Description, Health Care Utilization, and Outcomes for Home Health Care (HHC) COVID-19 Patients Early in the Pandemic: A Comparison to the General HHC Population

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Abstract
COVID-19 patients represent a new and distinct population in home health care. Little is known about health care utilization and incremental improvements in health for recovering COVID-19 patients after admission to home health care. Using a retrospective observational cohort study of 5452 episodes of home health care admitted to a New Jersey Home Health Agency between March 15 and May 31, 2020, this study describes COVID-19 Home Health Care (HHC) patients (n = 842) and compare them to the general HHC population (n = 4610). COVID HHC patients differ in significant ways from the typical HHC population. COVID patients were more likely to be 65 years of age and younger (41% vs 26%), be from a racial/ethnic minority (60% vs 31%), live with another person (85% vs 76%), have private insurance (28% vs 16%), and began HHC with greater independence in activities-of-daily-living (ADL/IADLs). COVID patients received fewer overall visits than their non-COVID counterparts (11.7 vs 16.3), although they had significantly more remote visits (1.7 vs 0.3). Multivariate analyses show that COVID patients early in the pandemic were 34% (CI, 28%-40%) less likely to be hospitalized and demonstrated significantly greater improvement in all the outcome measures examined compared to the general home health population.

Keywords
COVID-19, homecare, telehealth, utilization, hospitalization, activities of daily living

Introduction
Early in the COVID-19 pandemic attention focused on the ability of acute care settings to meet the rise in demand for health care. With little public guidance about who should seek inpatient care, and high levels of fear and uncertainty, hospital systems were quickly overwhelmed. Home health care (HHC) became a critical setting for acute care overflow for COVID patients. As acute care settings neared capacity, they referred recently admitted patients with few complications, as well as less critically ill patients to HHC.

HHC has the capacity to provide complex care to COVID post-acute patients as well as infected homebound patients not sick enough to require acute care.¹² Nonetheless, benchmarks for utilization of services and recovery for HHC COVID patients are largely unknown. Further, there is a paucity of research about how COVID+ patients compare to typical HHC patients. This study reports HHC patients’ health care utilization, examines risk of hospitalization, and improvements in patient outcomes in the HHC population.

At the start of 2021, the United States had more than 24 million documented infections, and approximately 400,000 deaths,³ signifying the vast majority of individuals will recuperate from COVID-19. A growing literature has begun to document COVID patients’ recovery process extends beyond the typical 2 weeks required for seasonal flu. An early study from Wuhan reported half of the patients experienced symptoms 3 months after being discharged from the hospital, and 35 patients (7% of the sample), reported no improvement.⁴ Mounting evidence indicates COVID survivors experience ongoing symptoms and deficits in functional abilities that lasts weeks or months, and many do not return to their previous state of health.⁵-¹¹ Perhaps most alarming are the subset of studies that focus on mild, outpatient cases, among relatively

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young patients with few comorbidities, which also indicate long-term adverse health outcomes. Most studies that explicitly examine age find that older patients are more likely to experience persistent symptoms, are less likely to return to usual health, and more likely to report reductions in their ability to perform daily activities.

A study of hospital discharged patients to HHC found significant improvement in symptoms and decreases in functional dependencies by discharge. While reductions in an index of activity-of-daily-living dependences were substantial (average of 6 at start of care (SOC), and 1.2 at discharge), nearly 1 in 4 patients still had dyspnea at discharge, and non-trivial proportions ended their care still dependent for toilet transfer (26%), bathing (28%), and ambulation (22%). These studies suggest COVID-19 recovery is not a short-term outcome.

Methods

Data come from OASIS assessments, patient electronic medical records, and the billing system from New Jersey’s largest not-for-profit certified Medicare HHC agency, the Visiting Nurse Association Health Group (VNAHG). The data represent a retrospective observational cohort study. The Institutional Review Board of the VNAHG reviewed and approved this study. No external funding supported this research.

