Effects of Permanent Supportive Housing on Health Care Utilization and Spending Among New Jersey Medicaid Enrollees Experiencing Homelessness

Derek DeLia, PhD,† Jose Nova, MS,‡ Sujoy Chakravarty, PhD,‡ Emmy Tiderington, PhD,§ Taiisa Kelly, BA,‖ and Joel C. Cantor, ScD‡¶*

Background: Permanent supportive housing (PSH) programs have the potential to improve health and reduce Medicaid expenditures for beneficiaries experiencing homelessness. However, most research on PSH has been limited to small samples of narrowly defined populations.

Objective: To evaluate the effects of PSH on Medicaid enrollees across New Jersey.

Research Design: Linked data from the Medicaid Management Information System and the Homeless Management Information System were used to compare PSH-placed Medicaid enrollees with a matched sample of other Medicaid enrollees experiencing homelessness. Comparisons of Medicaid-financed health care utilization and spending measures were made in a difference-in-differences framework 6 quarters before and after PSH placement.

Subjects: A total of 1442 Medicaid beneficiaries enrolled in PSH and 6064 Medicaid-enrolled homeless individuals not in PSH in 2013–2014.

Results: PSH placement is associated with a 14.3% reduction in emergency department visits ($P < 0.001$) and a 25.2% reduction in associated spending ($P < 0.001$). PSH also appears to reduce inpatient utilization and increase pharmacy spending with neutral effects on primary care visits and total costs of care (TCOC).

Conclusions: Placement in PSH is associated with lower hospital utilization and spending. No relationship was found, however, between PSH placement and TCOC, likely due to increased pharmacy spending in the PSH group. Greater access to prescription drugs may have improved the health of PSH-placed individuals in a way that reduced hospital episodes with neutral effects on TCOC.

Key Words: Medicaid, homelessness, permanent supportive housing, health care utilization, health care expenditures

(*Med Care* 2021;59: S199–S205)

The National Academies of Sciences, Engineering, and Medicine recommended that "…states should pursue opportunities to expand the use of Medicaid reimbursement for housing-related services to beneficiaries whose medical care cannot be well provided without safe, secure, and stable housing."[1] Although interest in establishing Medicaid-funded tenancy support service for certain persons experiencing homelessness is growing,[2] the design of Medicaid-supported housing-related services is hampered by gaps in available evidence about the effectiveness and cost of such services.[1,3]

Medicaid is a potential source of funding for tenancy support services as part of permanent supportive housing (PSH) initiatives. PSH is housing with "indefinite leasing or rental assistance paired with supportive services to assist homeless persons with a disability or families with an adult or child member with a disability achieve housing stability."[4] PSH services vary, but typically include combinations of assistance finding and maintaining housing, case management, referrals to mental and physical health care and social services, and other services.[5,6] Housing and supports in PSH are currently funded through a wide range of federal, state, local, and private sources. Agencies operating PSH programs often need to piece together multiple sources of funding in order to cover all of these components of care. The profile of PSH in New Jersey is similar to programs nationwide, drawing on funding from the Department of Housing and Urban Development (HUD) and the Department of Veterans Affairs. These programs supported over 5600 PSH units in 2019 in New Jersey. Compared with the United States as a whole, however, a lower share of units in New Jersey is designated for Veterans (25.6% compared with 37.8%).[7] Seventeen states use Medicaid to fund tenancy supports for selected populations under demonstration waivers or section 1915(i) state plan amendments.[8]

From the *Medstar Health Research Institute, Hyattsville, MD; †Department of Plastic and Reconstructive Surgery, Georgetown University School of Medicine, Washington, DC; ‡Center for State Health Policy, Institute for Health, Health Care Policy and Aging Research; §School of Social Work, Rutgers University, New Brunswick; ‖Monarch Housing Associates, Cranford; and ¶Edward J. Bloustein School of Planning and Public Policy, Rutgers University, New Brunswick, NJ.

