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Comparing Homeless and Domiciled Patients' Utilization of the Harris County, Texas Public Hospital System

David S. Buck, MD, MPH
Carlie A. Brown, MPH
Karoline Mortensen, PhD
John W. Riggs, MD
Luisa Franzini, PhD

Abstract: Homeless individuals have mortality rates three to six times higher than their housed counterparts and have elevated rates of mental illness, substance abuse, and co-morbidities that increase their need for health services. Data on the utilization of Harris County, Texas' public hospital system by 331 homeless individuals and a random sample of 17,824 domiciled patients were obtained from June 2008 to July 2009. Homeless individuals had increased readmission rates, especially within 30 days of discharge, resulting in significantly higher total annual length of stay. Homeless patients also more frequently utilize public hospitals for mental illness and HIV. Lack of community health services contributes to an increased dependence and preventable over-utilization of public hospital systems. Case management interventions integrating primary and behavioral care into health homes, medical respite programs, and training for health care professionals who provide indigent care will improve health outcomes of this population and reduce costs.

Key words: Homeless, hospital utilization, access to care, delivery of health services, length of stay.

The complex dynamics of homelessness obscure the actual number of this population, now estimated to be between 2.3 and 3.5 million in the United States alone,[1] and a reported 1.59 million Americans spent at least one night in a shelter or transitional housing in 2010.[2] Chronic and acute medical conditions are endemic among the

DAVID BUCK *is a Professor at Baylor College of Medicine, Department of Family and Community Medicine and President of Healthcare for the Homeless-Houston.* ***CARLIE BROWN*** *served as the Lead Project Coordinator for Healthcare for the Homeless-Houston, Baylor College of Medicine, Department of Family and Community Medicine until December 2011 and now serves as the Chief Development Officer for Healthcare for the Homeless, Houston.* ***KAROLINE MORTENSEN*** *is an Assistant Professor at the University of Maryland in the Department of Health Services Administration.* ***JOHN RIGGS*** *is an Associate Professor at the University of Texas Medical School Houston in the Department of Obstetrics and Gynecology.* ***LUISA FRANZINI*** *is an Associate Professor at the University of Texas School of Public Health in the Management, Policy and Community Health Division. Inquiries may be addressed to Dr. David S. Buck; Baylor College of Medicine; 3701 Kirby Drive, Ste. 600; Houston, TX 77098.*

homeless.[3–7] An estimated one-quarter to one-third of those living without permanent housing have dual diagnoses of mental illness and disability or substance abuse,[8] and significantly higher rates of coexisting substance abuse, mental illness, and AIDS complicate their diagnosis and treatment.[3,6,9,10] In addition, individuals with major mental illness lose more decades of potential years of life (13 to more than 30 depending on state and year) than the general population.[11] The homeless population experiences higher mortality rates than the general population.[12–15]

In Harris County, Texas, The Blue Ribbon Commission to End Chronic Homelessness found 55.7% of the homeless individuals surveyed reported mental illness and 57.7% reported substance abuse.[16] Lack of coordinated services in the community aggravate an already overwhelmed health care system. The *de facto* health care for the homeless has become the hospital emergency departments (EDs) and the Harris County Jail. The Harris County Jail is the largest provider of mental health beds in the state of Texas and the second largest in the nation.[17] Lack of services and access to care perpetuates what is known as *the revolving door phenomenon*, the rapid cycling of mentally ill homeless individuals between the streets/shelters, emergency departments, and incarceration.

In the U.S., one-fourth to one-third of homeless adults reported a past-year experience of inability to access needed medical services.[4,18] They face many barriers to health care: bias, inadequate discharge planning, lack of recuperative care, cost, transportation, mental illness, and a lifestyle on the street of competing priorities of food, clothing, and shelter. In addition, the complexity and diversity of state Medicaid applications and programs present barriers for the homeless, particularly for those without the capacity to document their eligibility.[19] The homeless are not integrated into a primary care system nor do they have a designated health home.[20,21] When homeless individuals are discharged from the hospital, it is usually without any medication but with a prescription that most lack means to fill. Some communities have responded to the high utilization of health care services by some individuals by designing innovative case management and care strategies.[22] Little if any infrastructure exists within national or state health plans or local indigent care programs to accommodate and provide interventions for homeless people with high utilization rates.[22] Locally, all of these barriers are accelerating with time.[23]

