

Issue Brief

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Innovations in Medicaid: Impacts of a Home-Based Intensive Care Model for Complex Medicaid Beneficiaries

Key Findings

1. Reduced ED visits and inpatient stays with an associated behavioral health diagnosis.

A primary goal of the intensive care model was to reduce ED visits and inpatient stays. Evidence suggests that the intervention successfully reduced ED visits and inpatient stays, driven by reductions in visits with an associated behavioral health diagnosis.

2. Increased probability of a follow-up visit with a primary care provider within 30 days of hospital discharge. The intensive care model was associated with higher use of primary care overall, and a much higher probability of a follow-up visit with a primary care provider within 30 days of hospital discharge, an expected result because the intervention prioritized patients recently discharged from the hospital.

3. Particularly strong effects for members with behavioral health diagnoses at baseline.

Members with behavioral health diagnoses at baseline experienced a decrease in ED visits and increase in outpatient visits that was at least as large if not larger than members without a documented behavioral health diagnosis.

I. Introduction

Effectively managing care for individuals with complex health care needs has the potential to both improve health care quality and reduce costs, but relatively few models have been implemented in a Medicaid population. The California Health Care Foundation invested in an innovative care delivery model by supporting a partnership between Landmark Health and two California Medicaid managed care health plans, the Inland Empire Health Plan (IEHP) and the Health Plan of San Mateo (HPSM). Building on the model it developed for Medicare Advantage populations outside

California, Landmark delivered coordinated home-based services, including on-demand clinical care and connections to social services, to two cohorts of high-risk Medicaid managed care members with multiple medical or behavioral health needs, many of whom were also dually eligible for Medicare.¹ To understand the impacts of the home-based intensive care model on utilization and quality of care and to identify lessons learned in adapting the model to serve Medicaid enrollees, the California Health Care Foundation, IEHP, HPSM, and Landmark contracted Mathematica to evaluate the initial implementation of the model from 2016 to 2018.

Our evaluations build on a growing body of evidence around intensive care models for high-risk patients. While evidence has been mixed, systematic reviews of programs in the late 1990s and early 2000s found positive results for approaches that focus on the hospital-to-home transition and provide home-based visits along with other core program components such as interdisciplinary care teams, regular interprofessional care meetings to review patients and patient care plans, and after-hours urgent telephone services.^{2,3} More recently, a randomized quality improvement trial administered by CareMore Health found a complex care management program reduced total medical expenditures by 37 percent and inpatient utilization by 59 percent for a group of high-need, high-cost Medicaid patients.⁴ Similarly, results from the Center for Medicare & Medicaid Innovation's Independence at Home Demonstration showed that delivering home-based primary care to targeted Medicare beneficiaries with multiple chronic conditions and functional limitations improved the quality of care and lowered Medicare expenditures. In its second performance year, the Independence at Home program saved Medicare an average \$1,010 per beneficiary and yielded positive impacts on quality-of-care indicators, including follow-up contact from providers after inpatient stays, hospital readmissions, and ED visits and stays for ambulatory care sensitive conditions (ACSC), which are defined as admissions that might have been preventable with appropriate access to primary care.⁵ However, findings about the impact of intensive care models for high-risk patients have not been consistent. A randomized evaluation of the Camden Coalition's hotspotting program, a post-discharge transition intervention that helps connect a population with medical and social complexity and substantially higher health care utilization to existing clinical and social resources, found no significant impact on participants' 180-day readmission rate.⁶

Model overview

Landmark's model for high-risk patients aims to reduce high-cost medical service use, such as emergency department visits and inpatient stays, and to improve patients' quality of life through more intensive, home-based medical management. The approach involves interdisciplinary care teams, in-home medical services, crisis management available at any time and every day, and coordination of health care and social services. Landmark tailors the intervention to patients based on their health status, care utilization needs, and available social supports.

Our findings from evaluating the Landmark–IEHP partnership over two years and Landmark–HPSM partnership over twenty-one months are consistent with this literature and reveal important lessons for applying intensive care models to high-need, high-cost Medicaid enrollees. IEHP and HPSM each contracted with Landmark according to their unique needs, so the target populations and study designs for the two plans were distinct, but both targeted dually eligible beneficiaries. We synthesize major findings for dually eligible beneficiaries – those receiving both Medicare and Medicaid services – from the two evaluations in Table I.1. The remainder of the brief presents more detailed findings from the two evaluations individually, including findings for the Medicaid-only IEHP population, which were consistent with those found for dual eligible members.

Table I.1. Summary of impacts of the intensive care model for members dually eligible for Medicare and Medicaid

Outcome category	IEHP Y1/Y2	HPSM
Hospital-based care		
Inpatient stays	↓↑	↓
Inpatient stays with a behavioral health diagnosis	↓↓	↓
ED visits	↓↓	↓
ED visits with a behavioral health diagnosis	↓↓	↓
Ambulatory care		
Primary care visits	↑↑	↑
Primary care visits (non-Landmark)	↑↑	↓
Specialty care visits	↑↑	↑
30-day prescription drug fills	↑↑	↓
Quality of care		
30-day post discharge follow-up	↑↑	↑
ACSC stays	↓↑	↓
30-day hospital readmissions	↓↓	↓

Notes: Arrows indicate the direction of the change, and statistically significant results ($p < 0.05$) are indicated by dark green arrows.