The work presented in this manuscript was conducted at the request of the New Jersey Department of Human Services Division of Medical Assistance and Health Services (DMAHS) and the NJ Housing and Mortgage Finance Agency (HMFA) and funded by The Nicholson Foundation and the DMAHS.

The authors declare no conflict of interest.

Correspondence to: Joel C. Cantor, ScD, Center for State Health Policy, Institute for Health, Health Care Policy and Aging Research, Rutgers University, 112 Paterson Street, 5th Floor, New Brunswick, NJ 08901. E-mail: jcantor@ifh.rutgers.edu.

Supplemental Digital Content is available for this article. Direct URL citations appear in the printed text and are provided in the HTML and PDF versions of this article on the journal's website, www.lww-medicalcare.com.

ISSN: 0025-7079/21/5904-S199

Other states, including New Jersey, use Medicaid resources under other authorities which are limited to defined populations with special needs. New Jersey does so for individuals with diagnosed serious mental illness (SMI) and documented rehabilitation needs.[9]

Although PSH has been shown to improve housing stability and reduce hospital inpatient and emergency department (ED) use, these findings are mainly from studies that followed, self-selected populations or have been small scale.[1,10–12] Moreover, although PSH models and funding priorities have changed significantly over time, most health-related PSH studies were conducted more than a decade ago. Among recommendations to address current evidence gaps, the National Academies noted that there has been "[i]nsufficient application of … integrated health data systems, homeless management information systems, and other data."[1]

This paper draws on a 6-year database linking New Jersey Medicaid and homeless services administrative data to evaluate the impact of PSH on Medicaid beneficiary's health services utilization and associated Medicaid program spending. The analysis focuses on Medicaid-enrolled adults ages 18 and over who were initially enrolled in PSH in 2013 or 2014. These PSH enrollees are compared with matched individuals not receiving PSH but with a similar history of homelessness, Medicaid enrollment, and medical diagnoses.

METHODS

Data

The data for the study come from the Medicaid Management Information system (MMIS) and Homeless Management Information System (HMIS) for 19 of the 21 New Jersey counties in 2011–2016. These data were linked by the New Jersey Division of Medical Assistance and Health Services using individual identifiers including name, date of birth, and Social Security numbers. Additional information about the linked MMIS-HMIS data for this study are presented elsewhere.[13] The data for the analysis presented here were arranged by person-quarter to conduct the matching and trend analyses described below. Arranging the data this way also allowed us to create a group of potential matches for PSH-placed individuals. As described below, matches were based on comparison subjects who were similar to PSH-placed individuals according to multiple characteristics, including the time period that would be used to mark preintervention and postintervention quarters. The study was approved by a university IRB.

Permanent Supportive Housing and Comparison Groups

The HMIS data were used to identify individuals with initial enrollment in PSH in 2013 or 2014. Such individuals (and matched comparisons defined below) were excluded from the study if they: (1) had a previous PSH admission during the study period; (2) did not have at least 6 quarters of Medicaid enrollment before PSH placement; or (3) did not have at least some Medicaid enrollment in each of the 6 quarters following PSH admission.

A comparison cohort with up to 5 matches per PSH enrollee was created using exact and minimum Mahalanobis distance matching with the "mahapick" command in STATA 16.0. Although more matches per case tends to improve statistical power, the gain in power fades quickly after 5 matches per case.[14] In sensitivity analysis, we also used 3 matches per case with no change in the main findings. Exact matching was based on the following variables from the MMIS: sex, race/ethnicity, Medicaid eligibility category, patient risk score classification, having SMI, and having a substance use disorder (SUD). Risk scores were based on the Chronic Illness and Disability Payment System in the following 6 categories: <0.5, 0.5–1, 1–2, 2–3, 3–5, and > 5.[15] SMI (eg, psychosis, bipolar disorder) was identified based on diagnoses defined by the Agency for Healthcare Research and Quality (AHRQ).[16] SUD was defined based on AHRQ's Clinical Classification Software.[17] The full specifications of codes used to identify SMI and SUD are found in the cited references. These were updated for ICD-10 coding using AHRQ update algorithms and the General Equivalence Mapping.[18,19]

