Health Care Delivery

Diagnostic Patterns in Hospital Use by an Urban Homeless Population

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Because patterns of disease and health care system usage by the homeless constitute a neglected area of research in the medical literature, we undertook a retrospective analysis of inpatient records on medically indigent adults, controlling for housing status, to add to the growing body of research in the area of homeless health care. Data on all 4,243 indigent patients admitted over 2 fiscal years (1985 and 1986) under the county medical services program of San Diego County, California, revealed 5.3% (226) to be homeless. The commonest major diagnostic category among the homeless discharges was "diseases and disorders of the skin, subcutaneous tissue, and breast," constituting 21.2% as compared with only 8.7% of the discharge diagnoses for housed indigent persons. Within this major diagnostic category, the predominant diagnosis-related group was cellulitis, accounting for 12.8% of diagnoses in the homeless and only 4.0% of discharge diagnoses in other medically indigent persons. A homeless housing status was also correlated with a higher percentage of discharges with the major diagnostic category of "substance use and substance-induced organic mental disorders" but was negatively correlated with that of "diseases and disorders of the circulatory system."

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In recent years interest in the physical health problems of the homeless medically indigent adult population has increased.[1-3] Although this population group is a difficult one to define demographically, it is generally agreed that it numbers at least a quarter of a million people nationwide and suffers disproportionately from a variety of undiagnosed and untreated health problems.[1,2,4,5] The high proportion of mental illness among homeless adults has been well documented.[6,7] Detailed information on the physical health problems of this population encountered on an outpatient basis has only recently begun to be gathered,[8,9] but an analysis of inpatient data is sorely lacking in the medical literature.

Aside from the ethical responsibility to provide health care for those who are ill but cannot afford payment, research into the physical health of the homeless population is important for several reasons. Not only mental health but also physical health problems, especially those that are chronic, may be the economic or social burden (or both) that initially leads to homelessness or prevents a return to a domiciled situation.

Second, the homeless are not a totally isolated group. Indeed, even when sick they are less able to withdraw from contact with others. Consequently, infectious disease problems of the homeless are public health concerns as well. Most dramatic are tuberculosis prevalence rates among the homeless that are 30 times higher than the nationwide prevalence rate, with asymptomatic infections reported as high as 22% to 50%.[10-13]

Third, in these days of efforts toward budgetary restraint, a better understanding of disease patterns and health care needs would lead to more appropriate preventive and cost-efficient curative programs for the homeless.

Fourth, as pointed out by Wright and co-workers, the material deprivation and environmental exposure inherent to the homeless condition provide a dramatic opportunity to study the effects of life-style and environment on health status.[1] A lower socioeconomic status has been shown to substantially increase the length of hospital stay and total charges,[14] but studies addressing differences in health system utilization within low socioeconomic groups are scarce.

In an attempt to clarify disease patterns and the health care needs of homeless adults, we present a retrospective analysis of 4,243 hospital admissions of medically indigent adults in the central region of the city of San Diego, California. Included in this group are 226 records (5.3%) representing those patients who gave no address on admission and thus were labeled as homeless. Psychiatric disorders requiring inpatient treatment are largely funded under the San Diego County Mental Health Program and for this reason are not represented in this analysis.

Patients and Methods

The findings reported here are from a retrospective analysis of all records of patients admitted to hospital under the San Diego County Medical Services program's central region during the fiscal years 1985 and 1986 (n=4,243). These

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TABLE 1.—*The 6 Most Common Major Diagnostic Categories in Both the Homeless and Housed Indigent Population Subgroups, San Diego, California (n=4,243)*

Major Diagnostic Category	Homeless, n=226* No.	%	Major Diagnostic Category	Housed, n=4,017* No.	%
Diseases and disorders of skin, subcutaneous tissue, and breast	48	21.2	Diseases and disorders of the digestive system	510	12.7
Diseases and disorders of digestive system	27	11.9	Diseases and disorders of the circulatory system	443	11.0
Diseases and disorders of nervous system	22	9.7	Diseases and disorders of the musculoskeletal system and connective tissue	437	10.9
Diseases and disorders of respiratory system	20	8.8	Diseases and disorders of the respiratory system	358	8.9
Injuries, poisonings, and toxic drug effects	16	7.1	Diseases and disorders of skin, subcutaneous tissue, and breast	350	8.7
Substance use and substance-induced organic mental disorders	12	5.3	Diseases and disorders of the nervous system	329	8.2

