The national burden of inpatient dermatology in adults

Justin D. Arnold, MMSc,[a] SunJung Yoon, MS,[b] and A. Yasmine Kirkorian, MD[a,c]
Washington, DC

Background: Management of inpatient skin disease represents a unique subspecialty within dermatology.

Objective: To assess the national burden of inpatient dermatology in adults.

Methods: Using the 2014 National Inpatient Sample, we performed a retrospective cohort study of adults hospitalized for dermatologic conditions.

Results: In 2014, there were 644,320 weighted hospitalizations principally for skin disease in adults, which cost the health care system $5.04 billion. Overall, skin disease was diagnosed in 1 in 8 hospitalized adults. Dermatologic hospitalizations were associated with a lack of medical insurance (odds ratio [OR], 2.27; 95% confidence interval [CI], 2.20-2.34), residence in a low-income community (OR, 1.10; 95% CI, 1.07-1.13), and small (OR, 1.27; 95% CI, 1.23-1.32) or rural hospitals (OR, 1.38; 95% CI, 1.32-1.44). Racial minorities were less likely to be hospitalized for skin disease than were whites (for blacks: OR, 0.77; 95% CI, 0.75-0.79; for Hispanics: OR, 0.85; 95% CI, 0.83-0.8; for Asians: OR, 0.59; 95% CI, 0.55-0.64). Only 0.47% of patients admitted for skin disease experienced in-hospital mortality; however, mortality rates were high in hospitalizations for cutaneous lymphomas (9.19%) and malignant melanoma (6.54%).

Limitations: We could not assess the impact of inpatient dermatology consultations on hospitalization outcomes.

Conclusions: Skin disease is highly prevalent among hospitalized patients. (J Am Acad Dermatol 2019;80:425-32.)

Key words: health care expenditures; Healthcare Cost and Utilization Project; Inpatient dermatology; National Inpatient Sample.

D irect medical care for skin conditions accounts for $46 billion in health care spending in the United States; however, the national costs associated with adult inpatient dermatology remain poorly characterized.[1] Understanding the burden of inpatient dermatology will allow policymakers, researchers, and clinicians to appropriately direct resources to improve outcomes and reduce preventable hospitalizations. In this study, we sought to assess the patient and hospital demographics, as well as the costs and in-hospital mortality, associated with dermatologic admissions.

METHODS
Data source
This study utilized the 2014 National Inpatient Sample (NIS), a resource sponsored by the Healthcare Cost and Utilization Project (HCUP) of the Agency for Healthcare Research and Quality. The NIS approximates a 20% stratified sample of all hospital discharges in the United States, excluding rehabilitation or long-term acute care stays, and it can be used to generate national hospitalization estimates with use of sample weights provided by HCUP.[2]

Identification of dermatologic hospitalizations

Hospitalizations chiefly for skin disease were identified by the presence of a dermatologic *International Classification of Diseases, Ninth Revision, Clinical Modification,* code in the primary diagnosis field, which represents the principal reason for admission. Patients who were hospitalized principally for nondermatologic conditions but who had comorbid skin disease were identified by the presence of a dermatologic *International Classification of Diseases, Ninth Revision, Clinical Modification,* code in a secondary diagnosis field (up to 15 secondary diagnoses can be associated with each discharge record in addition to the primary diagnosis). The 22 categories of skin disease used to classify hospitalizations were adapted from the American Academy of Dermatology's Burden of Skin Disease Report. We included disorders of the skin, hair, and nails but excluded disorders of the external ear, genitalia, eyelid, and lips.[1] Unclassifiable conditions, such as skin disorder not otherwise specified, were also excluded.

Statistical analysis

All analyses were performed by using survey procedures (Stata software, version 14.2, StataCorp, College Station, TX). A nationally representative sample was generated by using survey weights, sampling clusters, and hospital census division strata provided by HCUP. Costs were then calculated from the total charge for each hospitalization by using the cost-to-charge ratio file supplied by the database. Costs are defined as the amount paid for services by insurers and patients. Descriptive statistics were used to characterize admission frequencies, costs, length of stay, and mortality. Weighted multivariate logistic regression models were constructed with hospitalization for skin disease as the dependent variable and age, sex, race/ethnicity, geographic division, income quartile, payer, hospital teaching status, and bed size as the independent variables. A 2-sided *P* value less than .05 was considered statistically significant. Skin disease estimates with a relative standard error (standard error/weighted estimate greater than 0.30 or with a standard error equal to 0) were excluded from this analysis because of statistical unreliability. This research was deemed exempt from the need for

---

CAPSULE SUMMARY

- Inpatient management of skin disease represents a unique subspecialty within dermatology.

