

Health Care Utilization of Individuals Affected by Homelessness

Illinois, 2011–2018

Dana Madigan, DC, MPH, PhD*† and Lee S. Friedman, PhD*

Objectives: To describe individuals coded as homeless in state-level data comprising of outpatient and inpatient cases over a multi-year period to provide public health surveillance data on the health care utilization and needs of this population.

Research Design: In this cross-sectional study, outpatient and inpatient visits coded for homelessness were identified from the Illinois Hospital Discharge Database from January 1, 2011 through December 31, 2018. Demographic characteristics, primary diagnosis and comorbid conditions, and hospital course of treatment were described. Predictors of discharge to a health care facility versus routine discharge to home or self-care were evaluated using multi-variable logistic regression.

Results: There were 154,173 patient visits predominantly involving males, those aged 25–64 years, and non-Hispanic Whites and African Americans. The majority had comorbidities of depression, psychosis, and/or substance abuse (70.2%) and a routine discharge to home or self-care (81.9%). Discharge to home or self-care relative to another health care institution was associated with having charity coverage and being Black/African American.

Conclusions: Those experiencing homelessness experience a high burden of health concerns. Hospital billing records can be used to prioritize the distribution of limited public health resources for health care programs and interventions among those experiencing homelessness.

Key Words: homeless persons, delivery of health care, population surveillance

(*Med Care* 2021;59: S158–S164)

Those with unstable or a lack of housing are at an increased risk and experience increased severity of many health conditions, but these health concerns are difficult to measure and address with early intervention. The homeless population is comprised of families that move to where there is available work, individuals living out of personal vehicles, individuals that sleep in makeshift homes predominately in urban settings, persons living in various public and private shelters, and rough sleeping encampments.^{1,2} Because of the challenges in reaching this population, hospitals can play an important role in surveillance of this population because they may be the only point of contact a person affected by homelessness has with formal public health infrastructure outside of law enforcement and public education services. In addition, it is likely to be the only location we can gather comprehensive and reliable information about the health characteristics of these individuals.

A systematic review examining the health of individuals affected by homelessness in high-income countries noted that while there are many common public health priorities shared among the homeless across these countries, surveillance needs to occur regularly within these health systems since the optimal public health strategies for this population can vary across time and region and their health care needs are generally greater than the general population.³ Infectious diseases, such as tuberculosis, hepatitis, human immunodeficiency virus (HIV), and chronic infestations of scabies and lice are more common among homeless individuals.³ Chronic age-related conditions affect the homeless 10–15 years earlier than the general population, which is important since the median age of the homeless in the United States is ~50 years old.³ In the United States, these include substance abuse, mental illness, diabetes, cardiovascular disease, cerebrovascular disease, cognitive impairments, and functional impairments.³ Homeless individuals are more likely than the nonhomeless to seek care at an emergency department or hospital and the subset of individuals with substance abuse and mental disorders have been shown to seek care in the hospital setting more frequently during a calendar year.^{3–6}

Improved surveillance data of health care utilization patterns of the homeless may lend insights to programmatic and service

From the *School of Public Health, Division of Environmental and Occupational Health Sciences, University of Illinois at Chicago, Chicago; and †National University of Health Sciences, Lombard, IL.

The research reported in this publication was funded, in part, by the National Institute for Occupational Safety and Health (NIOSH) Illinois Education and Research Center (#T42OH008672). The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institute for Occupational Safety and Health. The sponsors had no role in the design, methods, subject recruitment, data collections, analysis or preparation of paper.

This study received IRB approval under University of Illinois at Chicago's protocol #2008-0060.

This project is in partial fulfillment of the dissertation requirements for the doctoral degree at the Graduate College of the University of Illinois at Chicago (D.M.).

The authors declare no conflict of interest.

Correspondence to: Dana Madigan, DC, MPH, PhD, School of Public Health, Division of Environmental and Occupational Health Sciences, University of Illinois at Chicago, 1603 W. Taylor Street, Chicago, IL 60612. E-mail: dmadig2@uic.edu.

Copyright © 2021 Wolters Kluwer Health, Inc. All rights reserved. ISSN: 0025-7079/21/5904-S158

needs of this population.⁷ Studies currently tend to look at hospital data covering very short periods of 1 year or less, restricted to specific facilities serving small geographic regions, include only those identified as homeless through newly implemented screening questionnaires rather than general ICD (International Classification of Diseases; World Health Organization, Geneva, Switzerland) coding, and limit their inclusion criteria to specific populations such as Veterans or the mentally ill.^{6,8–10} We aimed to describe all individuals coded as homeless in state-level data comprising of outpatient and inpatient cases over a multi-year time frame to provide public health surveillance data on the health care utilization and needs of this population.