As a result of higher mortality and morbidity rates and lack of access to care, homeless individuals have longer average length-of-stay (LOS), adding more direct costs per hospital stay.[10] They have been found to underuse health care delivered at homeless shelters, drop-in centers, and outpatient clinics in the year before their deaths,[24] despite experiencing higher morbidity and mortality, and are twice as likely as the general population to lack health insurance,[25] which has been found to significantly increase the likelihood of a non-emergent ED visit.[26] The homeless population uses the ED significantly more than the domiciled[9,27] and is more likely to visit EDs frequently.[28] Alcohol or substance abuse have been found to predict ED visits more strongly than predisposing factors (such as age and ethnicity) or enabling factors (including insurance status). They are more likely to be admitted to the hospital[29] and have longer hospitalizations.[10] Delays in seeking medical treatment, poor adherence to treatment and therapy, exposure to the environment, and cognitive impairment also contribute to the deterioration of health status.[30,31]

The purpose of this study is to identify patterns and costs of hospitalization for homeless patients. Clarifying the utilization patterns of the homeless population is essential in order to develop more cost-efficient and treatment-effective interventions. Our objectives are to compare average LOS of homeless patients with that of domiciled patients and to determine cost attributable to homelessness; to assess the frequency of hospitalizations; and to identify diagnoses for so-called *frequent flyers*.

Methods

Study design and data sources. This is a retrospective study of homeless adults admitted to either of the two public hospitals of the local public health care system, Harris County Hospital District (HCHD), serving the greater Houston metro area: Ben Taub General Hospital (BTGH) and Lyndon B. Johnson General Hospital (LBJ). Data on admissions from June 2008 to July 2009 for homeless patients and a random sample of domiciled patients aged 18 and over were obtained from HCHD. Virtually all HCHD patients are low-income, 62% are uninsured, 24% have Medicaid or Children's Health Insurance Program (CHIP) insurance, and 9% have Medicare coverage. For the analyses, we excluded admissions with inconsistent information (age difference greater than three years, gender inconsistency, and race/ethnicity inconsistency) and removed maternity-related admissions (ICD9 codes 630–679, V22, V23, and V24 as primary or secondary diagnosis).

Homeless status is defined in this study by reporting an address known to correspond to that of one of 62 shelters or homeless service agencies in the Houston area and by self-report. Homelessness is defined by HCHD's Health care for the Homeless program by a 9498 designation. This resulted in a dataset with 998 admissions for 331 homeless patients, and a random sample of 23,327 admissions for 17,824 domiciled patients. Personal identifiers were scrubbed and unique identifiers were added to identify re-admissions. Inpatient health care utilization and costs in homeless and domiciled patients were compared. In measuring cost, we used total charges as there were no payments for most patients.

Approval for this study was granted by the Internal Review Boards of Baylor College of Medicine, University of Texas Health Science Center at Houston's School of Public Health and the Harris County Hospital District. No identifying data were received, and therefore this study was exempt from the collection of consent forms.

Unit of analysis. Two units of analysis were examined as appropriate to each research question, including the admission and the patient, as admissions were linked to patients using unique identifiers.

Measures. The dependent variables include length-of-stay (LOS), obtained both as LOS per admission and LOS over all admissions during the one year period per patient measured in days; charges per admission and charges per patient for one year in dollars (no discounting is used because of the short time period for this study); number of re-admissions per patient and number of re-admissions per patient in the 30 days post-discharge period; and diagnoses. In this manuscript, references to charges "per patient" and LOS "per patient" refer to combined charges or LOS over the course of

a year. Primary or secondary diagnosis codes of all admissions had been assigned by health information management professional chart abstractors and were included in the analysis. The following diagnoses were identified: severe mental illness (SMI) which include ICD-9 codes 290.99, 293.00–294.99, 295.0–298.99, 301.00–301.99, 318.10, 318.2; substance abuse (SA) which include ICD-9 codes 291.00–292.99, 303.00–305.99, excluding 305.10; HIV which include ICD-9 codes 042.00–044.99; abscess which include ICD-9 code 682.9; nausea which include ICD-9 codes 787.0, 787.01, 787.02, 787.03; dehydration which include ICD-9 code 276.51; broken bones which include ICD-9 codes 800–829; and altered mental state which include ICD-9 code 780.97.