- There are significant disparities in the demographics, costs, and in-hospital mortality for patients admitted for dermatologic conditions.

- These findings emphasize the importance of expanding access to inpatient dermatologists given the high prevalence of skin disease among hospitalized individuals.

---

oversight and informed consent by the Children's National Institutional Review Board. All study researchers with access to the NIS were compliant with the HCUP data use agreement.

RESULTS

In 2014, there were 644,320 hospitalizations principally for skin disease in adults (95% confidence interval [CI], 631,340-657,299), representing 2.01% of all admissions and more than $5.04 billion in health care costs. Overall, skin disease was diagnosed in 12.1% (1 in 8) hospitalized adults either as the principal reason for admission or as a comorbid condition.

Bacterial skin infections were the most common form of skin disease observed in the inpatient setting and accounted for 535,605 hospitalizations (95% CI, 524,628-546,581). The second and third most numerous skin conditions requiring hospitalization were ulcers (44,590 [95% CI, 43,102-46,077]) and connective tissue disorders of the skin (14,550 [95% CI, 13,687-15,412]), respectively. The least common forms of skin disease observed in hospitalized adults were atopic dermatitis (250 [95% CI, 176-323]) and cutaneous congenital abnormalities (230 [95% CI, 159-300]), which includes disorders such as congenital ichthyoses and xeroderma pigmentosum. Hospitalization estimates for acne, rosacea, and seborrheic dermatitis, as well as vitiligo and melasma, were statistically unreliable (relative standard error >0.3) because of the low total number of admissions for these conditions.

Demographics

In multivariate logistic regression models, adults age 45 to 64 years (adjusted odds ratio [OR], 1.15; 95% CI, 1.13-1.18) were at higher risk of hospitalization for skin disease than were individuals age 18 to 44 years. After age 65, the risk of admission principally for skin disease decreased: an OR of 0.69 and 95% CI of 0.67 to 0.71 at age 65 to 84 years versus an OR of 0.73 and 95% CI of 0.71 to 0.76 at age 85 years or older.

Racial and ethnic minorities were less likely than whites to be hospitalized for skin disease. Asians (OR, 0.59; 95% CI, 0.55-0.64) and blacks (OR, 0.77;

Abbreviations used:

CI: Confidence interval
HCUP: Healthcare Cost and Utilization Program
NIS: National Inpatient Sample
OR: Odds ratio

95% CI, 0.75-0.79) were the least likely to be admitted for dermatologic conditions, followed by Hispanics (OR, 0.85; 95% CI, 0.83-0.88). Hospitalizations for skin disease were also associated with no medical insurance (a self-pay OR of 2.27 and 95% CI of 2.20-2.34 and a no-charge OR of 2.26 and 95% CI of 2.08-2.46), and public insurance (a Medicaid OR of 1.33 and 95% CI of 1.30-1.36 and a Medicare OR of 1.4 and 95% CI of 1.38-1.44) compared with private insurance.

The regions of the United States most strongly associated with dermatologic hospitalizations were the Mid-Atlantic region (OR, 1.28; 95% CI, 1.20-1.37), which includes New York, Pennsylvania, and New Jersey, and the New England region (OR, 1.18; 95% CI, 1.08-1.23), which includes Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut.

In regard to hospital characteristics, the likelihood of hospitalization increased as hospital size decreased (a medium bed size OR of 1.15 and 95% CI of 1.12-1.19 vs a small bed size OR of 1.27 and 95% CI of 1.23-1.32). Nonteaching status was also associated with hospitalizations for skin disease, as both rural (OR, 1.38; 95% CI, 1.32-1.44) and urban nonteaching (OR, 1.21; 95% CI, 1.17-1.25) hospitals had an increased likelihood of admission for dermatologic conditions. The demographics of patients admitted principally for skin disease are depicted in Table I.

