

Health & Housing in Delaware:

Matching Medicaid Claims and Encounters and the Community Management Information System Databases

Erin Nescott, M.S.;¹ Stephen Metraux, Ph.D.;² Mary Joan McDuffie, M.A.;³ Elizabeth Brown, MD, MSHP⁴

1. Center for Community Research & Service, Joseph R. Biden, Jr. School of Public Policy & Administration, University of Delaware
2. Center for Community Research & Service, Joseph R. Biden, Jr. School of Public Policy & Administration, University of Delaware
3. Center for Community Research & Service, Joseph R. Biden, Jr. School of Public Policy & Administration, University of Delaware
4. Division of Medicaid and Medical Assistance, State of Delaware Department of Health and Social Services

Acknowledgements

We gratefully acknowledge support for this project provided from the Delaware Division of Medicaid and Medical Assistance (DMMA), and data was provided by DMMA (Medicaid) and Housing Alliance Delaware (homeless services use). The content is solely the responsibility of the authors and does not necessarily represent the official view of the Delaware Division of Medicaid and Medical Assistance or the Housing Alliance Delaware.

Abstract

This study draws upon data from two databases: claims and encounters that were reimbursed by the state's Division of Medicaid and Medical Assistance (DMMA) and the Homeless Management Information System (HMIS) database that collects homeless services data on individuals experiencing homelessness. Records from both sets are matched to identify 838 adults who both experienced homelessness and were Medicaid eligible in 2019, and to select, through propensity score matching, an equal set of control observations who were similarly Medicaid-eligible but had no record of homelessness. Outcomes are compared based upon scores on the Charlson Elixhauser Comorbidity index, incidence of substance use disorder, inpatient, emergency department, and outpatient visits, and inpatient, emergency department, and outpatient costs. Using ordinary least squares regression models, we estimate homelessness (as indicated by use of homeless services) to be associated with excess costs of \$4,611 (non-chronic homelessness) to \$5,218 (chronic homelessness) per person over the course of 2019, compared to similar Medicaid enrollees who were housed.

Introduction

Homelessness has long been associated with poor health. Research has documented how health problems, including but not limited to mental health and substance abuse-related morbidities, have been catalysts of housing instability.¹ Health and behavioral health conditions often cause economic problems, difficulty maintaining and securing employment, loss of familial and social

supports, and other disruptions that can exacerbate unstable housing conditions leading to experiencing homelessness.² Conversely, homelessness intensifies health conditions as the absence of housing creates barriers to accessing to medical care, imposes conditions that can cause poor health conditions, and exposes people to trauma, stress, violence and other factors that are deleterious to good health.³

Worsened health conditions and lack of access make it likely that, once an individual experiencing homelessness accesses health care, their presenting conditions will have become more acute and require more extensive care. This is then reflected in increased health care expenses associated with health care services received. This has been demonstrated by numerous studies that have examined administrative records maintained by healthcare systems and third party payors and that have compared groups experiencing homelessness with comparable groups of housed controls.⁴ These studies have typically demonstrated substantial costs associated with homelessness, and decreased costs incurred after people transition from homelessness to permanent housing. Such studies illustrate a collateral benefit of addressing and ameliorating homelessness in its potential to mitigate poor health outcomes and reduce demands for health care and its corresponding costs.

In this study, we examine associations between homelessness and healthcare use in Delaware through matching records in the statewide homeless management information system (HMIS) database with the state's Medicaid claims and encounters database. This adds to the body of research on the impacts of homelessness on health and is the first such study specific to outcomes and costs in Delaware. As such, it provides specific findings that can be of assistance in coordinating health care and housing responses to unstable housing and homelessness.

