CORE | Center for Outcomes Research and Education

HEALTH IN HOUSING

EXPLORING THE INTERSECTION BETWEEN HOUSING & HEALTH CARE

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EXECUTIVE SUMMARY

This study, conducted by the Providence 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 cost 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.

KEY FINDINGS:

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

- Total Medicaid expenditures declined by 12%.
- 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% in the year after moving in, while ED use fell by 18%.
- 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.*

	Better	Worse
ACCESS	40%	4%

	Better	Worse
QUALITY	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.
- *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

THE BOTTOM LINE

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 in. Many also reported better access to and care 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, and we may be moving past the time when any sector can go it alone. 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.

HEALTH IN HOUSING

EXPLORING THE INTERSECTION BETWEEN HOUSING & HEALTH CARE

INTRODUCTION

This 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 three common affordable housing types: subsidized 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 this year 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) that are responsible for all care for Medicaid members in their community under a fixed global budget, but also enjoy new flexibilities in how that budget can be distributed within their communities in order 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 of a single housing property found promising evidence of reduced medical expenditures for individuals living at a permanent supportive housing facility, but results were too site-specific to generalize.[1] A few other studies have suggested a possible link between affordable housing and lower emergency department (ED) or hospital use,[2,3] but have not directly assessed potential cost savings associated with those reductions.

In this study, we expand 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 over 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 integrated services may play in driving outcomes.

KEY STUDY OBJECTIVES

OBJECTIVE ONE: 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 before and after moving into one of the participating affordable housing properties.

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

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

References

1. Bud Clark Commons Report: http://oregon.providence.org/our-services/c/center-for-outcomes-research-and-education-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. JAMA. 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. Am J of Public Health. 2013 Feb;103(2): 316-21.

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 cost. 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, and we also 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 was 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 residing at 12 different properties; 275 residents responded (54%).

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.

STATISTICAL ANALYSES

DESCRIPTIVE PRE VS. POST COMPARISONS: 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 <0.05.

DIFFERENCE-IN-DIFFERENCES (DiD) ANALYSIS: 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.

OUTCOMES MODELING: 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.

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

HOUSING PROFILES

A CLOSER LOOK AT THE PROPERTIES PARTICIPATING IN OUR 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 Incorporated, Northwest Housing Alternatives, and REACH Community Development.

Type	Description	Properties
FAM	Properties that mainly include 2-4 bedroom units and are built specifically for family and community-style housing.	74
PSH	Properties that serve individuals who had been experiencing homelessness, have behavioral health or substance use issues, as well as individual adults through studio and/or one bedroom units.	30
SPD	Properties that serve older adults who meet a minimum age requirement and/or those with specific physical and behavioral health disabilities.	41
	TOTAL	145

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 (Exhibits 1 and 2).

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 individuals living in the participating properties were included in the claims analysis. To be included, individuals must have moved into their current housing property during our study window, must have been members of our partnering Medicaid CCO, and must have 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 in our different housing types had very distinct demographic profiles (Exhibit 4). For example, residents in family housing (FAM) were more racially diverse, while residents in permanent supportive housing (PSH) and in individuals in housing for seniors and people with disabilities (SPD) profiled as having substantially greater medical complexity, with nearly nine in 10 (85%) having at least one physical (PH) or behavioral health (BH) chronic condition and nearly half having at least one of each.

BASELINE COSTS: At the time of their move-in, most participants in our Medicaid claims analysis had significant health care expenditures (Exhibit 4). 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.

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-Amer.	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 cond.	52%	16%	15%
	No PH, 1+ BH	8%	19%	11%
	1+ PH, no BH	28%	22%	40%
	Has PH & BH cond.	12%	43%	33%
	Baseline Expenditures (per member month)	$257	$649	$525

RESIDENTS INCLUDED IN THE SURVEY ANALYSIS

We selected 12 housing properties, four from each housing type, with a large number of Health Share members. 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 survey.