Costs

The mean hospitalization costs were lower for patients admitted principally for dermatologic conditions ($7949 per admission) than for patients without skin disease ($11,747 per admission). However, patients who were admitted principally for nondermatologic conditions and had comorbid skin disease incurred higher mean admission costs ($15,967 per admission), and longer lengths of stay (7.3 days verses 4.6 days for hospitalizations principally related to skin disease).

When analyzed by disease category, mean hospitalization costs were highest in admissions for cutaneous lymphomas ($35,130 per admission), nonmelanoma skin cancers ($18,739 per admission), and cutaneous congenital abnormalities ($16,840 per

admission). Cost were lowest in hospitalizations for urticarial disorders ($4,459 per admission), contact dermatitis ($4,951 per admission), and pruritic disorders ($5,792 per admission). The costs for dermatologic hospitalizations are depicted in Table II.

Mortality

In total, 3,055 individuals or 0.47% of patients hospitalized primarily for skin disease experienced in-hospital death. More than 51% of these deaths were in patients admitted primarily for bacterial skin infections, even though the mortality rate in this disease category was low (0.29%) overall. Mortality rates were higher in patients admitted for nondermatologic conditions (2.23%), and in those admitted principally for nondermatologic reasons who had, or developed, a skin condition during the hospitalization (3.29%). Although in-hospital death from skin conditions was rare, 9.19% of patients admitted for cutaneous lymphomas, and 6.54% of patients admitted for melanoma, experienced in-hospital mortality.

Age categories

Next, we assessed which categories of skin disease were responsible for the highest number of admissions for each age group (Table III). Among all age categories, bacterial skin infections remained the most common skin condition present in the inpatient setting. Connective tissue disorders, such as lupus and dermatomyositis, and sweat gland disorders, such as hidradenitis suppurativa, were highly prevalent in younger individuals admitted principally for skin diseases. As patients age, they were more commonly hospitalized for viral skin diseases and nonmelanoma skin cancers. Individuals ages 45 to 64 accounted for the most number of admissions and the highest proportion of costs for inpatient dermatology.

DISCUSSION

This study provides national level hospitalization data for adults admitted with skin disease. We demonstrate that hospitalizations principally for dermatologic conditions cost the United States health care system $5.04 billion in 2014, and that skin disease affects more than 1 in 8 hospitalized adults.

The most common reasons for inpatient admission, and therefore, the conditions accounting for the majority of inpatient costs for skin disease, were bacterial skin infections such as cellulitis. Emergency department visits and hospitalizations for skin infections have been increasing in the United States, thereby, increasing the already large