II. Impacts of the Home-Based Intensive Care Model among Inland Empire Health Plan Members

In 2016 Landmark began providing the home-based intensive care model to dual-eligible and Medicaid-only beneficiaries enrolled with IEHP. Our evaluation compared outcomes over two years for 359 dually eligible IEHP members engaged by Landmark (36 percent of the total engaged cohort) to a matched cohort of 2,865 IEHP members who were eligible for the home-based intensive care model but not engaged by December 2016. Members in both groups were continuously observable through the two-year follow up period that ended December 2018. We conducted separate analyses for Medicaid-only members, presented at the end of this section, but focus on our findings for dual eligible members in this synthesis brief, since the Landmark-HPSM partnership included only dual-eligible members.

Dual-eligible members were, on average, 65 years old, and 50 percent had at least one recorded behavioral health diagnosis in the baseline period.

Their average Chronic Illness and Disability Payment system score was 3, indicating these members were substantially less healthy and had a greater need for care than the average Medicaid beneficiary. Comparison group members had similar demographic and health characteristics as engaged members. Further details about the evaluation methods are available in the “Methods” box at the end of this brief.

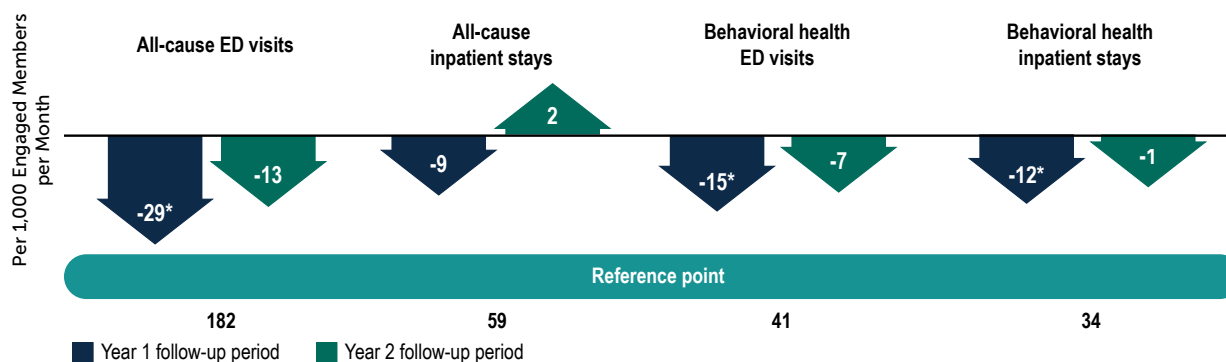
A. What were the impacts of the model on ED visits and inpatient stays, including those with a behavioral health diagnosis, for dual-eligible members?

A primary goal of the intervention was to reduce ED visits and inpatient stays. We found evidence that the intervention led to a decrease in ED visits and hospital stays in the first year, particularly for the subset of events that had an accompanying behavioral health diagnosis. The home-based intensive care model was associated with 29 fewer all-cause ED visits per 1,000 engaged members per month relative to the comparison group (about 16 percent

lower than our reference point, defined as the baseline rate among the engaged members). Similarly, considering visits with a behavioral health diagnosis, the intervention led to 15 fewer ED visits and 12 fewer inpatient stays per 1,000 engaged members per month relative to those of the comparison group (about 37 percent and 35 percent lower than our

reference point, respectively). These findings are consistent with the program’s expected reduction in ED visits and inpatient stays among frequent users through better use of usual care. We did not, however, detect any statistically significant changes in ED visits or inpatient stays in the second year.

Figure II.1. Impact on ED visits and inpatient stays among engaged IEHP members



* Significantly different from zero at the .05 level, two-tailed test.

B. What were the impacts of the model on the use of ambulatory care services such as primary care, specialty care, and prescription drugs, for dual-eligible members?

We hypothesized that overall, primary care visits would increase. Primary care visits with Landmark providers should increase because of the convenience of in-home visits. Visits with non-Landmark outpatient providers could increase because of increased referrals from Landmark providers, or they could decrease if the in-home services act as a substitute for non-Landmark primary care providers.

