

# Health in Housing: Exploring the Intersection between Housing and Health Care

A study completed by Center for Outcomes Research and Education (CORE) in partnership with Enterprise Community Partners, Inc., and with generous support from the Meyer Memorial Trust.



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### ABOUT THE CENTER FOR OUTCOMES RESEARCH AND EDUCATION (CORE)

The Center for Outcomes Research and Education is an independent research hub based in Portland, Oregon. They work on research projects to improve health system transformation and population health, particularly for Medicaid beneficiaries and low-income individuals. CORE partners with health systems, state agencies, and community groups to help them meet the triple aim of better health, better care and lower costs. Recent work includes quantifying how adverse life events impact health outcomes, and using cutting-edge data science to examine the intersection of health care with services such as housing, education, and corrections.

#### CORE Study Team:

Bill Wright, Ph.D.  
Grace Li, Ph.D.  
Maggie Weller, M.S.  
Keri Vartanian, Ph.D.

#### For more information:

Maggie Weller, Maggie.Weller@providence.org  
Keri Vartanian, Keri.Vartanian@providence.org  
Providence Health & Services  
5211 NE Glisan St., Bldg. C  
Portland, OR 97213



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#### Enterprise Project Team:

Amanda Saul  
Cheryl Gladstone  
Mari Matsumoto  
Howard Klink, Klink Consulting Group

#### For more information:

Amanda Saul, [asaul@enterprisecommunity.org](mailto:asaul@enterprisecommunity.org)  
Cheryl Gladstone, [cgladstone@enterprisecommunity.org](mailto:cgladstone@enterprisecommunity.org)

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## FOREWORD | HOUSING IS A CRITICAL VACCINE

By Megan T. Sandel, MD, MPH

Associate Professor of Pediatrics, Boston University School of Medicine | Board of Trustees, Enterprise Community Partners, Inc.

*Health in Housing: Exploring the Intersection between Housing and Health Care* is an important and pioneering study. Its findings contribute keen insights and evidence as we work toward elevating ongoing discussions on the intersection between health and housing into a clear national priority.

As a physician, *Health in Housing* speaks to what I see in my work every day: far too many low-income people who lack access to primary care and as a result seek treatment for chronic conditions at emergency rooms. For many of my patients, concerns about keeping up with doctor appointments and medications are far outweighed by trying to pay their rent on time or finding safe and stable housing.

An affordable home that connects people to opportunity through health care as well as good schools, jobs and transit is the foundation for a healthy, productive life. For many years, I have shared my fundamental belief that housing is a critical vaccine that can pave the way to long-term health and well-being. Securing affordable housing for vulnerable families with children, older adults and formerly homeless individuals is indeed the platform for increasing access to primary and preventative care. It is also a critical and necessary long-term investment.

The *Health in Housing* study involved residents and health care services based in Portland, Oregon, yet it holds national implications for health care systems, payers and policy makers looking for upstream solutions to address major health care needs and fulfill health care reform goals. Housing with integrated health services is an important solution toward bending the health care cost curve.

Adding to a growing evidence base, the study offers clear recommendations:

- States, localities and managed care organizations should invest resources such as Medicaid in housing solutions that research shows can improve health outcomes and reduce health expenditures for vulnerable individuals.
- Health services must be integral to affordable housing developments: States, policymakers and payers should explore devoting Medicaid resources to health-related services and resources such as resident services coordinators. As this study shows, stable housing plus health-related services can yield significant cost savings and improve resident health outcomes.

The study also provides a solid foundation on which to begin building policy reform:

- In support of more upstream investments into the social determinants of health, the Internal Revenue Service should require that community health needs assessments by nonprofit health organizations regularly include affordable housing in their assessments and community improvement plans.
- The Department of Housing and Urban Development should invest more in Section 4 grant dollars to build the capacity of community development organizations, and the Department of Health and Human Services should invest through the Health Resources and Services Administration to provide more technical assistance and support for housing organizations to collaborate on housing and health.

*Health in Housing* contributes vital evidence to move forward on major health care reform priorities: delivering quality health care, achieving better health outcomes, and reducing health care costs by creating affordable housing linked to health services. I welcome you to share this study with your peers and colleagues and think about how you can encourage further linkages between health and stable housing.



## EXECUTIVE SUMMARY

This study, conducted by the Center for Outcomes Research & Education (CORE), directly explores the link between affordable housing and health care through the lens of several national health reform metrics: better connection to primary care, fewer emergency department (ED) visits, improved access to and quality of care, and lower costs.

This is one of the first studies to directly assess the impact on health care costs when low-income individuals move into affordable housing. Medicaid claims data were used to measure changes in health care costs and use, and survey data were used to examine health care access and quality. The study included 145 housing properties of three different types: family housing (FAM), permanent supportive housing (PSH), and housing for seniors and people with disabilities (SPD). The impact of integrated services within housing was also considered.

### Four Key Findings

**1** Costs to health care systems were lower after people moved into affordable housing.

- Total Medicaid expenditures declined by 12 percent.
- Declines in expenditures were seen for all housing types.
- IMPLICATION: *Access to affordable housing will likely drive down costs to the health care system.*

Overall	FAM	PSH	SPD
-12%	-8%	-14%	-16%

**2** Primary care visits went up after move-in; emergency department visits went down.

- Outpatient primary care utilization increased 20 percent in the year after moving in, while ED use fell by 18 percent.
- Similar trends were observed for each housing type.
- IMPLICATION: *Affordable housing helps meet major health reform utilization metrics.*

Primary Care: +20%      ED Visits: -18%

**3** Residents reported that access to care and quality of care improved after moving into housing.

- Many residents reported that health care access and quality were better after move-in than before; very few people reported it was worse.
- IMPLICATION: *Expenditure and utilization differences did not come at the expense of access or quality.*

ACCESS to health care after moving to affordable housing	Better	Worse	QUALITY of health care after moving to affordable housing	Better	Worse
	40%	4%		38%	7%

**4** Integrated health services were a key driver of health care outcomes.

- The presence of health services was a driver of lower costs and ED use, despite low awareness among residents. (See Exhibits 1 to 21.)
- IMPLICATION: *Increasing use of these services may result in even greater cost differences.*

**Adjusted impact of health services:**

EXPENDITURES	-\$115 member/month	ED VISITS	-0.43 visits/year
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## In Summary: What We Learned

When Medicaid-covered residents moved into one of the 145 different affordable housing properties included in this study, their health care experiences changed dramatically. Over the following year, they used more primary care, had fewer ED visits, and accumulated lower medical expenditures than in the year before they moved to affordable housing. Many also reported better access to and quality of care.

The availability of integrated health services to housing residents was a key driver behind lower costs and fewer emergency department visits despite the fact that many residents did not know such services were available. This suggests there may be potential for even greater impact if awareness and use of health services were increased.

We live in a profoundly interconnected world. In the emerging era of accountable care, health care systems and affordable housing providers may want to mutually consider the potential benefits of stronger cross-sector collaboration.

The availability of integrated health services to housing residents was a key driver behind lower costs and fewer emergency department visits.



## INTRODUCTION

**T**his study was designed to assess the potential impact of affordable housing and integrated health services on health care outcomes. We used Medicaid claims and survey data to examine key health care outcomes for people who moved into one of three common affordable housing types: family housing, permanent supportive housing, or housing for seniors and people with disabilities. We paid special attention to the role integrated services played in driving variation in those outcomes.

This is a descriptive study that follows a cohort of people before and after they moved into affordable housing. The results are not contextualized against the experiences of similar individuals who did not receive housing. However, the results are still instructive, as there is very little research that directly ties housing to health care claims and encounter data.

### A Changing Conversation

Health care reform, particularly the accountable care movement, has increasingly called upon health care systems to recognize the importance of upstream factors – the “social determinants of health” – in driving health outcomes. Housing stability has been widely recognized as a key piece of that strategy, and some health care systems have begun investing in integrated services at affordable housing properties in hopes of providing better care at lower overall costs. However, the argument connecting housing stability to the priorities of health reform has, to date, been largely theoretical: There is a need for empirical research that connects data across these two sectors to examine the impact of housing and services on key health care outcomes such as cost, quality and health. Additionally, the national conversation is changing as the Centers for Medicare and Medicaid Services announced in 2015 that Medicaid dollars can be used for housing services and supports, and more states are beginning to leverage those dollars.

Oregon provides a unique environment to conduct such research. Beginning in 2012, the state reorganized its Medicaid delivery system through a series of regional Coordinated Care Organizations (CCOs). In this system, CCOs have the responsibility to care for Medicaid members in their community under a fixed global budget and a new flexibility in how that budget can be distributed to meet needs. Oregon’s CCOs create a potential architecture to rethink how health care dollars might be invested to control or reduce expenditures and promote population health.

### What’s New About this Study

There are many studies on the importance of affordable housing, but few directly explore the links between housing and health care. A small pilot study conducted by CORE in 2015 found promising evidence of reduced medical expenditures for individuals living at a permanent supportive housing facility, but results were too site-specific to generalize.<sup>1</sup> A few other studies have suggested a possible link between affordable housing and lower emergency department (ED) or hospital use,<sup>2,3</sup> but have not directly assessed potential cost savings associated with those reductions.

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1 Bud Clark Commons Report: [www.providenceoregon.org/CORE](http://www.providenceoregon.org/CORE).

2 Sadowski LS, Kee RA, VanderWeele TJ, Buchanan D. Effect of a housing and case management program on emergency department visits and hospitalizations among chronically ill homeless adults: A randomized trial. *Journal of the American Medical Association*. 2009 May 6; 301(17): 1771-8.

3 Srebnik D., Connor T., Sylla L. A pilot study of the impact of housing first-supported housing for intensive users of medical hospitalization and sobering services. *American Journal of Public Health*. 2013 Feb.; 103(2): 316-21.

This study expands upon these preliminary research efforts to assess the potential impacts of affordable housing on medical expenditures, as well as access to and quality of health care, using a combination of health care claims and self-reported survey data. Our study is more comprehensive than previous efforts, encompassing 145 low-income housing properties in and near Portland, Oregon, that are home to more than 10,000 individuals. This study is also unique in that it is not limited to individuals who were formerly or chronically homeless. In fact, it separately assesses impacts for different types of affordable housing (family housing, permanent supportive housing, and housing for seniors and people with disabilities). Additionally, this study examines the distinct role that integrated services may play in driving outcomes.

## Key Study Objectives

### OBJECTIVE 1

Assess the impact of affordable housing on health care outcomes in a low-income population who have experienced housing instability.

We used Medicaid claims and survey data to evaluate health care access, quality, utilization and expenditures for individuals before and after moving into one of the participating affordable housing properties.

### OBJECTIVE 2

Assess the role that discrete integrated services play in driving changes in health care expenditures and quality outcomes.