Table I. Demographics of adults hospitalized for skin disease

| | Primary inpatient diagnosis | | | | | | | |
| | Nonskin disease | | Skin disease | | | | | |
Variable	n	% (95% CI)	n	% (95% CI)	Crude OR (95% CI)	P value	Adjusted OR (95% CI)	P value
Age, y								
18-44	8,534,235	29.31 (28.90-29.72)	180,660	28.04 (27.66-28.42)	1.00	—	1.00	—
45-64	8,472,478	29.10 (28.86-29.33)	236,820	36.76 (36.45-37.06)	1.32 (1.28-1.35)	<.001	1.15 (1.13-1.18)	<.001
65-84	9,318,124	32.00 (31.71-32.29)	171,930	26.68 (26.33-27.05)	0.87 (0.84-0.89)	<.001	0.69 (0.67-0.71)	<.001
≥85	2,794,546	9.60 (9.44-9.75)	54,910	8.52 (8.31-8.74)	0.92 (0.89-0.95)	<.001	0.73 (0.71-0.76)	<.001
Sex								
Male	11,903,484	40.89 (40.62-41.15)	332,800	51.66 (51.34-51.99)	1.54 (1.52-1.56)	<.001	1.49 (1.46-1.51)	<.001
Female	17,211,035	59.11 (58.85-59.38)	311,390	48.34 (48.01-48.66)	1.00	—	1.00	—
Race								
White	18,857,868	68.31 (67.36-69.24)	444,140	71.94 (70.96-72.90)	1.00	—	1.00	—
Black	4,091,862	14.82 (14.20-15.46)	79,905	12.94 (12.34-13.57)	0.82 (0.8-0.84)	<.001	0.77 (0.75-0.79)	<.001
Hispanic	2,945,256	10.67 (10.04-11.33)	63,225	10.24 (09.56-10.97)	0.91 (0.88-0.94)	<.001	0.85 (0.83-0.88)	<.001
Asian or Pacific Islander	710,415	2.57 (2.36-2.80)	9155	1.48 (1.30-1.69)	0.54 (0.50-0.59)	<.001	0.59 (0.55-0.64)	<.001
Native American	165,179	0.60 (0.51-0.70)	4890	0.79 (0.67-0.94)	1.25 (1.15-1.37)	<.001	1.10 (1.01-1.21)	.032
Other	836,680	3.03 (2.77-3.31)	16,060	2.60 (2.34-2.90)	0.81 (0.77-0.85)	<.001	0.78 (0.74-0.82)	<.001
Household income quartile								
First	8,445,050	29.67 (28.76-30.59)	202,055	32.21 (31.20-33.23)	1.18 (1.15-1.22)	<.001	1.10 (1.07-1.13)	<.001
Second	7,871,024	27.65 (26.98-28.33)	174,070	27.74 (27.00-28.50)	1.09 (1.06-1.12)	<.001	1.01 (0.98-1.04)	.379
Third	6,524,955	22.92 (22.34-23.51)	137,865	21.97 (21.32-22.64)	1.04 (1.02-1.07)	<.001	1.01 (0.98-1.03)	.673
Fourth	5,623,629	19.76 (18.83-20.71)	113,410	18.08 (17.15-19.05)	1.00	—	1.00	—
Payer								
Medicare	13,491,615	46.42 (45.98-46.87)	288,430	44.86 (44.37-45.35)	1.15 (1.13-1.17)	<.001	1.41 (1.38-1.44)	<.001
Medicaid	5,186,615	17.85 (17.40-18.30)	123,600	19.22 (18.67-19.79)	1.28 (1.25-1.32)	<.001	1.33 (1.30-1.36)	<.001
Private insurance	8,206,653	28.24 (27.75-28.74)	151,845	23.62 (23.16-24.07)	1.00	—	1.00	—
Self-pay	1,222,656	4.21 (4.03-4.39)	53,875	8.38 (8.04-8.73)	2.38 (2.30-2.46)	<.001	2.27 (2.20-2.34)	<.001
No charge	128,155	0.44 (0.38-0.52)	5760	0.90 (0.77-1.05)	2.42 (2.22-2.65)	<.001	2.26 (2.08-2.46)	<.001
Other	826,644	2.84 (2.71-2.98)	19,480	3.03 (2.84-3.24)	1.27 (1.21-1.33)	<.001	1.21 (1.16-1.27)	<.001
Region								
New England	1,376,454	4.73 (4.30-5.19)	32,030	4.97 (4.47-5.52)	1.18 (1.10-1.26)	<.001	1.18 (1.08-1.23)	<.001
Mid-Atlantic	4,184,448	14.37 (13.79-14.97)	98,120	15.23 (14.53-15.96)	1.19 (1.12-1.25)	<.001	1.28 (1.20-1.37)	<.001
East North Central	4,598,065	15.79 (15.16-16.45)	101,680	15.78 (15.09-16.50)	1.12 (1.06-1.18)	<.001	1.14 (1.07-1.21)	<.001
West North Central	2,002,415	6.88 (6.47-7.31)	39,575	06.14 (05.75-06.56)	1.00	—	1.00	—
South Atlantic	6,030,294	20.71 (20.06-21.37)	133,430	20.71 (19.92-21.52)	1.12 (1.06-1.18)	<.001	1.11 (1.04-1.17)	.001
East South Central	2,035,092	6.99 (6.47-7.54)	47,175	7.32 (6.77-7.91)	1.17 (1.09-1.26)	<.001	1.07 (0.99-1.16)	.104
West South Central	3,305,025	11.35 (10.86-11.85)	75,435	11.71 (11.12-12.32)	1.15 (1.10-1.22)	<.001	1.11 (1.04-1.18)	.002
Mountain	1,740,247	5.98 (5.60-6.38)	36,630	5.69 (5.12-6.31)	1.07 (0.97-1.16)	.162	1.11 (1.02-1.22)	.021
Pacific	3,847,344	13.21 (12.67-13.77)	80,245	12.45 (11.82-13.12)	1.06 (1.00-1.12)	.059	1.13 (1.06-1.21)	<.001