*Not all patients are included in these listings.

data were supplied by Medicus Systems, the county medical services program administrative contractor, from their standard computer documentation on each admission. The designation "homeless" is defined in various ways in different studies. The Centers for Disease Control, for example, refer to the homeless as "those who do not have customary and regular access to a conventional dwelling or residence."[4] For the purposes of this study, a homeless status was assigned to all patients who did not give an address on hospital admission. During the two-year period analyzed, 226 (5.3%) met this criterion for homelessness. Also included in the data on each admission were identification number, sex, birth date, total days in the hospital, diagnosis-related group (DRG), and total charges during the hospital stay.

Because these data represent the clinical inpatient population of the homeless—that is, those with disease of sufficient severity to motivate their going to an emergency department and being admitted—it cannot be definitively concluded that they reflect the health care concerns of the homeless population as a whole. Indeed, only single adults between the ages of 21 and 64 are eligible for county medical services funding. These requirements exclude children, a subgroup of the homeless population that seems to be increasing.[15] Those homeless persons with Medicare or Medi-Cal (California's Medicaid) coverage would also not be included in this indigent population.

There are many bureaucratic barriers to obtaining eligibility for county funding. Applications, appointments, and interviews are all made more difficult, if not impossible, by a lack of shelter, an address, soap, running water, or a washing machine. It may also be assumed that because of a reluctance to being labeled as a transient, false or borrowed addresses often are given on admission, resulting in an underestimation of the percentage of homeless in the overall group.

As a whole, the selection bias would seem to select against recording homeless admissions, but those who are admitted might be expected to have a more advanced stage of disease. Despite difficulties involved in extrapolating patterns of inpatient diagnosis to the overall homeless population, these data reveal usage trends valuable in planning future health care programs for this group, and when compared with the domiciled indigent population, they can reveal major effects that lack of housing can have on health status.

Relative risk calculations and χ^2 analysis with Yates's correction factor were used to determine significant differences between frequencies of different major diagnostic categories and diagnosis-related groups in the homeless and housed subgroups. Two-way analysis of variance was used to test for the effect of housing status on cost and length of stay in several major diagnostic categories, and Student's *t* testing was applied for between-group differences in mean total cost and length of stay.

Results

The housed subgroup had an average age of 38.6 years (±12.5 [standard error of the mean]) compared with an average age of 38.0 (±10.2) in the homeless group. Men predominated in the county medical services group as a whole (66%), but the sex ratio was greater in the homeless subgroup, with 87% men and 13% women. No ethnic background data were available in the records analyzed.

As indicated in Figure 1, "diseases and disorders of the skin, subcutaneous tissue, and breast" (DRGs 257 to 284) made up almost a quarter (21.2%) of all hospital discharge diagnoses within the homeless group during the two years studied but accounted for only 8.7% of the housed-indigent discharge diagnoses. The most prevalent major diagnostic category among the housed group was "diseases and disorders of the digestive system" (DRGs 146 to 190), accounting for 12.7% of their total discharges (Table 1). Discharge diagnoses of circulatory (DRGs 103 to 145) and musculoskeletal

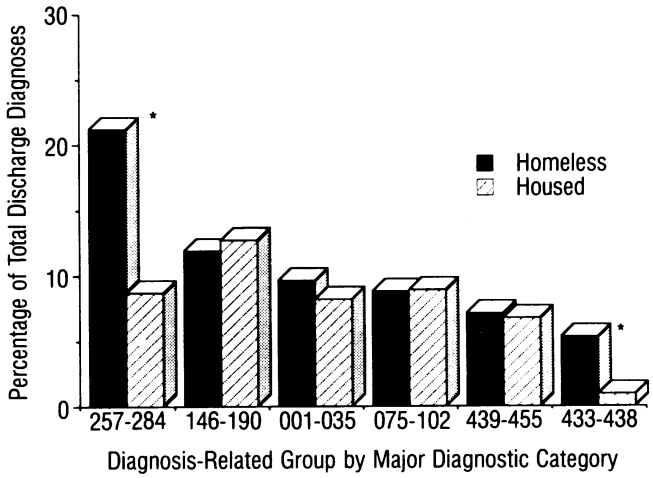

Figure 1.—The graph compares the frequency of the 6 most common discharge major diagnostic categories for 226 homeless indigent adults with the frequency of the same major diagnostic categories in housed indigent adults in San Diego. Diagnosis-related groups 257-284: diseases and disorders of the skin, subcutaneous tissue, and breast; 146-190: digestive system; 001-035: nervous system; 075-102: respiratory system; 439-455: injuries, poisonings, and toxic drug effects; 433-438: substance use and substance-induced organic mental disorders. *$P < .0001$