Exact matching also included the following variables from the HMIS: quarter of actual placement for PSH clients or pseudo-placement for comparisons (to account for seasonality), indicator of time in a place not fit for habitation (eg, living in an abandoned building) preplacement, and indicator of time in a homeless shelter preplacement. Finally, distance matching was based on age, number of chronic conditions, and days enrolled in Medicaid in the previous 4 quarters. Chronic conditions were identified using the Chronic Conditions Warehouse developed by the Centers for Medicare and Medicaid Services.[20] We evaluated the quality of the matching according to each variable using standardized differences with an absolute value of <0.1 taken as the standard for no meaningful difference between groups.[21]

Outcomes and Analysis

Trends in multiple outcome variables were tabulated for the PSH and matched comparison cohorts from 6 quarters before PSH placement to 6 quarters after. Outcome variables, measured quarterly, included ED visits, inpatient admissions, and primary care (PC) visits as well as Medicaid spending associated with these measures. In addition, we examined total Medicaid pharmacy spending and total costs of care (TCOC) defined as spending for all Medicaid-covered services.

PC visits were defined as ambulatory visits for evaluation and management identified in HCPCS/CPT codes as office/other outpatient services (99201–99215), office/other outpatient consultations (99241–99245), or preventive medicine services (99381–99397). Although specialists sometimes provide PC services, the focus of this analysis is on access to PC providers specifically. Thus, evaluation and management visits are included in the analysis only if that they were delivered by a provider specializing in PC (eg, family medicine, general internal medicine) and in an ambulatory care setting outside the ED. A full description of the codes used to identify PC visits and providers in the MMIS is provided in Supplemental Digital Content 1 (http://links.lww.com/MR/A244).

We displayed each outcome graphically for the PSH and comparison cohorts to identify potential breaks in trends after

PSH/pseudo-placement. We then estimated simple difference-in-differences (DD) models that included a pre/postindicator, a PSH placement indicator, and the interaction between them. To more clearly distinguish postplacement versus preplacement effects, we excluded the placement quarter in the DD models. We did not include the matching variables as covariates in the model because some do not vary over time (eg, sex, race) and others are potentially endogenous in the post-PSH period (eg, risk scores, time in shelters). We tested the parallel trends assumption in DD models graphically and by testing the statistical significance of an interaction term between the PSH indicator and linear time trend for observations in the pre-placement period.[22] If this term was statistically significant, we added a preplacement linear trend term and the preplacement interaction term to the final DD model. Otherwise, we estimated the simple DD model described above.

The DD models described above consider PSH as an intervention that begins sometime within the quarter of PSH placement. However, placement requires substantial clinical documentation of a housing-related disability, which can lead to increased utilization several months before actual initiation of PSH. Thus, as a sensitivity analysis, we also estimate models where the quarter before PSH placement is considered the beginning of the intervention, providing 5 preintervention and 7 postintervention quarters.

We estimated negative binomial models for counts (ie, visits, admissions) and gamma models with a log link for spending amounts. As these models are nonlinear, we cannot measure the DD effect as the coefficient for the interaction term. Instead, we calculated average predicted outcome values from the model for the PSH and comparison groups and calculated the DD effect from these values. We then calculated confidence intervals and *P*-values for the DD effects using contrast margins in STATA. Finally, SEs were adjusted for clustering within groups of treated (ie, PSH) individuals and their matched comparisons.