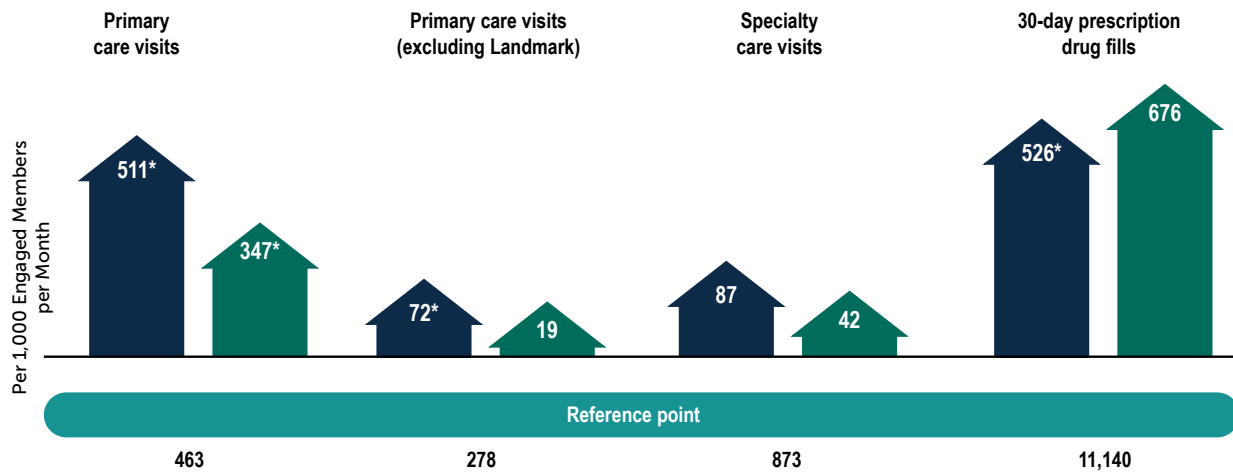
We found strong evidence that the intervention led to an increase in outpatient visits for engaged members in both program years, mainly driven by primary care visits. In the first year, the home-based intensive care model was associated with 72 more primary care visits per 1,000 engaged members per month relative to those of the comparison group (about 16 percent higher than our reference point). The program’s impact was even larger when accounting for visits with Landmark

providers, leading to 511 more primary care visits per 1,000 engaged members per month (almost twice our reference point). This association was still statistically significant in the second year when accounting for visits with Landmark providers.

We found no statistically significant associations between the model and changes in specialty care visits. The null result could indicate that the intervention had no impact, or that it caused an increase in specialty care use among some patients and a decrease among others that resulted in no net change at the population level.

For prescription drugs, the intervention could cause an increase in medication fills, due to increased medication adherence or better disease management, or it could also cause a decrease in prescription drug use because of a reduction in simultaneous use of multiple drugs in treatment. We found a significant increase in medication use in both years. In the first year, the 30-day prescription drug fill rate increased by 526 fills per 1,000 members per month more in the engaged group than in the comparison group.

Figure II.2. Impact on outpatient services and prescription drugs among engaged IEHP members



* Significantly different from zero at the .05 level, two-tailed test.

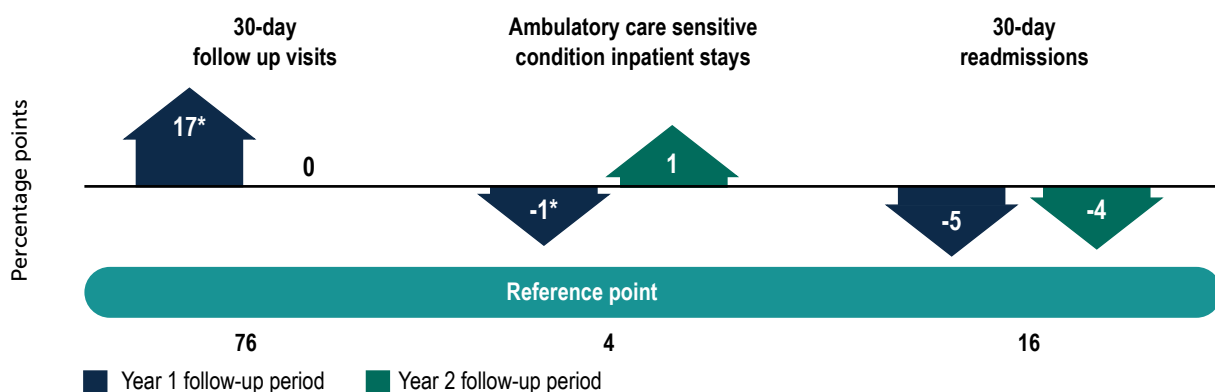
C. What were the impacts of the model on quality of care measures, including 30-day follow-up after hospital discharge, ACSC stays, and 30-day hospital readmissions, for dual-eligible members?

The program also aims to improve the transition to home after hospital discharge. Consistent with this goal, we found strong evidence of an increase in the probability of a 30-day post-discharge follow-up visit with a primary care provider, including visits with Landmark providers, in the first year. The probability of having a post-discharge follow-up increased by 17 percentage points more in the engaged group (to 93 percent) than in the

comparison group, but we did not find a similar impact in the second year.

In addition, we expected that the model would have a positive impact on other quality-of-care outcomes, including reducing the probability of having ACSC inpatient stays and 30-day all-cause hospital readmissions. Although the program was associated with a 1 percentage point decrease in the probability of having ACSC stays among engaged members in the first year (about 25 percent lower than our reference point), we did not observe a similar impact in the second year. We did not find any evidence that there was a change in 30-day readmissions in either program year.

Figure II.3. Impact on quality of care measures among engaged IEHP members



* Significantly different from zero at the .05 level, two-tailed test.

