

Predictors of Medical or Surgical and Psychiatric Hospitalizations Among a Population-Based Cohort of Homeless Adults

Catharine Chambers, MSc, Marko Katic, BA, Shirley Chiu, MA, Donald A. Redelmeier, MD, MSHSR, Wendy Levinson, MD, Alex Kiss, PhD, and Stephen W. Hwang, MD, MPH

Homeless adults are frequent users of inpatient hospital services. In a nationally representative sample of homeless persons in the United States, almost 1 in 4 respondents reported being hospitalized in the past year, a rate 4 times higher than US norms.¹

The frequent use of inpatient hospital services partially reflects the high prevalence of acute and chronic disease, injuries and assaults, substance use, and mental illness among this population.¹⁻³ However, the high rates of hospitalization have also been attributed to a lack of access to primary and preventative care, particularly in the United States, where 50% of homeless people have no health insurance.^{1,4-7} In a nationally representative sample of persons who used homeless services in the United States, Kushel et al.¹ showed that lack of health insurance and African American race/ethnicity, compared with non-Latino White race/ethnicity, were the only factors significantly associated with a lower odds of self-reported hospitalization. In a subsequent study, Kushel et al.⁴ showed that being uninsured significantly decreased the likelihood of self-reporting a nonmaternal hospitalization in the past year, whereas food instability and housing instability significantly increased the odds. Similarly, Lim et al.⁵ in their population-based study of homeless women in Los Angeles, California, showed that having health insurance was significantly associated with an increased likelihood of hospitalization.

These studies pointed to the enabling influence of health insurance on access to inpatient hospital services in the United States; however, these findings were likely not applicable in a Canadian setting in which individuals have access to universal health insurance coverage. Furthermore, most previous studies of health care utilization in the United States

Objectives. We identified factors associated with inpatient hospitalizations among a population-based cohort of homeless adults in Toronto, Ontario.

Methods. We recruited participants from shelters and meal programs. We then linked them to administrative databases to capture hospital admissions during the study (2005–2009). We used logistic regression to identify predictors of medical or surgical and psychiatric hospitalizations.

Results. Among 1165 homeless adults, 20% had a medical or surgical hospitalization, and 12% had a psychiatric hospitalization during the study. These individuals had a total of 921 hospitalizations, of which 548 were medical or surgical and 373 were psychiatric. Independent predictors of medical or surgical hospitalization included birth in Canada, having a primary care provider, higher perceived external health locus of control, and lower health status. Independent predictors of psychiatric hospitalization included being a current smoker, having a recent mental health problem, and having a lower perceived internal health locus of control. Being accompanied by a partner or dependent children was protective for hospitalization.

Conclusions. Health care need was a strong predictor of medical or surgical and psychiatric hospitalizations. Some hospitalizations among homeless adults were potentially avoidable, whereas others represented an unavoidable use of health services. (*Am J Public Health.* 2013;103:S380–S388. doi:10.2105/AJPH.2013.301646)

relied on self-reported data^{1,8-10} or restricted their analysis to a single health care institution.^{11,12} The purpose of this study was to identify factors associated with inpatient hospitalizations among a population-based cohort of homeless adults in Toronto, Ontario, using comprehensive administrative data. Analyses were stratified by type of inpatient service to examine the influence of predictors separately for medical or surgical and psychiatric hospitalizations.

METHODS

Recruitment and sampling methods for this study were previously described.¹³⁻¹⁵ Briefly, we selected a random sample of homeless adults from shelters and meal programs in Toronto over 12 consecutive months in 2004 and 2005. Recruitment was stratified to obtain

a 2:1:1 ratio of single adult men (i.e., men without dependent children), single adult women (i.e., women without dependent children), and family adults (i.e., men or women accompanied by a partner or dependent children) to ensure adequate sample size for comparison and to approximate the demographic characteristics of Toronto's homeless population.³ Findings from a pilot study showed that approximately 90% of homeless people in Toronto sleep at shelters, whereas 10% did not use shelters but did use meal programs.¹⁶ Therefore, 90% of the sample was recruited at shelters and the remaining 10% at meal programs.

Homelessness was defined as living within the last 7 days at a shelter, public place, vehicle, abandoned building, or someone else's home, and not having a home of one's own.¹⁷ Participants were excluded if they did

not meet the definition of homelessness, were unable to communicate in English, were unable to provide informed consent, or were meal program users who had not used a shelter in the past 7 days. Participants were also excluded if they did not have a valid provincial health insurance number, because this information was required for linkage to administrative data. All participants provided written informed consent and received \$15 for their participation.

