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# Answering Questions Using Virtual Research Data Center (VRDC)

## How using Home and Community-Based Services (HCBS) Impacts Hip Fracture Outcomes

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## EXECUTIVE SUMMARY

Health Management Associates (HMA) is now using Centers for Medicare & Medicaid Services (CMS) Virtual Research Data Center (VRDC) to answer important healthcare questions. One contractual obligation for use of CMS data is the release of a publicly available research paper using the dataset, which contains all Medicare fee for service (FFS) and Medicaid FFS and managed care organization (MCO) claims. In this analysis, HMA used the VRDC data to examine the relationship between Long-Term Services and Supports (LTSS) and Home and Community-Based Services (HCBS) on hip fracture outcomes for people who are dually eligible for Medicare and Medicaid benefits. The analysis found that patients who receive HCBS were less likely to incur a future inpatient stay. The report and data analysis are detailed below.

VRDC Medicare and Medicaid claims data can be used to develop best practices for the healthcare system, looking at patient demographics, including eligibility/enrollment types (including dual-eligibles), race/ethnicity, age, and other critical subgroups to inform equity analyses. These data can be used longitudinally to measure the effect of interventions as well as to inform population health strategies. HMA's nationally renowned subject matter experts can now incorporate VRDC data analysis and analytics into their recommendations to help your organization solve your toughest challenges.

## INTRODUCTION

Health Management Associates, Inc. (HMA), is uniquely positioned to access the Centers for Medicare & Medicaid Services (CMS) Virtual Research Data Center (VRDC), which allows us to analyze its comprehensive nationwide Medicaid and Medicare data. For example, HMA has been able to leverage VRDC data to study the relationship between long-term services and supports (LTSS) and home and community-based services (HCBS) on hip fracture outcomes.

Hip fractures place a significant burden on the US healthcare system, accounting for nearly $6 billion in spending for Medicare patients alone (about $50,000 per patient). Furthermore, inpatient hospitalizations comprise approximately 75 percent of the costs associated with hip fractures (Adeyemi & Delhougne, 2019). Another study of 758 patients ages 60 and older, found a 21 percent mortality rate one year post hip fracture and an increased likelihood of mortality with increasing age (Schnell et al., 2010).

Considering these facts and the push in the last decade to expand HCBS and LTSS services at large, our team researched whether these services affected the likelihood of readmission following an inpatient stay related to hip fracture. To answer this question, we carefully analyzed distinct datasets encompassing beneficiary dual status information and Medicare/Medicaid header and line- level claims. Given the longitudinal nature of the data present in the VRDC, we also conducted a Kaplan Meier Survival Analysis to explore the correlation between HCBS/LTSS and readmission on hip fracture patients over time.

In the context of this study, survival does not denote living or dying; rather under our definition **a person "survives" by avoiding an inpatient stay**. The model is, therefore, evaluating whether certain variables increase or decrease the probability of having an inpatient event. We found that waiver-based LTSS eligibility does not affect the likelihood of readmission, but HCBS decreases the probability of readmission by a statistically significant amount. These findings suggest that investment in HCBS may improve patient outcomes and potentially alleviate the considerable financial burden associated with hip fractures on the healthcare system.

## METHODS

A unique and extremely powerful facet of the VRDC's data is the ability to track members over time (i.e., longitudinally) across states and, for dually eligible members, between Medicare and Medicaid. The impact of post-acute care (PAC) on hip fracture recipients can be analyzed in countless ways, but we determined one that tracked their journey post-discharge for as long as the data allowed would be especially worthwhile. This section is divided into three components: the creation of the population, the time-series methods we used, and the application of those methods.

As mentioned previously, our research focused on fully dual eligible members who had a hip fracture inpatient episode and received post-acute care for that episode. To be included in our population, a member had to fit all three criteria. We also flagged LTSS eligibility and whether a patient had HCBS claims and used these as our primary explanatory variables. We applied the Kaiser Family Foundation's claims and demographic definition of HCBS and LTSS to the entire Medicaid population to identify recipients (Chidambaram and Alice Burns, 2023). HCBS falls under the LTSS umbrella, but we also conducted a separate analysis using only HCBS information. This LTSS definition originally was intended to count the number of LTSS recipients and acts as a cascading set of filters. Using the demographic files, we included members who had either a 1915c or 1115c waiver for a given month. Members who lacked these waivers but were in the top 70 percent of HCBS claims filed in a given state were also included. Because the HCBS definition is claims-based, we could more conclusively state that a member *received* the services rather than simply had the waiver for them. An inpatient (IP) episode is defined as having a single claim in the IP file for either Medicare or Medicaid.