D. What were the impacts of the model for Medicaid only members?

To assess program impacts for Medicaid-only members, we compared outcomes over the first year among 812 Medicaid-only IEHP members who engaged with Landmark by December 2016 with those of a matched cohort of 391 IEHP Medicaid-only members ineligible for the home-based intensive care model because of their enrollment with independent practice associations. We could not evaluate the program’s impacts for Medicaid-only members in the second year because of sample attrition in the comparison group caused by the exit of one comparison independent practice association from IEHP’s network. The comparison group members had similar demographic and health characteristics as the engaged members.

Overall, we found some evidence that the program reduced ED visits and inpatient stays in the first program year. In particular, the program led to a decrease in the probability of having two or more all-cause ED visits or an inpatient stay with an accompanying behavioral health diagnosis. The program was also associated with an increase in outpatient care utilization, mainly driven by primary care visits, and use of prescription drugs. We found an increase in the probability of having a post-discharge visit with an IEHP primary care provider or a Landmark provider within 30 days of a hospital discharge, but no impact on ACSC inpatient stays or 30-day readmission rates. We summarize major findings for Medi-Cal only enrollees for the IEHP evaluation in Table II.1.

Table II.1. Summary of impacts of the intensive care model for Medi-Cal only members

Outcome category	IEHP Y1
Hospital-based care	
Inpatient stays	↓
Inpatient stays with a behavioral health diagnosis	↓
ED visits	↓
ED visits with a behavioral health diagnosis	↓
Ambulatory care	
Primary care visits	↑
Primary care visits (non-Landmark)	↑
Specialty care visits	↑
30-day prescription drug fills	↑
Quality of care	
30-day post discharge follow-up	↑
ACSC stays	↓
30-day hospital readmissions	↓

Notes: Arrows indicate the direction of the change, and statistically significant results ($p < 0.05$) are indicated by dark green arrows.

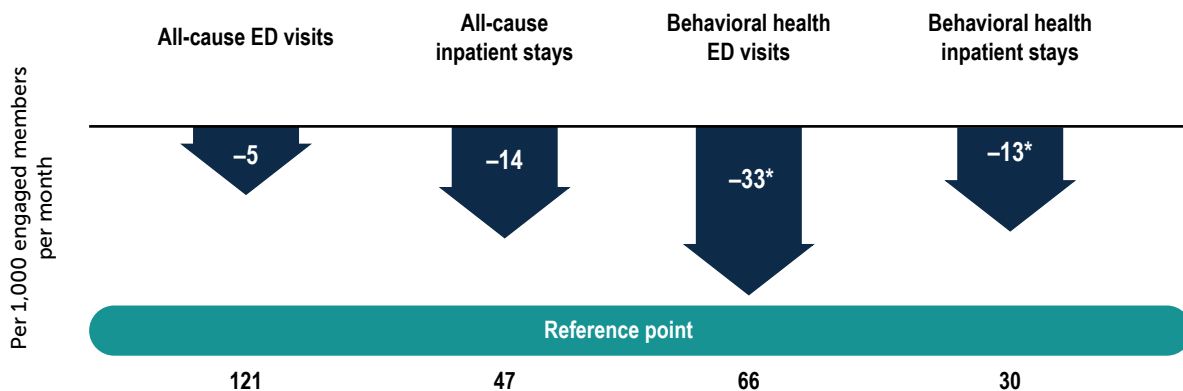
III. Impacts of the Home-Based Intensive Care Model among Health Plan of San Mateo Members

In November 2016, Landmark began providing coordinated home-based services, including clinical care, for HPSM’s Medicare and Medicaid dual-eligible population with multiple medical conditions and some co-occurring behavioral health conditions. We studied a cohort of 2,101 dual eligible HPSM beneficiaries between February 2015 and October 2018 where over 60 percent of individuals enrolled with Landmark. The study population had an average age of 78 years old; 50 percent had at least one recorded behavioral health diagnosis in the baseline period; and the average Hierarchical Condition Category risk score was 2.15, indicating that these members should cost more than twice the average Medicare beneficiary based on demographics and diagnoses. Unlike in the IEHP context, the HPSM evaluation included only those who were dual eligible for Medicaid and Medicare; we did not study Medicaid-only members in this evaluation. We used a single interrupted time series model to assess how trends in health care utilization and quality of care changed after the home-based intensive care model started engaging beneficiaries in November 2016. Further details about the methods are available in the Methods box at the end of the brief.

A. What were the impacts of the model on ED visits and inpatient stays, including those with a behavioral health diagnosis?

We hypothesized that the home-based intensive care model would reduce inpatient and ED use, overall and for the subset of events that had an accompanying behavioral health diagnosis. We found that the intervention was associated with reductions in the subset of ED visits and inpatient stays with a behavioral health diagnosis but not for ED visits and inpatient stays overall. The intervention was associated with 33 fewer ED visits with an associated behavioral health diagnosis per 1,000 engaged members per month (about 50 percent lower than our reference point, what would be predicted without the intervention) and 13 fewer inpatient stays with a behavioral health diagnosis per 1,000 engaged members per month relative to what would have been predicted absent the intervention (about 43 percent lower). We also found a negative association between the home-based intensive care model and all-cause ED visits and inpatient stays, but these findings were not statistically significant. The association of the intervention with a larger decrease in ED visits and inpatient stays with accompanying behavioral health diagnoses suggests that the Landmark model may be more successful with patients who have both medical and behavioral health comorbidities rather than either medical or behavioral health conditions on their own.