The independent covariates analyzed include age (continuous variable), gender (male *versus* female), race/ethnicity (African American, Hispanic, White, and other race), and hospital (LBJ *versus* BTGH).

Statistical analysis. *Descriptive statistics.* With admissions as the unit of analysis, we computed means, proportions and standard deviations for diagnoses, hospital, LOS, and charges. With patients as the unit of analysis, we computed means and standard deviations for age, gender, race/ethnicity, insurance status, patient LOS, patient charges, number of admissions, and number of 30-day readmissions. Unadjusted comparisons between admissions for domiciled and for homeless patients were carried out for age (using t-test); gender, race/ethnicity, hospital, and diagnosis (using chi-squared tests), LOS/admission and LOS/patient (using Mann-Whitney U test), and charges/admission and charges/patient (using t-test for log charges). We also compared 30-day readmissions/patient and admissions/patient (using Mann-Whitney U test) in domiciled and homeless patients.

Multivariate analyses. Multivariate regressions were used to estimate the association between the dependent variables and homeless status adjusting for covariates. Depending on the form of the dependent variable, we used Poisson adjusted for over-dispersion regression (LOS), Poisson regression (readmissions and 30-days readmissions), and ordinary least squares regression (log of charges) with age, gender, race/ethnicity, and hospital as covariates.

Results

Table 1 reports descriptive statistics for domiciled and homeless patients. Homeless patients were more likely to be male, African American, and White and less likely to be Hispanic compared with domiciled patients. There were no differences in age across the populations. Homeless patients were just as likely as domiciled patients to be uninsured. Less than 1% of homeless patients had commercial private insurance, compared with 7.2% of domiciled patients; and the homeless were more likely to have Medicaid coverage (29.6% *versus* 18.7%). Admissions for homeless patients were more likely related to diagnoses of SMI, HIV, and altered mental state, and less likely to be related to broken bones than for domiciled patients (Table 2). Interestingly, LOS *per admission* did not differ between the two groups, but LOS *per patient* was longer for homeless patients than for domiciled patients. *Charges per admission* were somewhat lower for admissions of homeless patients than for admissions of domiciled patients,

Table 1.

DEMOGRAPHIC CHARACTERISTICS FOR DOMICILED AND HOMELESS PATIENTS (MEASURED AT THE PATIENT LEVEL)[a]

	Domiciled Patients n=17,824				Homeless Patients n=331				
	Mean	Std. Dev	Min	Max	Mean	Std. Dev	Min	Max	P value
Age (years)	47.89	15.53	18	108	49.36	8.78	22	75	.09
Male	55	50			80	40			<.001
African American	36	48			55	50			<.001
Hispanic	40	49			14	35			<.001
Caucasian	19	39			31	46			<.001
Other race/ ethnicity	1.3	11.3			.003	5.5			0.14
Private insurance	7.2	26			.9	9			<.001
Self-Pay	58.4	49			60.0	49			.33
Medicaid	18.7	39			29.6	46			<.001
Medicare	10.0	30			6.3	24			.03
Other	5.7	23			3.6	19			.10

[a]Comparisons were conducted using t-test or chi-square according to continuous or categorical nature of the variable.

but *total charges per patient* over the one year period were higher for homeless patients than for domiciled patients. Homeless patients had more admissions over the year and were much more likely to be readmitted within 30 days of discharge than domiciled patients (Table 3).

Adjusting for age, gender, race/ethnicity, and hospital did not change the finding from the unadjusted comparisons (see Table 4). Results from the log-linear ordinary least squares regression on charges per admission show that the homeless have lower charges per admission than their domiciled counterparts. However, charges per patient were again higher for homeless persons relative to the general inpatient population. African Americans have statistically significantly lower charges than Whites; the effects for Hispanic and other race are not statistically significant. Males incurred higher charges than females, and site of care mattered (LBJ hospital had lower charges than BTGH). Length of stay per admission, analyzed with a negative binomial regression, did not differ significantly between the homeless and the domiciled. However, length of stay per patient, also tested using a negative binomial model, was statistically significantly higher for the homeless. Similarly, Poisson regressions on admissions and 30-day readmissions show that the homeless are much more likely to be readmitted than the other patients.