RESULTS

The PSH cohort included 1442 individuals. (Sixty-four PSH-placed individuals could not be matched with any comparison observations and were excluded from the analysis.) The comparison group consisted of 6778 total observations with 6064 unique individuals. Among the PSH cohort, there were 1275 with 5 matches, 37 with 4 matches, 36 with 3 matches, 53 with 2 matches, and 41 with 1 match. The quarter of PSH placement/quasi-placement was roughly uniformly distributed throughout the quarters of each year. The PSH and comparison cohorts were predominantly Black, female, and Medicaid eligible through the aged, blind, and disabled or non-ABD parent categories (Table 1). The 2 cohorts were well balanced with all but 1 variable meeting the 0.1 standardized difference threshold (see Table 1 and Love plot in Supplemental Digital Content 2, http://links.lww.com/MLR/C124). Average days in Medicaid fell just outside of this threshold with a small quantitative difference between the 2 groups.

ED visits per person moved roughly in parallel between the PSH and comparison cohort in the preplacement period (Fig. 1A). But in the postplacement period, they leveled off for the PSH cohort and rose somewhat for the comparison cohort. A similar pattern emerged for ED spending (Fig. 1B).

TABLE 1. Cohort Characteristics in Quarter of Actual or Simulated PSH Placement

Population Characteristic	Cohort		Standardized Difference
	PSH	Comparison	
Quarter (%)			0.005
1	27.74	27.78	
2	22.33	22.50	
3	26.01	25.82	
4	23.93	23.90	
Male	32.34	32.15	0.017
Race/ethnicity			0.045
White	25.94	25.57	
Black	66.44	67.85	
Hispanic	4.85	4.31	
Other	2.77	2.27	
Medicaid eligibility (%)			0.033
ABD	41.33	41.68	
Non-ABD parents	41.89	42.59	
ACA expansion/general assistance*	12.83	12.10	
Children's services	0.90	0.71	
Other	3.05	2.92	
Risk scores during prior calendar year (%)			0.031
≤0.5	12.76	12.75	
0.5–1	26.56	26.85	
1–2	28.29	28.89	
2–3	16.16	16.16	
3–5	13.04	12.61	
>5	3.19	2.74	
SMI diagnosis in prior 4 quarters (%)	41.26	40.54	0.015
SUD diagnosis in prior 4 quarters (%)	47.50	47.52	<0.001
Spent time in place not fit for habitation in prior 4 quarters (%)	13.04	11.17	0.057
Spent time in a shelter in prior 4 quarters (%)	34.05	32.99	0.022
Average age (y)	39.35	39.37	0.002
Average number of chronic conditions in prior 4 quarters	0.77	0.71	0.048
Average days in Medicaid in prior 4 quarters	361.00	362.78	0.129

*Before passage of the ACA, nondisabled childless adults with income below 24% of the FPL were covered under general assistance. After the ACA, these individuals were covered in the expansion population with income up to 138% of the FPL.

ABD indicates aged, blind, disabled; ACA, Affordable Care Act; FPL, federal poverty level; PSH, permanent supportive housing; SMI, serious mental illness; SUD, substance use disorder.

Sources: Linked records from the NJ Medicaid Management Information system (MMIS) and Homeless Management Information System (HMIS).

Graphical analysis suggests some reductions in inpatient utilization spending associated with PSH but with a "noisier" pattern (Fig. 2A). No apparent differences were observed for inpatient spending (Fig. 2B). Pharmacy spending had a shallow upward trend for the comparison group throughout the study period (Fig. 3). For the PSH cohort, the trend was similar until it accelerated in the second quarter before PSH placement and then accelerated further in the second quarter after placement. This trend then leveled off in the fifth and sixth postplacement quarters. Graphical analysis for the other outcome measures, including TCOC, did not reveal any clear