Exhibit 5. Client Survey Respondents

513 Surveys Sent	275 Respondents (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%
	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%

PARTICIPANT PROFILES

CONTINUED - A CLOSER LOOK AT RESIDENTS

WHAT WE WANTED TO KNOW

We wanted to know the disease burden of the individuals living in the different housing types. For the 1,625 individuals in the claims analysis, we used claims data to determine the percentage of individuals who had behavioral or physical health diagnoses. We also computed the prevalence of these conditions across all of the adult Health Share members (not just affordable housing residents) as a reference point for what may be considered typical.

WHAT WE FOUND

PHYSICAL HEALTH: The prevalence of physical health diagnoses were most common in SPD and lease 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
Physical Health				
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%
Behavioral Health				
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% 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 95th percentile.

TOTAL EXPENDITURES: Total health care expenditures for our claims panel were 12% lower (-$48 per member per month) in the year after moving into affordable housing than in the year before. 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 you'll see on the following page, we also saw dramatic changes in utilization. These changes, especially the reduction in more costly acute care, are the most likely source of the reduced expenditures.

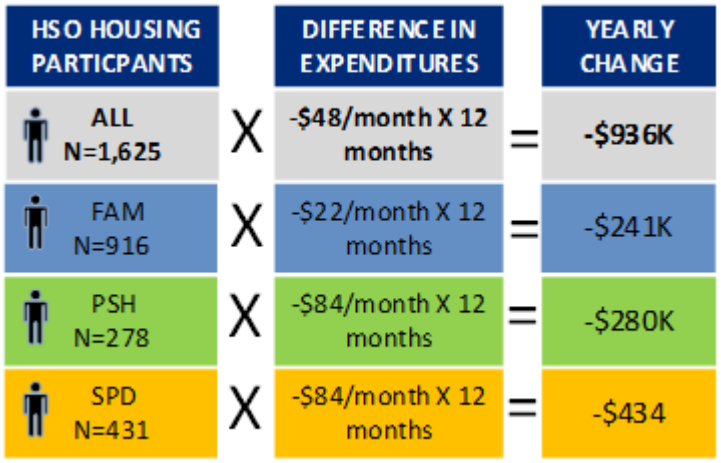
TOTAL ANNUALIZED DIFFERENCE: We can estimate the total difference in expenditures for the 1,625 individuals in our study (Exhibit 9). In total, Medicaid health care for these 1,625 persons cost $936,000 less in the year after they moved into affordable housing compared to the year before they moved in.

Exhibit 8. Pre/Post Change in Medicaid Health Care Expenditures (PMPM)[1]

	Pre	Post	Δ	%Δ	p value
Overall	$386	$338	-$48	-12%	**0.00**
FAM	$262	$240	-$22	-8%	0.12
PSH	$616	$532	-$84	-14%	**0.03**
SPD	$525	$441	-$84	-16%	**0.00**

1. Outliers above 95th percentile were removed.

Exhibit 9. Yearly Change in Medicaid Health Care Expenditures



RESULTS:

HEALTH CARE UTILIZATION

KEY FINDING

After moving into affordable housing, residents used more primary care (+20%) and less emergency department (ED) care (-18%) 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 was 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 mange 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%) in the year after moving in than in the year before. This statistically significant increase was observed for all housing types, with the largest change evident among PSH residents (+23%).