Sample

This sample includes 5452 episodes of HHC from admission to discharge (n = 4487 [82.3%]), transfer to hospital (n = 896 [9.2%]), or death (n = 69 [1.3%]) that began care between March 15, and May 31, 2020. Only the first episode was included for patients with multiple episodes within this timeframe, resulting in an unduplicated sample. About 15% (n = 842) had a COVID diagnosis.

Measurements

COVID diagnosis was designated by an ICD-10 code of U07.1. Hospitalizations were determined by Transfer to Inpatient Facility (TIF) and Discharge OASIS assessments. Comorbidities represents the number of secondary diagnoses identified in the start of care OASIS assessment. Utilization measures include billable visits lasting longer than 1 minute, and telephone calls and telehealth visits, which are not billable, but represent important points of contact between patients and health care providers.

Outcome measures were selected that would likely reflect impact of COVID-19 and recovery. Dyspnea is a common clinical symptom of COVID-19, as well as a predictor of mortality risk. Additional measures were included that are commonly used to assess the impact of HHC: hospitalization and functional improvement in grooming, dress upper body, dress lower body, bathing, toilet transfer, transferring, ambulation, feeding, and toilet hygiene.

Outcomes were measured at start of care, and again upon discharge. Improvement is measured by subtracting scores; positive scores indicate improvement. Episodes that ended in death, or a transfer to an impatient facility (TIF) were excluded from change analyses, as they are not assessed at discharge.

Multivariate models control for age, gender, race/ethnicity, living situation, comorbidities, insurance coverage, and county. Consistent with other studies, cognitive function, confusion, anxiety, pain, and self-management of oral medications are controlled.

There are no missing data from OASIS assessments due to government mandates. Patients who were non-responsive (n = 11) were coded as having no confusion or anxiety (M1710 & M1720). Patients who had no oral medications (M2020) (n = 70) were coded as being independent for oral medication regimens.

Statistical Analyses

Continuous variables are reported as means (SD) and categorical variables as frequencies (%). T-tests and χ² evaluate statistical significance between groups. Multiple regression models estimate the independent influence of factors on outcomes. Statistical tests were performed in SPSS, version 25.

Results

Comparing COVID Patients and the General HHNC Population

Table 1 shows patients with a COVID diagnosis were significantly more likely to be under 65 years of age (41% vs 26%), male (50% vs 43%; p < .001), and a racial/ethnic minority (60% vs 30%). COVID patients were significantly more likely to live with another person (85% vs 76%) and have private insurance (28% vs 16%), while non-COVID patients were significantly more likely to live alone (24% vs 15%) and be covered by Traditional Medicare (49% vs 31%). On average, patients with a COVID diagnosis had slightly fewer comorbidities (4.5 vs 4.6; p = .001).

About 70% of COVID patients had been discharged from a short stay acute hospital in the past 14 days, compared to 51% of non-COVID patients (p < .001). VNAHG made arrangements with local hospitals to take COVID patients onto care when there were not enough beds to admit them. In the sample, 40 patients went from the ED directly to HHC; this represents 3.0% of the COVID population (n = 25), compared to less than 1% of the non-COVID population (n = 15). These may represent critically ill patients who under other circumstances might be admitted to the hospital, receiving homecare after they were stabilized and discharged. Another indicator of severe illness is the need for oxygen within the
Table 1. Descriptive Summary of HHC patients in New Jersey with a Start of Episode between March 15 and May 31, 2020 by COVID status (n=5452).