For the purposes of recruitment, families were considered as units. In instances in which 2 adults of the same family unit were present, we randomly selected 1 adult for inclusion in the analysis. Of the 2516 single adults and family units we screened, 882 (35%) were ineligible to participate, an additional 443 (18%) individuals declined to participate, and 2 were identified as duplicate or invalid records. In total, 1189 adults were included in the study, corresponding to a response rate of 73%.

Survey Instrument

Predisposing, enabling, and need factors were assessed using structured, in-person interviews at baseline within the framework of the Behavioral Model of Health Services Utilization for Vulnerable Populations.¹⁸ Predisposing factors included demographic (e.g., age, family status) and social structural characteristics that affected the propensity to use services. Enabling factors included personal, family, and community factors (e.g., social support, perceived barriers to care) that impeded or facilitated health service use. Need factors included symptoms or conditions (e.g., physical or mental health status) that precipitated service use.

We assessed alcohol, drug, and mental health problems using the Addiction Severity Index.^{19,20} Addiction Severity Index scores were dichotomized for each subscale (≥ 0.17 for alcohol problems, ≥ 0.10 for drug problems, and ≥ 0.25 for mental health problems) using cut-off scores for homeless persons.¹⁷ Propensity to underseek care was assessed on a 4-point scale for seeking health care for (1) weight loss of more than 10 pounds in a month when not dieting; (2) shortness of breath with light exercise or light work; (3) chest pain when exercising; (4) loss of

TABLE 1—Characteristics of Study Participants: Toronto, Ontario, 2005–2009

Characteristic	Overall (n = 1165), No. (%) or Mean \pm SD	Medical/Surgical Hospitalization (n = 227), No. (%) or Mean \pm SD	Psychiatric Hospitalization (n = 134), No. (%) or Mean \pm SD
Predisposing factors			
Demographic group			
Single adult men	587 (50.4)	127 (56.0)	70 (52.2)
Single adult women	296 (25.4)	60 (26.4)	52 (38.8)
Family adult	282 (24.2)	40 (17.6)	12 (9.0)
Age, y	36.1 \pm 12.4	40.1 \pm 13.4	35.6 \pm 11.4
Lifetime duration of homelessness, y			
< 2	584 (50.1)	106 (46.7)	55 (41.0)
≥ 2	581 (49.9)	121 (53.3)	79 (59.0)
Race/ethnicity			
White	650 (55.8)	139 (61.2)	76 (56.7)
Black	260 (22.3)	36 (15.9)	30 (22.4)
Aboriginal	96 (8.2)	29 (12.8)	12 (9.0)
Other visible minorities	159 (13.7)	23 (10.1)	16 (11.9)
Place of birth			
Canada	796 (68.3)	173 (76.2)	97 (72.4)
Outside Canada	369 (31.7)	54 (23.8)	37 (27.6)
Highest level of education			
\leq some high school	587 (50.5)	123 (54.2)	72 (53.7)
High school diploma or equivalent	248 (21.3)	39 (17.2)	25 (18.7)
\geq college/vocational training	327 (28.1)	65 (28.6)	37 (27.6)
History of traumatic brain injury	553 (47.6)	115 (50.7)	63 (47.4)
Physical assault in past 12 mo	330 (28.6)	70 (31.1)	35 (26.1)
Sexual assault in past 12 mo	63 (5.5)	20 (8.9)	12 (9.0)
Current smoker	826 (71.0)	173 (76.2)	110 (82.1)
Alcohol problem in past 30 d ^a	339 (29.1)	72 (31.7)	36 (26.9)
Drug problem in past 30 d ^a	458 (39.1)	96 (42.3)	57 (42.5)
Mental health problem in past 30 d ^a	438 (37.6)	91 (40.1)	83 (61.9)
Propensity to underseek care score			
0	670 (57.5)	135 (59.5)	64 (47.8)
1	228 (19.6)	45 (19.8)	32 (23.9)
≥ 2	267 (22.9)	47 (20.7)	38 (28.4)
Enabling factors			
Monthly income, Can \$			
< 500	562 (49.5)	96 (43.1)	62 (46.6)
500–999	313 (27.6)	74 (33.2)	47 (35.3)
≥ 1000	260 (22.9)	53 (23.8)	24 (18.1)
Has a primary care provider	865 (74.4)	190 (83.7)	107 (79.9)
Unmet need for health care	192 (16.5)	37 (16.3)	23 (17.2)
Unmet need for mental health care	121 (10.5)	28 (12.4)	28 (21.1)
Competing priorities	62 (5.3)	11 (4.9)	10 (7.5)
MHLC internal control subscale score	27.6 \pm 5.5	27.2 \pm 6.0	26.2 \pm 6.3
MHLC external control from chance subscale score	19.6 \pm 6.4	19.8 \pm 6.3	19.8 \pm 6.8
MHLC external control from powerful others subscale score	21.0 \pm 6.9	22.4 \pm 6.5	21.9 \pm 6.5