Figure III.1. Impact on ED visits and inpatient stays among engaged HPSM members



* Significantly different from zero at the .05 level, two-tailed test. Data from 2016-2018.

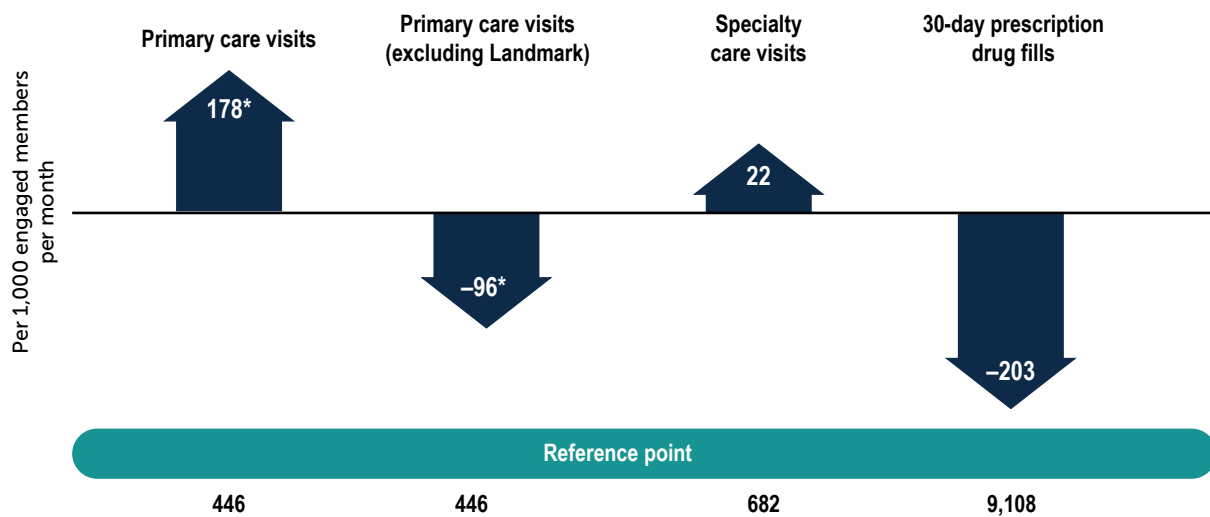
B. What were the impacts of the model on the use of ambulatory care services such as primary care, specialty care, and prescription drugs?

Consistent with our hypothesis, we found evidence that the intervention led to an increase in primary care visits for engaged members. The intervention was associated with 178 more primary care visits (including visits with Landmark providers and non-Landmark primary care providers) per 1,000 engaged members per month relative to the counterfactual trend line. In contrast to the IEHP context, we found evidence of substitution

from non-Landmark to Landmark providers among HPSM beneficiaries. Although we found increased primary care visits with all providers (considering both Landmark and non-Landmark), we saw decreased visits to non-Landmark primary care providers that were associated with the intervention: 96 fewer primary care visits with non-Landmark providers per 1,000 engaged members per month.

We found no statistically significant associations between the home-based intensive care model and changes in specialty care visits or 30-day standardized prescription fills.

Figure III.2. Impact on outpatient services and prescription drugs among engaged HPSM members



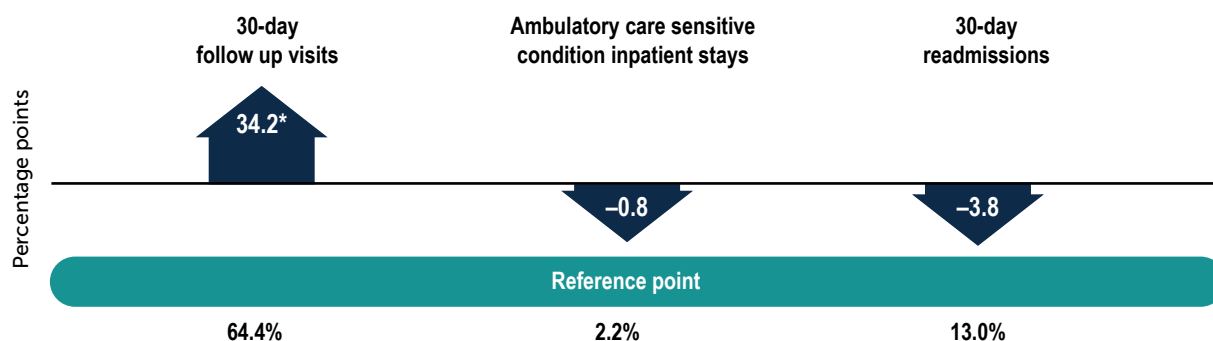
* Significantly different from zero at the .05 level, two-tailed test. Data from 2016-2018.

C. What were the impacts of the model on quality of care measures, including 30-day follow-up after hospital or skilled nursing facility discharge, ACSC inpatient stays, and 30-day hospital readmissions?

