Patterns of Healthcare Utilization and Spending Among Homebound Older Adults in the USA: an Observational Study

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BACKGROUND: Homebound older adults have complex social, medical, and financial needs, but little is known about their healthcare utilization and spending.
OBJECTIVE: To characterize healthcare utilization and spending among homebound older adults.
DESIGN: Cohort study using National Health and Aging Trends Study data linked to Medicare Fee-for-Service (FFS) claims data.
PARTICIPANTS: Adults aged 70 years and older with Medicare FFS coverage ($n = 6468$).
MAIN MEASURES: In a person-year analysis, survey-weighted rates and adjusted marginal differences in inpatient, outpatient, and emergency department utilization and spending 12 months post-interview were calculated by homebound status, defined as reporting never or rarely (no more than 1 day/week) leaving home in the last month.
KEY RESULTS: Compared to the non-homebound, homebound observations had lower annual unadjusted rates of accessing primary care (60.9% vs 71.9%, $p < 0.001$) and specialist care (61.0% vs 74.9%, $p < 0.001$) and higher annual rates of emergency department use (54.0% vs 32.6%, $p < 0.001$) and hospitalization (39.8% vs 19.8%, $p < 0.001$). Total annual Medicare spending was $11,346 higher among the homebound compared to the non-homebound ($p < 0.001$). In a single year analysis (2015), homebound older adults accounted for 11.0% of Medicare spending among those over 70 despite making up only 5.7% of this population. 13.6% of the homebound were in the 95th percentile or above of Medicare spending in 2015. In models adjusting for demographic, clinical, and geographic characteristics, homebound status was associated with a decreased likelihood of having an annual primary care or specialist visit and $2226 additional total annual Medicare spending.
CONCLUSIONS: Homebound older adults use more hospital-based care and less outpatient care than the non-homebound, contributing to higher levels of overall Medicare spending.

KEY WORDS: homebound; medicare; utilization; spending.

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INTRODUCTION

An estimated two million homebound older adults, defined as those leaving home once a week or less, live in the community in the USA, nearly 1.5 times the total nursing home population.[1,2] Homebound incidence is increasing following efforts to transition from institutional to community-based care.[3] Older adults now have a higher risk of becoming homebound than entering a nursing home, but little is known about the healthcare utilization and spending of this growing population.[4]

Homebound older adults are a diverse population, with Hispanic and Black non-Hispanic individuals experiencing higher rates of being homebound compared to White non-Hispanic individuals, especially during the COVID-19 pandemic.[5] Homebound adults have complex social and medical needs and experience high levels of dementia, chronic illness, and symptom burden.[6,7] They are often socially isolated and report being lonely and depressed, with lack of transportation being a common barrier.[8,9] Homebound older adults have a 2-year mortality rate of 40.3%, twice that of their non-homebound counterparts when adjusted for sociodemographics, comorbidities, and functional status.[10]

Homebound adults are often assumed to be among the high-cost patients who make up a large proportion of healthcare spending.[11,12] However, difficulties in identifying the homebound have limited research into their healthcare use and spending, as homebound status is not routinely collected. Few previous studies have been able to study this population directly; they instead examine those who receive home healthcare services or home-based care, which may not fully capture all those who are homebound.[13,14] While Musich et al. found homebound status to be associated with higher levels of spending and utilization, their study was limited to new enrollees in Medicare Supplement plans who are younger and wealthier than the general Medicare population.[15]

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Understanding the healthcare needs and costs of homebound older adults is vital to health policy priority setting and shaping the future of long-term care. Over the past two decades, federal and state policy makers have increased investment to provide more long-term services and supports (LTSS) to older patients in the home and funded projects like the Center for Medicare & Medicaid Innovation's (CMMI) Independence at Home (IAH) demonstration to provide home-based primary care to the frailest Medicare beneficiaries.[16,17] The American Rescue Plan Act of 2021 included $460 million in increased Medicaid funding for home and community-based services, and the Biden administration has proposed significant additional federal investment in these services.[18,19] The COVID-19 pandemic has accelerated efforts to identify new models for delivering care to homebound older adults.[20] Using linked survey and Medicare claims data, we aimed to describe healthcare utilization and spending patterns for a nationally representative sample of homebound older adults.