or connective tissue (DRGs 209 to 256) disorders were second and third most common, respectively, within the housed group but were absent from the top six major diagnostic categories of the homeless. Drug use-related diagnoses were among the six most prevalent categories for the homeless but not for the housed.

Although the average total cost and length of hospital stay were higher in the homeless subgroup (Table 2), these differences were found not to be significant by one-tailed Student's *t* testing. An analysis of each major diagnostic category that was found in at least ten homeless discharge diagnoses revealed large standard deviations, suggesting the presence of outliers that, on a closer analysis of individual DRGs, proved to be present. Two-way analysis of variance showed no influence of housing status on the cost and length of stay ($\alpha=0.05$).

Homeless persons were at an increased risk for both "substance use and substance-induced organic mental disorders" (DRGs 433 to 438, relative risk 5.20, 95% confidence interval 2.94 to 9.22) and "diseases and disorders of the skin, subcutaneous tissue, and breast" (DRGs 257 to 284, relative risk 2.44, 95% confidence interval 1.85 to 3.22) but were at less risk of being discharged with a diagnosis of circulatory disorders (DRGs 103 to 145, relative risk 0.28, 95% confidence interval 0.15 to 0.54).

The combined findings of a high discharge percentage (21.2%) and a relative risk of 2.44 for the diagnostic category of "diseases and disorders of the skin, subcutaneous tissue, and breast" among the homeless subgroup were felt to warrant a closer analysis. Breaking down this major category into diagnosis-related groups revealed that two of them, "cellulitis, age > 70 years and/or comorbidity or complication" (DRG 277) and "cellulitis, age 18 to 69 years without comorbidity or complication" (DRG 278), made up 60% of all the homeless discharges in this major diagnostic category and 12.8% of all homeless discharge diagnoses. In contrast, these two DRGs made up just 4.6% of the discharge diagnoses for the housed subgroup in this diagnostic category and 4% of the total housed discharges (relative risk 3.55, 95% confidence interval 2.24 to 4.64). The other diagnoses in the homeless group in this major diagnostic category were for skin grafts, skin ulcers, and trauma to the skin, subcutaneous tissue, and breast.

TABLE 2.—*Mean Total Costs and Total Hospital Days for Homeless and Housed Indigent Subgroups, San Diego, California*

Indigent Subgroup	Mean Total Cost ×$1,000 (SD), $	Mean Total Days (SD), d	Cases, No.
Homeless	7,290.3 (21,542)	7.1 (11.8)	226
Housed	6,778.2 (11,469)	6.2 (7.6)	4,017
Totals	6,805.5 (12,213)	6.2 (7.9)	4,243

SD=standard deviation

An analysis of total charges and length of hospital stay for cellulitis-associated DRGs showed that homeless admissions were on the average less expensive and shorter than for the same two DRGs in the housed subgroup (Table 3). These differences, however, were not statistically significant.