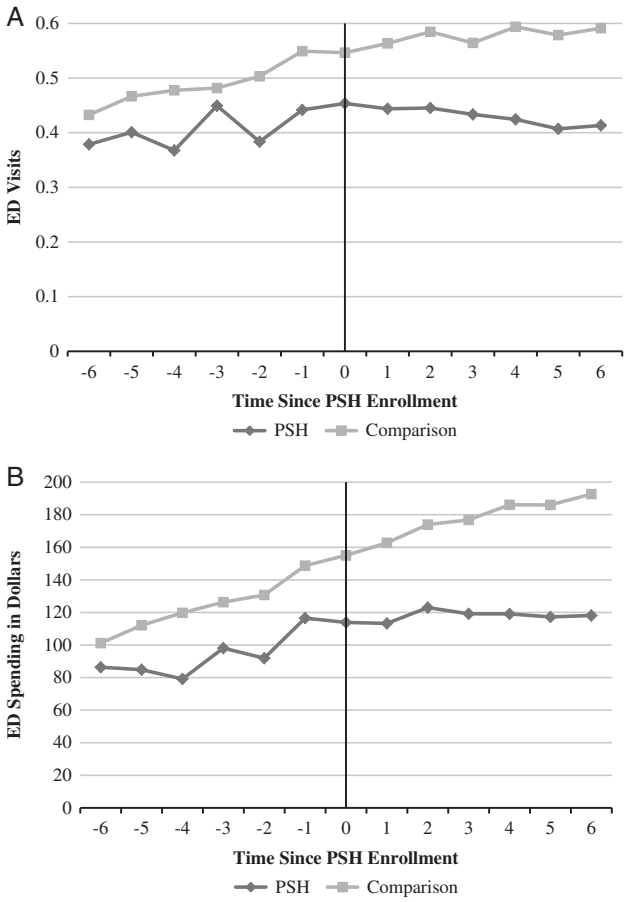

FIGURE 1. Trends in emergency department (ED) utilization and spending in permanent supportive housing (PSH) and comparison groups. A, Trends in ED visits. B, Trends in ED spending. In both (A) and (B), vertical axis represents utilization counts or associated spending per person per quarter. Horizontal axis represents number of quarters before (negative numbers) or after (positive numbers) actual or simulated PSH placement. *Sources*: Linked records from the New Jersey Medicaid Management Information system and Homeless Management Information System.

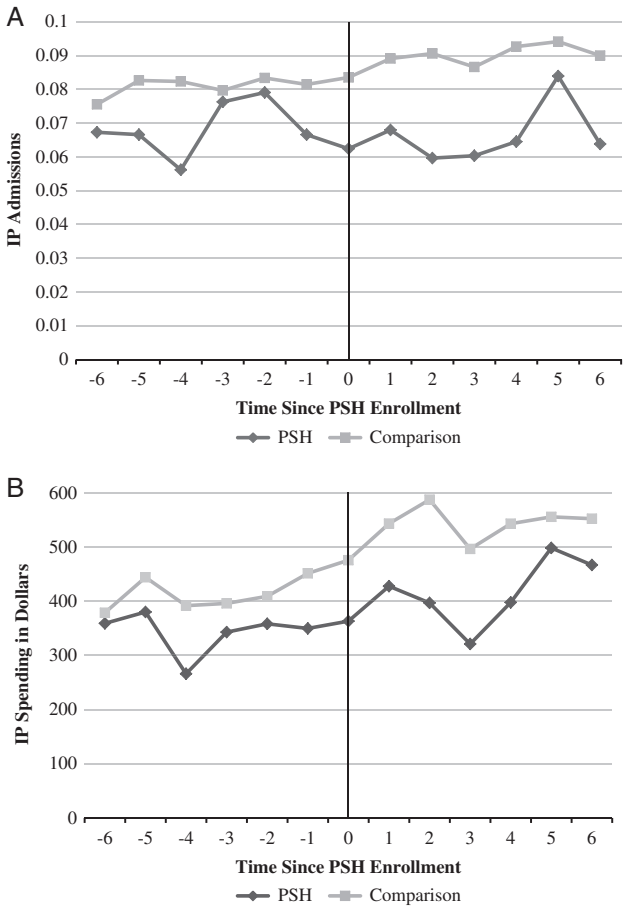

FIGURE 2. Trends in inpatient (IP) utilization in permanent supportive housing (PSH) and comparison groups. A, Trends in IP admissions per person per quarter for PSH and comparison groups. B, Trends in IP spending per person per quarter for PSH and comparison groups. In both (A) and (B), vertical axis represents utilization counts or associated spending per person per quarter. Horizontal axis represents number of quarters before (negative numbers) or after (positive numbers) actual or simulated PSH placement. *Sources*: Linked records from the New Jersey Medicaid Management Information system and Homeless Management Information System.