Our analysis centered on this population's time until their next IP episode for any cause. This study consisted of two distinct episode events: the hip fracture index IP was our trigger event, providing the initial inclusion in the population, and the second IP admission was our end event, indicating the end of the member's participation in the study. The hip fracture trigger event was required to be an "index" IP admission; that is, the service date on the claim was at least 60 days after the discharge date of the member's previous IP admission, thereby excluding what would otherwise be readmission episodes.

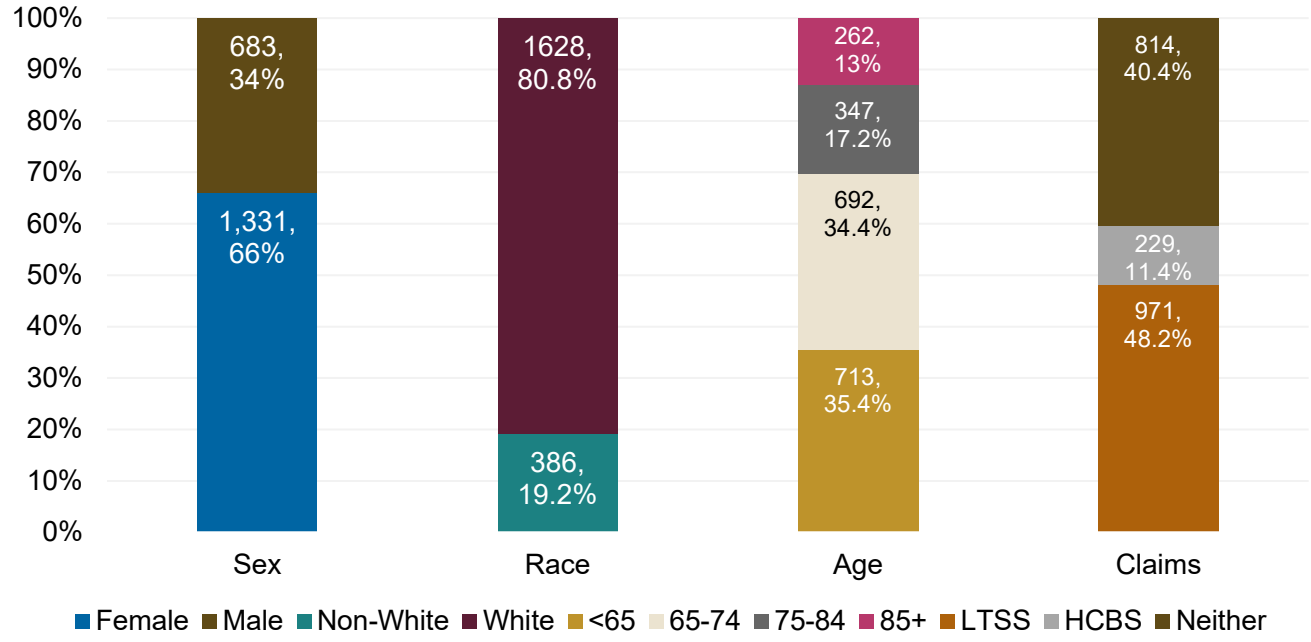
Because the end events do not have to relate to hip fractures, the population studied had to exclude members with comorbidities that would have increased the likelihood of admission irrespective of LTSS/HCBS care. (See Appendix for list of excluded comorbidities). For example, members with chronic kidney disease (CKD) are much more likely to have inpatient claims simply because their care cannot be provided fully in the home. Members also had to have PAC claims at any type of PAC facility (skilled nursing facility, long-term care hospital, inpatient rehabilitation facility, or home health agency) within five days of the discharge date on the IP claims. Finally, any member who was not fully dually eligible at the time of their admission and through their discharge from the PAC was excluded. Because LTSS eligibility varies significantly by state and between levels of dual eligibility, we excluded any members with partial dual eligibility from the study.