We examined the impact of integrated services offered at the housing residence on health care outcomes using Medicaid claims and survey data.

## METHODOLOGY

### Overview of Study Design

We employed a retrospective, pre/post, longitudinal cohort design to assess the impact of housing and services on a variety of health- and health care-related outcomes. We examined outcomes at three types of housing properties – family housing (FAM), permanent supportive housing (PSH), and housing for seniors and people with disabilities (SPD) – separately and together. Medicaid claims data were used to assess differences in health care utilization and expenditures, while survey data were used to assess quality, access and health outcomes.

This was a descriptive, pre/post study – our results do not include a comparison group. Further research will be needed to contextualize these findings against the experiences of similar individuals who did not acquire affordable housing.

### Assessing Utilization & Cost: Claims Data Analysis

We partnered with Health Share of Oregon, a local Medicaid CCO, to employ a comprehensive historical Medicaid claims database for assessing utilization and costs. Our data contained all Medicaid claims from January 2011 to June 2015, including physical, behavioral health and dental claims for anyone enrolled in one of the CCO's managed care plans during that time.

We obtained a list of residents at each of our 145 participating housing properties (a total of 10,903 residents), then probabilistically matched that list to the Medicaid claims database. Not all residents were members of our partnering CCO; also, we required residents to have move-in dates that fell within our analysis window and to have at least three months of health care coverage before and after their move-in date to include them in the analysis. After matching and applying exclusion criteria, our final claims analysis included data on 1,625 individuals across our participating study properties.

All participants were indexed according to the date they moved into their current housing property. Claims data were then used to construct a dataset capturing utilization and costs before and after that index date for each person.

### Assessing Access & Quality: Survey Data

We developed a short survey instrument to collect self-reported data directly from residents on several key outcomes:

- **Access & Quality:** Residents were asked about their ability to get all the health care they needed, and the quality of that care, before and since their move-in date.
- **Subjective Health:** Residents were asked to subjectively rate their health before and since their move-in date.
- **Use of Services:** Residents were asked about their awareness of, and use of, available services designed to support their health needs.

Surveys were sent to 513 individuals living at 12 different properties; 275 residents responded (54 percent).

In addition to resident surveys, we developed an assessment designed to be filled out by staff at each housing property. This tool was intended to assess the availability of distinct types of integrated supportive services available through each property, with a special focus on services related to health and health care. We received completed assessments capturing available services for each of our 145 distinct housing properties.

*See Appendix A for more detailed information on our study design, sampling criteria, data collection protocols and statistical methods for each type of analysis.*

## Statistical Analyses

Descriptive Pre vs. Post Comparisons	Difference-in-Differences (DiD) Analysis	Outcomes Modeling
<p>We used paired t-tests (used to statistically compare results from two populations) to assess whether rates of health care utilization and expenditures were significantly different before and after individuals moved into an affordable housing property. To provide more robust estimates and mitigate the influence of extreme outlier cases, analyses were repeated with outliers trimmed. Statistical significance was determined using p-value &lt;0.05.</p>	<p>To determine the impact of integrated services on outcomes over time, we performed difference-in-differences (DiD) analyses. This type of test assesses whether the pre/post change seen among clients in properties that offer a given service is different from the pre/post change seen among clients in properties without that service.</p>	<p>To account for potential demographic differences and health profiles, adjusted analyses were performed using multivariate regression models. These models provide estimates of effects while controlling for the influence of potentially confounding variables such as residents' age, gender, race, ethnicity or medical complexity.</p>

## HOUSING PROFILES: A CLOSER LOOK AT THE PROPERTIES PARTICIPATING IN THE STUDY

### Types of Properties

A total of 145 properties consisting of approximately 10,250 units participated in this study; these properties are run by nine different housing organizations and home to 10,903 residents. Participating properties cut across three major types of affordable housing: general supportive housing for families (FAM), permanent supportive housing (PSH), and housing for seniors and people with disabilities (SPD).

The following organizations partnered with us and had properties included in the study: Cascadia Behavioral Health, Catholic Charities, Cedar Sinai Park, Central City Concern, Home Forward, Human Solutions, Innovative Housing, Inc., Northwest Housing Alternatives and REACH Community Development.

Affordable housing is defined as income-restricted multifamily permanent rental housing that receives development, capital, rental and/or operating subsidies from federal, state and local sources.

Type	Description	Properties
<b>FAM</b>	Properties that mainly include two- to four-bedroom units and are built specifically for family and community-style housing.	<b>74</b>
<b>PSH</b>	Properties that serve individuals through studio and/or one-bedroom units, some of whom had been experiencing homelessness or have behavioral health or substance-use issues.	<b>30</b>
<b>SPD</b>	Properties that serve older adults who meet a minimum age requirement and/or individuals with specific physical and behavioral health disabilities.	<b>41</b>
		<b>145</b>

## Services & Staff

A key aim of our study was to assess the impact of integrated services, available or coordinated on site, on outcomes of interest. We used a property-assessment tool, completed by resident services coordinators or other staff, to capture the availability of different integrated health staff and services across the 145 participating housing properties.

Our assessment tool captured a wide variety of services, which we collapsed into a more discrete set of categories. (See Exhibits 1 and 2 on page 14.)

A wide range of health-related services were available for residents (Exhibit 2), with a diversity of staff available at various properties as well (Exhibit 1). The intensity and type of those services varied widely – more than half of the housing properties in our study offered integrated medical resources of some kind, for example, but only a few took the form of on-site doctors or nurses.

The wide variation of services and staff integrated into the housing properties provides an excellent opportunity to evaluate the impact of these services on key health outcomes.

Exhibit 1. Available On-site Staff	N	%
Resident Services Coordinator	128	88%
Activities Coordinator	9	6%
Community Health Worker or Health Navigator	16	11%
Doctor, Nurse or Nurse Practitioner	9	6%
Social Worker	11	8%
Other Health Professional	19	13%

Exhibit 2. Available Services	N	%
Food Resources	98	68%
Medical Resources	52	36%
Insurance Assistance	51	35%
Mental/Behavioral Health	42	29%
Fitness	33	23%
Nutrition/Cooking	27	19%
Transportation	22	15%
Dental Resources	5	3%
Other	79	54%

Source: Property-assessment tool filled out by staff (n=145)

## PARTICIPANT PROFILES: A CLOSER LOOK AT RESIDENTS OF PARTICIPATING PROPERTIES

### Residents Included in the Claims Analysis

A total of 1,625 qualifying individuals living in the 145 participating properties were included in the claims analysis. To qualify, individuals must have:

- Moved into their current housing property during our study window
- Been receiving Medicaid benefits through our partnering Medicaid CCO
- Had a minimum of three months of Medicaid coverage before and after their move-in date

We enforced these criteria to ensure adequate data for pre/post comparisons. Our claims panel was split between residents of each housing type (Exhibit 3). Note that our claims analysis did not include Medicare data.

### Demographics & Health

Residents' demographic profiles varied based on housing type (Exhibit 4). For example, residents in family housing (FAM) were more racially diverse, while those in permanent supportive housing (PSH) and housing for seniors and people with disabilities (SPD) profiled as having substantially greater medical complexity, with nearly nine in 10 (85 percent) having at least one physical (PH) or behavioral health (BH) chronic condition, and nearly half having at least one of each.

### Exhibit 3. Cohorts for Claims Analysis

Residents with Claims N=1,625	FAM	PSH	SPD
	N=916	N=278	N=431

### Exhibit 4. Profile of Claims Panel\*

DEMOGRAPHICS		FAM	PSH	SPD
Gender	Male	38%	65%	48%
	Female	62%	35%	52%
Age	<18	38%	1%	0%
	18-30	19%	6%	3%
	31-45	23%	26%	13%
	46-64	15%	60%	50%
	65+	4%	6%	34%
Race	White	43%	73%	70%
	Black/African-American	27%	15%	12%
	American Indian	1%	2%	2%
	Asian	4%	<1%	8%
	Other	24%	9%	7%
Ethnicity	Hispanic	15%	5%	4%
Health	No PH, no BH	52%	16%	15%
	No PH, 1+ BH	8%	19%	11%
	1+ PH, no BH	28%	22%	40%
	Has PH & BH	12%	43%	33%
	Baseline Expenditures (per member month)	\$257	\$649	\$525

\*Not all categories add up to 100 percent due to rounding.



## Baseline Costs

At the time of their move-in, most participants in our Medicaid claims analysis had significant health care expenditures (Exhibit 4, page 15). Residents in PSH averaged \$649 per month in total health care expenditures prior to moving in, much higher than the \$401 average monthly costs for a typical adult Medicaid member in our partnering CCO. Similarly, SPD residents averaged \$525 per month. Baseline expenditures were lower for residents of FAM housing, but those data also include children, whose average health care expenditures tend to be lower than adults.

## Residents Included in the Survey Analysis

We selected 12 of the original 145 housing properties included in the claims analysis to survey (four from each housing type) based on their having large numbers of residents receiving Medicaid benefits from our partnering CCO. We sent 513 surveys and 275 people responded (Exhibit 5). Sample characteristics were comparable to those of our claims panel (Exhibit 4), with FAM housing residents more likely to be female and racially diverse, while PSH and SPD residents tended to be older (Exhibit 6). Very few PSH and SPD residents reported having children in the home.

Residents under 18 years of age did not participate in the self-report survey.

## What We Wanted to Know

We wanted to understand the extent of the disease burden experienced by the individuals living in the different housing types. For the 1,625 individuals in the claims analysis, we used Medicaid claims data to determine the percentage of individuals who had behavioral or physical health diagnoses. We also computed the prevalence of these conditions experienced by individuals in our study across the total population of adult Oregonians in the Portland-metro area receiving Medicaid coverage through our partnering CCO (not just affordable housing residents) as a reference point for what may be considered typical.

## Exhibit 5. Client Survey Respondents

513 Surveys Sent	275 Residents (54% response rate)		
	FAM N=81	PSH N=83	SPD N=111

## Exhibit 6. Profile of Survey Respondents\*

DEMOGRAPHICS		FAM	PSH	SPD
Gender	Male	28%	68%	41%
	Female	72%	32%	59%
Age	18-30	31%	7%	2%
	31-45	32%	22%	5%
	46-64	31%	64%	51%
	65+	6%	7%	42%
Race	White	54%	70%	60%
	Black/African-American	28%	17%	11%
	American Indian	7%	7%	12%
	Asian	3%	1%	6%
	Other	8%	6%	10%
Ethnicity	Hispanic	7%	7%	9%
Household	≥ 1 child	83%	2%	2%

\*Not all categories add up to 100 percent due to rounding.