We expected that the home-based intensive care model would have a positive impact on the three quality of care outcomes we considered. Our analyses

showed that the intervention was associated with a 34-percentage point increase in the probability of a 30-day follow-up visit after an inpatient or skilled nursing facility stay. We assessed follow up visits after discharge from inpatient and skilled nursing facilities.⁷ However, we found no strong evidence of a change in ACSCs or 30-day readmissions.

Figure III.3. Impact on quality of care measures among engaged HPSM members



* Significantly different from zero at the .05 level, two-tailed test. Data from 2016-2018.

IV. Discussion

Overall, our estimates of the effect of Landmark’s home-based intensive care model were consistent with the program’s theory of action in terms of direction and magnitude. We found consistent evidence that the interventions were associated with decreases in ED visits and inpatient stays with an associated behavioral health diagnosis, increases in primary care visits, and a greater probability of primary care follow-up after discharge from inpatient stays (and skilled nursing facility stays for HPSM members). For members with documented behavioral health diagnosis at baseline, there were larger associated decreases in ED visits and inpatient stays, suggesting the population with behavioral health diagnoses – roughly half the study population – might experience particularly favorable impacts from home-based interventions. Despite having comprehensive insurance coverage that mitigates financial barriers, previous studies have documented organizational and geographic barriers to access for the dually eligible population.⁸ Our work affirms that home-based intensive care models show promise for improving access among high-risk dually eligible enrollees.

To consider the net effect of these reductions in ED and inpatient care, balanced against increases in primary care, we monetized observed changes in utilization in the IEHP evaluation using the California Medicaid reimbursement rate schedule, and found no statistically significant change in these standardized costs over the two years, suggesting these changes

largely offset one another. Although Medi-Cal often contracts through managed care rather than fee-for-service, we used the reimbursement rate schedule to understand how decreases in some types of services, like ED visits, might offset increases in other types of services, like primary care visits. This exercise helps illustrate changes in overall resource use, but does not estimate the impact of Landmark services on total costs to Medi-Cal in the short run.

We found mixed results for other outcomes. For specialist visits and prescription drug use, we found an increase in the IEHP context, but no evidence of change associated with the intervention in the HPSM context. In both evaluations, we found no strong evidence for reductions in 30-day all-cause hospital readmissions or inpatient stays for ACSC. The differences may be attributable to differences in the study populations (the HPSM population of dually eligible beneficiaries was considerably older on average) or differences in local-level implementation.

Our findings also align with the broader literature on home-based primary care. In a recent review article that examined outcomes in home-based primary care programs that treated homebound older adults, the authors found evidence for decreased ED visits in four of nine studies and decreases in hospital stays in six of nine studies (but increases in one study).⁹ The articles in that review were mostly observational studies, and the one study that was a randomized controlled trial found null results for ED visits and hospital stays.¹⁰

While the first-year evaluation of the IEHP and Landmark partnership used mixed methods and interviewed key stakeholders, the studies otherwise did not include survey measures of patients' well-being, their quality of life, or any other benefits of the intervention. One can infer from reductions in ED visits and inpatient stays that the intervention had a positive impact on members' well-being, but other improvements in quality of life might not have been captured.

Another limitation was that our evaluations were not based on a randomized controlled trial. Both evaluations were rigorously designed and used comparison groups when possible, however. The IEHP evaluation used a difference-in-differences design with an untreated comparison group, and the HPSM study used a single interrupted time series approach that used trends from the pre-intervention time period as a counterfactual to the intervention. Due to the lack of a comparison group, the HPSM study may also be confounded by other unmeasured changes in the health care and social service support systems that occurred around the same time as the Landmark intervention. We know of no specific changes in this time period. Both evaluation methods generate more reliable results than analyses that do not use a comparison group or account for pre-intervention trends in the outcomes. Despite these limitations, the evaluation results can be interpreted with confidence, especially where the findings align across the two studies and with the broader literature.

V. Lessons Learned

In summary, we found that Landmark's home-based intensive care model in the IEHP and HPSM settings accomplished many of its goals by changing patterns of health care use for engaged members. The model was associated with statistically significant decreases in ED visits and inpatient stays with an associated behavioral health diagnosis, increases in primary care visits, and increased rates of follow-up after discharge from inpatient and skilled nursing facility stays. As interest grows in innovative approaches for providing home-based care to complex patients, particularly in response to the COVID-19 pandemic,

we reflect on some lessons from the two evaluations that can inform future efforts.¹¹

First, adjusting to the Medicaid managed care landscape was a challenge. Medicaid enrollees, including dually eligible enrollees, differ markedly from the Medicare Advantage population in which Landmark's model was first developed, in that they suffer from higher rates of substance use disorders, have significant mental health needs, and have more functional limitations related to activities of daily living and instrumental activities of daily living. Many also have unmet social needs, including lack of access to transportation, unstable housing or homelessness, unsafe living conditions, unemployment or underemployment, and deep poverty, that complicate their effective treatment.¹² During an interview in 2017, Landmark operational staff described challenges in providing care to patients with behavioral health diagnoses, including connecting them to needed community resources. In response, Landmark hired additional social workers and behavioral health providers and reworked the approach to engaging beneficiaries. For example, in the IEHP setting, Landmark assigned social workers to lead the initial patient visit to better address patients' social and community support needs as a foundation for later medical management interventions, changes that appear to have made progress as the impact analysis findings show. The Landmark experience illustrates how programs newly adapted to provide comprehensive care and home-based visits to Medicaid enrollees will require tailoring to the unique needs of the Medicaid population if they were developed for Medicare Advantage or other populations.