With our population and our trigger and end events identified, our next step was to finalize the analysis methodology. As mentioned, a secondary component of this study was to evaluate the VRDC's ability to facilitate longitudinal analyses, so we required a method that could handle time-series data. Also of concern was the concept of censoring participant inclusion in the study because of some cause other than an end event. Members in our population were considered censored and no more data were gathered for them if: they lost their full-dual status, they died, or we could identify no further claims for them. Several methods, including the survival analysis we conducted, still allowed us to make use of the available data on these members, whereas other methodologies, such as linear regression, lacked that flexibility. In fact, this was the primary reason we did not use a linear model, in addition to its susceptibility to autocorrelation between time-series variables.

The specific model we used, the Cox Proportional Hazard (Cox PH), is highly extensible and can accommodate additional explanatory variables beyond those chosen. We selected a set of four initial variables for this analysis. Our focus was whether LTSS/HCBS reduces the likelihood of a highly at-risk population going to the hospital for any cause. Univariate analysis, however, may cause unexamined but influential factors to be ignored and confuse results. To help alleviate this challenge, we included three other potentially important variables: age (grouped into four categories: <65, 65-74, 75-84, 85+), race, and the type of post-acute care received following the hip fracture IP stay. We considered these all to have the potential to influence the probability of a readmission.

## RESULTS

### Figure 1: Demographics of Observed Patients, Totaling 2,014 Participants

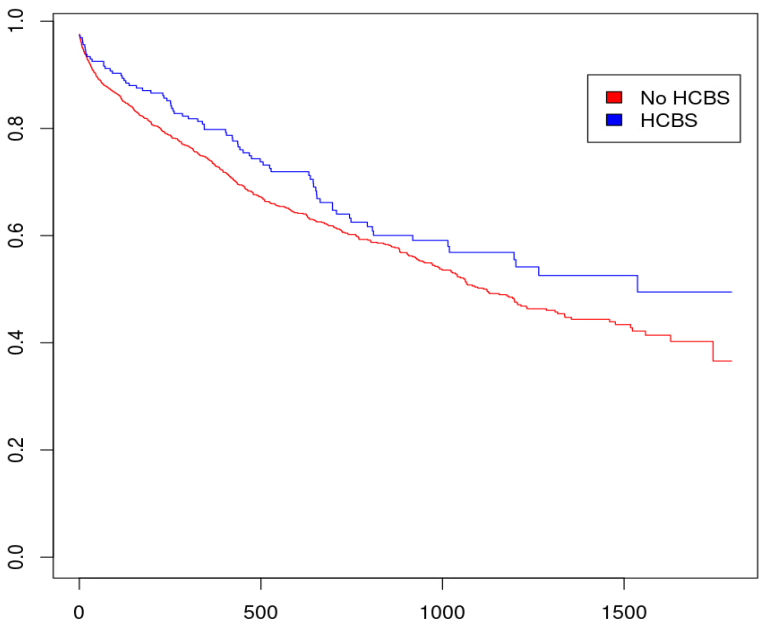


We focus on the HCBS definition in this section. Inclusion in the LTSS group was not correlated with any significant difference in readmission probability. We consider this a result of over-inclusion. Because the demographic and waiver information do not speak to whether members received services themselves, we believe many members of the LTSS group did not receive sufficient care to have an effect, whereas our HCBS definition is tied to a certain threshold of claims.

As the Kaplan Meier Survival Curve (Figure 1) illustrates, patients flagged with HCBS claims had a lower likelihood of readmission especially after the first 75-100 days after discharge from post-acute care.

Multivariate Cox PH results (Table 2) indicated that, when accounting for age groups, race, and post-acute care type, people with HCBS claims presented with a hazard ratio of 0.79 signifying that they were 20 percent less likely to be readmitted following a hip fracture compared with the non-HCBS group. The 65−74 age group yielded a hazard ratio of 0.81, indicating an almost 20 percent lower likelihood of readmission than their counterparts in the younger than 65 years of age group. Individuals in the 75−84 age group exhibited similar results, with a hazard ratio of 0.67, indicating a nearly 30 percent lower likelihood of readmission compared with their counterparts in the younger than 65 years old age group. Beneficiaries ages 85 and older were associated with a 28 percent lower likelihood of readmission than patients 64 and younger. Race and admission in a skilled nursing facility were not significantly associated with readmission.