## What We Found: Physical & Behavioral Health

Within the Medicaid claims panel sample, the prevalence of physical health diagnoses were most common in SPD and least common for FAM housing. In PSH and SPD, all physical health conditions were present at levels well above the average rates. The high rates in SPD are likely due to the elderly and disabled population. For PSH, this indicates the high level of physical health disease burden for these residents. Rates for physical health conditions were usually at or below typical levels for individuals in FAM housing, except asthma and obesity, which were present at above average rates (Exhibit 7).

**Behavioral Health:** The rates of behavioral health diagnoses were above average for residents in PSH and SPD. The most common diagnoses for residents in PSH and SPD were affective disorder and depression. All behavioral health diagnoses were most prevalent in PSH, where these conditions were present from two to six times higher than typical rates. In FAM housing, behavioral health diagnoses were prevalent in rates that were comparable to the average for the general Medicaid population (Exhibit 7).

### Exhibit 7. Physical and Behavioral Health Diagnoses

Diagnoses	FAM	PSH	SPD	Avg. Medicaid Member
<b>Physical Health</b>				
None	60%	35%	27%	64%
Hypertension	14%	42%	54%	20%
Asthma	18%	21%	20%	9%
Diabetes	8%	17%	28%	10%
Obesity	17%	20%	21%	12%
Chronic Obstructive Pulmonary Disease (COPD)	3%	15%	19%	3%
Liver Disease	3%	10%	11%	3%
Chronic Bronchitis	1%	8%	9%	2%
Chronic Ischemic Heart Disease (CIHD)	2%	5%	10%	3%
Chronic Heart Failure (CHF)	1%	6%	9%	1%
Emphysema	<1%	4%	5%	1%
<b>Behavioral Health</b>				
None	80%	49%	56%	83%
Affective Disorder	17%	51%	34%	13%
Depression	13%	34%	26%	10%
Chemical Dependency	2%	11%	9%	2%
Non-Organic Psychosis	3%	15%	10%	2%
Psychotic Disorder	3%	20%	11%	3%
Paranoid States	<1%	2%	2%	<1%

## RESULTS: HEALTH CARE EXPENDITURES

### Key Finding

For the 1,625 persons in our claims panel, health care expenditures were 12 percent lower the year after moving into affordable housing than in the year before. Expenditures were lower for residents across all three housing types, but were statistically significant for PSH and SPD residents. Total annual expenditures were \$936,000 lower in the year after moving in.

### What We Wanted to Know

Medicaid claims data were used to assess differences in total health care expenditures in the year before and after moving into affordable housing. We wanted to know if total expenditures tended to go down after moving into housing, which might indicate that housing helps optimize care delivery and reduce overall health care costs.

We computed total medical expenditures per member per month (PMPM) for the year before and the year after each participant's move-in date.

### What We Found

Results of our analysis on Medicaid health care expenditures are detailed in Exhibit 8. We accounted for the influence of outliers by removing participants with claims above the 95<sup>th</sup> percentile.

- Total Expenditures:** Total health care expenditures for our claims panel were 12 percent lower (-\$48 per member per month) in the year after moving into affordable housing than in the year before move-in. This difference was evident across all three types of housing, but was only statistically significant for PSH and SPD housing. Health care expenditures can change due to reduction in the number of services used or in the price of services. As noted in the Health Care Utilization section (page 19), there were dramatic changes in use. These changes, especially the reduction in more costly acute care, are the most likely source of the reduced expenditures.
- Total Annualized Difference:** We can estimate the total difference in expenditures for the 1,625 individuals in our study (Exhibit 9). In total, Medicaid health care for these 1,625 persons cost \$936,000 less in the year after they moved into affordable housing compared to the year before they moved in.

Exhibit 8. Pre/Post Change in Medicaid Health Care Expenditures (PMPM)*					
	Pre	Post	Δ	%Δ	p value
<b>Overall</b>	\$386	\$338	-\$48	-12%	<b>0.00</b>
<b>FAM</b>	\$262	\$240	-\$22	-8%	0.12
<b>PSH</b>	\$616	\$532	-\$84	-14%	<b>0.03</b>
<b>SPD</b>	\$525	\$441	-\$84	-16%	<b>0.00</b>

\*Outliers above the 95<sup>th</sup> percentile were removed.

### Exhibit 9. Yearly Change in Medicaid Health Care Expenditures

HSO HOUSING PARTICIPANTS		DIFFERENCE IN EXPENDITURES		YEARLY CHANGE
ALL N=1,625	X	-\$48/month x 12 months	=	-\$936K
FAM N=916	X	-\$22/month x 12 months	=	-\$241K
PSH N=278	X	-\$84/month x 12 months	=	-\$280K
SPD N=431	X	-\$84/month x 12 months	=	-\$434K

## RESULTS: HEALTH CARE UTILIZATION

### Key Finding

After moving into affordable housing, residents used more primary care (+20 percent) and less emergency department (ED) care (-18 percent) than in the year prior to moving in. This pattern held true across all three types of housing. Reductions in inpatient care were also evident, but were not statistically significant in this sample, possibly due to low statistical power.

### What We Wanted to Know

Medicaid claims data were used to determine the impact of housing on utilization of primary care, ED and inpatient care (excluding obstetric visits). We wanted to determine whether affordable housing improved connections to primary care and reduced the use of acute care services, which might indicate that housing makes it easier for people to manage their health in a more efficient and cost-effective manner.

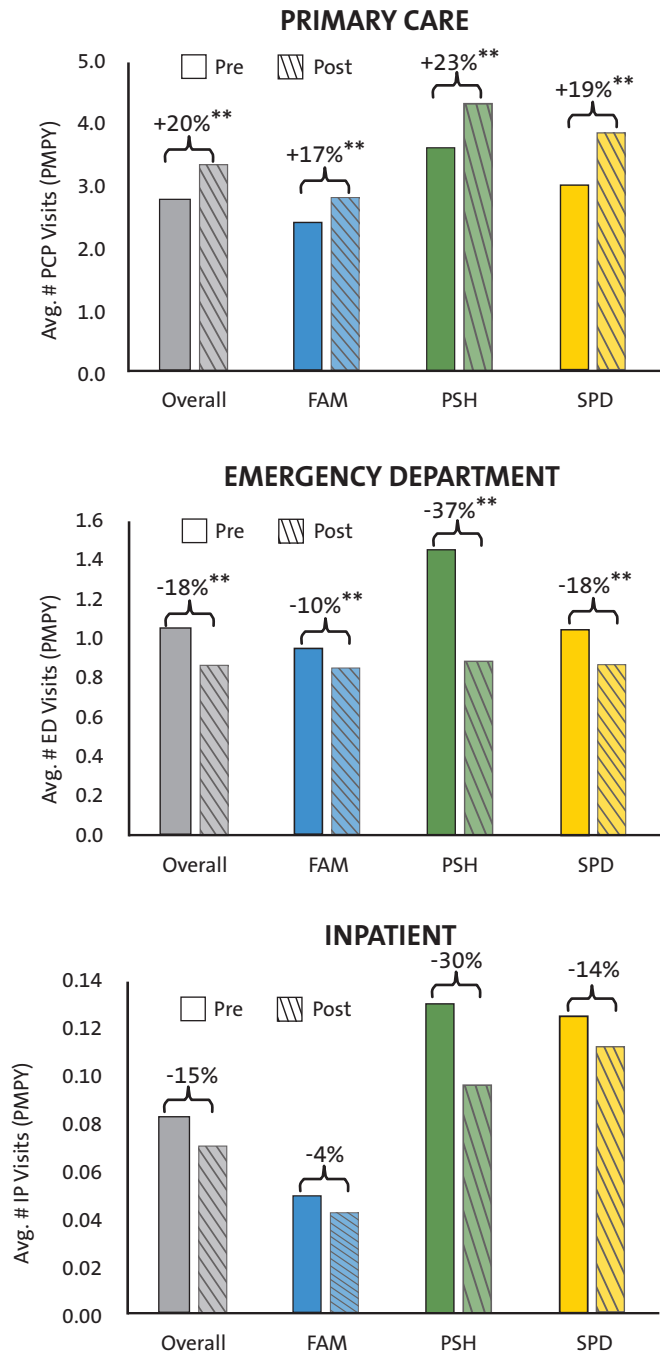
We computed the average number of visits per member per year (PMPY) for each of three types of care: primary care, ED visits and non-OB inpatient visits. We then compared utilization rates in our claims panel for the year before and the year after moving into housing.

### What We Found

Results of our analysis on health care utilization before and after moving into affordable housing are detailed in Exhibit 10.

- **Primary Care:** Residents used significantly more primary care (+20 percent) in the year after moving in than in the year before move-in. This statistically significant increase was observed for all housing types, with the largest change evident among PSH residents (+23 percent).

Exhibit 10. Pre/Post Avg. # of Visits PMPY\*



\*Outliers above 99th percentile were removed.

\*\*Statistically significant change, paired t-test,  $p < .05$ .

- **Emergency Department Visits:** Residents had significantly fewer ED visits (-18 percent) in the year after moving in than in the year before move-in. This difference was evident across all housing types, with the largest change among PSH residents (-37 percent).
- **Inpatient Events:** Residents did have fewer inpatient events in the year after moving in than in the year before move-in, but the results were not statistically significant. This may be a function of low statistical power given the study's sample size and the relative rarity of inpatient events.

Taken together, these data are suggestive of better optimized health care utilization, with more care happening in (less expensive) outpatient settings, and less care happening in (more expensive) acute settings. This is particularly evident in populations whose psychosocial risk was likely greatest prior to moving in (such as those in PSH or SPD housing), but was evident across all housing types.

*See Appendix B for a more detailed breakdown of changes in utilization across every category of health care.*

In the year after moving to affordable housing, residents used **20%** more primary care and had **18%** fewer emergency department visits.

## RESULTS: ACCESS & QUALITY OF CARE

### Key Finding

Results from our client survey indicate that reduced expenditures did not come at the expense of access to or quality of care. Many clients reported improved access and quality after moving in; very few reported having worse access or lower quality after moving in. We did find evidence of continuing unmet need in the domains of mental health and dental care.

### What We Wanted to Know

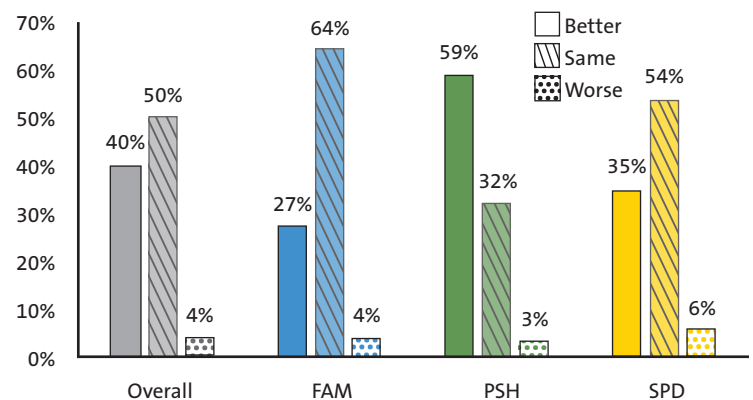
Client survey data were used to determine the self-reported change in access to and quality of health care since moving into affordable housing. We wanted to determine whether any reductions in expenditures came at the expense of people not getting care they felt they needed.

