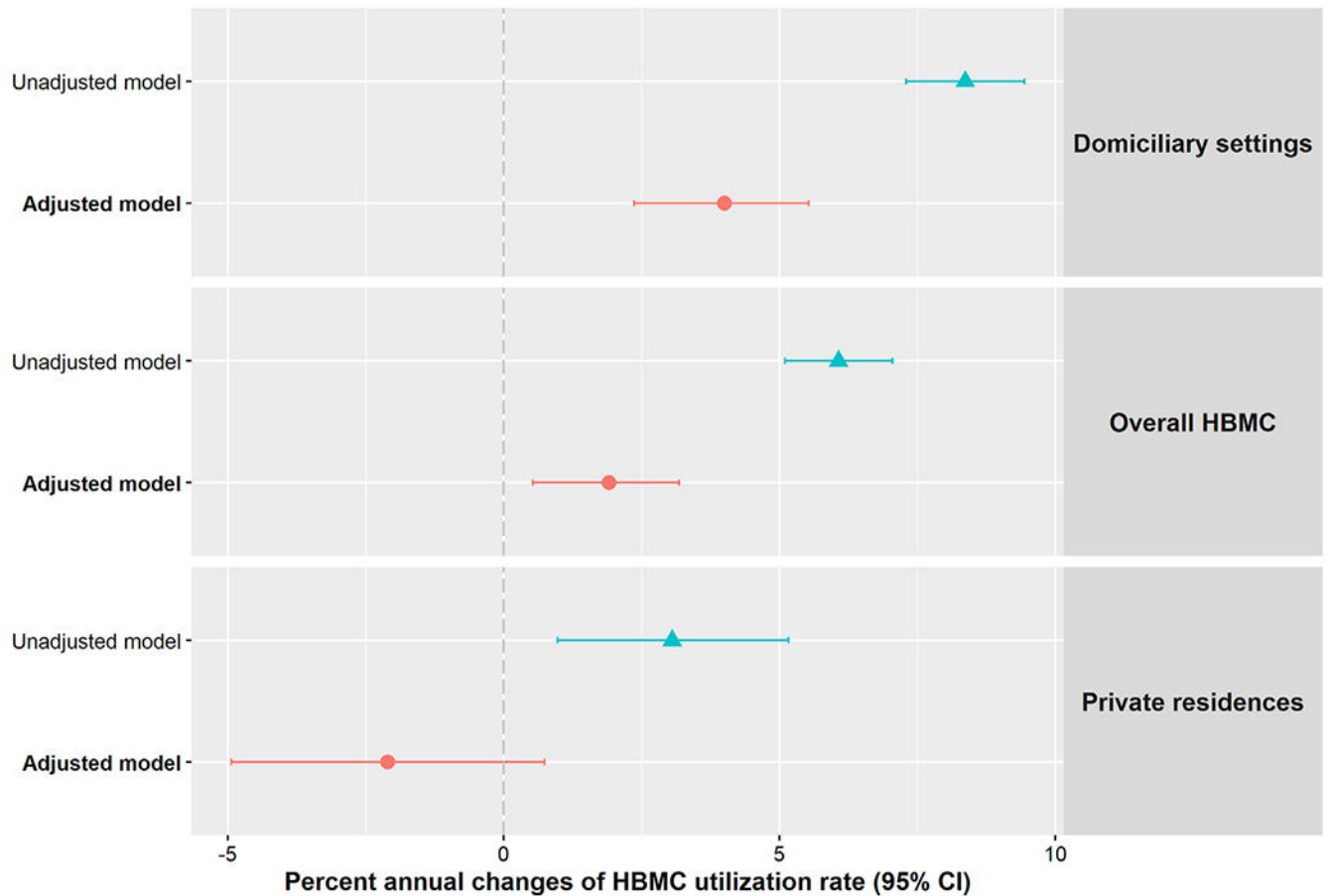
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**Fig. 1.** Distribution of HBMC utilization overall, as well as in private residences and domiciliary settings during 2012–2019. The box plot shows the HBMC utilization over time based on state-level data (each red dot is a state).



**Fig. 2.** State-level HBMC utilization in 2019. The increasing color shade corresponds to the 10th, 25th, 50th, 75th, 90th, and 95th percentiles of the utilization rate.



**Fig. 3.**

Annual percent change in utilization rate of HBMC in private residences, in domiciliary settings, and in both settings combined during 2012–2019. Note: We assessed trends in HBMC utilization (visits per 1000 FFS Medicare beneficiary enrollees) over time at the national level using linear mixed models with random intercept for state, with (Adjusted model) and without (Unadjusted model) adjusting for the following 6 state-level characteristics: numbers of providers with HBMC services per 10,000 FFS beneficiaries, the proportion of beneficiaries who had ADRD, participated in MA, were eligible for Medicaid, or used home health, and the state ranking of assisted living and residential care units per 1000 older adults. Separate models were run for HBMC visits in private residences, in domiciliary settings, and in both settings combined. All models used the natural log-transformed HBMC utilization rate as the response variable to account for its skewed distribution. The beta coefficient of the main explanatory variable (ie, calendar year, treated as continuous variable) was interpreted as annual percentage change in the geometric mean of the HBMC utilization rate.

Table 1

## Distribution of HBMC Utilization During 2012–2019

National Level	Overall HBMC	HBMC in Private Residences	HBMC in Domiciliary Settings
Visits			
Total visits in 2012	3,911,778	1,847,087	2,064,691
Total visits in 2019	5,524,939	1,931,738	3,593,201
Visits per 1000 FFS population			
National level in 2012*	117.2	55.3	61.9
National level in 2019*	167.2	58.5	108.7
State-level Median (IQR)	67.6 (34.1–151.3)	17.3 (7.9–41.9)	47.7 (23.1–86.6)
State-level (Minimum–Maximum)	(3.4–382.9)	(0.01–261.6)	(0.93–282.7)
Providers			
Total providers in 2012	27,635	11,424	16,211
Total providers in 2019	40,427	15,913	24,514
Providers per 10,000 FFS population			
Median (IQR)	2.9 (1.6–4.5)	1.1 (0.7–2.0)	2.2 (1.2–3.2)
(Minimum–Maximum)	(0.42–8.6)	(0.001–4.8)	(0.13–7.9)
Visits per provider			
Median (IQR)	143 (53–401)	120 (46–343)	131 (52–337)
(Minimum–Maximum)	(11–30,488)	(11–15,431)	(11–23,214)

Note: HBMC utilization was based on data from Medicare Provider Utilization and Payment Data: Physician and Other Supplier Public Use File during years 2012–2019. The raw HBMC utilization data were at the provider level, not at the individual patient level. Utilizations of HBMC were identified using the NPI and HCPCS: 99341–50 for HBMC in private residences, and 99324–28 and 99334–37 for HBMC in domiciliary settings. HBMC utilization as measured by counts of visits and visits per provider were summarized from NPI-level data. Utilization rates (visits per 1000 FFS population and providers per 10,000 FFS population) were summarized from state-level data unless otherwise specified.

\* The denominators used here were the U.S. total number of Medicare FFS beneficiaries: 33,375,586 in 2012 and 33,046,020 in 2019, respectively.