METHODS

Sample

We used data from the National Health and Aging Trends Study (NHATS), a nationally representative survey of Medicare beneficiaries aged 65 and older that began in 2011.[21] NHATS conducts annual in-person interviews with individuals or proxy respondents. Information is collected on demographics, living arrangements, health conditions, functional status, healthcare use, and economic status. The survey oversamples adults 90 years and older and Black non-Hispanic individuals. We included data from NHATS rounds one through six, collected from 2011 to 2016, the most recent years for which subsequent linked claims data (from 2011 to 2017) were available. Our sample was limited to individuals 70 and older as per NHATS technical guidelines for analyzing repeated survey rounds because, as the sample ages, the representativeness of people aged 65 to 69 decreases.[22] We excluded those residing in nursing homes or with fewer than 12 months of Fee-for-Service (FFS) Medicare coverage pre-NHATS survey. The Johns Hopkins University Institutional Review Board approved the NHATS protocol. The Icahn School of Medicine at Mount Sinai's Institutional Review Board and the Centers for Medicare & Medicaid Services (CMS) Privacy Board approved the study.

Measurements

Homebound status was the primary exposure of interest for this study. We defined homebound status in accordance with previously published constructs based on responses to NHATS questions.[2] Participants were asked "How often did you go out in the last month?" Participants who responded that they never or rarely (no more than 1 day/week) went out were considered homebound for that year.

We included demographic, clinical, and geographic measurements in our analyses to characterize the homebound population and to adjust for factors that confound the association between homebound status and healthcare utilization and spending. These included age, sex, race/ethnicity (Black non-Hispanic, Hispanic, White non-Hispanic, and other race [American Indian/Asian/Native Hawaiian]), education level, marital status, income quartile, functional status as defined by receiving help with activities of daily living (ADL), living alone, living in an assisted living facility, speaking a language other than English, Medicaid status, self-reported general health, and Charlson Comorbidity Index.[23] In addition, we included measures of sensory loss. Following Simning et al., we defined auditory impairment as self-reported inability to "hear well enough to carry on a conversation in a room with a radio or TV playing," even with a hearing aid.[24] We similarly defined visual impairment as self-reported inability to "see well enough to read newspaper print," even with glasses or contacts. We then categorized observations as having either auditory impairment, visual impairment, dual sensory impairment, or no auditory or visual impairment.

Presence of depressive symptoms was classified based on Patient Health Questionnaire (PHQ-2) score greater than 3, and anxiety was classified based on the Generalized Anxiety Disorder (GAD-2) score greater than 3.[21,22] We defined probable dementia using criteria established by NHATS which incorporate self-report of dementia, proxy responses to the Alzheimer's disease (AD)-8 screening tool, and a cognitive interview that assessed memory, orientation, and function both by self-report and direct cognitive assessment conducted by NHATS.[25] Observations were classified into metropolitan or non-metropolitan area (per Rural-Urban Continuum Code classification) based on the county in which the respondent resided at the time of interview.

We obtained information on healthcare utilization and costs from linked Medicare FFS claims data. Utilization outcomes included rates of inpatient admissions, emergency department (ED) visits, skilled nursing facility (SNF) visits, home health visits, hospice visits, primary care visits, and specialist visits in the year following the interview. Primary care and specialist visits were identified using Healthcare Common Procedure Coding System and Provider Specialty codes (Appendix Table 1).[26] Furthermore, in order to identify potentially preventable hospitalizations, we used ICD-9 and ICD-10 codes for a list of fourteen Ambulatory Care Sensitive Conditions as defined by the Agency for Healthcare Research and Quality, such as hypertension, dehydration, and diabetes complications (Appendix Table 2).[27]

We examined spending both in total per observation per year and by claim type. These claim types included inpatient, carrier (professional provider), SNF, home health, outpatient, hospice, and durable medical equipment. We obtained information on Medicare reimbursements by hospital referral region from the Dartmouth Atlas.[28] All dollar amounts were inflation adjusted to 2017 dollars using the CPI-U Index.