METHODS

Data Source

Data from the Illinois Hospital Discharge Database from January 1, 2011 through December 31, 2018 were used to identify outpatient and inpatient visits where patients are identified as affected by homelessness at the time of the clinical visit. The outpatient database includes all patients treated in emergency rooms for <24 hours who were not admitted to the hospital and those that are registered in the emergency department for ambulatory services. The inpatient database includes all patients treated for 24 hours or more for any medical reason. Both databases are based on billing records and include variables on patient demographics (age, sex, race/ethnicity), exposure (mechanism of injury), health outcomes (diagnoses, hospital procedures, discharge status), and economics (hospital charges, payer source). On the basis of the annual state audit of hospitals, the hospitals included in the datasets used for this analysis comprise 96.5% of all patient admissions statewide.^{11,12}

Case Definition

Patient visits were identified as cases in accordance with previous studies using hospital data to examine homelessness using a billing code of V60.0 for “lack of housing” [International Classification of Diseases, Ninth Revision (ICD-9; World Health Organization, Geneva, Switzerland; 1980)] or the equivalent code of Z59.0 for “homelessness” [International Classification of Diseases, Tenth Revision (ICD-10; World Health Organization, Geneva, Switzerland; 1992)].¹³ Alternative codes for inadequate housing (V60.1), which refers to poor infrastructure and unspecified housing or economic circumstances (V60.9), were not included in the case definition despite their inclusion in broader definitions¹⁴ because we do not have the capacity to verify unstable or lack of housing as opposed to inadequate housing.

The Centers for Disease Control and Prevention equivalence mapping between ICD-9 and ICD-10 recommends that V60.0 is equivalent to Z59.0. The difference in coding reflects the transition in the United States in the fourth quarter of 2015 from ICD-9 to ICD-10. The coding schemas for ICD-9 and ICD-10 codes are essentially capturing the same type of homeless population despite the slight change in terminology. The ICD-9 V60.0 codes captures persons with a lack of housing and explicitly identifies the following subgroups: hobos, social migrants, tramps, transients, and vagabonds. The ICD-10 Z59.0 code captures persons with a lack

of housing (permanent) (temporary) or shelter and explicitly identifies the following subgroups: nomad, nomadism (ie, new term for hobo), social migrant, tramp, transient, vagabond, vagabondage, and vagrancy.

Identifying Unique Visits Using Probabilistic Linkage

Using probabilistic data linkage methodology, we identified unique hospital visits. Identifying duplicates within datasets was done by using facility, attending clinician, primary ICD code, date of birth, sex, zip code, date of admission, and date of discharge. Then we manually screened these duplicates to identify truly mismatched ICD codes. Duplicates can result from system errors (eg, a record is submitted twice after data entry), errors between coders (eg, 2 or more coders accidentally enter a patient’s information twice), or from quality control practices at facilities that intentionally have 2 coders enter the same patient information. In addition, duplicate entries occur from split billing and sequential billing practices. Split billing generally is used when separate bills are issued for treatment by different specialists during a single hospitalization (eg, neurologist, endocrinologist, and surgeon). The patients will have multiple records for the same period of time, but the diagnoses may differ substantially based on the treating physician’s specialty. Sequential billing occurs in some hospitals where patients have multiple records with identical diagnoses, but different and consecutive admission and discharge dates. These occur primarily among patients with long lengths of stay. This resulted in removing 4318 duplicates for a final sample of 154,173 patient visits for those with an ICD code for homelessness.

Covariates

Key variables summarized include patient characteristics (sex, age, race, and ethnicity), facility information (name, location, trauma level), length of stay, total hospital costs, insurance coverage, discharge status, reason for visit, comorbidities, and acute injuries. Metropolitan areas were designated using the US Department of Agriculture Rural-Urban Continuum Codes.¹⁵ Total hospital charges is the sum of all procedure, service, and facility charges accumulated from the point of admission to discharge. Total hospital charges are in 2018 US dollars (USD) adjusted for annual inflation using the Bureau of Labor Statistics Consumer Price Index.¹⁶ Hospital charges are a proxy measure for cost, but may not directly reflect reimbursement rates, resource consumption, or comprehensive economic costs. As data were coded using both the ICD-9 and ICD-10 classification system, diagnoses were categorized and crosswalked to summarize groups of conditions. There were 10,448 (6.8%) visits without a coded primary diagnosis, primarily in outpatient visits (n=9470; 90.6%). The Elixhauser Comorbidity Index was used to assess comorbidities.¹⁷

Statistical Analysis

All statistical analyses were conducted using SAS software (version 9.4; SAS Institute Inc., Cary, NC). As part of the descriptive analysis, we compared demographic characteristics, geospatial trends, temporal trends, primary diagnosis, comorbid conditions, and hospital course of treatment measures.