breaks in trends between the 2 cohorts (Figs., Supplemental Digital Content 3, http://links.lww.com/MLR/C125).

In the main DD models, the parallel trends assumption was met for all but PC visits. As shown in Table 2, PSH is associated with reduced ED visits and ED spending. There were 7.0 fewer ED visits per 100 individuals per quarter in the PSH group relative to the comparison group, a 14.3% decrease relative to the pre-PSH comparison group mean ($P < 0.001$). Similarly, there was $31.08 less in ED spending per person per quarter in the PSH group relative to the comparison group ($P < 0.001$), a 25.2% decrease. PSH placement was associated with 1.2 fewer inpatients admissions per 100 individuals per quarter ($P=0.055$), a 14.6% decrease. Inpatient spending also fell for the PSH group but this reduction did not reach statistical significance. The findings for ED and inpatient outcomes were similar in the shifted models where PSH initiation or quasi-placement was considered to be the quarter before actual placement. Also, there was no association between PSH and TCOC or PC variables regardless of model specification (ie, accounting for parallel trends or main vs. shifted models).

Findings for pharmacy spending were sensitive to model specification. In the main DD model, the parallel trends assumption was rejected ($P=0.011$). Adjusting for nonparallel trends led to a small ($27.61) and statistically insignificant ($P=0.674$) positive association with PSH. But in the shifted model, the parallel trends assumption could not be rejected ($P=0.079$). Assuming parallel trends, PSH was associated with a large ($175.61) and statistically significant ($P=0.002$) increase in pharmacy spending. Moreover, the findings from the main and shifted models were similar to each other when making consistent assumptions about parallel versus nonparallel trends. (As shown in Supplemental Digital Content 4, DD findings were nearly identical when using a 3:1 matching strategy, http://links.lww.com/MLR/C126.)

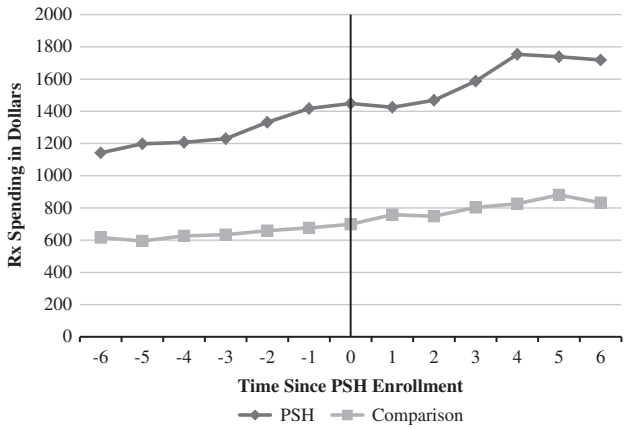

FIGURE 3. Trends in pharmacy spending per person per quarter for permanent supportive housing (PSH) and comparison groups. Rx indicates pharmacy spending. The vertical axis represents utilization counts or associated spending per person per quarter. Horizontal axis represents number of quarters before (negative numbers) or after (positive numbers) actual or simulated PSH placement. *Sources*: Linked records from the New Jersey Medicaid Management Information system and Homeless Management Information System.