Methods

In this study, we draw upon data from two databases: one containing the claims and encounters that were submitted to the state's Division of Medicaid and Medical Assistance (DMMA); and the HMIS database that collects homeless services data on individuals experiencing homelessness and is maintained for the State of Delaware's homeless continuum of care (COC) by Housing Alliance Delaware (HAD). Records from both sets are matched to identify people who are both homeless and Medicaid eligible in 2019, creating an integrated dataset with indicators related to homelessness status and health utilization. The project was reviewed and approved by the University of Delaware's Institutional Review Board (1647700-2).

The study group contains records for people who received three types of homelessness-related housing in 2019: temporary housing consisting of either shelter or transitional housing (n=490), rapid rehousing, where people receive housing with time-limited rental and services supports (n=302); and permanent supportive housing, (n=46), where people receive ongoing rental voucher and case management assistance. Of the 838 people in the study group, 190 (23%) were identified as "chronically homeless," operationalized by the U.S. Department of Housing and Urban Development (HUD) as "a single individual (or head of household) with a disabling condition who has either: Experienced homelessness for longer than a year, during which time the individual may have lived in a shelter, Safe Haven, or a place not meant for human habitation; or experienced homelessness four or more times in the last three years" for a combined time of at least twelve months.⁴ Given the extensive time of homelessness experienced among those in this subgroup, their use of Medicaid-reimbursed services were examined separately from the others in the study group.

The Medicaid records for those in the study group are compared to a set of matched controls who were Medicaid eligible with no record of homelessness during 2019. This control group was selected using propensity score matching (PSM) based non-health related characteristics available in the Medicaid records. PSM, a quasi-experimental method that is commonly used for studies similar to this,⁵ allows us to match each homeless individual with a comparable control group of similar characteristics. The characteristics that were used to match the control group include age, race and ethnicity, sex, county, and Medicaid eligibility category.

The study and control groups are compared on the basis of their health status, their services use, and the associated reimbursement costs, listed in the Medicaid claims, incurred through their health care use. We use the Charlson-Elixhauser Comorbidity Index as a means to assess health status. The Charlson-Elixhauser index was developed to assess mortality risk among elderly populations, and often used as a proxy for general health status. This index generates a weighted comorbidity score based upon a combination of 20 different health conditions. A score of 0–1 indicates low comorbidity and a score of 2 or higher is considered high comorbidity.^{6,7} Along with frequencies of the individual component conditions of the Charlson-Elixhauser Comorbidity Index, we also report diagnoses related to substance use, which is often higher among homeless populations and may account for differences in health care use when compared to housed populations.

Costs are used as a means to summarize and standardize Medicaid-reimbursed health care use across different modes of care (inpatient hospital, outpatient, emergency department, etc.) and as a measure by which to estimate additional costs to Medicaid associated with homelessness. We produce the latter estimate through fitting a basic ordinary least squares regression model that controls for comorbidity, substance use, and other factors that may also account for differences in health care use between housed and homeless populations.

Results

Frequency distributions of the homeless and comparison groups on the characteristics used for the PSM procedure are shown in Table 1. Chi-square analysis shows no statistically significant differences between the groups on these selection criteria. The table also shows some basic characteristics about the composition of the two groups. In both groups, around a quarter of the study population falls in the 30-39 age group (24%), while another rough quarter (26%) falls in the 50-59 age group. Slight majorities of both groups are female (54%), Black (54%), live in New Castle County (58%) and, in terms of eligibility for Medicaid coverage, fall in the expansion category (100% to 138% of the federal poverty line) (54%).

Table 1. Frequency Distributions of Homeless and Comparison Groups.