|                               | COVID patients (n=842) | Non-COVID patients (n=4610) | Test of significance |
|-------------------------------|------------------------|-----------------------------|----------------------|
| Age                           |                        |                             |                      |
| Younger than 65 years of age   | 342 (41)               | 1205 (26)                   | $X^2 = 113.94$ (df = 2)***** |
| 65 to 70 years of age          | 320 (38)               | 1618 (35)                   |                      |
| 80 years of age and older      | 180 (21)               | 1787 (39)                   |                      |
| Male                          | 422 (50)               | 1995 (43)                   | $X^2 = 13.51$ (df = 1)***** |
| Race/ethnicity                |                        |                             |                      |
| Hispanic                      | 196 (23)               | 365 (8)                     | $X^2 = 309.36$ (df = 4)***** |
| Asian                         | 75 (9)                 | 212 (5)                     |                      |
| Black                         | 231 (27)               | 845 (18)                    |                      |
| White                         | 339 (40)               | 3172 (69)                   |                      |
| “Other”                       | 1 (>1)                 | 7 (>1)                      |                      |
| Living situation              |                        |                             |                      |
| Live alone                    | 127 (15)               | 1117 (24)                   | $X^2 = 33.82$ (df = 1)***** |
| Live with another person      | 715 (85)               | 3493 (76)                   |                      |
| Mean number of comorbidities (SD) | 4.5 (0.9)           | 4.6 (0.9)                   | $t = -3.08$ (df = 5450)** |
| Insurance                     |                        |                             |                      |
| Medicare advantage FFS        | 103 (12)               | 675 (15)                    | $X^2 = 314.71$ (df = 5)***** |
| Medicare advantage PPS        | 100 (12)               | 608 (15)                    |                      |
| Medicare (traditional)        | 260 (31)               | 2237 (49)                   |                      |
| Medicaid (HMO & regular)      | 59 (7)                 | 310 (7)                     |                      |
| Private insurance             | 237 (28)               | 720 (16)                    |                      |
| “Other”                       | 83 (10)                | 60 (1)                      |                      |
| Referral source               |                        |                             |                      |
| Hospital                      | 580 (69)               | 2308 (50)                   | $X^2 = 194.64$ (df = 4)***** |
| Physician                     | 29 (3)                 | 809 (18)                    |                      |
| Rehab facility                | 132 (16)               | 495 (11)                    |                      |
| Skilled nursing facility      | 73 (9)                 | 552 (12)                    |                      |
| “Other”                       | 28 (3)                 | 446 (10)                    |                      |
| ED to home                    | 25 (3)                 | 15 (<1)                     | $X^2 = 68.33$ (df = 1)***** |
| Oxygen in the home            | 244 (29)               | 67 (2)                      | $X^2 = 1002.82$ (df = 1)***** |
| Remote patient monitoring     | 62 (7)                 | 76 (2)                      | $X^2 = 94.25$ (df = 1)***** |
| Discharged from a short stay acute hospital in the past 14 days | 589 (70) | 2335 (51) | $X^2 = 106.66$ (df = 1)***** |
| Cognitive function            | 0.40 (.67)             | 0.58 (.80)                  | $t = 6.04$ (df = 5450)***** |
| Confusion                     | 0.41 (.79)             | 0.61 (.95)                  | $t = 5.70$ (df = 5450)***** |
| Anxiety                       | 0.33 (.68)             | 0.56 (.80)                  | $t = 7.78$ (df = 5450)***** |
| Pain                          | 2.06 (1.27)            | 2.63 (1.01)                 | $t = 14.67$ (df = 5450)***** |
| Self-manage oral meds         | 2.21 (1.00)            | 2.26 (.95)                  | $t = 1.31$ (df = 5450) |
| Average outcomes at start of episode†(n = 750) (n = 3737) |                     |                             |                      |
| Grooming [range 0-3] (SD)     | 1.57 (.67)             | 1.80 (.64)                  | $t = 8.84$ (df = 4485)***** |
| Dress upper body [range 0-3] (SD) | 1.68 (.67)         | 1.86 (.61)                  | $t = 7.09$ (df = 4485)***** |
| Dress lower body [range 0-3] (SD) | 1.98 (.66)    | 2.15 (.59)                  | $t = 7.08$ (df = 4485)***** |
| Bathing [range 0-6] (SD)      | 3.90 (1.38)            | 4.23 (1.27)                 | $t = 6.28$ (df = 4485)***** |
| Toilet transfer [range 0-4] (SD) | 1.50 (.96)         | 1.59 (1.03)                 | $t = 2.21$ (df = 4485)** *** |
| Toilet hygiene [range 0-3] (SD) | 1.73 (.77)          | 1.85 (0.66)                 | $t = 4.38$ (df = 4485)***** |
| Transferring [range 0-5] (SD) | 1.71 (.72)            | 1.99 (0.76)                 | $t = 9.08$ (df = 4485)***** |
| Ambulation [range 0-6] (SD)   | 2.79 (.97)            | 3.11 (.99)                  | $t = 8.21$ (df = 4485)***** |
| Feeding [range 0-5] (SD)      | 0.79 (.64)            | 0.96 (.65)                  | $t = 6.46$ (df = 4485)***** |
| Dyspnea [range 0-4] (SD)      | 1.99 (.89)            | 1.42 (.97)                  | $t = -15.04$ (df = 4485)***** |