An adjusted multivariable logistic regression model was developed to evaluate predictors of being discharged to a health care facility versus being routinely discharged to home or self-care, a predefined status code, which for this population likely meant returning to a state of homelessness. Statistical evaluation of covariates, as well as a priori knowledge, was used to determine inclusion of covariates in the final models. The final model included patient characteristics (sex, age, race, and ethnicity), insurance coverage, operations, acute injuries, diagnoses, and comorbidities. A modified Elixhauser Comorbidity Index was created for this purpose that excluded depression and psychosis. These groups were modeled separately as crude analysis demonstrated a difference in discharge status based on these comorbidity groups. No evidence of multicollinearity among the independent variables was indicated. A 2-sided *P*-value <0.05 was considered statistically significant.

RESULTS

Characteristics of the Homeless Being Treated in the Hospital Setting

The number of hospital visits of those with reported homelessness increased between 2011 and 2018 from 9882 to 29,765 (average annual increase=2602, *P* < 0.001). There was minimal variability in visits seen by month or day of the week. Hospital visits predominantly involved males, adults between the ages of 25 and 64 years, and non-Hispanic Whites and African Americans (Table 1). Government insurance was the primary payer for these visits (Table 1). There were dramatic increases in those covered by Medicare and Medicaid (48.9% of visits in 2011 to 77.7% in 2018) and conversely, reductions in self-pay (ie, no health insurance; 32.0%–10.5%) and charity care (9.6%–1.5%) (Fig. 1). This change was concentrated around the implementation of the Patient Protection and Affordable Care Act (2014). Charity care refers to visits that have waived medical fees. Total cumulative charges in 2018 adjusted USD for treating homeless patients between 2011 and 2018 in Illinois was \$2.34 billion USD with most of the charges occurring among inpatient cases (\$2.02 billion).

Location and Type of Hospitals Treating Homeless in Illinois

The vast majority of visits were for those who identified as being Illinois residents; 93.1% of visits had patient zip codes located in Illinois and <2% of those claiming Medicaid coverage did so through a state other than Illinois Medicaid. The majority of visits were in facilities within Chicago (48.3%) and the surrounding suburbs (31.0%). In addition, a large proportion of visits occurred in facilities with a level I or II trauma unit (30.3% and 22.2%, respectively). Out of ~208 hospitals reporting to the billing system annually, around 30% of inpatient cases and 40% of outpatient cases were treated in just 10 hospitals within Illinois. Over 95% of visits were to metropolitan hospitals located in US Department of Agriculture metropolitan areas.

Reason for Hospital Visits

The most common primary reasons for hospital visits were mental disorders, substance abuse (drug and alcohol), musculoskeletal and connective tissue disorders, diseases of

TABLE 1. Demographic Characteristics of Patient Visits of Those Affected by Homelessness

Characteristic	Inpatient (N=76,952) (%)	Outpatient (N=77,221) (%)
Sex		
Female	20,445 (26.57)	20,809 (26.95)
Male	56,498 (73.42)	56,411 (73.05)
Unknown	9 (0.01)	1 (0.00)
Age (y)		
0–4	121 (0.16)	240 (0.31)
5–9	86 (0.11)	120 (0.16)
10–14	148 (0.19)	99 (0.13)
15–19	1315 (1.71)	1049 (1.36)
20–24	5592 (7.27)	4558 (5.90)
25–34	13,983 (18.17)	12,067 (15.63)
35–44	15,435 (20.06)	15,467 (20.03)
45–54	21,671 (28.16)	21,804 (28.24)
55–64	14,740 (19.15)	17,729 (22.96)
65–74	3283 (4.27)	3370 (4.36)
75 and older	578 (0.75)	712 (0.92)
Unknown	0 (0.00)	6 (0.01)
Mean age (SD)	44 (13.63)	45 (13.66)
Race/ethnicity		
Non-Hispanic White	35,021 (45.51)	31,332 (40.57)
Non-Hispanic African American	27,324 (35.51)	33,992 (44.02)
Hispanic	5159 (6.70)	4981 (6.45)
Asian	292 (0.38)	319 (0.41)
Pacific Islander	1268 (1.65)	161 (0.21)
American Indian/Alaska Native	250 (0.32)	129 (0.17)
Other	5334 (6.93)	4617 (5.98)
Unknown	2304 (2.99)	1690 (2.19)
Primary payer type		
Medicaid	39,002 (50.68)	35,665 (46.19)
Medicare	14,819 (19.26)	13,627 (17.65)
Self-pay/self-administered	8377 (10.89)	15,969 (20.68)
Charity	2019 (2.62)	3754 (4.86)
Private/commercial insurance	11,124 (14.46)	7131 (9.23)
Military (Champus Tricare, Champva)	90 (0.12)	65 (0.08)
Workers' compensation	7 (0.01)	18 (0.02)
Other	1514 (1.97)	992 (1.28)
Median hospital charges (IQR)	\$16,025.50 (\$10,002.00–\$27,450.00)	\$2049.12 (\$921.00–\$4478.00)