Statistical Analysis

Our unit of analysis was person-year and individuals were allowed to have repeat observations. This framework allowed us to increase our number of observations and account for the fact that an individual's homebound status can change from year to year.[29]

We examined demographic and clinical characteristics of our observations by homebound status using bivariate linear or logistic regression. We used logistic and zero-inflated negative binomial regressions to compare adjusted and unadjusted differences in utilization. We used a generalized linear model with a log distribution to compare the adjusted and unadjusted differences in overall, carrier, and outpatient spending, as well as two-part models for other expenditures with frequent zeros. In our adjusted models, we included sex, race, age, education, marital status, geographic region, metropolitan area, functional status, Medicaid enrollment, probable dementia, and Charlson Comorbidity Index. These covariates were selected based on our conceptual model of the determinants of homebound status and their potential relationship to healthcare utilization and spending.[10] Our adjusted spending models also included quintile of Medicare reimbursements by hospital referral region.

We examined the sensitivity of our findings to high end-of-life spending by excluding from our sample those who died within 12 months of their NHATS interview. We explored the sensitivity of our findings to place of residence by excluding those residing in assisted living facilities. We also investigated the sensitivity of our findings to using person-years as our unit of observation by limiting the sample to one survey year (2015), using the survey year with the largest sample size. We also used 2015 data to estimate the proportion of total annual Medicare FFS spending attributable to the homebound. Finally, because those who are homebound over longer periods of time may differ from those who may only be homebound temporarily, we also compared healthcare utilization and spending among individuals who were persistently homebound (i.e. had been homebound in 2015 and remained so in 2016) to those who were not homebound.

All analyses adjusted for NHATS analytic weights that consider survey design and differential probabilities of selection and non-response. All person-year analyses take into account clustering at the respondent level to account for repeat observations per respondent.[22] All analyses were conducted using Stata17.

Role of the Funding Source

The National Institute on Aging played no role in the design, conduct, and analysis of the study or in the decision to submit the manuscript for publication.

RESULTS

Our sample included 1537 (991 unique respondents) homebound and 17,352 (6095 unique respondents) non-homebound observations among 6468 individuals at least aged 70 years old with 12 or more months of continuous Medicare FFS coverage pre-NHATS interview. Individuals were allowed to switch between groups when their homebound status changed over time; 618 individuals contributed both homebound and non-homebound observations. Relative to non-homebound observations, homebound observations were older, more likely to be female, and less likely to be White non-Hispanic (Table 1). Homebound observations had significantly lower levels of education and income than non-homebound observations and were significantly more likely to reside in an assisted living facility, be in the lowest income quartile, and be dually eligible for Medicaid and Medicare. The homebound observations had higher levels of functional impairment, sensory impairment, probable dementia, and depression. Overall, the homebound observations were more likely to report being in fair or poor health and had a higher average Charlson Comorbidity Index score.

In unadjusted comparisons of annual healthcare utilization by homebound status (Fig. 1), homebound observations were more likely to have an inpatient admission (39.8% vs 19.8%, $p < 0.001$), potentially preventable hospitalization (14.8% vs 4.5%, $p < 0.001$), and emergency department visit (54.0% vs 32.6%, $p < 0.001$) in the year following the NHATS interview than the non-homebound. Homebound observations were also more likely than the non-homebound to have a SNF visit (20.3% vs 5.7%, $p < 0.001$), home health visit (38.4% vs 12.1%, $p < 0.001$), or hospice visit (17.6% vs 2.0%, $p < 0.001$). By contrast, non-homebound observations were more likely to have a primary care visit (71.9% vs 60.9%, $p < 0.001$) or specialist visit (74.9% vs 61.0%, $p < 0.001$) than the homebound. Nearly 90% of non-homebound observations had an annual primary care or specialist visit in comparison to 78.8% of homebound observations ($p < 0.001$). The mean number of annual visits for each type of utilization is presented in Appendix Table 3.