Continued

TABLE 1—Continued

Social support—loan	647 (68.0)	110 (64.7)	64 (59.3)
Social support—ride to appointment	551 (58.0)	88 (51.8)	48 (44.4)
Social support—suicide	655 (69.5)	114 (67.1)	56 (51.9)
Need factors			
PCS-12 score	46.0 ± 11.2	41.4 ± 12.5	43.7 ± 12.1
MCS-12 score	40.7 ± 13.2	40.0 ± 12.8	38.2 ± 12.8
No. of chronic health conditions ^b			
None	470 (40.4)	54 (23.8)	49 (36.6)
1	324 (27.8)	58 (25.6)	34 (25.4)
2	202 (17.4)	54 (23.8)	25 (18.7)
≥ 3	168 (14.4)	61 (26.9)	26 (19.4)

Note. MCS = Mental Component Summary; MHLC = Multidimensional Health Locus of Control; PCS = Physical Component Summary.

^aAlcohol, drug, and mental health problems in the past 30 days were assessed using the Addiction Severity Index.^{18–20}

^bChronic health conditions include diabetes, anemia, hypertension, heart disease and stroke, liver problems (including chronic viral hepatitis), arthritis or joint problems, cancer, physical handicaps, or HIV/AIDS.

consciousness, fainting, or passing out; or (5) bleeding other than nosebleeds and not caused by accident or injury.²¹ One point was assigned for each symptom rated as “a little important” or “not at all important.”

Competing priorities were based on difficulty in meeting shelter, food, clothing, washing, or bathroom needs over the past 30 days using a 4-point scale.²² Participants were classified as having competing priorities if they responded “usually” to any of the 5 items. Health locus of control, a measure of a person’s belief that their health is determined by their own behavior, was assessed using Form A of the Multidimensional Health Locus of Control (MHLC) instrument for subscales of internal control, external control from powerful others, and external control because of chance.²³ Perceived access to financial, instrumental, and emotional social support from informal social networks, based on items adapted from Lam and Rosenheck,²⁴ was dichotomized to indicate the presence or absence of social support.²⁵

Perceived health status was measured using the validated 12-item Short Form (SF-12) Health Survey.^{26,27} SF-12 physical component summary (PCS) and mental component summary (MCS) scores were calculated according to the publishers’ specifications and were standardized to the general US population (mean = 50; SD = 10), with higher scores representing better overall health status.²⁷

Chronic health conditions were based on items from the National Survey of Homeless Assistance Providers and Clients, and included diabetes; anemia; high blood pressure, heart disease, or stroke; liver problems including hepatitis; arthritis or joint problems; cancer; problems walking; lost limb or other handicap; and HIV infection or AIDS.¹⁷

Administrative Data Linkage

Administrative data were accessed through the Institute for Clinical Evaluative Sciences (ICES), an independent, nonprofit organization partially funded by the Ontario Ministry of Health and Long-Term Care. Homeless participants were linked to administrative data using a unique 10-digit provincial health number for eligible individuals under the Ontario Health Insurance Plan. In instances where either the participants’ health number could not be obtained (3% of the sample) or the health number provided was not valid (an additional 3%), we attempted to perform the linkage based on the participant’s first and last name, gender, and date of birth. Overall, linkage was successful for 1165 (98%) of the study participants.

We obtained hospitalization data from the Canadian Institute for Health Information Discharge Abstract Database (CIHI-DAD) and the Ontario Mental Health Reporting System (OMHRS). OMHRS was created in October 2005 to capture clinical, administrative, and

resource information for all adult inpatient admissions to mental health beds in the province; it includes inpatient admissions to general hospitals with designated adult inpatient mental health beds, as well as inpatient admissions to specialty psychiatric hospitals and provincial psychiatric hospitals. Before October 1, 2005, discharge data for adult inpatient mental health beds were captured in CIHI-DAD. To identify these mental health records in CIHI-DAD, we extracted hospital discharge records in which the most responsible service provider was coded as “psychiatry”; these records were merged with the OMHRS records to create a separate psychiatric hospitalizations data set. Institutions with designated adult inpatient mental health beds that had previously reported to CIHI-DAD were required to report to both CIHI-DAD and OMHRS during a dual reporting period from October 1, 2005, to March 31, 2006 (end of fiscal year). These duplicate psychiatric hospitalization records were identified in CIHI-DAD using an ICES-derived key variable and excluded from the merged data set. Encounters related to pregnancy and childbirth were excluded to eliminate the effect of these discharges on gender-specific differences in hospitalization rates.