(continued)
Among the COVID patients, 29% required oxygen compared to 2% of the non-COVID population. Remote monitoring also showed disparities with 7% of the COVID population having received remote monitoring compared to 2% of the non-COVID population.

COVID patients started their care with significantly higher cognitive functioning, and less confusion, anxiety, and pain. There were no differences in ability to manage medications without assistance. For ADL/IADL measures, higher scores indicate more dependency. At start of care COVID patients had more dyspnea than non-COVID patients (1.99 vs 1.47; \( p < .001 \)), but had less dependence in all 9 areas of ADL/IADL.

**Health Care Utilization**

COVID patients had fewer total contacts with health care providers than non-COVID patients (11.7 vs 16.3). Most visits were in-person, and COVID patients had significantly fewer in-person visits for each discipline (SN, PT, MSW, ST, HHA, and OT). Although COVID patients had fewer in-person visits, they utilized more remote services (1.7 vs 0.03). Virtual visits were mainly performed by nurses and physical therapists using applications the patient already had installed on their phone or tablet (e.g., Facetime, Google Duo, Skype).

**Outcomes**

Table 2 reports the unadjusted outcomes for the 2 groups. Among 10 outcomes, patients with a COVID diagnosis had significantly better outcomes in 9 of them. They were about half as likely to be hospitalized during their episode (9% vs 17%) and show significantly greater improvement in 8 of the 9 ADL/IADLs. The only exception was feeding, where there was no significant difference between groups (although it is the expected direction, with COVID patients tending toward greater improvement).

The results of the multivariate analyses are reported in Tables 3 to 6. Table 3 reports the Odds Ratios for the Logistic Regression predicting Hospitalization. Odds ratios greater than 1 indicate an increased probability of hospitalization, while odds ratios less than 1 indicate a reduced probability of hospitalization. Confidence intervals that straddle 1.0 (the null hypothesis) are not significant at conventional levels (\( p < .05 \)). Patients with a COVID diagnosis were significantly less likely to be hospitalized, even after including sociodemographic and clinical controls. Controlling for these factors, COVID patients were 34% (probability = odds/odds + 1 = .52/1 + .52) less likely to be hospitalized compared to non-COVID patients. Males were significantly more likely to be hospitalized than females (OR 1.30; 57% greater likelihood 1.3/(1 + 1.3)). And, for each additional comorbidity, patients had an increased risk of hospitalization (OR 1.4; 58% increase per comorbidity (1.4/(1 + 1.4))). Patients who needed greater assistance managing their oral medications were at increased risk of hospitalization (OR = 1.14 = 1.14/(1 + 1.4) = 53% increase for each response category).