Our unadjusted analysis of spending showed that homebound observations had significantly higher spending across most claim types (Fig. 2). Consistent with our findings on utilization, homebound observations did not spend significantly more on either outpatient spending or carrier spending. Overall, homebound observations incurred $21,923 in Medicare spending per year on average, in comparison to $10,577 for non-homebound observations. Mean spending for each claim type by homebound status is presented in Appendix Table 4. In 2015, homebound older adults aged 70 and older accounted for 11% of total Medicare FFS spending, despite making up only 5.7% of the Medicare FFS population at this age (Appendix Table 5). 13.6% of the homebound were in the 95th percentile or above of Medicare FFS spending in 2015.

After adjusting for demographic, clinical, and geographic differences (Fig 3), the likelihood of having an annual potentially preventable hospitalization was 1.1 percentage points higher (4.5% vs 3.4%, $p < 0.05$) among the homebound observations than the non-homebound. In comparison to the non-homebound, homebound observations had higher probabilities of having a SNF visit (6.4% vs 4.4%, $p = 0.002$), home

Table 1 Sample Characteristics by Homebound Status

Characteristic	Observations, no. (%)		*p* value
	Homebound (*n* = 1537)	Non-homebound (*n* = 17,352)	
Demographics			
Age, mean, y	83.8	78.3	< 0.001
Female	1151 (74.31)	9879 (55.56)	< 0.001
White non-Hispanic	928 (74.73)	13,062 (86.37)	< 0.001
Black non-Hispanic	390 (10.27)	3056 (6.63)	
Other (Am Indian/Asian/Nat. Hawaii)	39 (3.41)	410 (3.12)	
Hispanic	147 (11.59)	585 (3.88)	
High school education or higher	862 (64.17)	13,435 (82.22)	< 0.001
Income quartile 1 (lowest)	789 (45.96)	4642 (22.4)	< 0.001
Speaks language other than English	284 (23.09)	2660 (17.02)	0.001
Married	395 (30.39)	8092 (51.95)	< 0.001
Assisted living facility	176 (14.5)	331 (1.97)	< 0.001
Lives alone	569 (39.95)	6413 (34.45)	0.005
Medicaid insurance	486 (31.63)	2177 (10.62)	< 0.001
Clinical			
Hearing impairment only	313 (22.33)	2003 (10.95)	< 0.001
Vision impairment only	168 (9.58)	528 (2.49)	
Dual sensory impairment	120 (6.81)	202 (.91)	
Receives help with 0 ADL	392 (28.85)	14,494 (86.05)	< 0.001
Receives help with 1 ADL	230 (15.4)	1300 (6.76)	
Receives help with 2+ ADLs	890 (55.74)	1530 (7.19)	
Probable dementia	815 (49.13)	1988 (9.0)	< 0.001
Depression (PHQ-2 positive screen)	601 (40.28)	2055 (11.02)	< 0.001
Self-report fair or poor health	920 (59.94)	4126 (21.06)	< 0.001
Charlson Comorbidity Index, mean	3.20	1.97	< 0.001
Lives in metropolitan area	1243 (81.34)	13,496 (79.48)	0.262
Northeast	244 (17.1)	2814 (18.34)	0.397
Midwest	340 (21.1)	4134 (22.9)	
South	709 (44.04)	7399 (40.53)	
West	244 (17.76)	3005 (18.23)	

Note: Sample sizes represent unweighted person-year observations. Estimates are survey weighted means and percentages

health visit (12.8% vs 9.5%, $p < 0.001$), and hospice visit (3.0% vs 1.3%, $p < 0.001$). The likelihood of having an annual primary care visit was 10.5 percentage points lower among the homebound observations (58.5% vs 69.0%, $p < 0.001$), and the likelihood of having an annual specialist visit was 14.8 percentage points lower (55.7% vs 70.5%, $p < 0.001$) among the homebound observations. We did not observe a statistically significant difference in the annual adjusted rates of overall hospital admission (18.1% vs 16.1%, $p = 0.10$) or emergency department visits (28.6% vs 27.5%, $p = 0.46$). Overall, homebound status was associated with a marginal difference of $2226 in total Medicare spending per year ($p = 0.001$). The complete unadjusted and marginal differences for utilization and spending are included in Appendix Table 6.