Analysis

Hospitalization rates were calculated by dividing the total number of discharges by the total period under observation. Dates of death were obtained from the Registered Persons Database (RPDB) and used to adjust person-time of observation. Rates were calculated separately for medical or surgical and psychiatric discharges. Reasons for medical or surgical hospitalization were derived based on the *International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Canadian Enhancement (ICD-10-CA)* codes for the most responsible diagnosis (i.e., the diagnosis that contributed to the longest duration of stay in hospital).²⁸ Reasons for psychiatric hospitalization were derived based on *ICD-10-CA* codes for the most responsible diagnosis (for DAD records) or the *Diagnostic and Statistical Manual of Mental Disorders, 4th Revision (DSM-IV)* diagnostic codes for the primary provisional diagnosis at

TABLE 2—Most Responsible Diagnosis for Hospitalization of Study Participants: Toronto, Ontario, 2005–2009

Most Responsible Diagnosis ^a	No. (%)
Medical/surgical hospitalizations^b	
Infectious and parasitic diseases	38 (6.9)
Neoplasms	23 (4.2)
Endocrine, nutritional and metabolic diseases	17 (3.1)
Mental and behavioral disorders	19 (3.5)
Diseases of the nervous system	18 (3.3)
Diseases of the circulatory system	48 (8.8)
Diseases of the respiratory system	48 (8.8)
Diseases of the digestive system	90 (16.4)
Diseases of the skin and subcutaneous tissue	23 (4.2)
Diseases of the musculoskeletal system and connective tissue	32 (5.8)
Diseases of the genitourinary system	33 (6.0)
Symptoms, signs and abnormal clinical and laboratory findings	34 (6.2)
Injury, poisoning and certain other consequences of external causes	103 (18.8)
Factors influencing health status and contact with health services	14 (2.6)
Other diagnoses	8 (1.5)
Total	548 (100.0)
Psychiatric hospitalizations^c	
Delirium, dementia, and amnesic and other cognitive disorders	6 (1.6)
Substance-related disorders	52 (13.9)
Schizophrenia and other psychotic disorders	147 (39.4)
Mood disorders	67 (18.0)
Adjustment disorders	6 (1.6)
Personality disorders	11 (2.9)
Other diagnoses	10 (2.7)
Missing diagnoses ^d	74 (19.8)
Total	373 (100.0)

^aFor Canadian Institute for Health Information Discharge Abstract Database records: based on most responsible diagnosis using *International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Canadian Enhancement* diagnostic codes. For Ontario Mental Health Reporting System (OMHRS) records: based on primary provisional diagnosis at admission using *Diagnostic and Statistical Manual of Mental Disorders, 4th Revision* diagnostic codes.

^bAmong 227 (19.5%) homeless participants with medical or surgical hospitalizations during the study period.

^cAmong 134 (11.5%) homeless participants with psychiatric hospitalization during the study period.

^dBefore fiscal year 2008–2009, provisional diagnosis at admission was not a mandatory field in OMHRS for hospital stays < 72 hours.

admission (for OMHRS records).²⁹ *ICD-10-CA* diagnoses were converted into *DSM-IV* classifications according to specifications provided in Appendix H of the *DSM-IV*.²⁹

Logistic regression was used to calculate odds ratios (ORs) and 95% confidence intervals (CIs) comparing (1) homeless participants with at least 1 medical or surgical discharge during the study with those without a medical or surgical discharge, and (2) homeless participants with at least 1 psychiatric discharge during the study with those without

a psychiatric discharge. Backward stepwise selection was used to identify significant predictors, using *P* less than .1 as the significance level for entry into the model and *P* greater than .05 as the significance level for removal. The demographic group variable was forced into all multivariate regression models, regardless of significance. Interaction terms between demographic group and all significant variables were examined to test for effect modification; none of the tested interaction terms were significant. Independent variables

were assessed for multicollinearity, and no problems were detected. Social support variables were added to the survey partway through the study enrollment period; consequently, social support data were missing for approximately 20% of participants. These variables were examined in univariate analyses but were not included in multivariate analyses to maximize our analytic sample size. All analyses were performed using SAS 9.2 statistical analysis software (SAS Institute, Cary, NC).