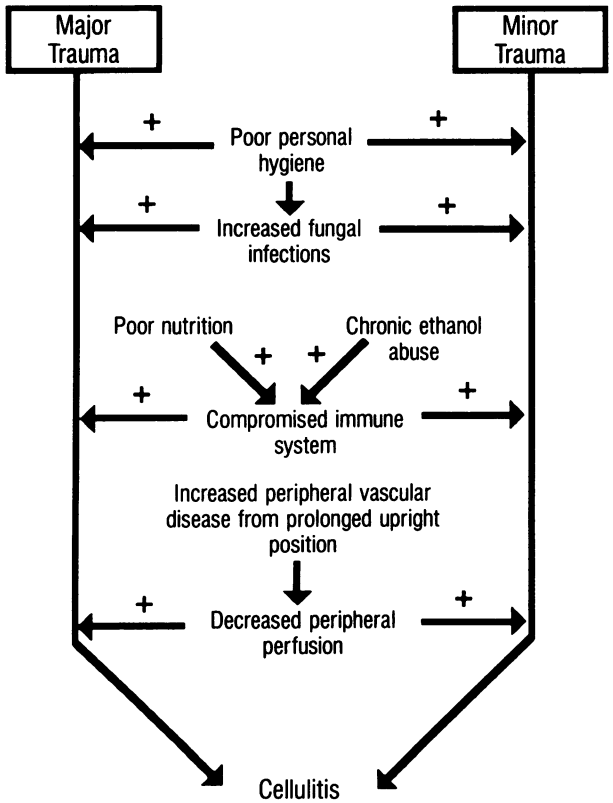

Figure 2.—The schema shows the factors proposed to be influencing the development of cellulitis among the homeless population. The causes of major trauma include accidents and postoperative wounds. The causes of minor trauma include abrasions from sleeping on the ground, insect bites, sunburn and windburn, infected intravenous needle puncture sites from drug use, and poorly fitting shoes.

Discussion

The past stereotype of the homeless as being a predominantly male, white, elderly, and undereducated population suffering from alcoholism or psychiatric disease has been challenged by contemporary demographic data. These data suggest a more heterogeneous population with an average age of 30 to 40 years, made up of at least 50% minority group members, anywhere from 10% to 30% women, and with a considerable proportion having had at least a high school education.[6,16] Ethnic and educational background information was unavailable in these data, but age and sex distribution correlates well with that of earlier studies.

The absence of data on inpatient diagnostic patterns among homeless populations prevents a close comparison of the outcome of this study with other data on homeless hospitalization patterns, but contrast with ambulatory disease prevalence data is possible. Wright and colleagues have analyzed 6,415 outpatient health records of New York City homeless persons[1] and found alcohol and drug problems (32.6%), trauma (30.7%), and upper respiratory tract disease (27.8%) as the most prevalent diagnoses. Cellulitis was classified under "limb disorders" in this analysis, which was diagnosed in 18.8% of this ambulatory homeless population. Comparing these results with geographically matched data from the 1979 National Ambulatory Care Survey revealed that the homeless had a greatly increased prevalence of both "substance abuse" and "limb disease." Although hospital admission records indicate a more advanced and serious degree of disease than those disorders that are handled solely on an outpatient basis, it is reasonable to expect that the most common diagnoses in the outpatient population would lead to an increased prevalence of admissions for the same general categories of disease.

TABLE 3.—*Mean Total Costs and Mean Total Days in Hospital per Discharge for Cellulitis Diagnosis-Related Groups (DRGs) in Homeless and Housed Indigent Population Subgroups, San Diego, California*

Indigent Subgroup	DRG 277*		DRG 278*	
	Mean Total Cost ×$1,000 (SD), $	Mean Total Days (SD), d	Mean Total Cost ×$1,000 (SD), $	Mean Total Days (SD), d
Homeless	4.3 (1.4) n=8	5.9 (2.2)	3.5 (1.9) n=21	4.4 (2.0)
Housed	6.1 (6.5) n=40	7.0 (6.4)	4.3 (2.8) n=12	6.1 (4.3)

SD=standard deviation

*DRG 277 refers to cellulitis in a person aged 70 or older and/or with comorbidity or complication; DRG 278 refers to cellulitis in a person aged 18 to 69 years without comorbidity or complication.

The high relative risk for substance abuse-related problems in the San Diego homeless population is not surprising. A high proportion of substance abuse-related health problems in the homeless is related to alcohol consumption.[17] It is estimated that 40% of homeless persons have a serious drinking problem.[9] What is not clear from studies is to what degree alcohol abuse precipitates homelessness or is a mechanism of coping with the stress of the homeless state.[18] It is interesting that only two persons in the homeless subgroup were specifically given the discharge diagnosis of either "alcohol dependence" (DRG 436) or "alcohol use except dependence" (DRG 437). Because alcohol has a broad range of deleterious effects on the body, it is likely that alcoholism is a secondary diagnosis for a significant percentage of the other admissions.