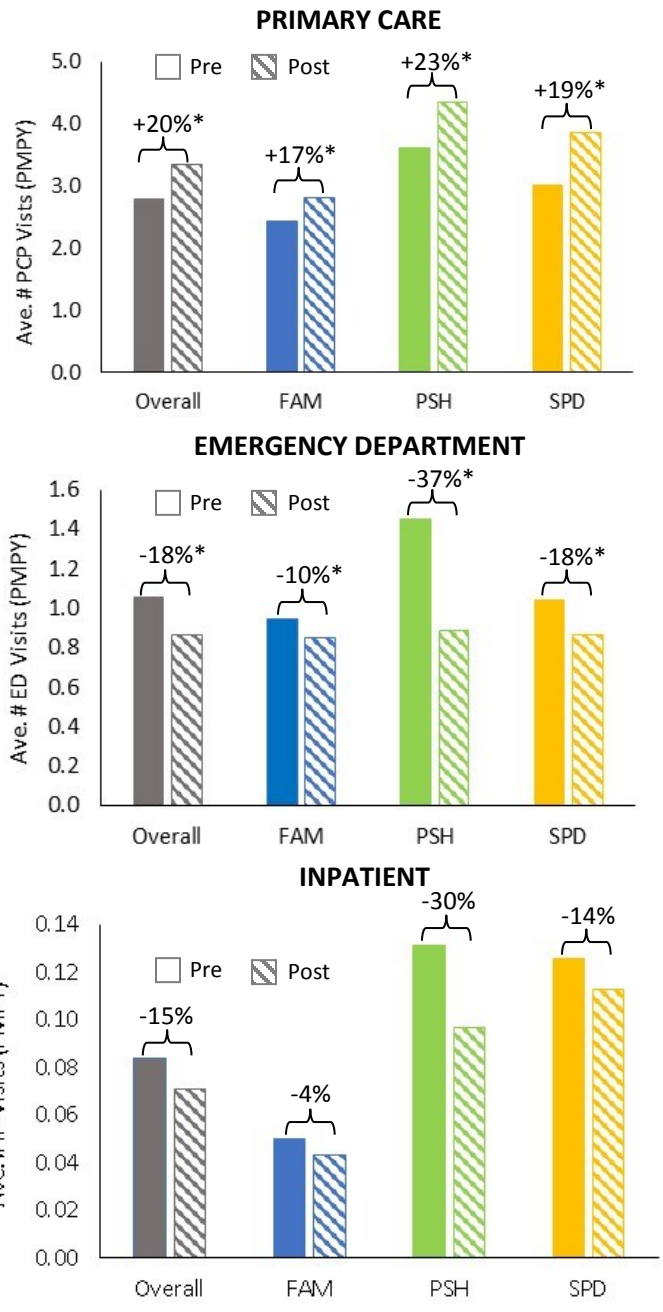
EMERGENCY DEPARTMENT VISITS: Residents had significantly fewer ED visits (-18%) in the year after moving in than in the year before. This difference was evident across all housing types, with the largest change among PSH residents (-37%).

INPATIENT EVENTS: Residents did have fewer inpatient events in the year after moving in than in the year before, 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, this data is 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.

For a more detailed breakdown of changes in utilization across every category of health care, please refer to Appendix B.

Exhibit 10. Pre/Post Avg. # of Visits PMPY[1]



*statistically significant change, paired t-test, p<.05.

1. Outliers above 99th percentile were removed.

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, and very few reported them getting worse. 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 was 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.

RESULTS

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%) said their access to care was *better,* and very few (4%) 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%) 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).

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%) reported better quality since moving in; very few (7%) reported that the quality of their care had gotten worse. Improvements were, again, most evident among the PSH and SPD clients.

Taken together, we see little evidence that differences in health care expenditures came about at the expense of residents' access to care, or the quality of the care they received. Indeed, moving into affordable housing was often associated with better access and quality.

For additional client survey results, please refer to Appendix B.

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

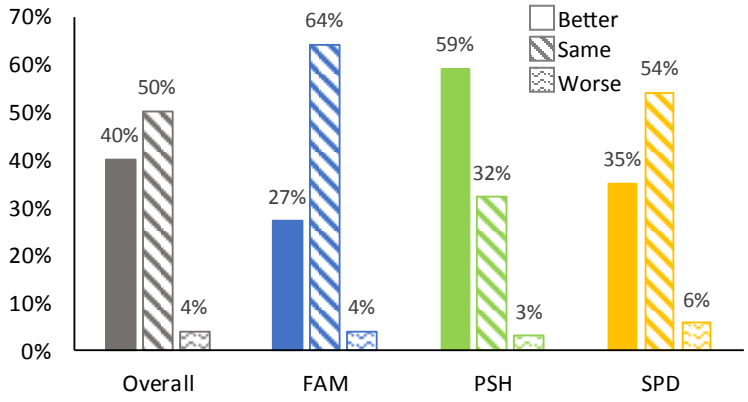
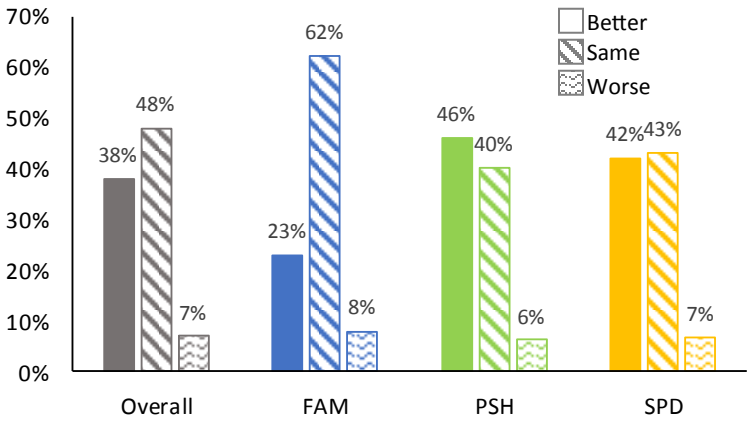