RESULTS

The sample of 1165 homeless adults included 587 (50.4%) single adult men, 296 (25.4%) single adult women, and 282 (24.2%) adults in families who were mostly single mothers accompanied by their dependent children (*n* = 201/282; 71.3%; Table 1). During the study, 227 (19.5%) participants had a medical or surgical hospitalization and 134 (11.5%) had a psychiatric hospitalization, including 48 (4.1%) who had both a medical or surgical and psychiatric hospitalization. These individuals had a total of 921 hospitalizations during the study, of which 548 (59.5%) were medical or surgical and 373 (40.5%) were psychiatric.

The mean rate of medical or surgical hospitalizations was 0.17 discharges per person-year (SD = 0.79; range = 0.00–14.91 discharges per person-year), and the mean rate of psychiatric hospitalizations was 0.09 discharges per person-year (SD = 0.38; range = 0.00–4.82 discharges per person-year). The mean duration of follow-up was 3.9 years (SD = 0.3 years; range = 1.1–4.3 years). Injuries, poisonings, and other external causes (*n* = 103) were the most common reasons for medical or surgical hospitalization, whereas schizophrenia and other psychotic disorders (*n* = 147) were the most common reasons for psychiatric hospitalization (Table 2).

Medical or Surgical Hospitalizations

Family adults, compared with single adult men, were relatively less likely to have a medical or surgical discharge during the study (Table 3). Predisposing factors significantly associated with medical or surgical hospitalization in

TABLE 3—Odds Ratios (ORs) and 95% Confidence Intervals (CIs) for Predictors of Medical or Surgical Hospitalization: Toronto, Ontario, 2005–2009

Characteristic	Univariate Model		Multivariate Model	
	OR (95% CI)	P	AOR (95% CI)	P
Predisposing factors				
Demographic group				
Single adult men (Ref)	1.00		1.00	
Single adult women	0.92 (0.65, 1.30)	.639	0.84 (0.58, 1.21)	.339
Family adult	0.60 (0.41, 0.88)	.01	0.63 (0.42, 0.96)	.031
Age, y	1.03 (1.02, 1.05)	< .001		
Lifetime duration of homelessness, y				
< 2 (Ref)	1.00			
≥ 2	1.19 (0.89, 1.59)	.249		
Race/ethnicity				
White (Ref)	1.00			
Black	0.59 (0.40, 0.88)	.01		
Aboriginal	1.59 (0.99, 2.56)	.055		
Other visible minorities	0.62 (0.39, 1.01)	.052		
Place of birth				
Outside Canada (Ref)	1.00		1.00	
Canada	1.62 (1.16, 2.26)	.005	1.48 (1.03, 2.12)	.035
Highest level of education				
≤ some high school (Ref)	1.00			
High school diploma or equivalent	0.70 (0.47, 1.05)	.082		
≥ college/vocational training	0.94 (0.67, 1.31)	.7		
History of traumatic brain injury	1.17 (0.87, 1.56)	.302		
Physical assault in past 12 mo	1.16 (0.85, 1.60)	.352		
Sexual assault in past 12 mo	2.01 (1.16, 3.48)	.014		
Current smoker	1.39 (1.00, 1.95)	.053		
Alcohol problem in past 30 d ^a	1.17 (0.85, 1.60)	.333		
Drug problem in past 30 d ^a	1.17 (0.87, 1.57)	.306		
Mental health problem in past 30 d ^a	1.14 (0.85, 1.53)	.388		
Propensity to underseek care score				
0 (Ref)	1.00			
1	0.97 (0.67, 1.42)	.893		
≥ 2	0.85 (0.59, 1.22)	.374		
Enabling factors				
Monthly income, Can \$				
< 500 (Ref)	1.00			
500–999	1.50 (1.07, 2.11)	.019		
≥ 1000	1.24 (0.86, 1.81)	.254		
Has a primary care provider	1.99 (1.36, 2.90)	< .001	1.77 (1.18, 2.67)	.006
Unmet need for health care	0.98 (0.66, 1.45)	.92		
Unmet need for mental health care	1.27 (0.81, 2.00)	.293		
Competing priorities	0.89 (0.45, 1.73)	.719		
MHLC internal control subscale score	0.98 (0.96, 1.01)	.214		
MHLC external control from chance subscale score	1.01 (0.98, 1.03)	.583		
MHLC external control from powerful others subscale score	1.04 (1.02, 1.06)	< .001	1.03 (1.01, 1.06)	.006

Continued

univariate analyses were older age, Black race/ethnicity (compared with White), birth in Canada, higher monthly incomes, and sexual assault in the past 12 months. Enabling factors significantly associated with medical or surgical hospitalization were having a primary care provider and higher MHLC for external control from powerful others subscale scores. In terms of need factors, participants with lower PCS-12 scores and those with a greater number of chronic health conditions were more likely to have a medical or surgical hospitalization.