In sensitivity analyses, the substantive findings remained unchanged when we restricted our sample to exclude decedents or those residing in assisted living facilities (Appendix Table 7). The marginal differences in hospitalizations and overall spending were directionally similar, but not significant, when we limited our sample to individuals surveyed in 2015 or compared the non-homebound to the persistently homebound (Appendix Table 8).

DISCUSSION

In this nationally representative analysis of Medicare FFS beneficiaries, we find that older homebound adults use higher levels of hospital-based care than non-homebound older adults. Despite being older and more medically complex, the homebound have lower rates of accessing outpatient care than the non-homebound. When adjusting for demographic, clinical, and geographic differences, we find the homebound have only a small increase in the probability of having a home health visit compared to the non-homebound, suggesting that the gap in outpatient care is not being substituted for by home-based care within Medicare. This is consistent with well-known barriers in Medicare to accessing home health services.[30]

The lower rate of primary care utilization we observe may partially explain our finding that the homebound experience more potentially preventable hospitalizations than the non-homebound and higher spending. Previous research suggests increasing access to home-based primary care may lower hospitalizations and overall spending for the homebound, depending on the intervention type.[31] Frail elders receiving home-based primary care in Washington, DC were found to have 17% lower Medicare costs per beneficiary over 2 years compared to matched controls not enrolled in the program.[13] CMMI's IAH Demonstration Project has similarly been associated with fewer hospital admissions and emergency department visits.[32] We estimate that a substantial proportion (16%) of homebound older adults would meet IAH eligibility, suggesting this is one group that may significantly benefit from an expansion of IAH to a wider set of Medicare beneficiaries.[33]

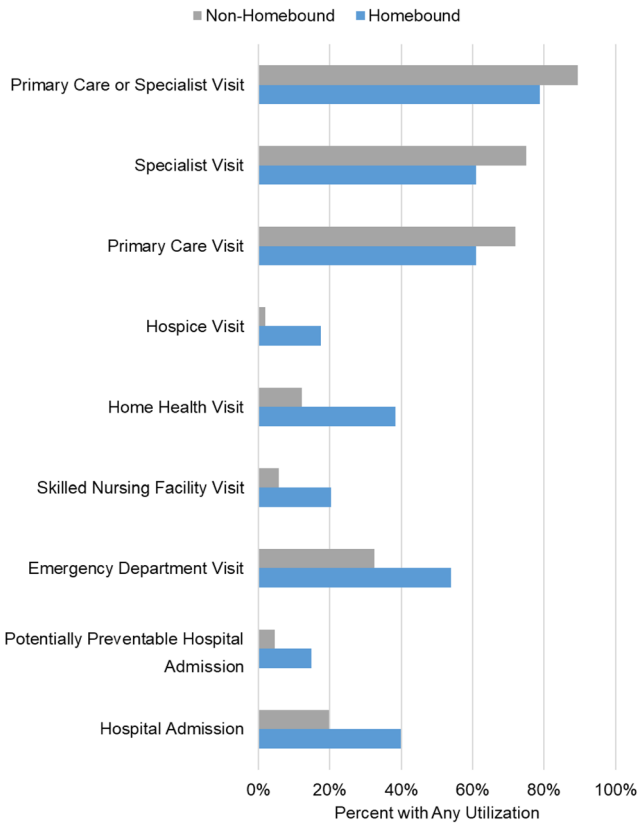

Figure 1 Percent of Medicare Fee-for-Service beneficiaries aged 70 and over with any health care utilization by category and homebound status, 2011–2017. *Note*: Authors' calculations using the 2011–2016 National Health and Aging Trends Study linked with Medicare Fee-for-Service claims data (n = 18,899 person year observations). Any utilization is defined as one or more admissions/visits for each category. Estimates are survey weighted percentages.