### What We Found

- Health Care Access:** Survey participants were asked whether their ability to get all the health care they need is better, the same or worse than it was before they moved into their current residence (Exhibit 11). We found that many respondents (40 percent) said their access to care was better and very few (4 percent) said it had gotten worse. Improvements were most evident among PSH residents.

We also wanted to understand respondents' current ability to access all the care they needed. We asked respondents whether they had recently needed medical, dental or mental health care, and if they did, whether they were able to get all the care they needed. We found that most (82 percent) of those who needed medical care were able to get all the care they needed, but that full access to dental and mental health care remained spottier (Exhibit 12).

**Exhibit 11. Access to Health Care Compared to the Year Before Moving into Current Residence**



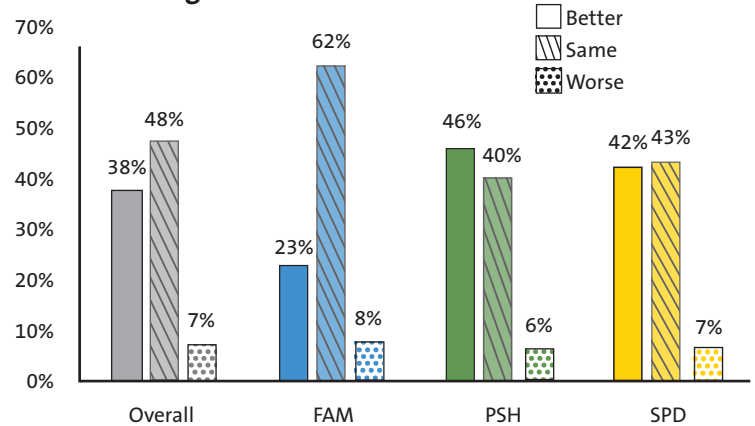
**Exhibit 12. Health Care Needs**

	Needed Care		Of Those, Received Care
Medical	82%	→	82%
Dental	62%	→	47%
Mental Health	45%	→	64%

- Quality of Care:** We asked participants to subjectively rate the overall quality of their health care since moving into their current housing property (Exhibit 13). Many participants (38 percent) reported better quality since moving in; very few (7 percent) reported that the quality of their care had gotten worse. Improvements were, again, most evident among the PSH and SPD clients.

See Appendix B for additional client survey results.

**Exhibit 13. Quality of Health Care Compared to the Year Before Moving into Current Residence**



**40%** of residents reported that their access to care improved after moving into affordable housing.



## RESULTS: SELF-REPORTED HEALTH

### Key Finding

A large portion of residents face substantial health challenges. Obtaining housing had a major self-reported health impact for individuals in permanent supportive housing (PSH), though there was no significant self-reported impact for adults in family housing (FAM) and housing for seniors and people with disabilities (SPD). Additionally, parents in family housing reported positive impacts on the self-reported health of their children.

### What We Wanted to Know

Self-reported survey data were used to determine whether clients' subjective assessments of their own health outcomes changed after moving into affordable housing. We were interested in exploring whether reduced medical expenditures after moving in were correlated with poorer health outcomes, or if there was any evidence that clients felt better about their own health status after moving into housing.

### What We Found

- **Overall Health:** A fairly substantial proportion of residents still face significant health challenges, especially in PSH and SPD housing, where nearly half rated their overall health as fair or poor (Exhibit 14).
- **Changes in Health Status:** We did not see strong evidence that affordable housing impacted subjective health in either direction: Clients were equally likely to report their health was better or worse since moving in, suggesting no clear directional pattern (Exhibit 15). The key exception was PSH clients, who were far more likely to report their health had improved (43 percent) than gotten worse (21 percent) since moving in.

Exhibit 14. Self-Reported Health of Residents

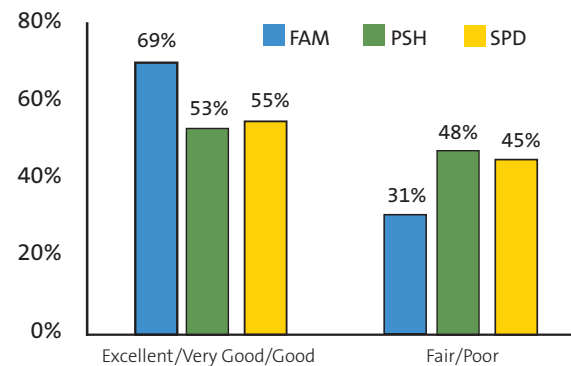
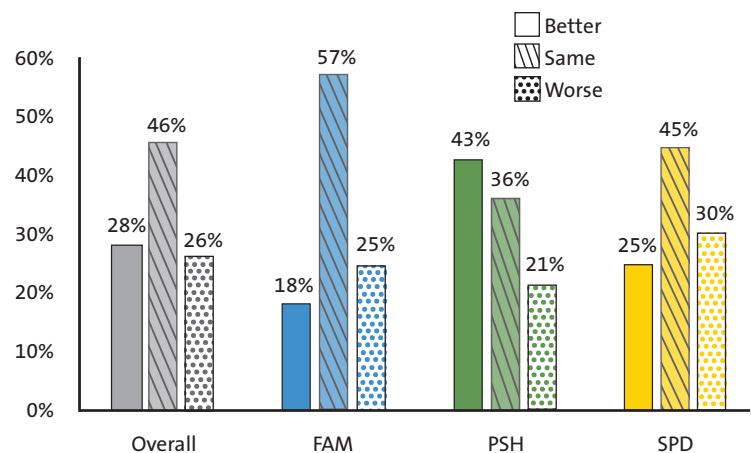


Exhibit 15. Change in Self-Reported Health Since Moving into Current Residence

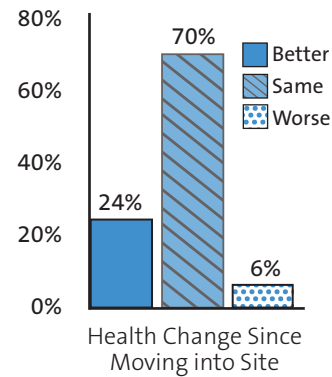


- Impacts on Children’s Health:** We also asked respondents with children (nearly all of whom were in FAM housing) to tell us about how their child’s health had changed since moving into their current residence (Exhibit 16). Here, we did see some signs of a positive health impact, with 24 percent reporting that their child’s health was better since moving in and only 6 percent reporting it was worse (the remainder were unchanged).

Overall, results on subjective health suggest that residents in these housing properties still face significant health challenges, but there is little evidence of significant changes in health since moving into affordable housing. It is important to note that most respondents had only been in their current housing unit for a year or two at the time of the survey, and long-term health impacts may not be evident in such a short time window. We did find some evidence that individuals in PSH thought that their housing had impacted their health, while housing also affected parents’ subjective assessment of their children’s health.

*See Appendix B for additional client survey results.*

**Exhibit 16. Change in Parents’ Subjective Assessment of Children’s Health Since Moving into Current Residence**



**24%** of families said their child’s health was better since moving into affordable housing.

## RESULTS: THE IMPACT OF SERVICES

### Key Finding

Analysis indicates that the presence of health services/staff is a significant driver of reductions in health care expenditures and emergency department (ED) usage. We did not find evidence that integrated social or wellness services were associated with reduced expenditures, but our study has important limitations and these services may provide other types of value.

### What We Wanted to Know

Housing agencies are increasingly exploring the addition of on-site staff and/or integrated services designed to help residents with their health needs. We wanted to investigate the potential role such services might play in driving outcomes: whether properties with such services tend to see better outcomes than properties without, and which types of services are closely associated with positive outcomes.

To explore the role of services in driving outcomes, we took two approaches. First, we divided our claims panel into those whose housing properties offered a given service, and those whose properties did not. Next, we compared their respective trends in outcomes between the pre/post-move-in periods using a difference-in-differences (DiD) analysis. This allowed us to assess associations between each type of service and our outcomes of interest. Second, we constructed multivariate regression models that explored the influence of each type of service on our outcomes while holding constant the influence of other services, as well as confounding factors like residents' demographic and health characteristics. This approach allows us to identify which factors are the most important underlying drivers of differences in utilization and costs over time.

### Data on Services

We captured data on which services were available at each housing property using a self-assessment tool filled out by a staff member representing each partnering housing property. We did not have sufficient statistical power in our study to rigorously test the influence of each individual service on outcomes. Instead, we grouped services into three broad categories (Exhibit 17), then grouped participants according to whether their property included at least one service of that type.

### AVAILABILITY VS. USE

It is important to note that we tested the impact of service availability on outcomes. This is not the same as use of services. In fact, clients may or may not be aware of and use all available services (see page 30). This indicates that the results for the impact of services are likely a conservative estimate.

#### Exhibit 17. Service Categories\*

##### HEALTH SERVICES/STAFF

Integrated medical, mental health or dental staff or services, including nurses and doctors, as well as transportation designed to help residents get to off-site services. (97 properties)

##### SOCIAL SERVICES/STAFF

Available assistance with psychosocial needs that might impact health, including community health workers and social workers. (15 properties)

##### WELLNESS SERVICES/STAFF

Assistance with general wellness, including staff who assist with food access, fitness and other residential activities. (107 properties)

\*Some properties offer more than one category of service.

## What We Found

- **Health Services/Staff:** Properties with health staff and services (such as doctors, nurses or other health professionals) saw significantly better reductions in ED visits and total expenditures than properties where those services were not available (Exhibit 18). We did not see differences between properties for primary care or inpatient visits. These results suggest that integrated medical resources may be a key driver of positive outcomes in some types of utilization, and in total expenditures.

- **Social Services/Staff & Wellness Services/Staff:** We did not see evidence in our DiD analysis that properties with social services/staff, such as social workers and community health workers (CHWs), had significantly better outcomes than properties without those resources (Appendix B). We also did not see significant differences in outcomes between properties with and without wellness staff, including staff who assist with food access or exercise and other activities for residents (Appendix B).

It is important to note that this study is focused on specific health and health care outcomes that were measured within a year of obtaining affordable housing. Social services/staff and wellness services/staff may represent longer-term investments in health care outcomes that are beyond the scope of this study. Additionally, we did not consider the potential impact of these services on outcomes outside of health and health care such as food instability; future work that accounts for these additional outcomes is certainly warranted.

The above comparisons are not adjusted for the characteristics of residents in each site – housing properties with such staff are likely ones whose residents already face greater challenges. Controlling for the influence of such confounders might yield a clearer picture of the impact of these types of services on health care outcomes, as explained below.