While the homeless inpatients were at a greater risk of being discharged with substance abuse-related diagnoses than were the housed subgroup, the major diagnostic category of "diseases and disorders of the skin, subcutaneous tissue, and breast" made up a much larger percentage of all homeless discharge diagnoses. In contrast to the chronic, difficult-to-treat disease of alcoholism, cellulitis is readily cured with appropriate antibiotic therapy. More important, cellulitis is often preventable by regular personal hygiene and early intervention. A number of factors inherent to the homeless life-style and environment could contribute to the increased prevalence of skin disease among the homeless subgroup. The immune system of homeless persons likely is weakened by poor nutrition, poor circulatory access to infected areas due to decreased perfusion, and concurrent fungal infections, all of which may contribute to the development of skin infections following serious or minor trauma (Figure 2).

Although analyzing the average total cost and length of stay revealed no significant differences between the homeless and housed subgroups, and two-way analysis of variance of the major diagnostic categories showed that housing status did not have an effect on mean cost and length of stay, calculations reveal that cellulitis alone among the homeless population cost the San Diego County Medical Services system about $100,000 over the two years studied and accounted for a total of 250 hospital bed-days during the same period.

A decreased relative risk in the homeless population of being discharged with the diagnosis of circulatory disorders has not been found in the analysis of ambulatory medical records. Of the diagnoses given in the outpatient New York data, 9.6% were for "heart disease," making it the 12th most common diagnosis, and while comparison with the data from the National Ambulatory Care Survey did not result in as high a ratio as with substance abuse or limb disorders, heart disease was still 1.6 times as common in the homeless group. This discrepancy between inpatient and outpatient data can be explained in part by the fact that the increased percentage of cellulitis-related discharges decreases the percent contribution of other discharge diagnoses. The incidence of hypertension may be another factor. There is an increased prevalence of high blood pressure among the homeless,[19] yet this disease is largely treated on an outpatient basis, effectively removing it as a primary diagnosis in the inpatient population. It is also notable that cardiovascular disease is often an invisible disease. Compared with the dramatic visual nature of skin disorders, the symptoms of heart disorders are much more easily attributed by the homeless to their lack of sleep and poor eating habits that accompany life on the street.

Summary

These data reveal that there are substantial differences in the discharge diagnoses between homeless and housed population subgroups in the city of San Diego. The average cost and length of stay for each subgroup and in each major diagnostic category, however, were not significantly different. Although homelessness conferred the highest relative risk of being discharged with a diagnosis of substance abuse problems, diseases and disorders of the skin made up the largest percentage of homeless discharges overall. It was found that most of the diagnoses within the major diagnostic category of "diseases and disorders of the skin, subcutaneous tissue, and breast" (DRGs 257 to 284) were associated with cellulitis. Unlike findings from ambulatory data sets, it was found that the homeless were at less risk of being discharged with the major diagnostic category of "diseases and disorders of the circulatory system" (DRGs 103 to 145). This decreased risk was attributed to the effect of the increased percentage of persons diagnosed with cellulitis as well as the outpatient treatment of hypertension and the indistinct symptoms of circulatory disorders.

Improved access to the basic elements necessary for personal hygiene, such as soap and water, would be an important first step in decreasing the high percentage of admissions for cellulitis among the homeless. Further measures, such as downtown first-aid stations where nurses and other health workers could provide wound care and a recognition of cellulitis in its early stages, may be indicated as well. Indeed, select members of the homeless population may be capable of self-monitoring skin infections and, if provided with adequate training and simple first-aid kits, act as volunteer community health care workers and educators themselves.

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Corneal Foreign Bodies

A RATHER SIMPLE but very, very painful situation is that of a foreign body in the cornea. A piece of metal, usually, but anything—a speck of dirt—can hit the cornea . . . and those of you who have had something like this know just how uncomfortable this can be. You might even have to use a drop of topical anesthetic just to examine these patients, particularly if they are young. These foreign bodies usually are easily removed; although if they have been there for more than 12 or 14 hours and if it is a metallic foreign body, it may develop a rust ring. What you should do is remove the foreign body and leave the rust ring for 24 hours. Over 24 hours that rust ring will soften and be easily removed with a blunt spud or a needle. If you try to remove a rust ring when you first see the patient, it might be very difficult.

—ROBERT L. STAMPER, MD

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