Tables 4 to 6 report the unstandardized regression coefficients for multivariate linear regression models predicting change in outcomes. Positive coefficients indicate improvements in outcomes. Results indicate that after controlling for sociodemographic and clinical differences patients recovering from COVID had significantly greater improvement in all outcomes compared to the general HHC population. Having lower functional ability at SOC (higher score) was associated with greater increases in functionality for each of the outcome measures. Patients with lower functional ability have greater room for improvement.
Patients who are 80 years and older had significantly less improvement for each outcome compared to those 65 to 70 years of age (referent). There are no racial/ethnic differences in any of the outcomes. Compared to patients who live with someone else (the referent), patients who lived alone had significantly better outcomes, except the risk of hospitalization. Adjusted models indicate greater cognitive impairment at start of care was associated with less improvement in each outcome, except hospitalization, regardless of COVID status. Similarly, more confusion at start of care was associated with less improvement in each of the ADL/IADLs.

**Discussion**

Ordinarily, HHC is ordered after a prolonged hospitalization or in the later stages of a chronic illness. However, during the early phase of the pandemic, HHC played an important new role with a subpopulation recovering from infection. HHC patients recovering from COVID during the first few months of the pandemic were different than the general HHC population in substantial ways. COVID HHC patients were younger, more likely to be minorities, and had fewer comorbidities. They were more likely to begin their HHC episode on the heels of an acute hospital stay discharge, if not directly from the ED, and were more likely to require oxygen, and remote monitoring. Recovering COVID patients entered care with higher ADL/IADL functioning. Because COVID patients entered care with higher functioning, they had less room for improvement. Despite this, they demonstrated greater improvements in dyspnea, and all of the ADL/IADLs compared to the general HHC population. Unlike typical HHC patients, who may have health histories marked by slow decline, COVID positive patients are younger and likely healthier prior to infection, then experience acute illness, and undergo a more rapid recovery. It could also be hypothesized that during the first wave of the pandemic, hospitals referred less severely ill patients to HHC.
to make room for sicker patients that later went to other post-acute settings when discharged. Therefore, the findings may reflect improved functionality, and lower likelihood of hospitalization, in a less severely ill COVID group. The analyses also showed that elderly patients (those 80 years and older) consistently demonstrated less improvement in dyspnea and ADL/IADLs.

COVID HHC patients had significantly different utilization of services compared to the general HHC population. The use of telehealth greatly expanded in the pandemic, particularly for the COVID population. Physical distancing between practitioners and patients offered by virtual care reduces potential infection, while still delivering needed services. Some commercial payers, and the Centers for Medicare and Medicaid Services modified their payment policy during the pandemic offering reimbursement for telemedicine care, across video and voice platforms. COVID patients utilized significantly more remote services than the general HHC population. However, virtual visits did not replace in-person care, and most care was provided during in-person home visits.

Reported hospitalization rates parallel those reported for the general Medicare-certified HHC population, as well as recent reports of hospitalization among recovering COVID patients in HHC. COVID patients were hospitalized at a lower rate than non-COVID patients, even after accounting for their younger demographics and fewer comorbidities. These results may indicate that careful planning and delivery of services to COVID patients, including remote monitoring, allowed for real-time detection of patient well-being, with clinicians using expert knowledge of when patients require emergent care.

Table 4. Factors Associated with Changes in Functional Abilities among HHC Patients between Start of Care and Discharge (n = 4487)*.