**Figure 2: HCBS versus Non HCBS KM Survivor Curve**



## Table 1: Multivariate Cox Proportional Hazard

| | Multivariate Cox Proportional Hazard Results | | | | | | |
|---|---|---|---|---|---|---|---|
| | **coef** | **exp(coef)** | **se(coef)** | **z** | **Pr(>\|z\|)** | **LCI** | **UCI** |
| HCBS_Claims_Flag(1) | -0.23028 | 0.79431 | 0.11838 | -1.945 | 0.051744 | 0.6298 | 1.0017 |
| **Age Group (ref = <65)** | | | | | | | |
| 65-74 | -0.21107 | 0.80972 | 0.08836 | -2.389 | 0.016909 | 0.681 | 0.9628 |
| 75-84 | -0.39061 | 0.67664 | 0.11282 | -3.462 | 0.000536 | 0.5424 | 0.8441 |
| 85+ | -0.32015 | 0.72604 | 0.12424 | -2.577 | 0.009971 | 0.5691 | 0.9262 |
| **Pac Type (ref = HHA)** | | | | | | | |
| IRF | 2.96038 | 19.30522 | 1.16238 | 2.547 | 0.010871 | 1.9781 | 188.4048 |
| SNF | -0.22556 | 0.79807 | 0.57971 | -0.389 | 0.697207 | 0.2562 | 2.4859 |
| **Race (ref = Other)** | | | | | | | |
| White | 0.03855 | 1.0393 | 0.30543 | 0.126 | 0.899562 | 0.5712 | 1.8911 |
| Non-White | -0.09448 | 0.90985 | 0.31508 | -0.3 | 0.764296 | 0.4907 | 1.6872 |

Some trends emerged from the analysis that we consider to be a result of differing behaviors between groups. Table A1 in the Appendix indicates a drop in readmission rates as patients age, with a 40.4 percent readmission rate for people younger than 65 years old versus 31.3 percent in the 85+ age group. We believe that this disparity is a result of missing data. The difference in censoring between these two groups, 60 percent and 69 percent in the younger than 65 years old and the 85+ age groups, respectively, is notable. The older groups simply contributed less data. Readmission rates also were lower in the older age groups when breaking it down by 3, 7, 30, and 60 days after a hip fracture incident, as Table A2 in the Appendix demonstrates.

## DISCUSSION AND NEXT STEPS

Broadly, our research had two components of focus: the population and the methodology applied to it. We used these components to address the question of whether HCBS reduces the odds of a hip fracture population's next IP admission. Secondarily, we used the opportunity to evaluate the VRDC's ability to facilitate longitudinal analyses of its data.

We found that receiving HCBS significantly affected the probability of a future inpatient stay. But notably, this impact was not shared by the larger LTSS population. Hence, we propose that this study has two primary takeaways related to HCBS and LTSS effectiveness. First, the data provide evidence to support HCBS's value as an instrument of care, particularly as a mechanism for keeping members out of the hospital. But second, these data also suggest an extant threshold before which LTSS and perhaps even HCBS have no effect. On the one hand, waiver-based inclusion requirements not backed by claims demonstrated no impact, whereas on the other hand, the top 30 percent of the people with HCBS claims were able to avoid hospitalization for a longer period. We therefore also view this study as an extended exploratory analysis of HCBS and LTSS care outcomes. A natural extension of this work would be to examine where the threshold of effectiveness lays.

Beyond identifying this threshold, we consider the population definition we used to be the most adaptable area for future work and the component that is most easily modified to fit other research needs. We see two clear next steps to adjust our dually eligible, PAC-receiving population. First, we could refine the exclusion criteria to include or remove comorbidities, especially via a claims-based definition rather than the member's inclusion in the chronic conditions 27 data, a CMS-maintained beneficiary level dataset which tracks whether and when beneficiaries qualify for any of 27 categories of chronic conditions. Second, we could refine the end event to be more specific rather than the broader any-cause admissions. Incorporating an analysis of emergency department visits as an end event could also provide valuable and highly relevant information. In addition, we would like to expand our analysis methods to include mixed-effect regression, as it is the preferred method for FDA time series analyses and would allow us to examine interactions between explanatory variables at the member level.