In adjusted analyses, family adult status remained significantly and independently associated with medical or surgical hospitalization. Other significant factors included birth in Canada, having a primary care provider, lower MHLC for external control for powerful others subscale scores, lower PCS-12 scores, and a greater number of chronic health conditions.

Psychiatric Hospitalizations

Family adults were also relatively less likely to have a psychiatric hospitalization during the study, whereas single adult women were more likely to have a psychiatric hospitalization compared with single adult men (Table 4). Predisposing factors significantly associated with psychiatric hospitalization in univariate analyses were having a cumulative lifetime duration of homelessness of 2 or more years, being a current smoker, having a mental health problem in the past 30 days, and higher scores for the propensity to underseek care. Enabling factors significantly associated with psychiatric hospitalization were self-reported unmet needs for mental health care, lower MHLC internal control subscale scores, and an absence of social support. In terms of need factors, both lower PCS-12 and lower MCS-12 scores were associated with psychiatric hospitalization.

In adjusted analyses, family adult status remained significantly and independently associated with psychiatric hospitalization during the study. The association between single adult women and psychiatric hospitalization was marginally significant in adjusted analyses. Current smokers, those who had mental health problems, and those who had lower MHLC internal control subscale scores had

TABLE 3—Continued

Social support—loan	0.83 (0.59, 1.18)	.305		
Social support—ride to appointment	0.74 (0.53, 1.03)	.07		
Social support—suicide	0.87 (0.61, 1.25)	.453		
Need factors				
PCS-12 score	0.96 (0.94, 0.97)	< .001	0.98 (0.96, 0.99)	.003
MCS-12 score	1.00 (0.98, 1.01)	.373		
No. of chronic health conditions ^b				
None (Ref)	1.00		1.00	
1	1.68 (1.12, 2.51)	.011	1.46 (0.95, 2.22)	.081
2	2.81 (1.84, 4.28)	< .001	2.09 (1.31, 3.33)	.002
≥ 3	4.39 (2.88, 6.71)	< .001	2.59 (1.55, 4.31)	< .001

Note. AOR = adjusted odds ratio; MCS = Mental Component Summary; MHLC = Multidimensional Health Locus of Control; PCS = Physical Component Summary.

^aAlcohol, drug, and mental health problems in the past 30 days were assessed using the Addiction Severity Index.^{19,20}

^bChronic health conditions include diabetes, anemia, hypertension, heart disease and stroke, liver problems (including chronic viral hepatitis), arthritis or joint problems, cancer, physical handicaps, or HIV/AIDS.

significantly higher odds of psychiatric hospitalization in adjusted analyses.

DISCUSSION

In this study, we examined predisposing, enabling, and need factors associated with medical or surgical and psychiatric discharges from inpatient care among a population-based cohort of homeless adults under a system of universal health insurance. We found that 20% participants had a medical or surgical discharge and 12% had a psychiatric discharge over the course of the study, corresponding to an average annual rate of 0.17 discharges per person-year for medical or surgical hospitalizations and 0.09 discharges per person-year for psychiatric hospitalizations. These findings were consistent with self-reported rates of overnight hospitalization in the past year, which ranged from 10% to 30% among homeless populations,^{1,3–5} and were considerably higher than annual age-standardized acute inpatient hospitalization rates of 7% for the general population of Ontario.³⁰

Our findings showed that homeless adults in families, predominantly homeless women accompanied by their dependent children, were less likely to be hospitalized compared with single adult men. The association was stronger for psychiatric discharges. Homeless families in our study, compared with single men and women, possessed fewer predisposing,

enabling, and need factors that influenced the likelihood of health services use. Homeless families in our sample were younger, were homeless for shorter durations of time, were more likely to be minorities or immigrants, had more education and higher monthly incomes, had fewer chronic health conditions, and were less likely to have recent mental health or substance use problems.³¹ Together with previous work, these findings suggested that homeless families were a distinct population who were healthier overall and might have had less need for health services, perhaps reflecting a lower burden of physical and psychiatric illness.³² Alternatively, homeless families might have been recruited into our study when they were experiencing temporary or episodic homelessness and might not have been exposed to the same degree of physical, mental or emotional, and social stressors as their single adult counterparts who experienced long-term homelessness.^{9,33} However, the inverse association between family status and hospitalization remained significant even after adjusting for predisposing, enabling, and need factors, suggesting the presence of other, possibly unmeasured, factors that might confound this relationship. Immigrants in our study were also less prone to medical or surgical hospitalization during the study. As with homeless families, recent immigrants might be a distinct subgroup of the homeless population who tended to be healthier with

less need for health services.¹⁴ A similar protective effect of immigrant status was observed for emergency department visits.³⁴