Exhibit 12. Health Care Needs

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

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



RESULTS:

SELF-REPORTED HEALTH

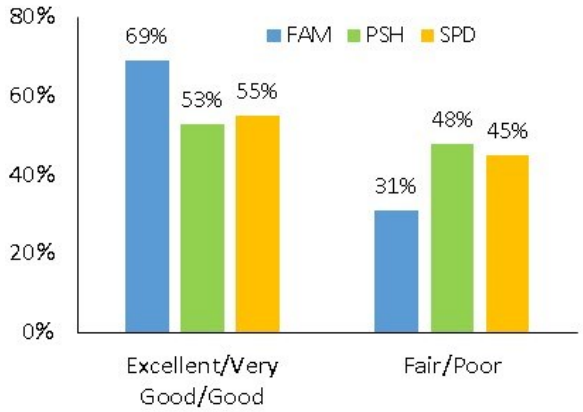
KEY FINDING

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 was used to determine whether clients' subjective assessments of their own health outcomes changed after moving into affordable housing. We were interested in exploring whether or not 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.

Exhibit 14. Self-Reported Health of Residents

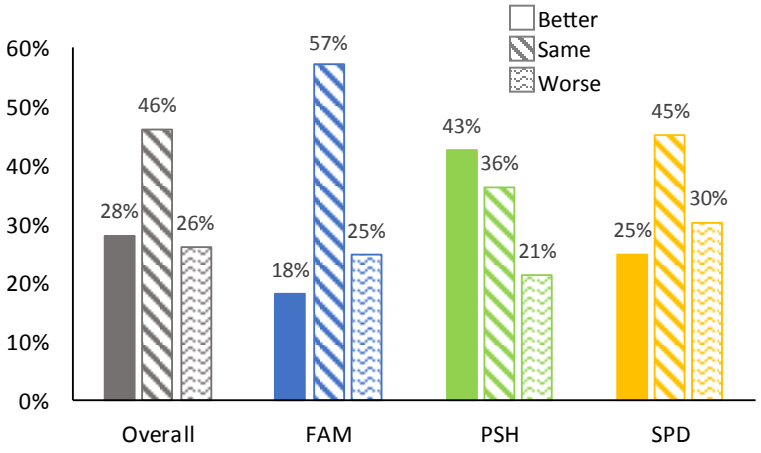


WHAT WE FOUND

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).

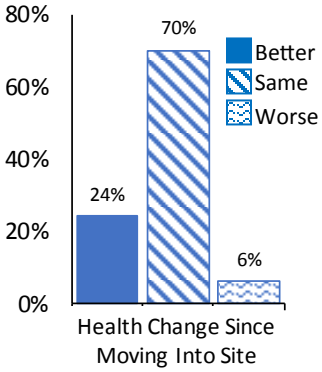
CHANGES IN HEALTH STATUS: We did not see strong evidence that affordable housing impacted subjective health in either direction: clients were equally likely to report their health was better or worse since moving in, suggesting no clear directional pattern (Exhibit 15). The key exception was PSH clients, who were far more likely to report their health had improved (43%) than gotten worse (21%) since moving in.