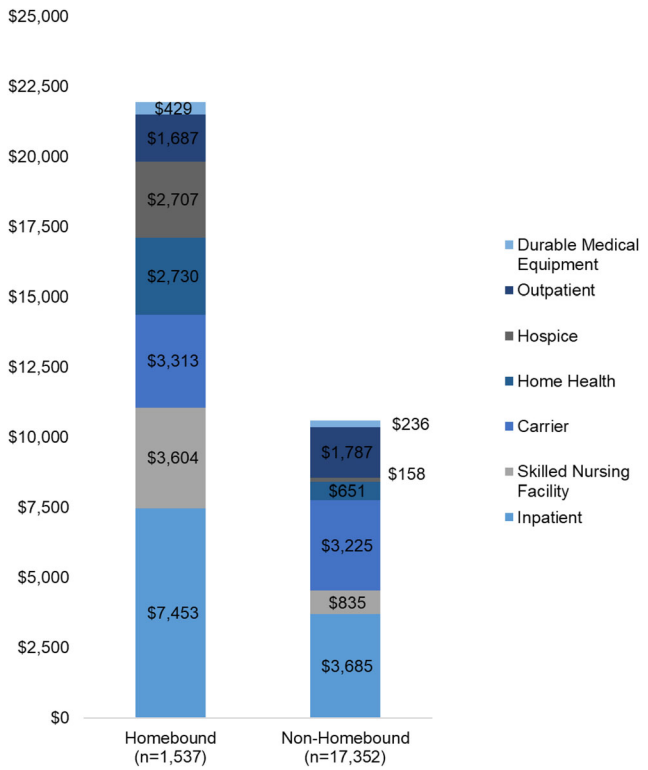

Figure 2 Average Medicare Fee-for-Service spending among adults aged 70 and over by billing category and homebound status, 2011–2017. *Note*: Authors' calculations using the 2011–2016 National Health and Aging Trends Study linked with Medicare Fee-for-Service claims data (n = 18,899 person year observations). Estimates are survey weighted averages CPI-U inflation adjusted to 2017 dollars.

Our study extends earlier research on the homebound to a nationally representative sample of homebound older adults, regardless of receipt of home-based care. Consistent with previous findings, we observe the homebound are hospitalized at higher rates and have higher overall healthcare utilization than the non-homebound.[2,34] We also find that the rate of overall Medicare spending is higher among homebound older adults than non-homebound older adults, though this difference is attenuated after adjustment.

Medicare costs are known to be highly concentrated among a small number of beneficiaries. In 2005, the Congressional Budget Office estimated that the top 5% of the most costly Medicare beneficiaries accounted for 43% of Medicare spending, a result that has remained consistent with more recent findings.[35,36] We find that homebound older adults in 2015 accounted for 11.0% of Medicare spending among those over 70 despite making up only 5.7% of this population. The homebound are even more concentrated among the top spenders, making up 13.6% of those in the 95th percentile or above of Medicare spending. Our findings suggest that the homebound, a group often invisible to the healthcare system, may be an important population to target for quality improvement and to reduce Medicare spending.[37]

There is currently significant policy interest in improving access to home-based services for older adults, including both medical and non-medical care. The Biden administration is proposing to address the persistent shortage of Medicaid home health services by increasing the amount the federal government contributes to state Medicaid expenditures through raising the federal matching rate and mandating that states expand access to these services.[38] CMS is additionally considering new value-based purchasing programs for home health services to improve the quality of service delivery.[39] Additional investments are timely as COVID-19 has exacerbated home care workforce shortages.[40] Any policy proposal that seeks to address the high rate of healthcare utilization and spending among the homebound should recognize the income limitations, social isolation, and lack of transportation that many older homebound adults face, as well as the opportunities to improve outcomes by addressing these factors.