More generally, however, we see this research as a first step in analyzing the effects of LTSS/HCBS on the PAC population and demonstrating the high potential of the VRDC as a tool for complex longitudinal analyses. We believe it is also highly extensible to other populations of interest. A behavioral health analysis of members with opioid use disorder, for example, seems feasible and would likely lead to invaluable insights.

### FUTURE USES

VRDC Medicare and Medicaid claims data can be used to develop best practices for the healthcare system, looking at patient demographics, including eligibility/enrollment types (including dual-eligibles), race/ethnicity, age, and other critical subgroups to inform equity analyses. These data can be used longitudinally to measure the effect of interventions as well as to inform population health strategies.

## REFERENCES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## APPENDIX

List of comorbidities used in the population exclusion criteria:

- COPD
- Stroke/TIA
- CKD
- Alzheimer's/dementia
- Diabetes
- Ischemic heart disease

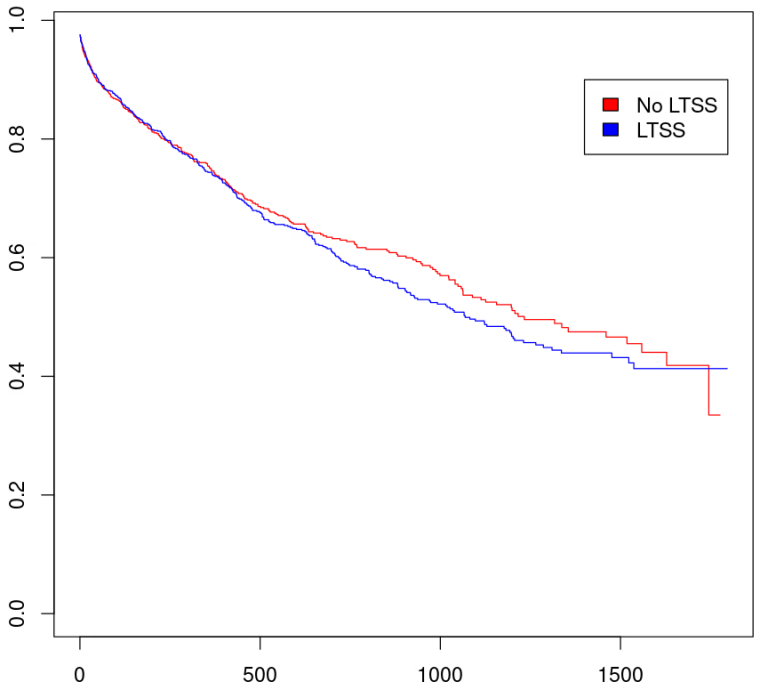
### Table A1: Overall Readmission Rates versus Censoring for Each Age Group

| Age Group | Readmission | Censored |
|---|---|---|
| <65 | 40.47% | 59.53% |
| 65-74 | 32.72% | 67.28% |
| 75-84 | 31.16% | 68.84% |
| 85+ | 31.37% | 68.63% |

### Table A2: Readmission Rate versus Censoring at 3, 7, 30, 60 Days by Age Group

| Cumulative Event Rate by Age and Day Group | | |
|---|---|---|
| Age Group | Discharge Day Groups | Cumulative Event Percent |
| <65 | 3 Days | 4.87% |
| 65-74 | 3 Days | 2.69% |
| 75-84 | 3 Days | 1.70% |
| 85+ | 3 Days | 3.32% |
| | | |
| <65 | 7 Days | 5.98% |
| 65-74 | 7 Days | 3.97% |
| 75-84 | 7 Days | 2.55% |
| 85+ | 7 Days | 4.43% |
| | | |
| <65 | 30-31 Days (30) | 9.74% |
| 65-74 | 30-31 Days (30) | 8.07% |
| 75-84 | 30-31 Days (30) | 4.82% |
| 85+ | 30-31 Days (31) | 6.27% |
| | | |
| <65 | 60 Days | 12.93% |
| 65-74 | 60 Days | 10.62% |
| 75-84 | 60 Days | 6.80% |
| 85+ | 60 Days | 8.86% |

**Figure A1: LTSS versus Non-LTSS KM Survivor Curve**

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