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% reporting that their child's health was better since moving in and only 6% reporting it was worse (the remainder were unchanged).

Exhibit 16. Change in Subjective Health of Your Child Since Moving into Current Residence



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 in to affordable housing. It is important to note that most respondents had only been in their current housing unit for a year or perhaps 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 of a possible subjective health impact of housing perceived by individuals in PSH and on parents' subjective assessment of their children's health.

For additional client survey results, please refer to Appendix B.

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 this question, 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, then compared their respective trends in outcomes between the pre- and post-move-in period 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.

AVAILABILTY 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 12). This indicates the results for the impact of services is likely a conservative estimate.

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 agency. 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.

Exhibit 17. Service Categories

HEALTH SERVICES/STAFF	SOCIAL SERVICES/STAFF	WELLNESS 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 offsite services (97 properties).	Available assistance with psychosocial needs that might impact health, including community health workers and social workers (15 properties).	Assistance with general wellness, including staff who assist with food access, fitness, and other residential activities (107 properties).

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.

For a more detailed statistical methodology for the difference in differences (DiD) and multivariate regression models, please refer to Appendix A.

Exhibit 18. Impact of Integrated Health 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 [1]	+0.6/year	+0.9/year	-0.27/year	0.29
ED Visits[1]	-0.3/year	0.0 (no change)	-0.34/year	0.00*
IP Visits[1]	0.00 (no change)	+0.03	-0.03/year	0.29
Costs PMPM[2]	-$66/month	+$12/month	-$78	0.01*

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

1. Outliers above 99th percentile were removed.
2. Outliers above the 95th percentile were removed.

RESULTS:

THE IMPACT OF SERVICES

SOCIAL SERVICES/STAFF & WELLNESS 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 (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.

It is important to note that the above 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 to begin with. 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 below).

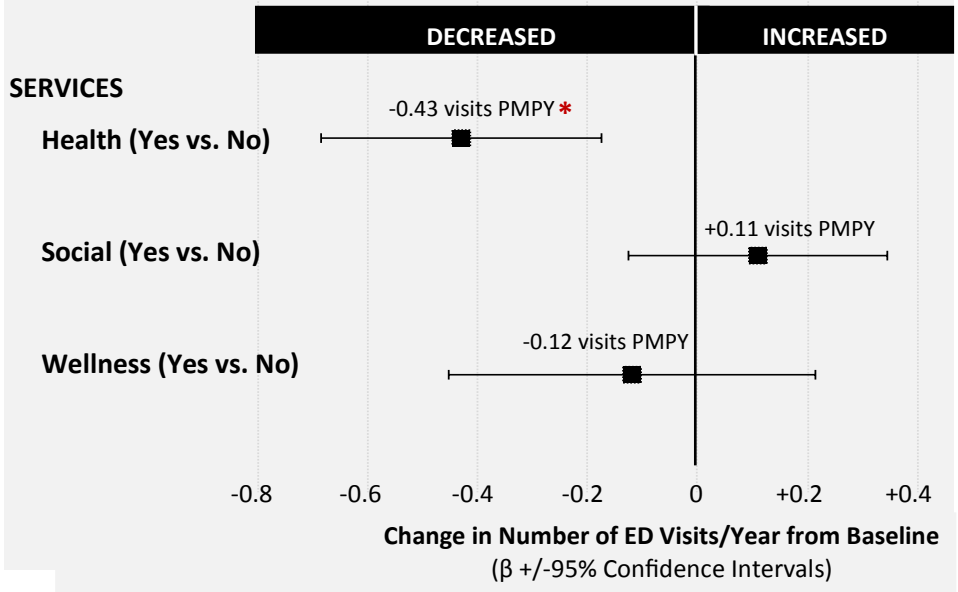
MULTIVARIATE MODEL: ED UTILIZATION

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. PSH itself was also predictive of reduced ED visits, with or without integrated services.

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 those facing greater health challenges (see Appendix B).

Exhibit 19. Adjusted Impact of Services/Staff on ED Visits



*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% 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.