Table 2.

DIAGNOSES FOR ADMISSIONS OF DOMICILED AND HOMELESS PATIENTS (MEASURED AT THE ADMISSION LEVEL)

	Admissions of Domiciled Patients n=23,327		Admissions of Homeless Patients n=998			
	Mean	Std. Dev	Mean	Std. Dev	Test	P value
Serious Mental Illness (SMI)	1.4	11.8	5.0	21.8	Chi square	<.001
Substance Abuse (SA)	2.2	14.67	2.8	16.55	Chi square	.19
HIV	2.0	13.9	3.6	18.7	Chi square	<.001
Abscess	0	0	0	0	Chi square	.58
Nausea	1.1	10.5	1.0	9.9	Chi square	.78
Dehydration	0.3	5.6	0.6	7.7	Chi square	.11
Broken bones	8.3	27.5	4.2	20.1	Chi square	<.001
Altered mental state	2.1	14.2	3.0	17.1	Chi square	.04
Any diagnoses above	16.7	37.3	19.3	39.5	Chi square	.03

Discussion

The results for diagnoses of patients in the HCHD are similar to those found by Salit et al.[10] We found substantially higher percentage of serious mental illness diagnoses among homeless patients (5.0 in homeless patients compared with 1.4 in domiciled patients) and altered mental state (3.0 in homeless patients compared with 2.1 in domiciled patients). Admissions related to broken bones, a diagnosis appropriate and typical of ED utilization, were found to be significantly higher in domiciled patients, in comparison with non-urgent or preventable admissions for homeless patients—serious mental illness, HIV, and altered mental state. The findings on mental illness, HIV, and substance abuse/altered mental state were consistent with the findings for the New York City public hospital system. HIV was found to be 31% more prevalent among those who utilize New York City's shelter system than in the general adult population.[32]

Studies conducted in New York City[10] and recently in Toronto[12] found that homeless patients incur higher hospitalization costs due to increased LOS. Increased LOS was attributed to those not needing hospitalization but too ill to return to shelters or the street.[12] They therefore remain inpatient while awaiting discharge to another health care facility. Unlike the studies conducted in New York City and Toronto, our results do not indicate a significant difference between LOS per *admission* but we did find that the total *annual* LOS and frequency of readmissions were nearly three times higher for homeless patients than for domiciled patients (3.02 admissions *versus* 1.31 admissions) as were the rates of readmission within 30 days (an average of 0.21 times in domiciled persons *versus* 1.84 times for homeless individuals).

Table 3.

ADMISSION INFORMATION FOR DOMICILED AND HOMELESS PATIENTS

	Domiciled Patients n=17,824 Admissions Domiciled Patients = 23,327				Homeless Patients n=331 Admissions Homeless Patients = 998					
	Mean	**Std. Dev**	**Min**	**Max**	**Mean**	**Std. Dev**	**Min**	**Max**	**Test**	**P value**
LBJ Hospital	36.6	48.2			22.7	41.9			Chi square	<.001
LOS (days)/admission	6.92	10.07	1	294	7.35	9.66	1	87	MWU	.12
LOS/patient	9.04	13.62	1	294	22.14	30.08	1	232	MWU	<.001
Charges/admission	32,896	47,492	1	1,312,848	28,727	40,033	1	368,480	t test[a]	.005
Charges/patient	43,169	60,371	1	1,312,848	86,474	116,675	2	1,100,919	t test[a]	<.001
Number of admissions	1.31	0.88	0	18	3.02	2.02	0	16	MWU	<.001
Number of 30-day readmissions	0.21	0.61	0	9	1.84	1.65	0	12	MWU	<.001
	N	**Median**	**25th**	**75th**	**N**	**Median**	**25th**	**75th**		
LOS/admission	23,327	4.00	2	8	998	4.0	2	8		
Charges/admission	23,327	20,467	11,352	35,838	998	17,085	9,228	30,062		
LOS/patient	17,824	5.0	2	10	331	12.00	6	24		
Charges/patient	17,824	25,184	13,577	46,701	331	48,278	26,202	82,070		

[a]t test for log charges
LBJ = Lyndon B. Johnson
LOS = Length of stay

Table 4.