	Non-Homeless		Homeless	
	#	%	#	%
Age Groups				
18 to 29	170	20%	171	20%
30 to 39	202	24%	202	24%
40 to 49	153	18%	154	18%
50 to 59	217	26%	216	26%
60 & older	96	11%	95	11%
Total	838	100%	838	100%
<i>Chi-Square: .0137 p=1.0000</i>				

Sex				
Female	455	54%	456	54%
Male	383	46%	382	46%
Total	838	100%	838	100%
<i>Chi-Square: .0024 p=.9609</i>				
Race				
Black	454	54%	456	54%
White	343	41%	342	41%
Other	41	5%	40	5%
Total	838	100%	838	100%
<i>Chi-Square: .0182 p=.9909</i>				
County				
Kent	240	29%	238	29%
New Castle	481	58%	478	57%
Sussex	114	14%	116	14%
Total	835	100%	832	100%
<i>Missing: 3-non-Homeless; 6-Homeless</i>				
<i>Chi-Square: 1.0351 p=.7927</i>				
Medicaid Coverage				
Expansion	452	54%	448	53%
MAGI [^]	192	23%	193	23%
<i>(Parent/Caretaker Medicaid MAGI-based)</i>				
SSI-Disability	133	16%	131	16%
MAGI [^]	12	1%	18	2%
SSI-Aged	15	2%	15	2%
Pregnancy Cov.	16	2%	15	2%
Other	18	2%	18	2%
Total	838	100%	838	100%
<i>Chi-Square: 1.2678 p=.9893</i>				

[^] MAGI is defined as Modified Adjusted Gross Income

Table 2 shows results related to the Charlson Elixhauser Comorbidity index and the incidences of substance use disorder diagnoses, which are not included in calculating the index scores. These give some basic indications of the health of the two groups. Looking first at the overall index scores indicates that the homeless group, and particularly the chronically homeless subgroup, have substantially higher levels of comorbidity than the controls. At the extremes, 51% of the controls had a 0 score, while only 30% and 18% of the overall homeless group and chronically homeless subgroup, respectively, had the healthiest score. On the other end, while only 7% of the control group had scores of 5 and over, 13% of the overall homeless group and 19% of the chronically homeless had such scores. Among substance use diagnoses, twice as many of the overall homeless group, 35% compared to 15%, had at least one dependency diagnosis, and 43% of the chronically homeless subgroup had Medicaid records of some dependency diagnosis. In contrast to these stark differences, the differences in frequencies

between groups for incidences of the individual comorbidity components did not, in all but a few cases, differ substantially. Only four diagnoses: alcohol abuse and pulmonary circulation disorders, showed statistically significant differences.

Table 2. Charlson Elixhauser Comorbidity Results and Substance Use Disorder Diagnoses

	Non-Homeless (N=838)	All Homeless (N=838)	Chronic Homeless (N=190)
Charlson-Elixhauser Comorbidity Score***			
0	51%	30%	18%
1-2	31%	38%	44%
3-4	11%	18%	19%
5+	7%	13%	19%
Charlson-Elixhauser Comorbidity Score Diagnosis Components			
Alcohol Abuse*	19%	23%	22%
Cardiac arrhythmia	21%	22%	20%
Chronic pulmonary disease	8%	10%	10%
Coagulopathy	4%	5%	4%
Complicated diabetes	13%	13%	14%
Congestive heart disease	8%	9%	9%
Deficiency anemia	19%	19%	17%
Fluid and electrolyte disorders	21%	23%	21%
Hemiplegia	2%	2%	n/d
HIV/AIDS	2%	3%	1%
Hypertension	42%	42%	44%
Liver disease	13%	14%	13%
Peripheral vascular disease	8%	8%	6%
Behavioral conditions	25%	29%	33%
Pulmonary circulation disorders***	1%	4%	3%
Renal failure	5%	5%	n/d
Tumor	6%	4%	4%
Weight Loss	2%	2%	n/d
Substance Use Diagnoses			
Opioid dependence of any type***	14%	31%	39%
Cocaine dependence***	3%	13%	13%
Other substance dependence***	1%	5%	8%
Opioid, Cocaine, or other dependence***	15%	35%	43%

Notes: Cancer and dementia diagnoses, which are component in calculating the Charlson-Elixhauser score, are not reported due to insufficient numbers in cell sizes ($n < 10$) in both all homeless and control groups to maintain anonymity. Substance use diagnoses are not Charlson-Elixhauser score components. Chi-square test of difference between all homeless and control groups yield: * - p-value < 0.05 ; *** - p-value < 0.001 . "Other Substance Dependence" includes

dependencies on stimulants, sedatives, hallucinogens, inhalants, and other psychoactive substances.