IQR indicates interquartile range.

the respiratory system, diseases of the circulatory system, and skin diseases. This was similar when comparing males and females; however, pregnancy complications replaced diseases of the circulatory system as the fifth most common primary diagnosis in females. When comparing primary diagnosis for the following major age groups—children (under 18 y), adults (aged 18–64), and older adults (aged 65 and older)—mental disorders remained the most common diagnosis in all 3 age groups. However, among children, diseases of the respiratory system, infectious diseases, skin diseases, superficial injuries, and conditions of the eye and ear were the next most common. In older adults, mental disorders were followed by diseases of the circulatory system, diseases of the respiratory system, substance abuse, musculoskeletal and connective tissue disorders, and skin diseases. There was little variation

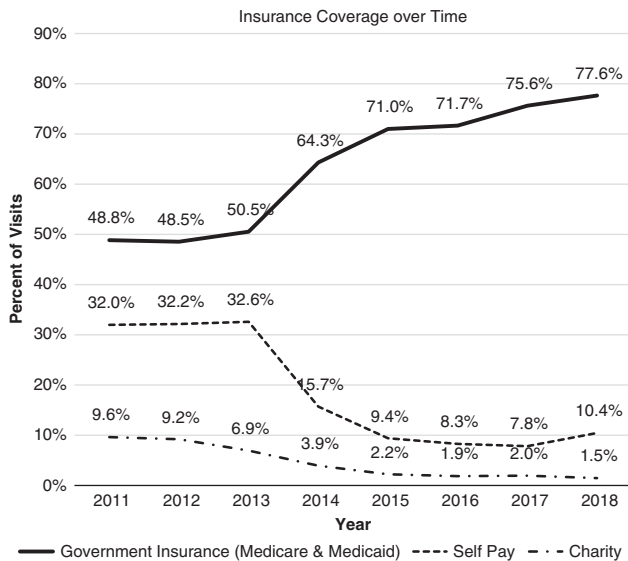


FIGURE 1. Percent of visits covered by government insurance, self-pay, and charity each year.

when comparing those with governmental insurance to those that were self-pay or charity, with only skin diseases being more common than diseases of the circulatory system in self-pay or charity visits.

The primary reason for the hospital visits coincided strongly with the reported comorbid conditions as characterized by the Elixhauser Comorbidity Index (Table 2). Drug abuse, depression, alcohol abuse, or psychosis was found in 108,232 visits (70.2%), whereas HIV/acquired immunodeficiency syndrome (AIDS) was identified as a comorbidity in 1691 visits (1.1%).

When stratifying mental disorders, the most common diagnosis was for mood disorders ($n=24,507$; 31.9% of inpatient visits vs. $n=4502$; 5.8% of outpatient visits) followed by nonmood psychotic disorders (eg, schizophrenia, schizotypal, and delusional disorders; $n=14,122$; 18.4% of inpatient visits vs. $n=3719$; 4.8% of outpatient visits). The most common substance abuse diagnoses were as follows: alcohol ($n=5609$; 7.3% of inpatient visits vs. $n=10,534$; 13.6% of outpatient visits), opioids and analgesics ($n=1371$; 1.8% of inpatient visits vs. $n=570$; 0.7% of outpatient visits), cocaine ($n=221$; 0.3% of inpatient visits vs. $n=290$; 0.4% of outpatient visits), sedatives, hypnotics, and anxiolytics ($n=234$; 0.3% of inpatient visits vs. $n=61$; 0.1% of outpatient visits), other stimulants ($n=141$; 0.2% of inpatient visits vs. $n=60$; 0.1% of outpatient visits), and cannabis and hallucinogens ($n=64$; 0.1% of inpatient visits vs. $n=124$; 0.2% of outpatient visits).