For complete results from our multivariate models, please refer to Appendix B. A more detailed description of our methods can be found in Appendix A.

RESULTS:

THE IMPACT OF SERVICES

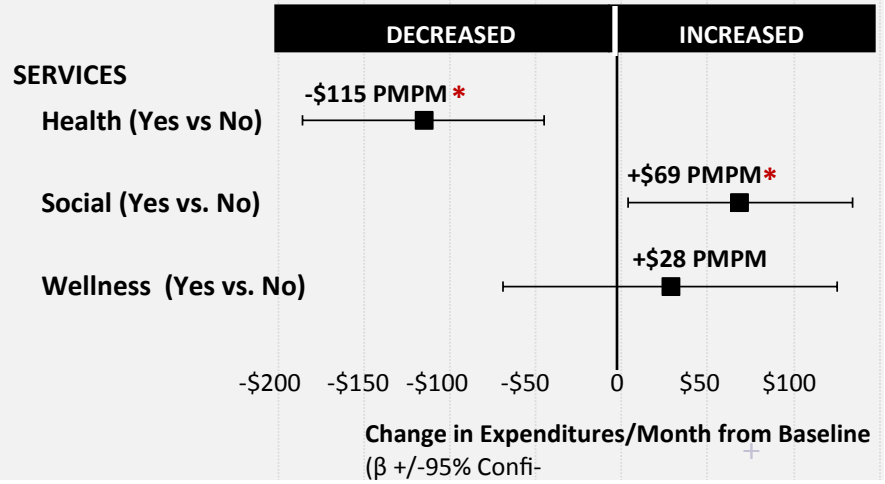
MULTIVARIATE MODEL: TOTAL MEDICAL EXPENDITURES

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 onsite social workers and CHWs) are associated with *increased* expenditures. It is important to note that more expenditures are not always a negative outcome — this may represent these staff in connecting people to health care services to which they would otherwise lack access. We did not see these staff have a comparable increase on ED visits, so this could represent "appropriate" increases in utilization. Whether costs constitutes "desirable" health care expenditures or not is beyond the scope of the current study, but could be fruitful for follow-up work.

Exhibit 20. Adjusted Impact of Services on PMPM Expenditures



*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% confidence intervals around the estimated effect. Bars to the left of the center line represent factors associated with *less 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.

THE BOTTOM LINE: 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 stable housing and building 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 may represent their work improving access and helping connect residents to necessary health care services.

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 was before moving in (as measured by our medical complexity risk score), the greater the decline in their ED use and expenditures after moving in (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 those who were aware of a service, how often it was actually used.

Exhibit 21. Percent Aware of Offered Service [1]

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

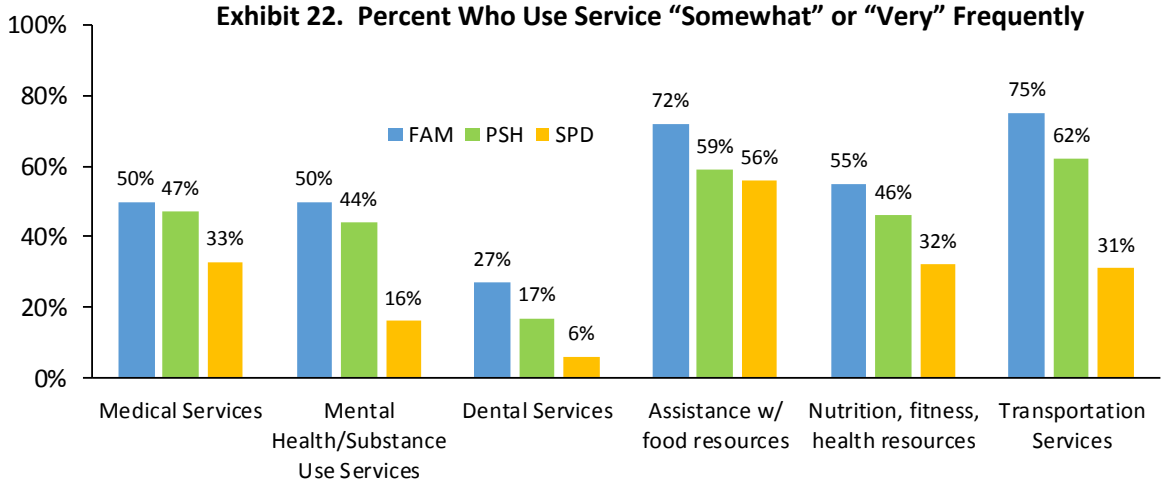
1. Among those living at properties offering the service.
2. None of the 12 surveyed properties reported offering dental services.