Notably, a large proportion of homebound older adults (14.5%) reside in assisted living facilities. The number of these facilities is growing as state Medicaid programs have shifted resources away from nursing homes and toward offering LTSS in the community.[41] Providing home-based medical care in these facilities may allow clinicians to see a greater number of patients per day as they can serve multiple patients in the same residence. Telemedicine provides another

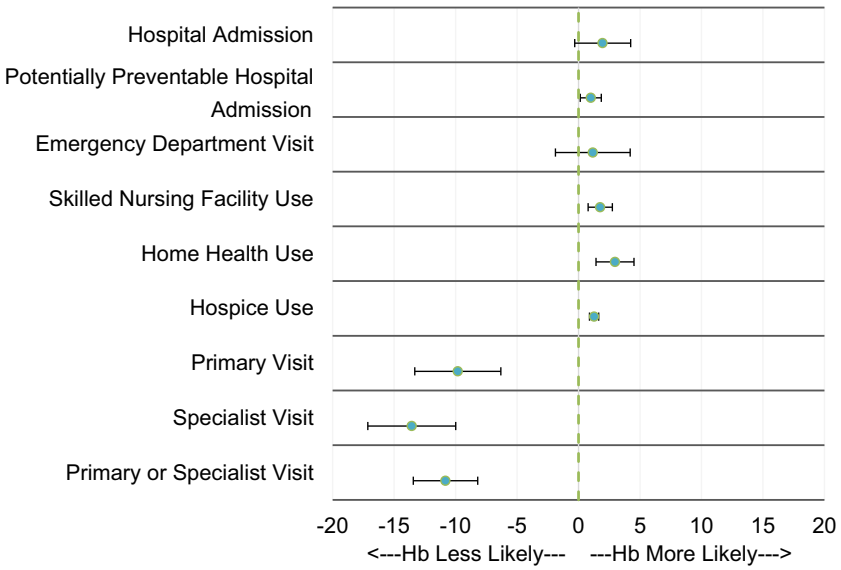

Figure 3 Adjusted percentage point difference in the probability of any healthcare utilization among Medicare Fee-for-Service beneficiaries aged 70 and older by category and homebound status, 2011–2017. ***Note*****: Hb = homebound. Authors' calculations using the 2011–2016 National Health and Aging Trends Study linked with Medicare Fee-for-Service claims data (*n* = 18,899 person year observations). Estimates are marginal differences from survey weighted logistic regression and 95% confidence intervals adjusted for sex, race, age, education, marital status, geographic region, metropolitan area, functional status, Medicaid enrollment, probable dementia, and Charlson Comorbidity Index.**

alternative to in-person visits, though recent experiences during the COVID-19 pandemic highlight the challenges of virtually reaching homebound older adults.[42]

There are several limitations to this study. We used person-years as the unit of observation in our primary analysis which allows individuals to be included multiple times. Analyses were clustered at the respondent level to account for repeat observations per respondent. A sensitivity analysis of data from 2015 with individuals as the unit of observation showed no substantive difference in our conclusions with the exception of total spending analyses, giving us confidence in our findings. Our sample is also restricted to those who have Medicare FFS coverage, who make up approximately 62% of the Medicare population.[43] Medicare Advantage accounts for an increasing number of enrollees and such plans likely have different incentives to encourage or limit home-based care than traditional Medicare, limiting the generalizability of our results to the total Medicare-eligible population. Our data also do not provide an estimate of total healthcare spending. We do not have access to Part D or out-of-pocket medical spending or spending by Medicaid for those individuals who are dually eligible. Including these data would give a more complete picture of the costs associated with being homebound for older adults. While our measure of homebound status is limited to a 1-month period (i.e., last 30 days), based on self-report, and cannot distinguish between those temporarily and permanently homebound, it is the best measure of homebound status available and has been used widely.[2,4] Finally, although we adjusted for multiple covariates, this is a descriptive analysis and no causal inferences can be made from our results.

In summary, homebound status among older US adults from 2011 to 2017 was associated with higher levels of hospital admissions and spending, but lower levels of outpatient care. These findings highlight the importance of meeting the needs of this growing part of the population.

Supplementary Information *The online version contains supplementary material available at https://doi.org/10.1007/s11606-022-07742-8.*

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Declarations:

Conflict of Interest: *The authors declare that they do not have a conflict of interest.*

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