Hospital bed size								
Small	5,471,087	18.79 (18.14-19.46)	137,865	21.40 (20.59-22.23)	<.001	1.23 (1.18-1.27)	<.001	1.27 (1.23-3.12)	<.001
Medium	8,520,220	29.26 (28.57-29.95)	195,635	30.36 (29.51-31.23)	<.001	1.12 (1.08-1.15)	<.001	1.15 (1.12-1.19)	<.001
Large	15,128,077	51.95 (51.11-52.80)	310,820	48.24 (47.23-49.25)	—	1.00	—	1.00	—
Hospital reaching status								
Rural	2,837,678	9.74 (9.27-10.24)	79,110	12.28 (11.78-12.79)	<.001	1.37 (1.32-1.43)	<.001	1.38 (1.32-1.44)	<.001
Urban nonteaching	7,853,332	26.97 (26.31-27.63)	190,460	29.56 (28.70-30.44)	<.001	1.19 (1.16-1.23)	<.001	1.21 (1.17-1.25)	<.001
Urban teaching	18,428,374	63.29 (62.51-64.05)	374,750	58.16 (57.20-59.11)	—	1.00	—	1.00	—

CI, Confidence interval; *OR*, odds ratio.

financial burden associated with this category of skin disease.[3] A multitude of factors are likely contributing to the rising number of bacterial skin infections, such as the spread of multidrug resistant pathogens, a rising prevalence of comorbidities such as diabetes, and an aging population. Although multiple public health campaigns are aimed at addressing these factors, dermatologists, primary care physicians, infectious disease specialists, and other outpatient medical staff can also attempt to reduce the inpatient burden of skin infections by addressing risk factors such as ulcers, fungal infections, and excoriations, and by following clinical guidelines for empiric antibiotics to avoid outpatient treatment failures.[4-7]

Some patients with bacterial skin infections, however, will still ultimately require hospitalization. Inpatient dermatology consultations may play a critical role in optimizing care for these patients. Li et al. recently demonstrated that early dermatology consultations identified pseudocellulitis earlier than hospitalist teams and reduced the length of stay in these patients by 2.1 days. This group also estimated that universal adoption of dermatology consultations for suspected cellulitis would produce a net savings of $210 million annually for the American health care system or $582 for each cellulitis admission (assuming a cost of $138.89 per inpatient dermatology consultation).[8] Additionally, Ko et al. demonstrated that dermatology consultations for suspected cellulitis within 24 hours of hospital entry led to shorter courses of antibiotic therapy and improved wound care recommendations in 48% of patients.[9]

Further, dermatology consultations will likely benefit individuals hospitalized for any form of skin disease, as dermatology consultations change the inpatient diagnosis 45% to 76% of the time.[10-12] Accordingly, in patients hospitalized with chronic inflammatory skin conditions, dermatology consultations reduced the length of stay by 2.6 days as well as the likelihood for readmission.[13] Some argue that generalists with specialized training in dermatology may be adequate replacements for board certified dermatologists in the inpatient setting. This is unlikely as a monthly dermatology lecture series given to hospitalists for nearly 5 years failed to improve the diagnostic accuracy of hospitalists for skin related conditions.[14] In sum, these results highlight the importance of expanding access to dermatology consultation services given the high burden of inpatient skin disease.

In regard to demographics, insurance status had the largest impact on the likelihood of hospitalization for skin disease in this study, as self-paying