Table 3 shows Medicaid-reimbursed health care costs, both total and broken down by the primary types of health care service: inpatient hospitalization, emergency department (ED), and outpatient. For each service category, substantially higher proportions of the homeless group, and particularly the chronically homeless subgroup, make up the higher cost groupings. Conversely, much higher proportions of the control group show zero costs in each service category. For inpatient, 4% of the control group had \$15,000 in costs or higher, while over 3 times of the chronic homeless group (13%) and exactly 3 times of the non-chronic homeless group (12%) fell into this category. 86% of the control group had no inpatient costs, while only 65% each of the chronic and non-chronic groups had held at \$0 for inpatient costs. Twelve percent of the control group had over \$300 in ED costs, compared to 46% for the chronic group and 38% for the non-chronic group. The control group holds the highest proportion of \$0 for ED costs (62%) and is followed by the chronically homeless group at 27% and the non-chronic homeless at 31%. Considering outpatient costs, 12% had costs above \$10,500 in the control group, with 20% of the chronic group and 13% of the non-chronic homelessness group in this category. For the \$500 or below outpatient category, the control group had 35% of clients, the chronic 13%, and the non-chronic 16%. Similar trends are shown with looked at the distribution of the sum (total inpatient, emergency, outpatient): 9% of the control group had \$16,000 or more in cost, with 26% of the chronic group and 24% of the non-chronic homeless group in the same category. Forty-three percent of the control group had \$0 for summed total costs, with 17% of the chronic group with \$0 and 24% of the non-chronic.

Table 3. Medicaid Reimbursed Health Care Costs

	Non-Homeless N=802	Homeless N=791	Chronic Homeless N=173
Inpatient Cost*			
\$0	86%	65%	65%
\$1-\$14,999	10%	23%	22%
\$15,000 or more	4%	12%	13%
Emergency Department Cost*			
\$0	62%	31%	27%
\$1-\$300	27%	32%	27%
\$301-\$699	9%	23%	26%
\$700 or more	3%	15%	20%
Outpatient Cost*			
\$0	16%	7%	13%
\$1-\$500	19%	11%	
\$501-\$4500	50%	49%	44%
\$4501-\$10,500	9%	21%	24%
\$10,501-\$15,999	3%	7%	12%
\$16,000 or more	4%	6%	8%
Total Cost*			

\$0	15%	6%	17%
\$1-\$1,000	28%	18%	
\$1,001-\$5,000	34%	31%	32%
\$5,001-\$15,999	13%	22%	25%
\$16,000 or more	9%	24%	26%

Chi-square test of difference between all homeless and control groups yield: * - p-value < 0.001. First two cells in outpatient and total cost sections of the chronically homeless column are combined due to insufficient numbers in dataset. Total Cost represents sum of inpatient, emergency department, and outpatient costs.

Table 4 shows results of two ordinary least squares regression models with total costs as the dependent variable, logged in the first model and unlogged in the second. To safeguard against disproportionate impacts of individuals with exceedingly high Medicaid costs on the results, 83 outliers (those with total services costs in the highest 5%) were omitted from the analysis. After controlling for significant cost variation among different types of Medicaid eligibility, significantly lower costs for the male category and significantly higher costs for people with substance use diagnoses of dependency and higher comorbidity scores, the estimated, adjusted cost associated with homelessness is between \$4,611 (non-chronically homeless) and \$5,218 (chronically homeless) per person, when compared to the non-homeless control group.