*See Appendix A for a more detailed statistical methodology for the difference-in-differences (DiD) and multivariate regression models.*

*See Appendix B for the results of the DiD analysis of Social and Wellness Services/Staff.*

**Exhibit 18. Impact of Integrated Health Social Services/Staff on Key Outcomes**

	Property has Health Services N=1,259	Property does not have Health Services N=366	Difference in Outcomes with Service	
	Change from Baseline	Change from Baseline	DiD	p-val
PCP Visits <sup>1</sup>	+0.6/year	+0.9/year	-0.27/year	0.29
ED Visits <sup>1</sup>	-0.3/year	0.0 (no change)	-0.34/year	0.00*
IP Visits <sup>1</sup>	0.0 (no change)	+0.03	-0.03/year	0.29
Costs PMPM <sup>2</sup>	-\$66/month	+\$12/month	-\$78	0.01*

1. Outliers above the 99th percentile were removed.

2. Outliers above the 95th percentile were removed.

\*Statistically significant change; difference in differences (DiD) analysis, p<0.05

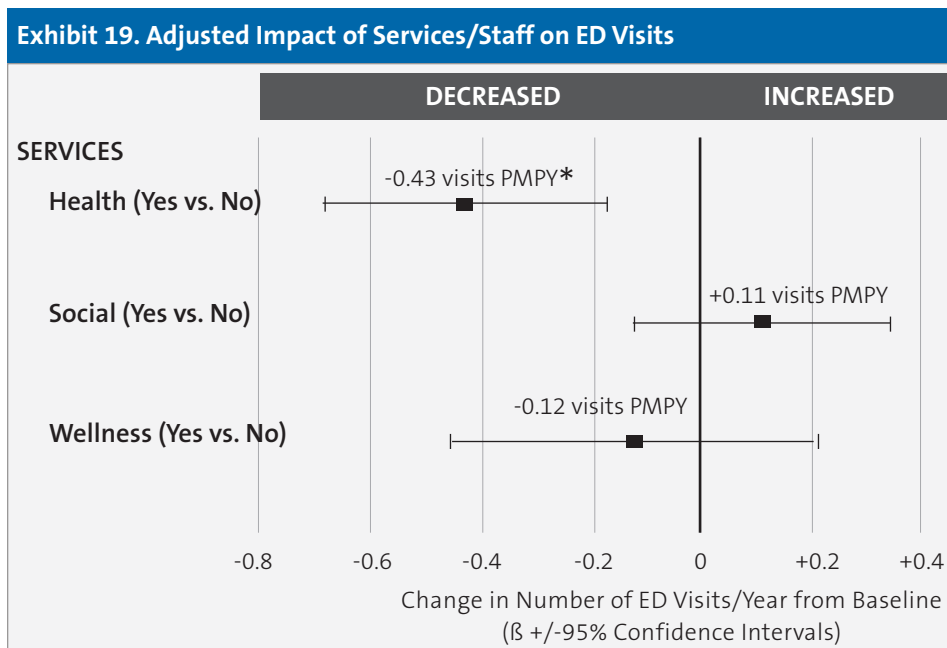
## Multivariate Model: ED Utilization

Our multivariate regression model assessing the factors that best predict reduced ED visits over time is summarized in Exhibit 19. This model shows the impact of each factor on changes in ED utilization over time – while holding constant the influence of the other variables, including housing type, age, race, gender and risk score. Importantly, this allows us to assess services while controlling for the influence of important confounders, such as the fact that sites with integrated services may also tend to have residents with greater health needs.

Results suggest that the most important predictor of decreased ED utilization is the presence of integrated health staff and services. Holding other factors constant, clients at these sites saw a statistically significant reduction in ED visits per member per year.

We also found that populations who are sicker at baseline (before moving in) were more likely to see decreased ED visits after moving in, suggesting that housing may be particularly important for individuals facing greater health challenges (see Appendix B).

See Appendix B for complete results from our multivariate models. A more detailed description of our methods can be found in Appendix A.



\*Statistically significant,  $p < 0.05$

### How to Read this Chart

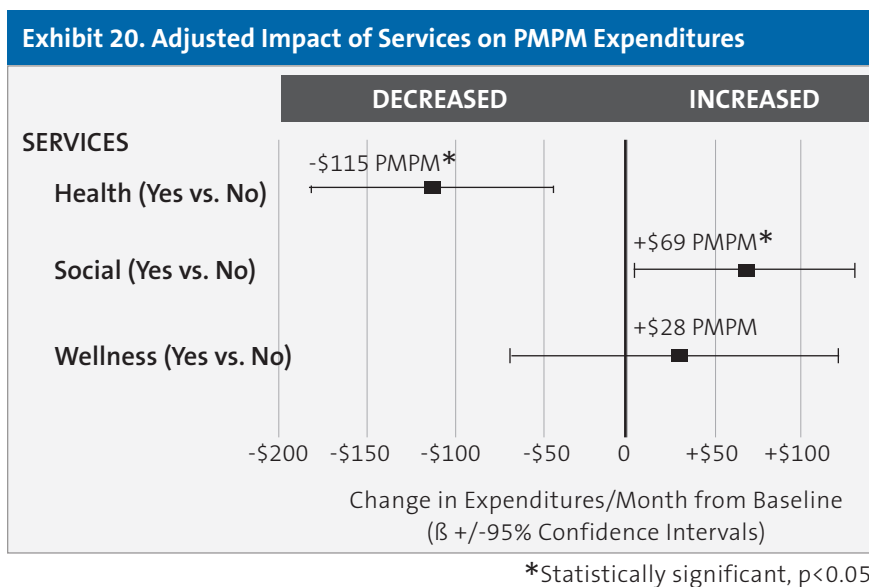
The data points in the chart represent the estimated mean effect each factor has on pre/post changes in ED use. The bars represent 95 percent confidence intervals around the estimated effect. Bars to the left of the center line represent factors associated with less ED use than before move-in; bars to the right equal more ED use. All effects hold constant the influence of other factors in the model.

## Multivariate Model: Total Medical Expenditures

Results for our multivariate model assessing the factors that best predict reductions in total cost are summarized in Exhibit 20. This model shows the impact of each factor on total health care expenditures over time – while holding constant the influence of the other variables, including housing type, age, race, gender and risk score. Importantly, this allows us to assess integrated services while controlling for the influence of important confounders, such as the fact that sites with embedded services may also tend to have sicker residents.

Similar to the model for ED visits, results suggest that the most important predictor of decreased expenditures is the presence of integrated health staff and services. Holding other confounders constant, properties with integrated health services saw an average reduction of \$115 per member per month. We also found that residents that were sicker at baseline were more likely to have reduced expenditures (Appendix B).

Results on expenditures also suggest that social support services (including on-site social workers and CHWs) are associated with increased expenditures. It is important to note that more expenditures are not always a negative outcome. Increased expenditures may represent the cost for these staff to connect people to health care services to which they would otherwise lack access, and therefore represent “appropriate” increases in utilization. Whether costs constitute “desirable” health care expenditures is beyond the scope of the current study, but could be fruitful for follow-up work.



### How to Read this Chart

The data points in the chart represent the estimated mean effect each factor has on pre/post changes in ED use. The bars represent 95 percent confidence intervals around the estimated effect. Bars to the left of the center line represent factors associated with fewer medical expenditures than before move-in; bars to the right indicate more medical expenditures. All effects hold constant the influence of other factors in the model.

## In Summary: What Have We Learned?

By assessing multiple factors within a single statistical model, we can determine which factors are important while accounting for the confounding influence of the others. We constructed two such models: one designed to identify the key drivers of changes in ED use, and one to identify the key drivers of changes in total medical expenditures. In each case, we were following individuals through the acquisition of affordable housing and built a model that would predict what happened to them in the year after they moved in. Taken together, these results provide several important insights:

### 1. Integrated health services are a key driver of ED & cost outcomes.

All else being equal, clients at properties with integrated health resources had significantly reduced ED use and expenditures after moving into affordable housing. Strengthening cross-sector partnerships to coordinate housing and health services could prove to be a fruitful strategy for health care reform.

### 2. Some services increased costs, but that may not be a bad thing.

All else being equal, clients at properties with integrated social workers and CHWs saw increased total expenditures. These were not ED costs (there was no similar impact in our ED model), so the data may represent that social workers and CHWs help connect residents to necessary health care services, thereby improving access.

### 3. The greater the client health needs at move-in, the more housing helped.

All else being equal, the greater the health need of the client before moving in (as measured by our medical complexity risk score), the greater the decline in their ED use and expenditures after moving in (see Appendix B). This may represent the importance of affordable housing as a resource for people managing complex health challenges.



## RESULTS: AWARENESS OF SERVICES

### Key Finding

Even when integrated services were offered, awareness of those services was generally low. Among clients who were aware, usage was variable but satisfaction was high. Given the importance of integrated health services in driving reduced expenditures, increasing awareness of and use of existing services may generate strong returns.

### What We Wanted to Know

We wanted to understand how many residents were aware of services offered at their properties, and how often those services were actually being utilized. We assessed awareness of services at properties where they were actually available; and among residents who were aware of a service, we assessed how often it was actually used.

### What We Found

- **Awareness:** Survey participants were asked to report whether a particular service was offered at the property where they lived; their response was compared to the official service reports from managers at each property. Results showed that at the properties where a given service was available, residents were often not aware of it (Exhibit 21).