Acute injuries accounted for 15.2% of visits ($n=23,457$) and these injuries were most commonly due to exposures to weather and environmental conditions ($n=2988$; 12.7%; of which $n=2304$ were cold-related and $n=300$ were heat-related), falls ($n=2862$; 12.2%), assaults ($n=1813$; 7.7%), suicide attempts ($n=1242$; 5.3%), and poisonings or adverse effects of drugs ($n=1233$; 5.3%).

Length of Stay and Discharge Outcomes

A small percentage of hospitalizations resulted in death or discharge to hospice ($n=351$; 0.23%) (Table 3). The large

TABLE 2. Elixhauser Comorbidities in Patient Visits of Those Affected by Homelessness

Comorbidity	Inpatient (N=76,952) (%)	Outpatient (N=77,221) (%)
Mean number of comorbidities (SD)	3.07 (1.68)	1.37 (1.33)
No. patient visits with 3+ comorbidities	45,013 (58.49)	13,233 (17.14)
Type of comorbidity		
Drug abuse	37,428 (48.64)	11,706 (15.16)
Depression	29,184 (37.92)	12,422 (16.09)
Alcohol abuse	28,433 (36.95)	18,338 (23.75)
Psychosis	22,378 (29.08)	11,276 (14.60)
Hypertension (uncomplicated)	22,274 (28.95)	14,776 (19.13)
Chronic pulmonary disease	17,419 (22.64)	9674 (12.53)
Fluid and electrolyte disorders	12,495 (16.24)	2555 (3.31)
Other neurological disorders	7814 (10.15)	4258 (5.51)
Diabetes (uncomplicated)	6805 (8.84)	5537 (7.17)
Obesity	6706 (8.71)	1105 (1.43)
Cardiac arrhythmia	5981 (7.77)	2851 (3.69)
Liver disease	4935 (6.41)	1241 (1.61)
Congestive heart failure	4313 (5.60)	1705 (2.21)
Hypertension (complicated)	3617 (4.70)	1159 (1.50)
Diabetes (complicated)	3601 (4.68)	1315 (1.70)
Coagulopathy	3052 (3.97)	413 (0.53)
Renal failure	3031 (3.94)	848 (1.10)
Hypothyroidism	2906 (3.78)	863 (1.12)
Weight loss	2871 (3.73)	300 (0.39)
Deficiency anemia	2777 (3.61)	442 (0.57)
Peripheral vascular disorders	1411 (1.83)	453 (0.59)
Pulmonary circulation disorders	1105 (1.44)	144 (0.19)
HIV/AIDS	968 (1.26)	723 (0.94)
Solid tumor without metastasis	957 (1.24)	222 (0.29)
Valvular disease	888 (1.15)	281 (0.36)
Rheumatoid arthritis/collagen	664 (0.86)	402 (0.52)
Paralysis	563 (0.73)	188 (0.24)
Peptic ulcer disease without bleeding	554 (0.72)	121 (0.16)
Metastatic cancer	421 (0.55)	57 (0.07)
Blood loss anemia	261 (0.34)	20 (0.03)
Lymphoma	126 (0.16)	34 (0.04)

AIDS indicates acquired immunodeficiency syndrome; HIV, human immunodeficiency virus.

majority of visits (81.9%) had a routine discharge to home or self-care (76.4% of inpatient visits and 87.4% of outpatient visits) (Table 3). Approximately 4.8% of visits ($n=7472$) resulted in being discharged or transferred to psychiatric facilities (Table 3), of which 397 (5.3%) were following suicide attempts and 3560 (47.6%) had a primary diagnosis code for a mental disorder. Individuals discharged or transferred to psychiatric facilities were predominantly male ($n=5456$; 73.0%), White ($n=3756$; 50.3%), aged 45–54 years ($n=2029$; 27.2%), and with government insurance ($n=5156$; 69.0%). Few were discharged or transferred to a court or law enforcement (0.37%) (Table 3). Visits resulting in being discharged or transferred to a court or law enforcement had a primary diagnosis code for a mental disorder ($n=239$; 42.1%) or drug and alcohol abuse ($n=88$; 16.0%) and individuals were predominantly male ($n=437$; 76.9%), White ($n=329$; 57.9%), aged 25–34 years ($n=159$; 28.0%), and with government insurance ($n=353$; 62.1%).