|                              | Grooming | Dress upper body | Dress lower body |
|------------------------------|----------|------------------|------------------|
| COVID-19 diagnosis           | 0.19 (0.13-0.24)*** | 0.25 (0.19-0.30)*** | 0.34 (0.27-0.40)*** |
| Start of episode outcome     | 0.61 (0.57-0.64)*** | 0.60 (0.56-0.64)*** | 0.58 (0.54-0.62)*** |
| Age                          |           |                  |                  |
| 64 years of age and younger  | −0.02 (−0.09-0.04) | −0.01 (−0.08-0.05) | −0.01 (−0.08-0.07) |
| 65 to 79 years of age        | 1.00 (referent) | 1.00 (referent) | 1.00 (referent) |
| 80 years of age and older    | −0.14 (−0.18--0.09)*** | −0.14 (−0.19--0.09)*** | −0.18 (−0.23--0.12)*** |
| Sex                          |           |                  |                  |
| Female                       | 1.00 (referent) | 1.00 (referent) | 1.00 (referent) |
| Male                         | −0.01 (−0.05-0.03) | −0.01 (−0.05-0.03) | 0.04 (−0.01-0.08) |
| Race/ethnicity               |           |                  |                  |
| White                        | 1.00 (referent) | 1.00 (referent) | 1.00 (referent) |
| Hispanic                     | −0.00 (−0.07-0.07) | 0.02 (−0.05-0.09) | 0.07 (−0.01-0.16) |
| Asian                        | 0.00 (−0.09-0.09) | 0.00 (−0.09-0.10) | −0.03 (−0.14-0.07) |
| Black                        | 0.01 (−0.05-0.07) | 0.02 (−0.04-0.08) | 0.06 (−0.01-0.13) |
| Living situation             |           |                  |                  |
| Live with other person(s)    | 1.00 (referent) | 1.00 (referent) | 1.00 (referent) |
| Live alone                   | 0.17 (0.12-0.21)*** | 0.18 (0.13-0.23)*** | 0.25 (0.19-0.31)*** |
| Cognitive function           | −0.20 (−0.24--0.16)*** | −0.17 (−0.21--0.13)*** | −0.18 (−0.22--0.13)*** |
| Confusion                    | −0.12 (−0.15--0.09)*** | −0.14 (−0.17--0.11)*** | −0.12 (−0.16--0.08)*** |
| Anxiety                      | 0.02 (−0.01-0.05) | 0.02 (−0.01-0.05)*** | 0.02 (0.01-0.05) |
| Pain                         | 0.02 (0.00-0.04)* | 0.03 (0.01-0.05) | 0.04 (0.02-0.06)*** |
| Self-manage oral meds        | −0.04 (−0.06--0.01)* | −0.04 (−0.07--0.02)*** | −0.06 (−0.09--0.03)*** |
| Comorbidities                | −0.02 (−0.05--0.00)* | −0.02 (−0.04-0.00) | −0.03 (−0.05-0.00)* |

Notes. OR = odds ratio; HHC = home health care. Insurance group and county included as controls in the models. Coefficients not reported to save space.
*p < .05. **p < .01. ***p < .001.
body dressing (30%), transferring (29%) grooming and upper body dressing (both 27%), toilet hygiene (25%), toilet transfer (23%) and feeding (15%). Having no measures of these outcomes prior to COVID infection, it is unknown whether these patients returned to their baseline level of health or continue to have enduring sequelae. This would represent a high level of dependency for a young subpopulation.

The improved outcomes for patients living alone were surprising. Patients who live alone may have greater motivation, in order to retain independence. Those who live with another individual may be less likely to perform ADL/IADLs for themselves, which could limit improvement. While those explanations are causal, there is also the possibility that differential selection into living situations explain these differences. Patients who live alone may have a greater (unmeasured) potential to improve which is why they are living independently.

This study indicates that HHC has met the challenge of a COVID-19 population requiring care in the communities in which they serve. During the study period acute care facilities were overwhelmed with patients, and there was great concern for maintaining adequate bed and staffing capacity in these settings. Arrangements were made identify patients in the ED and hospital setting that could be transferred to HHC. Results indicated COVID positive patients were able to safely and effectively receive care in their homes. Compared to the general HHC population, patients recovering from COVID had a reduced risk of hospitalization and demonstrated greater increases in ADL/IADLs by the end of their care. COVID patients also showed a greater improvement in dyspnea, which was more impaired at SOC than non-COVID patients. Patients with a COVID diagnosis had greater utilization of virtual care, although care was primarily provided in person. These findings should be helpful for resource planning in the event of future waves of COVID patients requiring HHC. Further research needs to explore whether the population of patients referred to HHC changed throughout the course of the pandemic.