Table II. Costs of inpatient dermatology in adults

Primary hospitalization diagnosis	Mean admission cost	Total costs	No. of admissions	No. of admissions 95% CI	Mean length of stay, d	In-hospital mortality	Mortality %
Cutaneous lymphoma	$35,130	$62,530,618	1795	1519-2070	12.4	165	9.19%
Nonmelanoma skin cancers	$18,739	$91,260,416	4940	4438-5441	5.9	90	1.82%
Cutaneous congenital abnormalities	$16,840	$3,789,102	230	159-300	7.3	*	*
Connective tissue disorders of the skin	$15,577	$222,129,914	14,550	13,687-15,412	6.8	290	1.99%
Ulcers	$12,984	$571,016,384	44,590	43,102-46,077	7.9	500	1.12%
Malignant melanoma	$11,967	$28,721,317	2445	2197-2692	4.0	160	6.54%
Sweat gland disorders	$11,961	$47,964,140	4100	3716-4483	5.9	*	*
Drug eruptions	$10,658	$89,953,130	8605	8132-9077	4.7	125	1.45%
Bullous diseases	$10,276	$25,586,912	2530	2290-2769	6.2	50	1.98%
Noncancerous skin growths	$9986	$61,365,800	6220	5713-6726	3.2	0	0.00%
Psoriasis	$8759	$15,504,274	1825	1501-2148	4.6	0	0.00%
Viral diseases	$8364	$82,384,788	10,070	9562-10,577	4.6	90	0.89%
Infestations	$7340	$2,899,434	395	305-484	5.2	0	0.00%
Bacterial infections	$7024	$3,709,951,140	535,605	524,628-546,581	4.3	1565	0.29%
Hair and nail disorders	$6263	$2,317,282	385	298-471	3.3	0	0.00%
Atopic dermatitis	$6191	$1,454,794	250	176-323	3.9	0	0.00%
Fungal infections	$6152	$5,936,376	965	827-1102	4.0	0	0.00%
Pruritus	$5792	$3,764,528	680	555-804	3.6	0	0.00%
Contact dermatitis	$4951	$11,906,990	2445	2197-2692	3.1	0	0.00%
Urticaria	$4459	$7,424,374	1700	1518-1881	2.5	*	*
Acne, rosacea, seborrheic dermatitis[†]	NA	NA	NA	NA	NA	NA	NA
Vitiligo, melasma[†]	NA	NA	NA	NA	NA	NA	NA
Skin disease, principal diagnosis	$7949	$5,047,837,360	644,320	631,340-657,299	4.6	3055	0.47%
Comorbid skin disease	$15,967	$44,853,753,555	2,881,841	2,824,365-2,939,317	7.3	94,815	3.29%
No skin disease	$11,747	$335,597,763,583	29,119,384	28,622,702-29,616,066	4.7	648,940	2.23%

CI, Confidence interval; *NA*, not available.
*In accordance with the Healthcare Cost and Utilization Program privacy protections, values of 10 or less cannot be reported.
[†]Estimates do not meet the criteria for statistical reliability.

patients were significantly more likely to be admitted for dermatologic conditions compared to individuals with other forms of insurance. Previous literature has repeatedly demonstrated that uninsured individuals have poorer access to outpatient dermatologists compared to the general population, resulting in uninsured patients presenting with later stages of skin disease and experiencing worse clinical outcomes.[15,16] Rural communities also have poor access to outpatient dermatologists, and in this study, hospitals in rural communities, and those with small bed sizes, were associated with an increased risk of hospitalization for skin disease.[17] Our findings suggest that reduced access to outpatient dermatologists may be translating to an increased likelihood of hospitalization for skin disease. Further research is necessary to directly analyze if outpatient access to dermatologists influences the likelihood of hospitalization for skin disease, as we cannot prove

causation here because of this study's observational nature.

Our results also demonstrate that white race was a risk factor for dermatologic hospitalizations, which is consistent with results from previous studies showing that certain forms of skin disease—such as cellulitis, melanoma, nonmelanoma skin cancers, and psoriasis—are more prevalent in white populations.[18-21] The higher prevalence of certain skin conditions in whites may account for the predilection of admissions for white patients observed in this study. An inherent selection bias may also account for the association of hospitalizations for skin disease with white populations. White individuals have been shown to have a stronger awareness of skin cancer and the need for routine skin surveillance compared to minority groups, and therefore, may also be more likely to seek treatment and subsequently be hospitalized for dermatologic conditions.[22]