Second, the intervention had a larger impact on ED visits and inpatient stays for members with behavioral health diagnoses at baseline, which was unexpected to the evaluators given the challenges of working with populations that have both physical and behavioral health needs. Our findings suggest the population with behavioral health needs might be a particularly high-need population that found considerable benefit from the home-based intensive care model. Future interventions might consider

focusing on beneficiaries with co-occurring behavioral health needs, particularly when resources are limited and health plans must selectively target subgroups.

Third, based on findings from the IEHP study, which separately identified changes in the first and second year of the intervention, there are concerns that the positive impacts might not be sustained over time. The IEHP study found positive impacts in the first year that were generally not sustained into year two. Although churn was generally an issue in the Medicaid-only population, it was less common in the dually eligible population, meaning these results are not attributable simply to sample selection. As health care innovators consider home-based intensive care models, they should expect that results may be uneven over time, and look to confirm whether early experiences persist. When managing chronic conditions such as diabetes and high blood pressure, it is also possible that the long-term benefits of care management may take more than two years to accrue.

Finally, the two evaluations presented in this brief represent an important investment in rigorous evaluation work. But the evaluations also highlight the challenges of conducting non-experimental studies when examining impacts for high-cost, high-need populations. Even the most carefully designed non-experimental studies cannot completely eliminate potential selection bias, where members who self-select to engage with the home-based intensive care model might be different than comparison beneficiaries who do not. Non-experimental studies also risk regression-to-the-mean bias, in which members likely engage with services after a crisis and then appear to improve over time simply because their reference point is their moment of crisis. Future studies could generate stronger evidence if they employ a randomized controlled trial, which mitigates biases and allows researchers to estimate a true causal impact of the intervention. Although not always feasible from technical, ethical, or cost perspectives, randomized controlled trials are the gold standard for generating evaluation evidence that health care plans and policymakers can rely on to inform their decision making.

The partnership between Landmark, IEHP, and HPSM represented a novel care model that aimed to provide better care to Medicaid members with multiple chronic conditions. While providing services to a cohort of high-risk and high-cost Medicaid members is challenging, the partnership succeeded in achieving favorable results on several of the core outcomes of the intervention. Moreover, all partners were committed to learning from their experience and to broadly disseminating those findings, a commendable effort not consistently seen with health care innovations. Together with findings from other programs, our findings support the idea that providing coordinated home-based services that include a behavioral health component and address patients' unmet social needs can meaningfully reduce acute care spending. Supported by a growing body of evidence, home-based care models have established themselves as an important approach to improving the quality and efficiency of care for patients with complex health care needs across the spectrum of healthcare payers.

Endnotes

¹ Landmark selected adult beneficiaries with five or more chronic conditions from the following diagnoses documented in claims: hypertension, heart disease and heart failure, chronic kidney disease, diabetes, pulmonary disease, cancer, vascular disease, depression, dementia, and liver disease. Eligibility for Landmark's services was not conditional on utilization.

² Bodenheimer, T., and R. Berry-Millett. "Follow the Money—Controlling Expenditures by Improving Care for Patients Needing Costly Services." *New England Journal of Medicine*, vol. 361, no. 16, 2009, pp. 1521–1523.

³ S. Goodell, T. Bodenheimer, and R. Berry-Millett. "Care Management of Patients with Complex Health Care Needs." Synthesis Project, Research Synthesis Report no. 19, December 2009. Available at https://pdfs.semanticscholar.org/a25f/1bb0c8e97c1a00aa5766773ee74106fb5abe.pdf?_ga=2.76809813.1749707410.1583423767-1702678407.1582826259. Accessed March 5, 2020.

⁴ Powers, B.W., F. Modarai, S. Palakodeti, M. Sharma, N. Mehta, S.H. Jain, and V. Garg. "Impact of Complex Care Management on Spending and Utilization for High-Need, High-Cost Medicaid Patients." *American Journal of Managed Care*, vol. 26, no. 2, 2020.

⁵ Centers for Medicare & Medicaid Services. "Affordable Care Act Payment Model Continues to Improve Care, Lower Costs." 2016. Available at <https://www.cms.gov/newsroom/press-releases/affordable-care-act-payment-model-continues-improve-care-lower-costs>. Accessed September 27, 2018.

⁶ Finkelstein, A., A. Zhou, S. Taubman, and J. Doyle. "Health Care Hotspotting—A Randomized, Controlled Trial." *New England Journal of Medicine*, vol. 382, no. 2, 2020, pp. 152–162.

⁷ IEHP and HPSM defined their quality metrics for follow up care differently. The HPSM study examined follow-up care following inpatient and SNF stays, while the IEHP study only looked at follow up following inpatient stays.