**Conclusion**

Early in the pandemic, hospitals discharged patients to rehabilitation and skilled nursing facilities to recover. As infections in these facilities rapidly increased, a shift occurred to send these patients to HHC. Moreover, with the passage of time, medical knowledge likely led to greater operational

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**Table 5. Factors Associated with Changes in Functional Abilities among HHC Patients between Start of Care and Discharge (n = 4487)**

|                      | Bathing          | Toilet transfer | Toilet hygiene |
|----------------------|------------------|-----------------|----------------|
| **COVID diagnosis**  | 0.66 (0.54-0.78)*** | 0.28 (0.22-0.35)*** | 0.29 (0.23-0.35)*** |
| **Start of episode ADL** | 0.60 (0.56-0.63)*** | 0.58 (0.55-0.60)*** | 0.59 (0.55-0.63)*** |
| **Age**              |                  |                 |                |
| 64 years of age and younger | 0.01 (−0.13–0.14) | −0.06 (−0.13–0.02) | −0.00 (−0.07–0.07) |
| 65 to 79 years of age  | 1.00 (referent)  | 1.00 (referent)  | 1.00 (referent)  |
| 80 years of age and older| −0.29 (−0.39–−0.19)*** | −0.06 (−0.12–−0.01)* | −0.14 (−0.19–−0.09)*** |
| **Sex**              |                  |                 |                |
| Female               | 1.00 (referent)  | 1.00 (referent)  | 1.00 (referent)  |
| Male                 | 0.09 (0.00-0.17)* | −0.01 (−0.06–0.03) | 0.00 (−0.04–0.05) |
| **Race/ethnicity**   |                  |                 |                |
| White                | 1.00 (referent)  | 1.00 (referent)  | 1.00 (referent)  |
| Hispanic             | 0.12 (−0.03–0.28) | −0.00 (−0.09–0.08) | 0.00 (−0.08–0.08) |
| Asian                | −0.02 (−0.21–0.17) | 0.07 (−0.04–0.17) | 0.03 (−0.07–0.12) |
| Black                | 0.06 (−0.07–0.18) | −0.01 (−0.08–0.06) | 0.03 (−0.03–0.10) |
| **Living situation** |                  |                 |                |
| Live with other person(s) | 1.00 (referent)  | 1.00 (referent)  | 1.00 (referent)  |
| Live alone           | 0.31 (0.21-0.41)*** | 0.15 (0.09-0.20)*** | 0.20 (0.15-0.26)*** |
| Cognitive function    | −0.34 (−0.43–−0.26)*** | −0.18 (−0.23–−0.13)*** | −0.17 (−0.21–−0.13)*** |
| Confusion             | −0.23 (−0.30–−0.16)*** | −0.11 (−0.14–−0.07)*** | −0.13 (−0.16–−0.09)*** |
| Anxiety               | 0.01 (−0.05–0.07)  | 0.01 (−0.02–0.04)  | 0.02 (−0.01–0.05)  |
| Pain                 | 0.03 (−0.01–0.07)  | 0.04 (0.02–0.07)   | 0.04 (0.02-0.06)*** |
| Self-manage oral meds | −0.08 (−0.13–−0.03)**  | 0.01 (−0.02–0.03)   | −0.03 (−0.05–0.00)   |
| Comorbidities         | −0.08 (−0.13–−0.04)*** | −0.02 (−0.05–0.00) | −0.03 (−0.04–0.10)* |

**Notes.** OR = odds ratio; HHC = home health care. Insurance group and county included as controls in the models. Coefficients not reported to save space. *p < .05. **p < .01. ***p < .001.
efficiency and more accurate placement of patients to the proper level of care. The authors suspect that over time, HHC began to treat sicker COVID patients with greater impairments. The evolution in COVID patient referrals to HHC through the course of the pandemic is an important area for future research. While HHC’s function of receiving acute facilities’ overflow during surge capacity will likely decrease, HHC will continue to be an important provider of care for post-acute COVID patients, particularly those who wish to avoid inpatient facilities, as well as homebound patients.