Table III. Burden of inpatient dermatology in adults by age category

Age, y	Hospitalization costs for skin disease by age category	Principal diagnosis	No. of admissions by disease category	95% CI for no. of admissions
18-44	$1,289,371,379	Bacterial infections	150,640	146,611-154,669
		Connective tissue disorders	8595	7983-9207
		Ulcers	7305	6846-7764
		Noncancerous skin growths	2995	2687-3303
		Sweat gland disorders	2370	2102-2638
45-64	$1,930,400,268	Bacterial Infections	200,215	195,788-204,642
		Ulcers	15,215	14,491-15,939
		Connective tissue disorders	4395	4042-4748
		Drug eruptions	3025	2773-3277
		Viral diseases	3000	2735-3265
65-84	$1,413,859,863	Bacterial Infections	140,830	137,723-143,937
		Ulcers	15,365	14,699-16,031
		Viral diseases	3530	3268-3792
		Drug eruptions	2600	2361-2839
		Nonmelanoma skin cancers	2360	2072-2648
≥85	$414,205,850	Bacterial Infections	43,920	42,476-45,364
		Ulcers	6705	6312-7098
		Viral diseases	1335	1175-1495
		Nonmelanoma skin cancers	780	651-909
		Drug eruptions	625	517-733

CI, Confidence interval.

Patients hospitalized principally for nondermatologic conditions but who had comorbid skin disease, incurred higher costs and experienced higher in-hospital mortality rates than did patients without skin disease. We hypothesize that these poor outcomes are largely a result of hospital-acquired skin infections, given that bacterial skin infections represented the most common dermatologic condition encountered in hospitalized adults, and because nosocomial skin and soft- tissue infections are known to be associated with higher rates of morbidity and mortality than are community-acquired infections.[23] The poor outcomes observed in individuals admitted principally for nondermatologic conditions with secondary skin disease may also be caused by the development of pressure ulcers—the second most numerous skin condition observed here—as patients who develop pressure ulcers in the hospital have longer lengths of stay and higher mortality rates.[24] In sum, these results further support the intensification of services, such as inpatient dermatology consultations, to improve diagnostic accuracy, wound care, and disease management in adults hospitalized primarily for or with skin disease.

This study has multiple limitations. First, although our results demonstrate that populations with historically poor access to outpatient dermatologists are also highly likely to be hospitalized for skin disease, we cannot establish causation because of the observational nature of this study. Second, we were unable to assess the effect of inpatient dermatology consultations on hospital outcomes such as length of stay, costs, or mortality because the database lacked information on a patient's care team. Third, the demographic data that we report here apply to all forms of skin disease combined, and a more nuanced picture of the disparities within each category of skin disease is still required. Fourth, this study does not include conditions with skin manifestations that are often managed by other specialties, such as graft-versus-host disease or burns. We also excluded diseases of the external ear, genitalia, eyelid, and lips because of ambiguity in which specialty primarily manages these disorders. For example, some dermatologists will refer patients with eyelid or inner ear lesions to ophthalmology or otolaryngology, respectively. Our results may therefore underestimate the true burden of skin disease in hospitalized adults. Lastly, we were unable to assess whether dermatologist density is associated with the number of dermatologic hospitalizations in a given region.

In summary, our results demonstrate that adults hospitalized for skin disease represent a significant financial burden to the health care system, and that skin disease is commonly encountered in the inpatient setting. Additionally, socioeconomic and geographic factors, such as lack of medical insurance or residence in low-income or rural communities,

significantly increase one's risk of hospitalization for skin disease. Our findings also support expanding access to inpatient dermatology consultations given the high prevalence of skin disease in hospitalized adults.