REGRESSION ANALYSIS FOR DEPENDANT VARIABLES (NUMBER OF ADMISSIONS = 24,325; NUMBER OF PATIENTS = 18,155)

	Log linear Model				Negative binomial Model				Poisson Model			
	Log (charges/ admission)		Log (charges/ patient)		Length of stay (LOS)/ admission		LOS/ patient		Re-admissions		30-day re-admissions	
Dependent variable	**Coeff.**	**P value**	**Coeff.**	**P value**	**Coeff.**	**P value**	**Coeff.**	**P value**	**Coeff.**	**P value**	**Coeff.**	**P value**
Constant	9.88	<.01	9.91	<.01	1.41	<.01	2.81	<.01	1.01	<.01	.06	.77
Homeless	−0.23	<.01	.64	<.01	−0.03	.45	.85	<.01	.83	<.01	2.13	<.01
Age (years)	.00	.05	.00	<.01	.00	<.01	.01	<.01	.00	<.01	.01	<.01
African-American	−0.07	<.01	−0.08	<.01	−0.04	.02	−0.04	.07	.03	.12	.07	.06
Hispanic	−0.02	.35	−0.04	.13	−0.08	<.01	−0.07	<.01	.03	.09	.07	.08
Other race	−0.11	.13	−0.10	.23	.00	.97	.04	.59	−0.01	.86	−0.18	.25
Male	0.15	<.01	.19	<.01	.13	<.01	.16	<.01	.01	.32	.06	.06
Lyndon B. Johnson General Hospital	−0.27	<.01			−0.41	<.01						

Social policies in Toronto and New York City offer the homeless housing, case management, medical convalescence, substance abuse and mental health treatment, and primary health care. They address the causes of homelessness and work to decrease their number. Despite having the fourth highest number of homeless individuals in the nation (5.4% of those counted in the 2010 point-in-time count for The 2010 Annual Homeless Assessment Report to Congress)[2] a dearth of aftercare resources in Harris County leave discharged homeless patients little choice but to return to the streets or day shelter (and exposure to more disease). A number of cities across the U.S. have medical respite programs that assist homeless individuals being discharged from the hospital by providing follow-up medical care.[33] The models of these programs and intensity of care vary from apartment units and hotel/motels with limited care to nursing homes, shelters to free standing facilities. Of the 57 known medical respite programs in the U.S. in 2011, three are in Texas (California has 15 established programs and two emerging programs).[33] Respite care provides interim care and transition into a primary care health home.[33,34]

Due to the complex needs and high rate of mental illness in the homeless population, health homes that provide integrated primary and behavioral (mental health and substance abuse) care are increasingly recognized as a best practice. This collaborative model provides integrated social support and case management, and improves access to comprehensive care, utilizes evidence-based practices, improves outcomes and reduces the cost of long-term care. Despite the glaring need for an integrated effort, collaboration with county systems is often lacking, misaligned with federal and other agencies, and has no mechanism for sharing patient information between agencies. Detrimentally, it is only after a patient has been stabilized in another agency that the county health system can assume their ongoing care. Despite the findings that hospital and jail inreach programs have proven effective in interrupting the revolving door phenomenon,[17] such programs are virtually non-existent in Harris County.

A limitation of this study is that homelessness was identified by reporting an address known to correspond to that of a shelters or homeless service agencies in the Houston area and by self-report as there is no mechanism within the electronic medical record/patient database that designates individuals as being homeless. It is therefore understood that a portion of the homeless population that utilized the hospital services were not identifiable as homeless. However, understanding utilization patterns of those for whom our health system fails is necessary in continuing to examine better and more efficient ways to provide care and reduce costs. It may also help better address the needs of the population as a whole. This distinctive population requires a special clinician, the training for which is not presently available, and this health care model requires thoroughly integrated behavioral health and primary care. Medical respite care centers; hospital inreach between public hospitals, jails, and community organizations; the establishment of integrated primary and behavioral health homes; and training for health care professionals specific to treating the complex needs of this disenfranchised population would increase effectiveness and continuity of care.

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