We identified several predictors of discharge to a health care facility opposed to discharge to home or self-care, which were

TABLE 3. Length of Stay and Discharge Status of Patient Visits of Those Affected by Homelessness

Variable	Inpatient (N=76,952) (%)	Outpatient (N=77,221) (%)
Length of stay		
Outpatient visits > 1 day	NA	5615 (7.27)
Inpatient length of stay [mean days (SD)]	6.21 (6.99)	NA
Visit characteristics		
Operations	5941 (7.72)	565 (0.73)
Suffered an acute injury in the hospital	755 (0.98)	38 (0.05)
Discharge description		
Routine discharge to home or self-care	58,803 (76.42)	67,485 (87.39)
Discharge/transferred to long-term/ intermediate facility	8704 (11.31)	646 (0.84)
Discharged/transferred to a psychiatric hospital or psychiatric distinct unit of a hospital	2601 (3.38)	4871 (6.31)
Left against medical advice/discontinued care	3458 (4.49)	2260 (2.93)
Discharged/transferred to a short-term/ acute facility	1297 (1.69)	877 (1.14)
Other	1088 (1.41)	697 (0.90)
Discharged/transferred to court/law enforcement	291 (0.38)	277 (0.36)
Discharge/transferred to home health care service	416 (0.54)	51 (0.07)
Expired/hospice	294 (0.38)	57 (0.07)

similar between inpatient and outpatient visits. The strongest predictor that an individual affected by homelessness would be discharged to a secondary health care facility was a suicide attempt (Table 4). Other factors consistently associated with discharge to a health care facility include having governmental insurance, serious comorbidities as measured by the modified Elixhauser Comorbidity Index, depression, and psychosis (Table 4). Suicide attempts, depression, and psychosis were much stronger predictors for outpatient visits than inpatient visits (Table 4). Having charity coverage and being Black/African American were consistently associated with not being discharged to a health care facility (Table 4).

DISCUSSION

This study found that the large majority of hospital visits in Illinois for those coded as homeless had comorbidities of depression, psychosis, and/or substance abuse (70.2%). Only a small fraction of visits were treated for acute injuries, the most common causes of injury were from weather-related risks, falls, and from being assaulted. Mental health issues were the most common primary diagnosis across all major age groups, even in children. Among hospital visits for the female homeless, pregnancy complications were identified in the top 5 primary diagnoses.

The large majority of visits (81.9%) had a routine discharge to home or self-care (76.4% of inpatient visits and 87.4% of outpatient visits) which for this population would predominately involve returning to their conditions of homelessness. However, this study demonstrates that disparities persist for racial groups or those that are uninsured. African Americans represented 40% of the hospital visits despite representing <15% of the Illinois population

TABLE 4. Predictors of Discharge to Another Health Care Facility Compared With Routine Discharge to Home or Self-Care

Predictor	Inpatient Adjusted OR 95% CI	Outpatient Adjusted OR 95% CI	All Adjusted OR 95% CI
Year of visit	0.98 (0.97–0.99)	1.01 (1.00–1.03)	0.99 (0.98–0.99)
Male	0.94 (0.9–0.99)	1.02 (0.96–1.09)	1.01 (0.97–1.05)
Age (per 10 y)	1.31 (1.28–1.32)	0.86 (0.84–0.88)	1.09 (1.08–1.10)
Race/ethnicity			
Black/African American	0.81 (0.78–0.85)	0.66 (0.62–0.70)	0.76 (0.74–0.79)
Hispanic or Latino	0.91 (0.84–0.99)	1.00 (0.89–1.12)	0.94 (0.88–1.01)
Other	1.01 (0.94–1.08)	0.80 (0.71–0.91)	0.94 (0.88–0.99)
Payer			
Government insurance	1.11 (1.05–1.17)	1.18 (1.08–1.29)	1.13 (1.08–1.19)
Charity	0.61 (0.52–0.71)	0.67 (0.56–0.80)	0.63 (0.56–0.71)
Self-pay	0.59 (0.54–0.65)	0.95 (0.85–1.06)	0.74 (0.70–0.79)
Acute injury	1.74 (1.65–1.83)	0.71 (0.65–0.78)	1.34 (1.28–1.39)
Suicide attempt	2.52 (2.19–2.91)	7.75 (5.86–10.25)	3.15 (2.78–3.57)
Comorbidity			
Depression	1.09 (1.05–1.14)	4.26 (4.02–4.51)	1.91 (1.85–1.98)
Psychoses	1.75 (1.67–1.83)	4.26 (4.01–4.53)	2.76 (2.66–2.86)
Operation	2.42 (2.27–2.58)	1.06 (0.77–1.45)	3.14 (2.95–3.33)
Additional comorbidity (modified Elixhauser)	1.09 (1.08–1.10)	1.11 (1.09–1.13)	1.17 (1.15–1.18)

CI indicates confidence interval; OR, odds ratio.