Homeless participants who had a primary care provider tended to have a higher likelihood of medical or surgical hospitalization. This finding was contrary to studies of non-homeless populations that showed that continuity of care might prevent hospitalization.^{35,36} The contradictory finding might be a result because having a primary care provider improved access to inpatient acute care for homeless adults, independent of the effects of health status. Alternatively, having a primary care provider might serve as a marker for more serious, complex health conditions that require frequent management in primary care settings. Participants who had stronger beliefs that their health was under external control by powerful others—for example, physicians—were also more likely to have a medical or surgical hospitalization.²³ This finding again highlighted the important association between having a primary care provider and the likelihood of hospitalization.

Not surprisingly, need factors were strong predictors of medical or surgical hospitalization. These factors were also associated with the likelihood of psychiatric hospitalization in univariate analyses, although they did not remain significant in the final multivariate model. For psychiatric hospitalization, having a mental health problem in the past month was the strongest predictor of hospitalization in adjusted analyses. These findings were consistent with previous research that suggested that substance abuse and mental illness together account for the majority of hospitalizations among homeless persons.^{37,38} Hospitalizations because of substance abuse and mental illness, as well as preventable conditions such as injuries, poisonings, and other circumstances of external causes, were the primary reasons for medical or surgical and psychiatric hospitalizations in this study.

Current smoking status was also associated with an increased likelihood of psychiatric hospitalization, a somewhat surprising finding, but one that might indicate that substance use was a coping mechanism for mental health problems. The extremely high smoking rates among study participants (>70%) was notable, given that only 17% of Canadians report being

TABLE 4—Odds Ratios (ORs) and 95% Confidence Intervals (CIs) for Predictors of Psychiatric Hospitalization: Toronto, Ontario, 2005–2009

Characteristic	Univariate Model		Multivariate Model	
	OR (95% CI)	P	AOR (95% CI)	P
Need factors				
Demographic group				
Single adult men (Ref)	1.00		1.00	
Single adult women	1.57 (1.07, 2.32)	.023	1.49 (0.99, 2.26)	.059
Family adult	0.33 (0.18, 0.62)	< .001	0.36 (0.18, 0.69)	.002
Age, y	1.00 (0.98, 1.01)	.601		
Lifetime duration of homelessness, y				
< 2 (Ref)	1.00			
≥ 2	1.51 (1.05, 2.18)	.026		
Race/ethnicity				
White (Ref)	1.00			
Black	0.99 (0.63, 1.54)	.948		
Aboriginal	1.08 (0.56, 2.07)	.819		
Other visible minorities	0.85 (0.48, 1.49)	.562		
Place of birth				
Outside Canada (Ref)	1.00			
Canada	1.25 (0.83, 1.86)	.283		
Highest level of education				
≤ some high school (Ref)	1.00			
High school diploma or equivalent	0.80 (0.50, 1.30)	.369		
≥ college/vocational training	0.91 (0.60, 1.39)	.671		
History of traumatic brain injury	0.99 (0.69, 1.42)	.957		
Physical assault in past 12 mo	0.87 (0.58, 1.31)	.5		
Sexual assault in past 12 mo	1.89 (0.98, 3.65)	.057		
Current smoker	2.01 (1.27, 3.19)	.003	1.78 (1.08, 2.95)	.025
Alcohol problem in past 30 d ^a	0.88 (0.59, 1.32)	.545		
Drug problem in past 30 d ^a	1.16 (0.81, 1.68)	.417		
Mental health problem in past 30 d ^a	3.10 (2.14, 4.49)	< .001	2.74 (1.86, 4.03)	< .001
Propensity to underseek care score				
0 (Ref)	1.00			
1	1.55 (0.98, 2.43)	.06		
≥ 2	1.57 (1.02, 2.41)	.039		
Enabling factors				
Monthly income, Can \$				
< 500 (Ref)	1.00			
500–999	1.43 (0.95, 2.14)	.088		
≥ 1000	0.82 (0.50, 1.35)	.433		
Has a primary care provider	1.42 (0.91, 2.21)	.125		
Unmet need for health care	1.05 (0.65, 1.70)	.832		
Unmet need for mental health care	2.67 (1.67, 4.26)	< .001		
Competing priorities	1.52 (0.75, 3.06)	.245		
MHLC internal control subscale score	0.95 (0.92, 0.98)	.002	0.95 (0.92, 0.98)	.003
MHLC external control from chance subscale score	1.00 (0.98, 1.03)	.753		
MHLC external control from powerful others subscale score	1.02 (1.00, 1.05)	.107		