REFERENCES

1. Lim HW, Collins SAB, Resneck JS, et al. The burden of skin disease in the United States. *J Am Acad Dermatol*. 2017;76(5): 958-972.e2.
2. Healthcare Cost and Utilization Project. Overview of the National (Nationwide) Inpatient Sample (NIS). Available at: www.hcup-us.ahrq.gov/nisoverview.jsp. Accessed April 1, 2018.
3. Kaye KS, Patel DA, Stephens JM, Khachatryan A, Patel A, Johnson K. Rising United States hospital admissions for acute bacterial skin and skin structure infections: recent trends and economic impact. *PLoS One*. 2015;10(11):e0143276.
4. Interagency Task Force on Antimicrobial Resistance. A public health plan to combat antimicrobial resistance. Available at: https://www.cdc.gov/drugresistance/pdf/public-health-action-plan-combat-antimicrobial-resistance.pdf. Accessed April 16, 2018.
5. Harrison N. Obesity and public health campaigning. *Lancet Diabetes Endocrinol*. 2014;2(2):109.
6. Quirke M, Ayoub F, Mccabe A, et al. Risk factors for non-purulent leg cellulitis: a systematic review and meta-analysis. *Br J Dermatol*. 2017;177(2):382-394.
7. Stevens DL, Bisno AL, Chambers HF, et al. Practice guidelines for the diagnosis and management of skin and soft tissue infections: 2014 update by the Infectious Diseases Society of America. *Clin Infect Dis*. 2014;59(2):e10-e52.
8. Li DG, Xia FD, Khosravi H, et al. Outcomes of early dermatology consultation for inpatients diagnosed with cellulitis. *JAMA Dermatol*. 2018;154:537-543.
9. Ko LN, Garza-Mayers AC, St John J, et al. Effect of dermatology consultation on outcomes for patients with presumed cellulitis: a randomized clinical trial. *JAMA Dermatol*. 2018; 154:529-536.
10. Hu L, Haynes H, Ferrazza D, Kupper T, Qureshi A. Impact of specialist consultations on inpatient admissions for dermatology-specific and related DRGs. *J Gen Intern Med*. 2013;28(11):1477-1482.
11. Davila M, Christenson LJ, Sontheimer RD. Epidemiology and outcomes of dermatology in-patient consultations in a midwestern U.S. university hospital. *Dermatol Online J*. 2010;16(2):12.
12. Kroshinsky D, Cotliar J, Hughey LC, Shinkai K, Fox LP. Association of dermatology consultation with accuracy of cutaneous disorder diagnoses in hospitalized patients: a multicenter analysis. *JAMA Dermatol*. 2016;152(4):477-480.
13. Milani-nejad N, Zhang M, Kaffenberger BH. Association of Dermatology consultations with patient care outcomes in hospitalized patients with inflammatory skin diseases. *JAMA Dermatol*. 2017;153(6):523-528.
14. Beshay A, Liu M, Fox L, Shinkai K. Inpatient dermatology consultative programs: a continued need, tools for needs assessment for curriculum development, and a call for new methods of teaching. *J Am Acad Dermatol*. 2016;74(4): 769-771.
15. Resneck JS, Isenstein A, Kimball AB. Few Medicaid and uninsured patients are accessing dermatologists. *J Am Acad Dermatol*. 2006;55(6):1084-1088.
16. Roetzheim RG, Pal N, Tennant C, et al. Effects of health insurance and race on early detection of cancer. *J Natl Cancer Inst*. 1999;91(16):1409-1415.
17. Vaidya T, Zubritsky L, Alikhan A, Housholder A. Socioeconomic and geographic barriers to dermatology care in urban and rural US populations. *J Am Acad Dermatol*. 2018;78(2): 406-408.
18. Halpern J, Holder R, Langford NJ. Ethnicity and other risk factors for acute lower limb cellulitis: a U.K.-based prospective case-control study. *Br J Dermatol*. 2008;158(6):1288-1292.
19. Mahendraraj K, Sidhu K, Lau CS, Mcroy GJ, Chamberlain RS, Smith FO. Malignant melanoma in African-Americans: a population-based clinical outcomes study involving 1106 African-American patients from the Surveillance, Epidemiology, and End Result (SEER) database (1988-2011). *Medicine (Baltimore)*. 2017;96(15):e6258.
20. Miller DL, Weinstock MA. Nonmelanoma skin cancer in the United States: incidence. *J Am Acad Dermatol*. 1994;30(5 Pt 1): 774-778.
21. Rachakonda TD, Schupp CW, Armstrong AW. Psoriasis prevalence among adults in the United States. *J Am Acad Dermatol*. 2014;70(3):512-516.
22. Korta DZ, Saggar V, Wu TP, Sanchez M. Racial differences in skin cancer awareness and surveillance practices at a public hospital dermatology clinic. *J Am Acad Dermatol*. 2014;70(2): 312-317.
23. Zilberberg MD, Shorr AF, Micek ST, et al. Epidemiology and outcomes of hospitalizations with complicated skin and skin-structure infections: implications of healthcare-associated infection risk factors. *Infect Control Hosp Epidemiol*. 2009;30(12):1203-1210.
24. Lyder CH, Wang Y, Metersky M, et al. Hospital-acquired pressure ulcers: results from the national Medicare Patient Safety Monitoring System study. *J Am Geriatr Soc*. 2012;60(9): 1603-1608.