TABLE 2. Difference-in-Differences Estimates

Outcome Measure	Baseline Mean*	Estimate	95% Confidence Interval	*P*
Main models				
ED visits	0.487	−0.070	−0.110 to −0.030	<0.001
ED spending ($)	123.154	−31.078	−43.616 to −18.540	<0.001
Inpatient admissions	0.082	−0.012	−0.024 to −0.000	0.055
Inpatient spending ($)	422.351	−59.105	−160.449 to 42.238	0.253
Primary care visits	0.871	−0.048	−0.129 to 0.033	0.244
Primary care spending ($)	27.217	−1.833	−1.177 to 4.843	0.233
Pharmacy spending ($)	627.809	27.607	−101.038 to 156.252	0.674
Total Medicaid spending ($)	2434.083	−14.520	−254.509 to 225.468	0.906
Shifted models†				
ED visits	0.474	−0.067	−0.107 to −0.027	0.001
ED spending ($)	118.13	−28.563	−41.317 to −15.810	<0.001
Inpatient admissions	0.082	−0.012	−0.024 to −0.000	0.049
Inpatient spending ($)	414.257	−63.350	−159.809 to 33.109	0.198
Primary care visits	0.871	0.066	0.006–0.127	0.033
Primary care spending ($)	26.814	1.684	−1.323 to 4.693	0.272
Pharmacy spending ($)	619.301	175.613	66.604–284.622	0.002
Total Medicaid spending ($)	2407.222	13.474	−219.917 to 246.865	0.910

*On the basis of mean values for individuals in the comparison group in the preintervention period.

†Beginning of PSH intervention measured one quarter earlier to account for provision of services 3–6 months before placement into housing.

ED indicates emergency department.

Sources: Linked records from the NJ Medicaid Management Information system (MMIS) and Homeless Management Information System (HMIS).

DISCUSSION

The analysis above examines the relationship between PSH placement and Medicaid utilization and spending outcomes. Relative to a matched comparison group, previously homeless adults placed in PSH had reduced ED and inpatient utilization, reduced ED spending, and no change in inpatient spending. Effects on TCOC, however, were neutral, largely due to increased pharmaceutical spending. PC utilization and spending were also exhibited neutral effects.

Findings regarding ED utilization and spending were robust but findings on pharmacy spending were sensitive to model specifications, ranging from modest ($27.61/quarter) without statistical significance to large ($175.61/quarter) and highly significant. The main specification difference hinged on when to mark the beginning of the PSH intervention, since PSH-related services for some individuals may be initiated before placement into housing. Specifically, it is possible that visits to providers to obtain documentation of a disability could be accompanied by prescription of medications to treat behavioral health or other chronic conditions. The sensitivity of pharmacy spending to this timing has implications for the way in which PSH services are organized and evaluated. Although it is ideal to provide all program benefits immediately, limits in the housing stock and administrative considerations may lead to some unavoidable delays. Thus, a more precise evaluation of PSH would require more detail on when specific services were initiated for each individual.

Overall, these findings suggest that PSH may have improved health outcomes by helping previously homeless Medicaid enrollees avoid adverse health events associated with hospital episodes. Greater access to prescription drugs may have played a role in reducing hospital episodes but with an offsetting increase in spending, which ultimately led to a neutral impact of PSH on TCOC. Still, the combined effects of PSH may have been to improve the health of especially vulnerable Medicaid enrollees with no net increase in total spending. We note that our analysis considered only the spending associated Medicaid-financed health services. The costs of PSH services and potential benefits outside of the Medicaid program were not included.

Our results are consistent with prior literature with respect to trends in ED and inpatient utilization.[1,10–12] As noted by the National Academies of Sciences, Engineering and Medicine (2018), "providing PSH to individuals with high medical needs who are also experiencing homelessness decreases emergency department use and hospital stays."[1] Although we find no association between PSH and PC utilization, others have found a positive association with outpatient visits. For example, a randomized study of Housing First in Chicago by Basu et al[23] found that those enrolled in PSH had 3.8 more outpatient visits each year along with less hospital, residential substance abuse, and nursing home services.