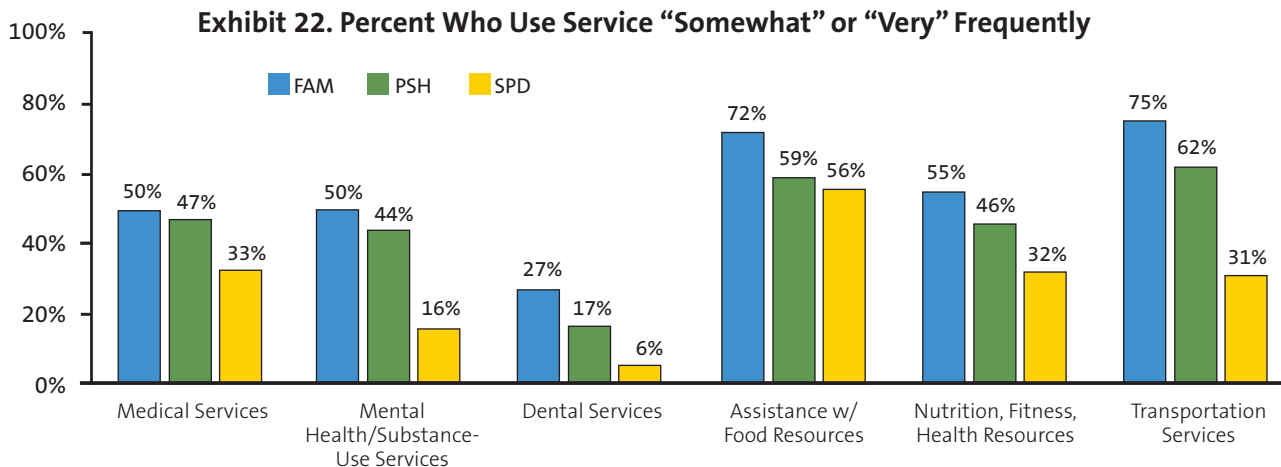
**Exhibit 21. Percent Aware of Offered Service<sup>1</sup>**

Medical Services	33%
Mental Health Services	26%
Dental Health Services	N/A <sup>2</sup>
Food Resources	66%
Nutrition/Fitness	36%
Transportation	15%
Insurance Assistance	10%

1. Among those living at properties offering the service.

2. None of the 12 surveyed properties reported offering dental services.

- Use of Services:** We asked clients who were aware of a service how often they actually used it (Exhibit 22). We found evidence of untapped potential at properties with services; for instance, fewer than half of those who knew about available medical services reported using them “somewhat” or “very” frequently (versus “rarely” or “never”). Although no surveyed properties officially reported offering dental services, some of the surveyed individuals reported accessing dental services that they believed were part of the integrated services offered through their property.



## Room to Grow: Implications of the Awareness Gap

Results from client surveys indicate that clients are often not aware that services are available, and are not necessarily using the services even if they do know. This represents both a challenge and an opportunity for affordable housing properties with integrated services. For instance, our earlier analysis suggests availability of medical services was associated with reduced ED visits and expenditures; this was true despite the fact many people at those properties were not aware of or using the service. Increasing awareness and use of existing resources among residents should create even stronger impacts, and might represent a relatively easy-to-implement first step toward larger efforts to expand the integration of services that create positive health care outcomes.

Increasing awareness and use of services may generate strong returns.

## CONCLUSIONS

### Overview & Study Goals

This study examined the intersection between affordable housing, integrated services and health care outcomes for Medicaid members. We followed a panel of over 1,600 Medicaid members in the year before and the year after they moved into affordable housing, including permanent supportive housing, family housing, and housing for seniors and people with disabilities. We used claims data to examine differences in utilization and expenditures before and after moving into housing, and survey data to assess the impacts of housing on health care access and quality measures.

### Key Takeaways

- **Expenditures:** Total health care expenditures were 12 percent less the year after moving in when compared to the year before, averaging a reduction of nearly \$50 per member per month (PMPM). Overall, care for the 1,625 participants in our panel cost \$936,000 less after move-in than in the year before.
- **Utilization:** After moving into affordable housing, clients used more primary care and had fewer emergency department (ED) visits than in the year before they moved in. These changes were most dramatic for people moving into permanent supportive housing.
- **Access & Quality:** Many clients reported improved health care access and quality after moving into their current residence, suggesting that expenditure reductions did not come at the expense of client experience.
- **Impact of Services:** The availability of integrated medical service/staff was a key driver of the reduction in health care expenditures and ED usage. This was true despite relatively low awareness of those services among clients living at properties that offered them, suggesting there may be room for an even greater impact on health care outcomes.

### Implications

Health care reform, and especially the accountable care movement, is increasingly driving health systems to think upstream in order to avoid expensive downstream utilization. Our results suggest that affordable housing and, in particular, housing with integrated health services and staff may actually help bend the health care cost curve without compromising quality or access to care. In the year after moving into affordable housing, participants in our study had fewer ED visits and lower total expenditures, but also used more primary care and often reported better access to needed care and higher quality care. Taken together, these results suggest the potential for housing and integrated services to play a key role in health care reform.

## Limitations

This study was a descriptive, pre/post look at what happens to low-income people after they move into affordable housing. We did not have a comparison group of similar low-income persons without housing against which we could contextualize experiences. Our study is not designed to make causal assertions about why health expenditures were lower after moving into housing. It is possible, for instance, that lower costs could represent a natural change that would have occurred regardless of housing, or may have been the result of some other unmeasured factor for which we did not account.

It is important to note that participants in our study were not selected due to enrollment in any particular health care intervention designed to reduce costs, nor were they deliberately selected at a crisis or “high point” in utilization that might be expected to resolve itself over time. They were selected because they were residents in affordable housing, and we simply looked retrospectively at utilization patterns and expenditures before and after they moved in. There is no a priori reason to expect their costs to go down. Nonetheless, further research that more systematically compares the experiences of similar populations with and without affordable housing would help clarify the potential connection between housing and health highlighted in our findings.

## A Blended Future

This study provides promising, early evidence that affordable housing, especially in combination with integrated health services, may help optimize health care utilization and lower costs. The magnitude of the expenditure differences we observed is not large enough to offset the entire cost of affordable housing for a low-income person, but reducing health care costs is far from the only reason to do so. In addition to the human benefits of shelter, safety and dignity, the effects of affordable housing may also ripple through criminal justice, education and other systems. We live in a profoundly interconnected world, and we may be moving past the time when any sector can go it alone.

Health care and housing each is only one part of the other’s value equation. It doesn’t have to be the health care system’s role to find everyone a home, but our results suggest that it may be in its interests to partner with the housing sector in ways that improve outcomes for everyone. In the emerging era of accountable care, health care systems and affordable housing providers may want to mutually consider the potential benefits of stronger cross-sector collaboration.

In addition to the human benefits of shelter, safety and dignity, the effects of affordable housing may also ripple through criminal justice, education and other systems.

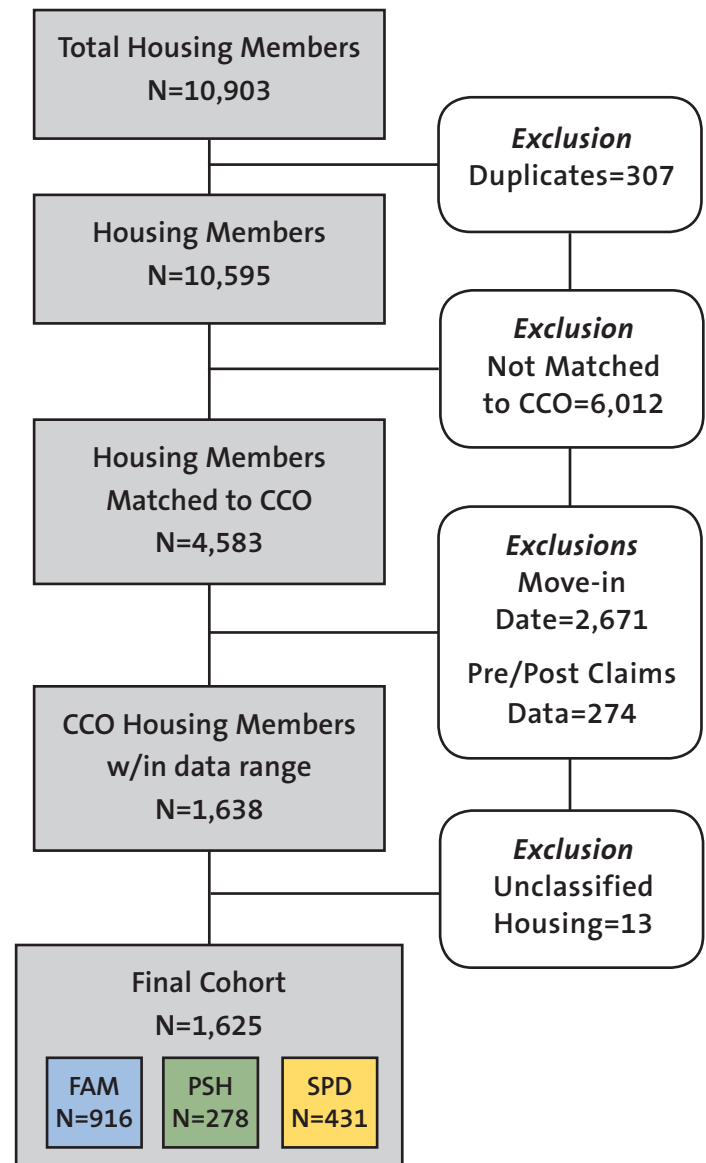
## APPENDIX A: TECHNICAL METHODS

### Claims

- Population:** We collected a list of all Medicaid members living in the 145 participating properties and applied necessary exclusions to get our final analytic cohort (Exhibit 23). For the total 10,903 housing members, we removed any duplicate names due to members who lived at multiple addresses during the study period. For duplicate members, the most recent address was used for further analysis. Next, we performed probabilistic matching between the list of housing members and the Health Share of Oregon Coordinated Care Organization (CCO) Medicaid database to exclude members who did not have available claims data. Individuals were matched by name, date of birth and address. We also excluded individuals with a move-in date outside of the defined move-in window (April 1, 2011 – January 31, 2015) and we required that individuals have continuous Medicaid claims data available three months prior to and following their move-in date. Overall, we looked at Medicaid claims data from January 1, 2011 – June 30, 2015. Finally, we excluded any individuals who lived in properties that were not classified as family housing (FAM), permanent supportive housing (PSH), or housing for seniors and people with disabilities (SPD). After all exclusions were applied, the final cohort for the claims analysis consisted of 1,625 individuals of which 916 were in FAM housing, 278 were in PSH and 431 were in SPD housing.

- Method:** We used paired t-tests to assess whether rates of health care utilization and expenditure were significantly different before and after individuals moved into a stable housing site. To provide more robust estimates and mitigate the influence of extreme outlier cases, analyses were repeated with outliers trimmed. Specifically, we trimmed outliers at 95 percent level for costs, and at 99 percent level for utilization. To determine the impact of embedded services on outcomes over time, we

Exhibit 23. Claims Population



performed difference-in-differences (DiD) analyses. This type of test assesses whether the pre/post change seen among clients in properties that offer a given service is different from the pre/post change seen among clients in properties without that service. To assess the impact of services on the outcome while accounting for potential demographic differences and health profiles, adjusted analyses were performed using multivariable regression models. These analyses allow us to determine the impact of each factor on change in the outcomes over time while controlling for potentially confounding variables such as housing type, age, gender, race, ethnicity and risk score. To satisfy the distributional criteria for this model, costs and utilizations were trimmed at 95 percent and 99 percent levels, respectively. All analyses were conducted using SAS version 9.4 (SAS Institute, Inc.). Significance was considered at p-values <0.05.