Continued

current smokers.³⁹ Finally, participants who believed that their health status was the result of their own behavior, as opposed to chance or external control from others, had a decreased likelihood of psychiatric hospitalization.²³

Limitations

Certain limitations to this study should be acknowledged. Health care utilization was assessed using administrative data in Ontario; as such, hospitalizations that occurred out-of-province might have been missed. Predictors of hospitalization were assessed at 1 point in time using a cross-sectional survey and could not be assumed to be constant for the entire duration of follow-up. The sampling strategy excluded individuals who did not use shelters or meal programs; however, previous research suggested that this unsheltered homeless population in Toronto was very small.⁴⁰ Homeless participants were required to have a valid provincial health number, which might have biased the sample toward individuals who had better health care access. Furthermore, 18% of homeless individuals who were screened declined to participate, which might have decreased the representativeness of the sample.

Conclusions

The frequent use of inpatient services among homeless persons could have considerable consequences for the health care system, such as longer inpatient stays and higher attributable costs.^{37,41} In this study, poor health status and the presence of mental health problems were strong predictors of medical or surgical and psychiatric hospitalizations, respectively. The findings also suggested that many of these hospitalizations were potentially avoidable, particularly for medical or surgical hospitalizations in which the largest number of diagnoses could be attributed to injuries, poisonings, and other external causes. By contrast, the large number of psychiatric hospitalizations for schizophrenia and other psychotic disorders might represent a necessary and unavoidable use of mental health services. Improved access to primary and preventative health services for homeless individuals as well as improvements to their social circumstances and living

TABLE 4—Continued

Social support—loan	0.65 (0.43, 0.98)	.039
Social support—ride to appointment	0.54 (0.36, 0.81)	.003
Social support—suicide	0.42 (0.28, 0.64)	< .001
Need factors		
PCS-12 score	0.98 (0.97, 1.00)	.012
MCS-12 score	0.98 (0.97, 1.00)	.018
No. of chronic health conditions ^b		
None (Ref)	1.00	
1	1.01 (0.63, 1.60)	.975
2	1.21 (0.73, 2.03)	.459
≥ 3	1.57 (0.94, 2.63)	.083

Note. AOR = adjusted odds ratio; MCS = Mental Component Summary; MHLC = Multidimensional Health Locus of Control; PCS = Physical Component Summary.

^aAlcohol, drug, and mental health problems in the past 30 days were assessed using the Addiction Severity Index.^{19,20}

^bChronic health conditions include diabetes, anemia, hypertension, heart disease and stroke, liver problems (including chronic viral hepatitis), arthritis or joint problems, cancer, physical handicaps, or HIV/AIDS.

situations, including access to affordable and stable housing,^{37,41} merit further consideration. Doing so has the potential to reduce the use of costly inpatient health care. ■

About the Authors

Catharine Chambers, Shirley Chiu, and Stephen W. Hwang are with the Centre for Research on Inner City Health, part of the Keenan Research Centre in the Li Ka Shing Knowledge Institute at St Michael's Hospital, Toronto, Ontario. Marko Katic and Alex Kiss are with the Department of Research Design and Biostatistics, Sunnybrook Health Sciences Centre, Toronto. Donald A. Redelmeier is with the Institute for Clinical Evaluative Sciences, Sunnybrook Health Sciences Centre, Toronto. Wendy Levinson is with the Department of Medicine, University of Toronto, Toronto.

Correspondence should be sent to Stephen W. Hwang, MD, MPH, Centre for Research on Inner City Health, St. Michael's Hospital, 30 Bond Street, Toronto, ON, Canada M5B 1W8 (e-mail: hhwangs@smh.ca). Reprints can be ordered at <http://www.ajph.org> by clicking the "Reprints" link.

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Contributors

C. Chambers, D. A. Redelmeier, W. Levinson, A. Kiss, and S. W. Hwang contributed to the study concept and design. S. W. Hwang originated and supervised the overall study. S. Chiu oversaw all aspects of the data collection. C. Chambers, M. Katic, and S. W. Hwang analyzed and interpreted the data. C. Chambers and S. W. Hwang drafted and edited the article. S. Chiu, D. A. Redelmeier, and W. Levinson critically revised the article for important intellectual content. All authors approved the final version of the article to be published.

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Human Participant Protection

This study was approved by the Research Ethics Board at St. Michael's Hospital, Toronto. All participants provided written informed consent.

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