More broadly, we note that prior work has used mainly smaller, self-selected, location-specific samples and often focused on specific high-need populations including those with specific health conditions such as SMI or specific population groups such as Veterans. Our study examines trends among virtually all persons placed in PSH in 19 of 21 New Jersey

counties over 2 years. It may be that our somewhat weaker findings about hospital use and lack of association with PC reflect the population-based nature of our study where PSH may be delivered more inconsistently, and the study population is more heterogeneous, than in prior randomized trials or quasi-experimental studies. Further, the growing complexity of the policy environment, including increased emphasis on "coordinated entry" programs which require centralized, regional management of housing placements, and adoption of Housing First which requires rapid housing placement without preconditions such as substance use abstinence or engagement in mental health treatment, may make improving health services patterns more difficult in recent years than in many of the PSH evaluations that were conducted a decade ago or more.

Prior research in New Jersey showed that the population of homeless adults meeting HUD chronic homelessness criteria (typically required for PSH placement) but not placed in PSH faced greater behavioral health challenges relative to those placed in PSH.[24] Specifically, currently homeless adults likely to be eligible for PSH had higher rates of any mental illness in combination with a SUD, SMI conditions, and an opioid use or dependence diagnosis compared with those placed in PSH. In that study, PSH and non-PSH groups had similar distributions of nonbehavioral health chronic conditions. These findings suggest that there may be greater opportunities to reduce avoidable hospital use if PSH were expanded to the eligible-but-not-enrolled group, but they also reveal that achieving those reductions may be challenging.

The analysis is subject to limitations that should be addressed in future analysis. First, although a strength of our study is the inclusion of a large diverse population of PSH-placed individuals, this created challenges in the construction of a comparison group where some cases did not have the desired 5 matches under the strict criteria used for matching (although 3:1 matching produced nearly identical results). Second, although the preintervention outcome trends were mostly parallel between the 2 study cohorts in the preplacement period (and modeling adjustments were made when not), the levels of the outcome variables were fairly different between the 2 groups in the preperiod, creating somewhat different potential for change over time between the 2 groups. Third, our use of several outcome measures raises the issue of inflated type I error due to multiple comparisons. However, our findings for ED visits and ED spending in all models and pharmacy spending in the shifted model would be retained even with a conservative Bonferroni correction.[25] Fourth, we were unable to capture variations in the design and quality of PSH programs in the administrative data available to us. Finally, our data permitted us to examine health services use and spending outcomes for only 6 months post-PSH placement, and it may take longer to achieve the maximum benefit of housing supports among the complex patients eligible for such placements. For example, our findings suggest that the impact of PSH on prescription drug spending occurs fairly quickly once individuals are engaged in supportive housing interventions, but drug regimens may need to be adjusted over time to achieve maximum benefit for chronic disease management.

Some of these limitations may be addressed by extending the analysis in future research to larger geographic regions, over longer periods of time, and by supplementing administrative data with primary data collection about PSH program details. Comparative effectiveness research using preidentified typologies of PSH may also help to identify which tenancy support services in which combinations result in better health outcomes and more efficient use of Medicaid resources.[5] Larger studies may also enable examination of a broader range of health services outcomes (eg, community behavioral health care) or more detailed characterization of the complexity of patient health conditions, enabling a more nuanced assessment of the role of PSH on improving health care access and other outcomes.

Overall, our analysis finds that PSH placement was associated with reductions in Medicaid-financed ED spending and utilization within the first 6 months of placement. Some evidence suggests that these spending reductions may have been offset by increased use of prescription drugs with neutral effects on TCOC. Given the significant accumulation of physical and mental health problems that are common in homeless populations, a 6-month observation window may be insufficient to detect all PSH program effects.

ACKNOWLEDGMENTS

The authors gratefully acknowledge contributions of Rutgers colleagues Margaret Koller, Dave Goldin, Kristen Lloyd, Oliver Lontok, and Jolene Chou. The views expressed in this paper and any errors or omissions are the sole responsibility of the authors, and do not necessarily reflect the views of the sponsors.

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