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).

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.

Exhibit 22. Percent Who Use Service "Somewhat" or "Very" Frequently



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.

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% 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 following moving into their current residence, suggesting that expenditure reductions did not come at the expense of client experience.

THE 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 care quality. 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, however, 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 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 stable housing would help clarify the potential connection between housing and health highlighted in our findings.

THE BOTTOM LINE:

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 housing 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.

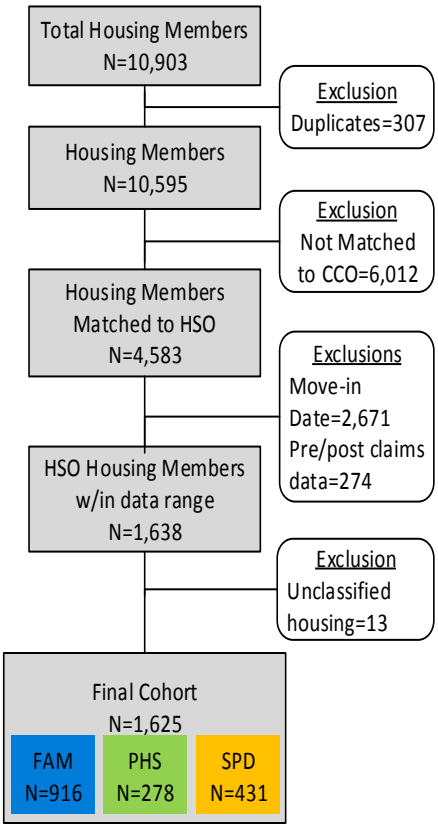
Health care and housing are each only one part of the other's value equation. It doesn't have to be the health care system's job to find everyone a home, but our results suggest that it may be in their interests to partner with the housing sector in ways that improve outcomes for everyone. In the emerging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

APPENDIX A:

TECHNICAL METHODS

CLAIMS

Exhibit 23. Claims population



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 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 (4/1/2011-1/31/2015) 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 1/1/2011-6/30/2015. 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 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 allows 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, four from each housing type, with a large number of Health Share members. Surveys were mailed to 513 individuals residing at these properties. We worked closely with staff at each property to increase resident awareness of the survey and, by the end of the 2-month fielding period, 275 residents responded (54%). 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%	**0.00**	2.4	2.8	16%	**0.00**	3.5	4.4	26%	**0.01**	3.1	3.8	22%	**0.00**
ED	1.1	0.9	-18%	**0.00**	0.9	0.8	-10%	0.08	1.5	0.9	-37%	**0.00**	1.0	0.9	-18%	**0.05**
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%	**0.00**	0.00	0.00	0%	0.09	0.02	0.00	-100%	**0.01**	0.02	0.00	-100%	**0.01**
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%	**0.00**	5.6	5.4	-4%	0.51	11.2	9.8	-12%	0.06	9.1	7.2	-20%	**0.00**
Specialty	3.7	2.9	-22%	**0.00**	2.5	1.9	-24%	**0.00**	5.3	4.4	-17%	**0.01**	5.0	3.8	-23%	**0.00**
ASC	0.09	0.13	53%	**0.00**	0.06	0.09	55%	**0.03**	0.12	0.17	43%	0.13	0.12	0.19	60%	**0.02**
Pharmacy	16.4	21.4	30%	**0.00**	10.7	13.3	25%	**0.00**	26.1	37.8	45%	**0.00**	22.2	27.7	25%	**0.00**
Other	17.2	10.2	-41%	**0.00**	9.8	5.4	-45%	**0.00**	26.0	18.2	-30%	**0.00**	27.0	15.2	-44%	**0.00**