Table 4. OLS Cost Analysis

Covariate	Parameter Estimate	Pr > t	Parameter Estimate	Pr > t
	Cost (logged)		Cost (unlogged)	
Homeless Status				
Homeless-chronic	2.66	<.0001	5218	<.0001
Homeless - not chronic	1.74	<.0001	4611	<.0001
Non-homeless (reference)	0	0	0	0
Comorbidity Score	0.05	0.4900	431	0.0071
SUD Diagnosis				
Diagnosis present	3.30	<.0001	9031	<.0001
No Diagnosis (reference)	0	0	0	0
Medicaid aid category				
MAGI [^] (Parent/Caretaker Medicaid MAGI-based)	0.03	0.9524	-3049	0.0022
SSI-Disability	1.11	0.0281	4498	<.0001
SSI-Aged	0.76	0.5791	1249	0.6679
MAGI [^]	0.81	0.5362	695	0.8019
Pregnancy coverage	3.33	0.0089	9992	0.0002
Expansion (reference)	0	0	0	0
Age	0.05	0.0015	57	0.0630
Gender				
Male	-2.51	<.0001	-1709	0.0359
Female (reference)	0	0	0	0

Race/Ethnicity				
Black, non-Hispanic	-0.24	0.5181	-344	0.6579
Other race	-5.11	0.0480	-3755	0.4921
Hispanic	-0.23	0.7969	-1423	0.4437
White, non-Hispanic (reference)	0	0	0	0
County				
Kent	-0.07	0.8596	2163	0.0099
Sussex	0.17	0.7418	511	0.6440
Unknown county	-2.14	0.4082	-5408	0.3240
New Castle (reference)	0	0	0	0

Notes: 83 outliers (those with total services costs in the highest 5%) were omitted from the analysis. Prior to dropping these outliers, the skewness was 7.7 and the kurtosis was 88.4 indicating that the outliers were impacting the mean. After the outliers were dropped, skewness was 1.8 and kurtosis was 2.9, more within an acceptable range. Of the 83 clients dropped: 43% were non-homeless and 57% were homeless. This brings the total N to 1593. The R-Square is 0.1173 (logged) and 0.1542 (unlogged). ^ MAGI is defined as Modified Adjusted Gross Income

Discussion

This study examined people with records of homeless services use who were also eligible for Medicaid in 2019, and compared them to a set of controls who, as a group, were very similar in terms of demographics, type of Medicaid eligibility, and county of Medicaid receipt. The homeless group had a higher level of comorbidity, as measured by the Charlson-Elixhauser Comorbidity Index, and a substantially higher prevalence of dependency diagnoses for substance use. People in the homeless group had consistently higher levels of Medicaid services use overall. This translated into higher mean costs, which remained after adjusting for the various measures that were available in the Medicaid data. All in all, based on these data we estimate that homelessness (as indicated by use of homeless services) is associated with costs of \$4,611 (non-chronic) to \$5,218 per person over the course of 2019.

These findings are consistent with findings in other states showing both that homelessness is associated with poorer health and increased costs for state Medicaid programs. Although from this study we cannot definitively state that homelessness caused an individual to be sicker or the sickness caused homelessness, we have found that individuals who are homeless are sicker and have higher expenditures in Medicaid. Implicit in these findings is what has been shown in other states, namely that expenditures on getting people rehoused, and especially people who meet criteria for chronic homelessness, can be offset, at least in part, by savings from reductions in Medicaid costs.

Research has shown that homelessness creates new health problems and worsens existing ones. Health issues among people who are homeless are often a complex combination of physical, mental health, substance use, and social problems. Housing and health care work best together and are critical to preventing and ending homelessness. Health care services have a greater impact when a patient is stably housed.⁸

While expanding the availability of housing for homeless populations should not be contingent upon potential cost offsets, the promise of such savings could facilitate the financing of new housing.

This is one of only a few Delaware-specific studies that have been able to examine the collateral impacts of homelessness upon a related services system. Similarly structured studies looking at the impacts of homelessness on criminal justice, child welfare and mental health systems may reveal further cross-system services use dynamics that could inform and facilitate services interventions.