(or ~30% in Chicago), and African Americans were far less likely to be discharged to a secondary facility that could delay return to conditions of homelessness or assist with transitioning out of homelessness.

This work provides comprehensive details on what has been observed in other studies examining the health concerns of those affected by homelessness; there is a high prevalence of mental disorders, substance abuse, infectious disease, and chronic disease seen at an earlier age^{3–6} and observed very few patients over the age of 75 years. There has traditionally been a lot of focus on subpopulations suffering from health conditions with significant consequences, such as HIV/AIDS. This data show there is a much higher prevalence of other conditions and there may be unintended health consequences from focusing exclusively on narrow subgroups, rather than developing broad programs. However, policies that have been successful in addressing conditions like HIV/AIDS in this population could provide insights for further improving the general health care of those affected by homelessness.

There remains a significant burden of care and cost to hospitals for the health care of those affected by homelessness. However, with the expansion of the insurance coverage in Illinois because of the Patient Protection and Affordable Care Act implementation (January 1, 2014), the proportion of patient visits without any insurance coverage decreased dramatically. Although reimbursement rates fluctuate, it can be assumed they are significantly lower than \$2.34 billion dollars in charges for this population found in

this study and these charges only represent one component of direct costs. These visits are concentrated in a small percentage of hospitals within the state of Illinois and demonstrates that this burden of care falls disproportionately on specific facilities. Although it may be hard to adequately address and accommodate at the facility level, this clustering of visits may provide benefits when trying to reach this population or implement interventions that provide a transition from homelessness to residency programs.

It is not feasible to develop transition programs in every hospital but our data show that programs could be housed in a small fraction of hospitals that treat the vast majority of the homeless population seen in emergency departments. Discharge to medical respite programs which are short-term residential care programs for those too sick to be discharged back to the streets have demonstrated some success in limiting readmissions, but it occurs far less frequently. Most homeless individuals are discharged to other settings which have not been shown to achieve similar results as medical respite programs.¹⁸ Safety-net hospitals, which provide care regardless of insurance status or ability to pay, are more likely to serve this population but have been shown to employ fewer strategies to reduce readmissions.¹⁹

The Patient Protection and Affordable Care Act may allow for increased access of care outside of emergency departments, but this population has shown frequent hospitalizations and emergency department visits despite this coverage, which may be due to a lack of alternative services.⁶ For example, while those with insurance coverage are better able to access mental health treatment, Illinois has one of the lowest Medicaid-to-Medicare fee ratios resulting in physicians getting reimbursed much less through Medicaid than they would receive for the same service through Medicare. This can create a barrier for the Medicaid population in accessing services as providers may be more reluctant to treat this population and may contribute to the behavioral health care professional shortage in Illinois (14 professionals per 10,000 residents compared with the already less than ideal national average of 21 per 10,000).²⁰ Illinois spends \$77 per capita on mental health services compared with the \$133 national average, with ~3 quarters of those funds going to community-based mental health programs and 1 quarter to in-state psychiatric hospitals.²⁰ Mental illness is a known risk factor for incarceration and has significant costs to individuals and society.²⁰ Therefore, more comprehensive interventions are indicated to better address the health needs of those affected by homelessness.

Limitations

There are several limitations to this study. Primarily, misclassification is a concern as many individuals may not be coded as affected by homelessness and there is no way to validate the cases that are coded relative to duration, cause, and current status of homelessness. Because of common social biases for this population, substance abuse and mental illness may be coded differentially in this population. In addition, ICD-9 and ICD-10 codes cannot be

converted in a one-to-one manner and there may be some lost information that is incongruent between the 2 systems.

CONCLUSIONS

Hospital discharge data are a valuable public health surveillance tool for evaluating health care issues affecting the homeless. Those experiencing homelessness experience a high burden of health concerns and may lack the supportive services needed for improving their health when routinely discharged to home or self-care. Hospital billing records can be used to prioritize the distribution of limited public health resources for health care programs and interventions among those experiencing homelessness. Although hospitals provide a valuable source of care to this population, they are likely experiencing a larger burden of care as this is a main access point for psychiatric and other health care services since other facilities have been shut down or experienced a loss in funding or reimbursement. In addition, there is evidence that when these health services are not taken on by hospitals, it is shifted to other social systems that are not designed to address psychiatric and other medical needs, such as the criminal justice.²⁰ Therefore, it is imperative that this population has access to services at the most cost-effective, primary prevention point.