## Surveys

- **Population:** We selected 12 housing properties from the original 145, four from each housing type, with a large number of residents with Medicaid coverage through our partnering CCO, Health Share of Oregon. Surveys were mailed to 513 individuals living at these properties. We worked closely with staff at each property to increase resident awareness of the survey and, by the end of the two-month fielding period, 275 residents (all Health Share members) responded (54 percent). In addition to resident surveys, we developed an assessment designed to be completed by staff at each housing property. This tool was intended to assess the availability of distinct types of integrated supportive services at each housing property, with a focus on health- and health care-related services. We received completed assessments capturing available services for each of the 145 participating housing properties.
- **Method:** Continuous variables were summarized using descriptive statistics (n, mean±SD). Categorical variables were summarized using frequencies and percentages.

## APPENDIX B: HEALTH CARE UTILIZATION

Exhibit 24 provides a complete pre- versus post-breakdown of utilization of health care by domain overall and by housing type. The domains include primary care (PCP), emergency department (ED), inpatient non-obstetrics (IP non-OB), inpatient behavioral health (IPBH), outpatient behavioral health (OPBH), labs, specialty care, ambulatory surgical care (ASC), pharmacy and other.

Exhibit 24. Utilization (PMPY) by Housing Type																
	OVERALL				FAM				PSH				SPD			
	Pre	Post	%Δ	p-val	Pre	Post	%Δ	p-val	Pre	Post	%Δ	p-val	Pre	Post	%Δ	p-val
PCP	2.8	3.4	20%	<b>0.00</b>	2.4	2.8	16%	<b>0.00</b>	3.5	4.4	26%	<b>0.01</b>	3.1	3.8	22%	<b>0.00</b>
ED	1.1	0.9	-18%	<b>0.00</b>	0.9	0.8	-10%	0.08	1.5	0.9	-37%	<b>0.00</b>	1.0	0.9	-18%	<b>0.05</b>
IP Non-OB	0.08	0.07	-15%	0.21	0.048	0.046	-4%	0.81	0.14	0.10	-30%	0.16	0.13	0.11	-14%	0.49
IPBH	0.01	0	-100%	<b>0.00</b>	0.00	0.00	0%	0.09	0.02	0.00	-100%	<b>0.01</b>	0.02	0.00	-100%	<b>0.01</b>
OPBH	3.9	3.7	-4%	0.54	1.5	1.4	-5%	0.80	10.0	9.9	-1%	0.95	4.9	4.5	-9%	0.36
Labs	7.5	6.7	-11%	<b>0.00</b>	5.6	5.4	-4%	0.51	11.2	9.8	-12%	0.06	9.1	7.2	-20%	<b>0.00</b>
Specialty	3.7	2.9	-22%	<b>0.00</b>	2.5	1.9	-24%	<b>0.00</b>	5.3	4.4	-17%	0.01	5.0	3.8	-23%	<b>0.00</b>
ASC	0.09	0.13	53%	<b>0.00</b>	0.06	0.09	55%	<b>0.03</b>	0.12	0.17	43%	<b>0.13</b>	0.12	0.19	60%	<b>0.02</b>
Pharmacy	16.4	21.4	30%	<b>0.00</b>	10.7	13.3	25%	<b>0.00</b>	26.1	37.8	45%	<b>0.00</b>	22.2	27.7	25%	<b>0.00</b>
Other	17.2	10.2	-41%	<b>0.00</b>	9.8	5.4	-45%	<b>0.00</b>	26.0	18.2	-30%	<b>0.00</b>	27.0	15.2	-44%	<b>0.00</b>

Exhibit 25 describes the percentage of individuals who had at least one of each type of visit in the time following moving into their current housing compared with prior to move-in. Overall, the percentage of individuals utilizing primary care increased significantly (18 percent) and the percentage of individuals with ED visits decreased significantly (-11 percent) in the period following move-in to their current housing property compared to the period before move-in (Exhibit 27). Inpatient admissions had a non-significant downward trend. These same trends were observed when the data were separated and examined by housing type.

Exhibit 25. Percent With a Visit by Housing Type																
	OVERALL				FAM				PSH				SPD			
	Pre	Post	%Δ	p-val	Pre	Post	%Δ	p-val	Pre	Post	%Δ	p-val	Pre	Post	%Δ	p-val
PCP	57%	67%	18%	<b>0.00</b>	60%	67%	15%	<b>0.00</b>	55%	67%	22%	<b>0.00</b>	54%	66%	22%	<b>0.00</b>
ED	40%	36%	-11%	<b>0.00</b>	37%	36%	-3%	0.54	52%	38%	-28%	<b>0.00</b>	38%	33%	-13%	0.06
IP Non-OB	8%	7%	-11%	0.29	4%	4%	-5%	0.80	13%	11%	-16%	0.37	12%	11%	-11%	0.46

## Family Housing: Adults & Children

Claims analysis for family housing (FAM) was comprised of adults and children. To understand the impact of FAM housing on adults and children separately, we broke down the claims analysis of utilization by adults ( $\geq 18$  years) and children ( $< 18$  years).

Exhibit 26 displays the pre- versus post-utilization, percent change and p-value for the following domains: primary care (PCP), emergency department (ED), inpatient non-obstetrics (IP non-OB), inpatient behavioral health (IPBH), outpatient behavioral health (OPBH), labs, specialty care, ambulatory surgical care (ASC), pharmacy and other.

Exhibit 27 displays the percentage of individuals who had at least one of each type of visit in the period following moving into housing compared with prior to move-in, which represents the percentage of adults or children utilizing care.

Exhibit 26. Utilization of Adults and Children in Family Housing (PMPY)								
	ADULT N=568				CHILDREN N=348			
	Pre	Post	% $\Delta$	p-val	Pre	Post	% $\Delta$	p-val
PCP	2.5	3.2	27%	<b>0.00</b>	2.3	2.2	-5%	0.51
ED	1.1	1.0	-10%	0.18	0.7	0.7	-10%	0.32
IP Non-OB	0.057	0.065	14%	0.65	0.038	0.009	-76%	<b>0.01</b>
IPBH	0.01	0.00	-100%	0.09	0.00	0.00	0%	N/A
Labs	8.4	7.9	-5%	0.36	1.3	1.5	12%	0.47
OPBH	2.2	2.0	-8%	0.67	0.4	0.6	23%	0.70
Specialty	3.2	2.5	-22%	<b>0.00</b>	1.4	1.0	-31%	<b>0.01</b>
ASC	0.08	0.12	49%	0.07	0.02	0.04	75%	0.16
Pharmacy	15.7	19.1	22%	<b>0.00</b>	2.8	4.2	49%	<b>0.00</b>
Other	13.4	6.9	-48%	<b>0.00</b>	4.2	2.9	-30%	<b>0.00</b>

Exhibit 27. Adults and Children in Family Housing With a Visit								
	ADULT N=568				CHILDREN N=348			
	Pre	Post	% $\Delta$	p-val	Pre	Post	% $\Delta$	p-val
PCP	56%	66%	17%	<b>0.00</b>	64%	69%	8%	0.13
ED	39%	38%	-4%	0.54	34%	33%	-5%	0.56
IP Non-OB	5%	5%	11%	0.66	3%	1%	-73%	<b>0.02</b>



## Services & Staff: Health Care Utilization

The tables below in Exhibit 28 describe the change in utilization for residents at properties with specific integrated services. The tables display the difference in pre- versus post-utilization for individuals living at properties that offer each specific service and those at properties that do not offer each specific service. The difference-in-differences (DiD) assesses whether the pre/post change seen among clients at properties that offer a given service is different from the pre/post change seen among clients in properties without that service.

### Exhibit 28. PMPY Utilization by Properties With and Without Each Service

	Medical Resources				Dental Resources				Mental Health Resources			
	Yes N=707 (Post-Pre)	No N=918 (Post-Pre)	DiD (Yes-No)	p-value	Yes N=28 (Post-Pre)	No N=1,579 (Post-Pre)	DiD (Yes-No)	p-value	Yes N=476 (Post-Pre)	No N=1,199 (Post-Pre)	DiD (Yes-No)	p-value
PCP	0.36	0.71	-0.36	0.09	-0.27	0.57	-0.84	0.30	0.95	0.42	0.53	0.06
ED	-0.15	-0.23	0.08	0.38	0.05	-0.20	0.25	0.51	-0.40	-0.12	-0.28	0.02
IP Non-OB	0.001	-0.024	0.024	0.25	0.04	-0.01	0.05	0.19	-0.03	-0.01	-0.02	0.34

	Fitness				Nutrition				Food Resources			
	Yes N=549 (Post-Pre)	No N=1,076 (Post-Pre)	DiD (Yes-No)	p-value	Yes N=532 (Post-Pre)	No N=1,593 (Post-Pre)	DiD (Yes-No)	p-value	Yes N=1,243 (Post-Pre)	No N=382 (Post-Pre)	DiD (Yes-No)	p-value
PCP	0.37	0.66	-0.29	0.19	0.02	0.82	-0.80	0.00	0.50	0.74	-0.24	0.33
ED	-0.02	-0.29	0.27	0.00	-0.17	-0.21	0.04	0.71	-0.17	-0.28	0.11	0.32
IP Non-OB	-0.011	-0.014	0.004	0.87	-0.01	-0.02	0.01	0.63	-0.01	-0.01	0.00	0.93

	Insurance				Transportation				Other			
	Yes N=563 (Post-Pre)	No N=1,062 (Post-Pre)	DiD (Yes-No)	p-value	Yes N=199 (Post-Pre)	No N=1,426 (Post-Pre)	DiD (Yes-No)	p-value	Yes N=739 (Post-Pre)	No N=886 (Post-Pre)	DiD (Yes-No)	p-value
PCP	0.62	0.52	0.10	0.67	0.40	0.58	-0.18	0.58	0.69	0.45	0.24	0.28
ED	-0.34	-0.12	-0.22	0.04	-0.36	-0.17	-0.19	0.23	-0.33	-0.08	-0.24	0.01
IP Non-OB	0.00	-0.02	0.02	0.34	-0.02	-0.01	0.00	0.93	-0.03	0.00	-0.04	0.08

The tables below in Exhibit 29 describe the change in utilization for residents at properties with specific types of staff. The table displays the difference in pre- versus post-utilization for individuals living at properties that offer the specific type of staff and those at properties that do not offer the specific staff type. The difference-in-differences (DiD) assesses whether the pre/post change seen among clients in properties that offer a given staff member is different from the pre/post change seen among clients in properties without that type of staff member.