Limitations

This study has limitations. Gaps in CMIS data coverage diminished the size and representativeness of the study group, and limited our ability to assess relationships between time homelessness is experienced and Medicaid use. The unavailability of social security numbers may have limited the accuracy of the matches, although manual inspection of the matches indicates that those that matched appeared accurate. While these limitations may have reduced the ability of the study group to be representative of the entire adult homeless population, it was a large enough group in itself to merit assessing differences in health case. However, due to the nature of the cross-sectional data, a direction of causality cannot be claimed. Researchers are unable to determine if clients are sicker when they become homeless, or if becoming homeless makes them sicker.

Conclusion

This report shows costs of homelessness borne by Medicaid, and suggests that Medicaid expenditures focused on addressing homelessness can potentially be offset by reduction in health care provision. This study also suggests that homeless prevention measures such as rental assistance, provided at an unprecedented scale through the Delaware Housing Assistance Program, has hidden cost savings through reduced Medicaid expenditures for recipients who otherwise might have become homeless. This is an example of the wide range of further research that can be done to confirm and to better understand the dynamics of the cost savings that are found here.

Ms. Nescott may be contacted at eplynych@udel.edu.

References

1. Cantor, J. C., Chakravarty, S., Nova, J., Kelly, T., Delia, D., Tiderington, E., & Brown, R. W. (2020, March). Medicaid utilization and spending among homeless adults in New Jersey: Implications for Medicaid-funded tenancy support services. *The Milbank Quarterly*, 98(1), 106–130. <https://doi.org/10.1111/1468-0009.12446> PubMed
2. Alegría, M., NeMoyer, A., Falgàs Bagué, I., Wang, Y., & Alvarez, K. (2018, September 17). Social determinants of mental health: Where we are and where we need to go. *Current Psychiatry Reports*, 20(11), 95. <https://doi.org/10.1007/s11920-018-0969-9> PubMed
3. Office of the Assistant Secretary. (2021). health conditions among individuals with a history of homelessness. HHS Office of Planning And Evaluation Office Of Behavioral Health, Disability, And Aging Policy. ASPE Research Brief. <https://permanent.fdlp.gov/gpo184594/HomelessHistRB.pdf>
4. Koh, K. A., Racine, M., Gaeta, J. M., Goldie, J., Martin, D. P., Bock, B., . . . Song, Z. (2020, February). Health care spending and use among people experiencing unstable housing in the

era of accountable care organizations. *Health Affairs (Project Hope)*, 39(2), 214–223.
<https://doi.org/10.1377/hlthaff.2019.00687> PubMed

5. National Alliance to End Homelessness. (2015, Dec). Here's what you need to know about HUD's new chronic homelessness definition. Retrieved from: <https://endhomelessness.org/blog/heres-what-you-need-to-know-about-huds-new-chronic-homelessness-definition/>
6. Brennan, K., Buggs, K., Zuckerman, P., Muyeba, S., Henry, A., Gettens, J., & Kunte, P. (2020). The preventive effect of housing first on health care utilization and costs among chronically homeless individuals: New evidence using propensity score analysis. Massachusetts Blue Cross Blue Shield. Retrieved from: https://www.bluecrossmafoundation.org/sites/g/files/cspkws2101/files/2020-12/Housing%20First_report_FINAL.pdf
7. Gagne, J. J., Glynn, R. J., Avorn, J., Levin, R., & Schneeweiss, S. (2011, July). A combined comorbidity score predicted mortality in elderly patients better than existing scores. *Journal of Clinical Epidemiology*, 64(7), 749–759. PubMed
<https://doi.org/10.1016/j.jclinepi.2010.10.004>
8. National Council on Healthcare for the Homeless. (2019). Homelessness & health: What's the connection? Retrieved from: <https://nhchc.org/wp-content/uploads/2019/08/homelessness-and-health.pdf>

Copyright (c) 2023 Delaware Academy of Medicine / Delaware Public Health Association.

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<https://creativecommons.org/licenses/by-nc-nd/4.0/>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.