Exhibit 25 describes the percent of individuals who had at least one of each type of visit in the time following moving into their current housing compared to prior. Overall, the percentage of individuals utilizing primary care increased significantly (18%) and the percentage of individuals with ED visits decreased significantly (-11%) 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 was 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%	**0.00**	60%	67%	15%	**0.00**	55%	67%	22%	**0.00**	54%	66%	22%	**0.00**
ED	40%	36%	-11%	**0.00**	37%	36%	-3%	0.54	52%	38%	-28%	**0.00**	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

APPENDIX B:

HEALTH CARE UTILIZATION

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 (≥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 to prior, 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	%Δ	p-val	Pre	Post	%Δ	p-val
PCP	2.5	3.2	27%	**0.00**	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%	**0.01**
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%	**0.00**	1.4	1.0	-31%	**0.01**
ASC	0.08	0.12	49%	0.07	0.02	0.04	75%	0.16
Pharmacy	15.7	19.1	22%	**0.00**	2.8	4.2	49%	**0.00**
Other	13.4	6.9	-48%	**0.00**	4.2	2.9	-30%	**0.00**

Exhibit 27. Adults and Children in Family Housing with a Visit

	ADULT N=568				CHILDREN N=348			
	Pre	Post	%Δ	p-val	Pre	Post	%Δ	p-val
PCP	56%	66%	17%	**0.00**	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%	**0.02**

APPENDIX B:

HEALTH CARE UTILIZATION

SERVICES & STAFF

The tables below in Exhibit 28 describe the change in utilization for residents at properties with specific integrated services. The table displays 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-1579 (Post-Pre)	DiD (Yes-No)	p-value	Yes N=476 (Post-Pre)	No N=1199 (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

APPENDIX B:

HEALTH CARE UTILIZATION

SERVICES & STAFF

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 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 was no data available for properties with only a community navigator.

Exhibit 30. Closer Look: Community Health Workers (CHW) 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

APPENDIX B:

EXPENDITURES

SERVICES & STAFF

Exhibits 31 and 32 describe the change in expenditures for residents at properties with specific services or staff. The table displays 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	**0.04**
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	**0.00**

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	**0.00**
Activities Coordinator	-$21	-$53	$31	0.29
Community Health Worker	-$11	-$59	$48	0.11
Doctor/Nurse	-$304	-$43	-$261	**0.02**
Social Worker	-$12	-$54	$42	0.19
Other Health Professional	-$159	-$40	-$119	**0.02**

APPENDIX 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%-100% of individuals using the services reported that they were very/somewhat helpful.

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%

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% of FAM, 29% of PSH, and 26% 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 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 childcare, community center, eviction prevention, yoga, physical therapy, and activities for seniors or children.

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 childcare	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

APPENDIX B:

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 to begin with. 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 12 and 13).

The unadjusted impact of the health services can be found on page 11.

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

	Property has Social Services N=410	Property does not Have Social Services N=1215	Difference in Outcomes with Service	
	Change from Baseline	Change from Baseline	DiD	p-val
PCP Visits	+0.1 per year	+0.8 per year	-0.45	0.06
ED Visits	0.0 (no change)	-0.3 per year	0.03	0.20
IP Visits	-0.01 per year	+0.01 per year	0.01	0.60
Costs PMPM	-$16/month	-$59/month	$43	0.13

Exhibit 37. Impact of Integrated Wellness Services/Staff on Outcomes

	Property has Wellness Services N=1434	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	0.00 (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, $p<0.05$.

APPENDIX B:

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. Complete Adjusted Models

	Diff in # ED visits (PMPY)			Diff in Cost (PMPM)		
CHARACTERISTICS	**β**	**95% CI**	**P-val**	**β (SE)**	**95% CI**	**P-val**
Has >=1 Medical Related Services and Staff	-0.43	-0.68, -0.18	**0.00**	-$115	-$185, -$45	**0.00**
Has >=1 Social Services and Staff	0.11	-0.13, 0.35	0.33	$69	$4, $134	**0.04**
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	**0.01**