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Table 6. Factors Associated with Changes in Functional Abilities among HHC Patients between Start of Care and Discharge (n=4487)*.

| Unstandardized regression coefficients (95% confidence interval) |
|---------------------------------------------------------------|
| Transferring | Ambulation | Feeding | Dyspnea |
| COVID diagnosis | 0.24 (0.17-0.30)*** | 0.49 (0.40-0.58)*** | 0.13 (0.08-0.17)*** | 0.08 (0.03-0.13)*** |
| Start of episode ADL | 0.51 (0.47-0.54)*** | 0.37 (0.33-0.41)*** | 0.58 (0.55-0.61)*** | 0.76 (0.74-0.77)*** |
| Age | | | | |
| 64 years of age and younger | -0.01 (-0.09–0.06) | 0.00 (-0.10-0.11) | -0.03 (-0.08-0.03) | 0.05 (-0.00-0.11) |
| 65-79 years of age | 1.00 (referent) | 1.00 (referent) | 1.00 (referent) | 1.00 (referent) |
| 80 years of age and older | -0.09 (-0.14–-0.04)*** | -0.23 (-0.31–-0.16)*** | -0.10 (-0.14–-0.06)*** | -0.08 (-0.12–-0.03)*** |
| Sex | | | | |
| Female | 1.00 (referent) | 1.00 (referent) | 1.00 (referent) | 1.00 (referent) |
| Male | -0.02 (-0.06-0.03) | 0.06 (-0.01-0.12) | -0.00 (-0.04-0.03) | 0.00 (-0.04-0.04) |
| Race/ethnicity | | | | |
| White | 1.00 (referent) | 1.00 (referent) | 1.00 (referent) | 1.00 (referent) |
| Hispanic | 0.04 (-0.04-0.12) | 0.11 (-0.01-0.22) | 0.00 (-0.06-0.06) | 0.05 (-0.01-0.12) |
| Asian | 0.05 (-0.05-0.15) | 0.13 (-0.02-0.27) | -0.03 (-0.11-0.04) | 0.00 (-0.07-0.08) |
| Black | 0.03 (-0.03-0.10) | 0.08 (-0.01-0.18) | 0.00 (-0.04-0.05) | 0.03 (-0.03-0.08) |
| Living situation | | | | |
| Live with other person(s) | 1.00 (referent) | 1.00 (referent) | 1.00 (referent) | 1.00 (referent) |
| Live alone | 0.12 (0.06-0.17)*** | 0.12 (0.04-0.20)*** | 0.12 (0.08-0.16)*** | 0.05 (0.01-0.09)* |
| Cognitive function | -0.18 (-0.22–-0.13)*** | -0.21 (-0.28–-0.15)*** | -0.12 (-0.16–-0.09)*** | -0.04 (-0.07–-0.01)* |
| Confusion | -0.09 (-0.13–-0.06)*** | -0.14 (-0.19–-0.09)*** | -0.08 (-0.11–-0.05)*** | 0.01 (-0.02-0.04) |
| Anxiety | 0.02 (-0.01-0.05) | 0.03 (-0.01-0.08) | 0.02 (-0.01-0.04) | -0.01 (-0.04-0.01) |
| Pain | 0.03 (0.01-0.05)* | -0.01 (-0.04-0.02) | 0.03 (0.02-0.05)*** | 0.01 (-0.00-0.00) |
| Self-manage oral meds | -0.00 (-0.03-0.02) | 0.01 (-0.03-0.05) | -0.00 (-0.02-0.02) | 0.00 (-0.02-0.02) |
| Comorbidities | -0.02 (-0.05-0.00) | -0.03 (-0.07-0.00) | -0.02 (-0.04-0.00)* | -0.03 (-0.05-0.01)** |

Notes. OR = odds ratio; HHC = home health care. Insurance group and county included as controls in the models. Coefficients not reported to save space. *p < .05. **p < .01. ***p < .001.

Reproducible Research Statement

Study protocol, statistical code, and data set: Not available.

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