⁸ Niefeld M.R. and J.D. Kasper. Access to ambulatory medical and long-term care services among elderly Medicare and Medicaid beneficiaries: organizational, financial, and geographic barriers. *Med Care Res Rev.* 2005 Jun;62(3):300-19. doi: 10.1177/1077558705275418. PMID: 15894706.

⁹ Stall, N., M. Nowaczynski, and S.K. Sinha. "Systematic Review of Outcomes from Home-Based Primary Care Programs for Homebound Older Adults." *Journal of the American Geriatrics Society*, vol. 62, no. 12, 2014, pp. 2243–2251.

¹⁰ Hughes, S.L., F.M. Weaver, A. Giobbie-Hurder, L. Manheim, W. Henderson, J.D. Kubal, and J. Cummings. "Effectiveness of Team Managed Home-Based Primary Care: A Randomized Multicenter Trial." *Journal of the American Medical Association*, vol. 284, no. 22, 2000, pp. 2877–2885.

¹¹ Wiener, S. "Interest in Hospital-at-Home Programs Explodes During COVID-19." Association of September 29, 2020. Available at https://www.aamc.org/news-insights/interest-hospital-home-programs-explodes-during-covid-19?utm_source=sfmc&utm_medium=email&utm_campaign=aamcnews&utm_content=newsletter. Accessed October 20, 2020.

¹² Spencer A., B. Freda, T. McGinnis, and L. Gottlieb. "Measuring Social Determinants of Health among Medicaid Beneficiaries: Early State Lessons." Center for Health Care Strategies website. https://www.chcs.org/media/CHCS-SDOH-Measures-Brief_120716_FINAL.pdf. Published December, 2016. Accessed November 2, 2020

Acknowledgements

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Methods for IEHP Study

Regression analysis. The impact estimates are based on a difference-in-differences study design. With this design, we measure program effects as the change in outcomes among study participants before versus after enrollment relative to the change in outcomes among a comparison group with similar characteristics over the same period. In this analysis, we define the pre-enrollment period as the year before each participant's enrollment date and the post-enrollment period as the two years after. Under the assumption that external trends affect both groups similarly, a comparison group that is well matched on observable and unobservable characteristics will produce unbiased estimates of program effects. The relative difference between the treatment and comparison group is calculated by comparing the pre-post difference among engaged group members to the pre-post difference among comparison group members.

Sample selection. Our main analysis sample is restricted to beneficiaries who were continuously enrolled with IEHP and observable for the entire analysis period, 2015-2018. We imposed this restriction to ensure that (1) there were no gaps in enrollment and (2) our sample did not change over time in ways that would bias our results. N = 3,224 dually eligible enrollees (years 1 and 2); N = 1,203 Medi-Cal only enrollees (year 1 only)

Sensitivity analyses. We also analyzed the sensitivity of our results by implementing two difference-in-differences analysis models, one without adding any covariates to the regression model and the other excluding extreme values (higher than the 99th percentile) from the continuous outcome measures. Both models provided results consistent with the findings from the primary analysis.

Qualitative analyses. We conducted interviews in 2016 and 2017 with IEHP and Landmark operational staff and IEHP primary care providers who treated Landmark-engaged patients.

Methods for HPSM Study

Regression analysis. We used a single interrupted time series model with a study sample that included all members eligible for home-based intensive care services, regardless of whether they engaged with the intervention (intention-to-treat). To account for the gradual ramp-up in engagement, we assessed the association between each outcome variable and the fraction of the beneficiary cohort engaged with Landmark rather than the association with time since Landmark began enrollment. We could not identify a viable comparison group within HPSM's patient population because all beneficiaries in HPSM who met chronic conditions criteria were eligible for home-based intensive care services, and more than half those eligible beneficiaries enrolled. The single interrupted time series approach, which does not require a comparison group, uses many time periods in the pre-intervention period to estimate trends in the outcome variable of interest, such as ED visits per 1,000 members per month, and then uses this forecast as a counterfactual against which to compare the observed outcomes during the intervention period. The estimated effect of the intervention is the difference between the outcome observed in the data and the forecast benchmark drawn from pre-intervention trends.

Sample selection. Our main analysis sample is restricted to beneficiaries who were continuously dually eligible and enrolled with HPSM for the entire analysis period from February 2015 to October 2018. We imposed this restriction to ensure that (1) there were no gaps in enrollment and (2) our sample did not change over time in ways that would bias our results. N = 2,101 dually eligible enrollees.

Sensitivity analyses. We conducted several sensitivity analyses to test the robustness of our main analysis to alternative choices for sample selection and regression model specification. In one sensitivity analysis, we conducted a placebo test that restricted the sample to beneficiaries who were never engaged with home-based intensive care services during the study period. For this never-engaged group, we would expect to see no break in outcome trends around the time Landmark began engaging with HPSM beneficiaries. These alternative sample and model choices enabled us to test the robustness of our results to different decisions we made about how to conduct our analysis. Results reported in this brief are consistent across multiple sensitivity analyses and the placebo test, which gives us confidence that we are observing a real effect of the intervention.