REFERENCES

1. Rossi PH. *Down and Out in America: The Origins of Homelessness*. Chicago: The University of Chicago Press; 1989.
2. Wasserman JA, Clair JM. *At Home on the Street: People, Poverty, and a Hidden Culture of Homelessness*. Boulder: Lynne Reinner Publishers Inc; 2010.
3. Fazel S, Geddes JR, Kushel M. The health of homeless people in high-income countries: descriptive epidemiology, health consequences, and clinical and policy recommendations. *Lancet*. 2014;384:1529–1540.
4. Lam C, Arora S, Menchine M. Increased 30-day emergency department revisits among homeless patients with mental health conditions. *West J Emerg Med*. 2016;17:607–612.
5. Mitchell MS, León CLK, Byrne TH, et al. Cost of health care utilization among homeless frequent emergency department users. *Psychol Serv*. 2017;14:193–202.
6. Lin W-C, Bharel M, Zhang J, et al. Frequent emergency department visits and hospitalizations among homeless people with Medicaid: implications for Medicaid expansion. *Am J Public Health*. 2015;105(suppl):S716–S722.
7. Hwang SW, Burns T. Health interventions for people who are homeless. *Lancet*. 2014;384:1541–1547.
8. Feldman BJ, Calogero CG, Elsayed KS, et al. Prevalence of homelessness in the emergency department setting. *West J Emerg Med*. 2017;18:366–372.
9. Cheung A, Somers JM, Moniruzzaman A, et al. Emergency department use and hospitalizations among homeless adults with substance dependence and mental disorders. *Addict Sci Clin Pract*. 2015;10:17.
10. Montgomery AE, Dichter ME, Thomasson AM, et al. Disparities in housing status among veterans with general medical, cognitive, and behavioral health conditions. *Psychiatr Serv*. 2015;66:317–320.
11. Illinois Department of Public Health; Illinois Health Facilities and Services Review. *Annual Hospital Questionnaire: Hospital Profiles and Annual Bed Reports, 2011*. Springfield: Illinois Department of Public Health; Illinois Health Facilities and Services Review; 2013. Available at: <https://www2.illinois.gov/sites/hfsrb/InventoriesData/FacilityProfiles/pages/default.aspx>. Accessed December 7, 2017.
12. Lale A, Krajewski A, Friedman LS. Undertriage of firearm-related injuries in a major metropolitan area. *JAMA Surg*. 2017;152:467–474.
13. Kanak M, Stewart A, Vinci R, et al. Trends in homeless children and young adults seeking shelter in a Boston Pediatric Emergency Department

- following state housing policy changes, 2011–2016. *Am J Public Health*. 2018;108:1076–1078.
14. Peterson R, Gundlapalli AV, Metraux S, et al. Identifying homelessness among veterans using VA administrative data: opportunities to expand detection criteria. *PLoS One*. 2015;10:e0132664.
15. United States Department of Agriculture Economic Research Service. USDA ERS—Rural-Urban Continuum Codes. Available at: <https://www.ers.usda.gov/data-products/rural-urban-continuum-codes/>. Accessed December 2, 2019.
16. Bureau of Labor Statistics. Consumer Price Index (CPI) Inflation Calculator. Available at: <https://data.bls.gov/cgi-bin/cpicalc.pl>. Accessed December 2, 2019.
17. Elixhauser A, Steiner C, Harris DR, et al. Comorbidity measures for use with administrative data. *Med Care*. 1998;36:8–27.
18. Kertesz SG, Posner MA, O'Connell JJ, et al. Post-hospital medical respite care and hospital readmission of homeless persons. *J Prev Interv Community*. 2009;37:129–142.
19. Figueroa JF, Joynt KE, Zhou X, et al. Safety-net hospitals face more barriers yet use fewer strategies to reduce readmissions. *Med Care*. 2017;55:229–235.
20. Heun-Johnson H, Menchine M, Goldman D, et al. The cost of mental illness Illinois facts and figures. 2018. Available at: <http://www.chicagotribune.com/suburbs/daily-southtown/opinion/ct-sta-kadner-mental-st-0529-20150528-story.html>. Accessed November 18, 2019.