### Exhibit 29. PMPY Utilization by Properties With and Without Specific Staff

	Resident Services Coordinator				Activities Coordinator				Community Health Worker/Navigator			
	Yes N=1,561 (Post-Pre)	No N=61 (Post-Pre)	DiD (Yes-No)	p-value	Yes N=229 (Post-Pre)	No N=1,396 (Post-Pre)	DiD (Yes-No)	p-value	Yes N=369 (Post-Pre)	No N=1,256 (Post-Pre)	DiD (Yes-No)	p-value
PCP	0.58	-0.05	0.63	0.256	-0.52	0.74	-1.26	<.0001	0.18	0.67	-0.49	0.04
ED	-0.20	0.04	-0.24	0.29	-0.08	-0.21	0.14	0.23	-0.08	-0.23	0.14	0.12
IP Non-OB	-0.01	-0.09	0.08	0.13	-0.02	-0.01	-0.01	0.78	-0.002	-0.016	0.01	0.55

	Doctor/Nurse				Social Worker				Other Health Professional			
	Yes N=34 (Post-Pre)	No N=1,591 (Post-Pre)	DiD (Yes-No)	p-value	Yes N=234 (Post-Pre)	No N=1,391 (Post-Pre)	DiD (Yes-No)	p-value	Yes N=104 (Post-Pre)	No N=1,521 (Post-Pre)	DiD (Yes-No)	p-value
PCP	0.64	0.56	0.08	0.91	-0.22	0.69	-0.91	0.0008	0.52	0.56	-0.04	0.94
ED	-0.78	-0.18	-0.59	0.06	-0.01	-0.23	0.22	0.05	0.07	-0.21	0.28	0.15
IP Non-OB	-0.06	-0.01	-0.05	0.62	-0.02	-0.01	-0.01	0.81	-0.06	-0.01	-0.05	0.23

Exhibit 30 displays the pre- versus post-utilization changes for properties without a community health worker (CHW) or community navigator, properties with only a CHW, and properties with both a CHW and community navigator. There were no data available for properties with only a community navigator.

### Exhibit 30. Closer Look: CHWs and Community Navigators and PMPY Utilization

	No CHW or Community Navigator N=1,256				CHW Only N=181				CHW & Community Navigator N=188			
	Pre	Post	%Δ	p-value	Pre	Post	%Δ	p-value	Pre	Post	%Δ	p-value
PCP	2.8	3.4	24%	0.00	3.3	2.8	-16%	0.05	2.6	3.5	33%	0.00
ED	1.1	0.9	-20%	0.00	0.8	0.7	-15%	0.24	0.9	0.8	-6%	0.75
IP Non-OB	0.085	0.069	-19%	0.17	0.077	0.062	-19%	0.59	0.079	0.091	15%	0.70

## Services & Staff: Expenditures

Exhibits 31 and 32 describe the change in expenditures for residents at properties with specific services or staff. The tables display the difference in pre- versus post-expenditures for individuals living at properties that offer each specific service/staff and those at properties that do not offer each specific service. The difference-in-differences (DiD) assesses whether the post/pre change seen among clients in properties that offer a given service/staff is different from the post/pre change seen among clients in properties without that service/staff.

**Exhibit 31. PMPM Expenditures by Properties With and Without Each Type of Service**

Change in PMPM Expenditures by Service Type				
	Yes (Post-Pre)	No (Post-Pre)	DiD (Yes-No)	p-value
Medical Resources	-\$32	-\$61	\$29	0.25
Dental Resources	\$63	-\$50	\$113	0.09
Mental Health Resources	-\$66	-\$42	-\$24	0.44
Fitness	-\$11	-\$68	\$57	<b>0.04</b>
Nutrition	-\$21	-\$61	\$40	0.12
Food Resources	-\$39	-\$80	\$41	0.17
Insurance	-\$78	-\$32	-\$46	0.09
Transportation	-\$47	-\$48	\$1	0.98
Other	-\$100	-\$7	-\$93	<b>0.00</b>

**Exhibit 32. PMPM Expenditures by Properties With and Without Each Type of Staff**

Change in PMPM Expenditures by Staff				
	Yes (Post-Pre)	No (Post-Pre)	DiD (Yes-No)	p-value
Resident Services Coordinator	-\$38	-\$317	\$279	<b>0.00</b>
Activities Coordinator	-\$21	-\$53	\$31	0.29
Community Health Worker	-\$11	-\$59	\$48	0.11
Doctor/Nurse	-\$304	-\$43	-\$261	<b>0.02</b>
Social Worker	-\$12	-\$54	\$42	0.19
Other Health Professional	-\$159	-\$40	-\$119	<b>0.02</b>

### Satisfaction with Services

Exhibit 33 describes survey results for questions regarding satisfaction with services. For individuals who used each service, we asked if they found that service to be helpful. We found that 90 percent to 100 percent of individuals using the services reported that they were very/somewhat helpful.

Additionally, all survey participants (not just those that utilized services) were asked whether they were satisfied with the offered services and resources at their property. For each housing type, more than half were very/somewhat satisfied with the services/

resources that were offered (Exhibit 33). These respondents include those that may live at a property with very limited or no offered resources/services, and those that are unaware of the available services.

Exhibit 34 describes the unmet service need. To determine if there was unmet need for the housing residents, we asked individuals participating in the survey if they wanted additional services that were not offered at their property (Exhibit 34). We found that 32 percent of FAM, 29 percent of PSH and 26 percent of SPD respondents wanted services that were not currently offered at their property.

We asked these individuals who reported wanting unoffered services to write in the types of services they would like to have. The complete list of their responses were compiled and are reported in Exhibit 35 in alphabetical order. Many of the services listed are those that are offered at some properties, such as medical services or transportation, and the request for these services implies that either that service is not offered or they are unaware that it is offered at their property. Other requested services include child care, community center, eviction prevention, yoga, physical therapy and activities for seniors or children.

### Exhibit 33. Satisfaction With Services

	FAM	PSH	SPD
Reported that each service was very/somewhat helpful (range)	100%	100%	90%-100%
Very/somewhat satisfied with offered services & resources	57%	53%	56%

### Exhibit 34. Unmet Need

	FAM	PSH	SPD
Want health services that are not offered at their housing site	32%	29%	26%

### Exhibit 35. Services Requested by Housing Participants

FAM	PSH	SPD
Access to produce/healthy meals	Food resources	Access to produce/healthy meals
Activities for children	Free/discounted gym memberships	Activities for seniors
Community center	On-site dental	Eviction prevention
Free/discounted gym memberships	On-site exercise room	Fitness/on-site exercise room
On-site child care	On-site medical care	Nutrition/cooking
On-site dental care	On-site mental health services	On-site dental care
On-site exercise room	Transportation (better/more reliable)	On-site medical care
On-site medical care		On-site mental health services
On-site mental health		Physical therapy
On-site preventive screenings		Private mental health services
Transportation (better/more reliable)		Transportation (better/more reliable)
		Yoga

## Adjusted Impact of Services

- **Social Services/Staff:** We did not see evidence in our difference-in-differences (DiD) analysis that properties with social services/staff, such as social workers and community health workers (CHWs), had significantly better outcomes than properties without those resources (Exhibit 36). There were some absolute differences between properties, but none were statistically significant.
- **Wellness Services/Staff:** We did not see significant differences in outcomes between properties with and without wellness staff, including staff who assist with food access or exercise and other activities for residents (Exhibit 37). While we did find some absolute differences between properties, none were statistically significant.

It is important to note that these comparisons are not adjusted for the characteristics of residents in each site – housing properties with such staff are likely ones whose residents face greater challenges overall. Controlling for the influence of such confounders might yield a clearer picture of the impact of these types of services on health care outcomes (see pages 27 and 28).

The unadjusted impact of the health services can be found on pages 25 and 26.

**Exhibit 36. Impact of Integrated Social Services/Staff on Outcomes**

	Property has Social Services N=410	Property does not have Social Services N=1,215	Difference in Outcomes with Service	
	Change from Baseline	Change from Baseline	DiD	p-val
PCP Visits	+0.1/year	+0.8/year	-0.45	0.06
ED Visits	0.0 (no change)	-0.3/year	0.3	0.20
IP Visits	-0.01/year	+0.01/year	0.01	0.60
Costs PMPM	-\$16/month	-\$59/month	\$43	0.13

**Exhibit 37. Impact of Integrated Social Services/Staff on Outcomes**

	Property has Wellness Services N=1,434	Property does not have Wellness Services N=191	Difference in Outcomes with Service	
	Change from Baseline	Change from Baseline	DiD	p-val
PCP Visits	+0.6/year	+1.2 /year	-0.40	0.25
ED Visits	-0.2/year	-0.3/year	0.05	0.71
IP Visits	0.0 (no change)	-0.01/year	-0.01	0.81
Costs PMPM	-\$48/month	-\$64/month	\$16	0.86

**NOTE:** No statistically significant results using difference in differences (DiD) analysis,  $p < 0.05$ .

## Complete Models: Adjusted Impact of Key Variables on ED and Cost Outcomes

Exhibit 38 displays the complete multivariate regression model assessing the factors that best predict reduced emergency department (ED) visits or costs over time. This model shows the impact of each factor on changes in ED utilization or costs over time – while holding constant the influence of the other variables, including housing type, age, race, gender and risk score. Importantly, this allows us to assess the impact of key variables while controlling for the influence of important confounders, such as the fact that properties with integrated services may also tend to have residents with greater health needs.

Exhibit 38. Completed Adjusted Models						
Characteristics	Diff in # ED visits (PMPY)			Diff in Cost (PMPM)		
	$\beta$	95% CI	p-val	$\beta$ (SE)	95%CI	p-val
Has >=1 Medical Related Services and Staff	-0.43	-0.68, -0.18	<b>0.00</b>	-\$115	-\$185, -\$45	<b>0.00</b>
Has >=1 Social Services and Staff	0.11	-0.13, 0.35	0.33	\$69	\$4, \$134	<b>0.04</b>
Has >=1 Wellness Related Services and Staff	-0.12	-0.45, 0.21	0.50	\$28	-\$69, \$125	0.57
No Services/Staff	-0.5	-1.19, 0.19	0.15	-\$26	-\$221, \$169	0.79
PSH vs. FAM	-0.27	-0.37, 0.21	0.61	-\$57	-\$140, \$26	0.22
SPD vs. FAM	0.8	0.51, 1.09	0.09	-\$75	-\$170, \$19	0.08
Age	-0.003	-0.003, 0.009	0.30	-\$0.04	-\$2, \$2	0.96
White vs. Non-White	-0.03	-0.25, 0.19	0.80	\$23	-\$38, \$84	0.45
Hispanic vs. Non-Hispanic	0.13	-0.22, 0.48	0.47	\$8	-\$89, \$104	0.88
Female vs. Male	-0.03	-0.23, 0.17	0.80	\$20	-\$36, \$75	0.49
Risk Score	-0.08	-0.16, 0.00	0.02	-\$27	-\$49, -\$5	<b>0.01</b>



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[www.EnterpriseCommunity.com](http://www.EnterpriseCommunity.com)

70 Corporate Center  
11000 Broken Land Parkway, Suite 700  
Columbia, MD 21044



[www.providenceoregon.org/CORE](http://www.providenceoregon.org/CORE)

5211 NE Glisan Street  
Portland, OR 97213