Dermatology-specific and all-cause 30-day and calendar-year readmissions and costs for dermatologic diseases from 2010 to 2014

Myron Zhang, MD,[a] Alina Markova, MD,[b] Joanna Harp, MD,[a] Stephen Dusza, DrPH,[b] Misha Rosenbach, MD,[c] and Benjamin H. Kaffenberger, MD[d]

New York, New York; Philadelphia, Pennsylvania; and Columbus, Ohio

Background: Readmissions for skin disease, particularly for the same diagnosis and over time, have not been well studied.

Objective: To characterize hospital readmissions for skin disease.

Methods: A cross-sectional observational study examined the Nationwide Readmissions Database from 2010 to 2014, a national sample of hospital discharges in the United States.

Results: Of the patients in 3,602,599 dermatologic hospitalizations from 2010 to 2014, 9.8% were readmitted for any cause, 3.3% were admitted for the same diagnosis within 30 days, and 7.8% were readmitted for the same diagnosis within the calendar year (CY). The cost of all CY same-cause readmissions was $508 million per year. Mycosis fungoides had the highest 30-day all-cause readmission rate (32%), vascular hamartomas and dermatomyositis had the highest 30-day same-cause readmission rates (21% and 18%, respectively), and dermatomyositis and systemic lupus erythematosus had the highest CY same-cause readmission rates (31% and 24%, respectively). Readmission rates stayed stable from 2010 to 2014. Readmission for the same diagnosis was strongly associated with Medicaid and morbid obesity.

Limitations: This study is a broad description of hospitalizations for skin disease. Conclusions for individual diseases are not intended.

Conclusion: The rates and costs of readmissions for skin diseases remained high from 2010 to 2014. This study identifies diseases associated with high risk of hospital readmission, but disease-specific studies are needed. The diseases and risk factors presented should guide additional studies focused on strategies to reduce readmissions in specific skin diseases. (J Am Acad Dermatol 2019;81:740-8.)

Key words: cost of care; dermatology hospitalizations; dermatology readmissions; epidemiology; hospital readmissions; inpatient dermatology; Nationwide Readmissions Database.

The burden of dermatologic disease management in the inpatient setting has been increasingly recognized in recent years. The cutaneous conditions prompting dermatologic consultation and contributing to inpatient admissions have been described[1,2] and quantified,[3,4] respectively. Furthermore, dermatologic consultation has been found to improve the management of

From the Department of Dermatology, Weill Cornell Medicine, New York[a]; Dermatology Service, Memorial Sloan Kettering Cancer Center, New York[b]; Department of Dermatology, University of Pennsylvania, Philadelphia[c]; and Division of Dermatology, Department of Internal Medicine, The Ohio State University Wexner Medical Center, Columbus.[d]

Funding sources: Supported in part through the National Institutes of Health/National Cancer Institute Cancer Center (Support Grant P30 CA008748).

Conflicts of Interest: None disclosed

Accepted for publication May 10, 2019.

Reprints not available from the authors.

Correspondence to: Myron Zhang, MD, 1305 York Ave, Floor 9, Box 90, New York, NY 10021. E-mail: zhang.myron@gmail.com.

Published online May 15, 2019.

0190-9622/$36.00

https://doi.org/10.1016/j.jaad.2019.05.023

these cutaneous conditions within the hospitalization.[5-8] There are few studies of readmissions for skin disease, and the characteristics and costs of readmissions for the same diagnosis and over time in particular are not well understood. Identifying patterns of both short- and long-term readmissions can help inform efforts to reduce associated morbidity and costs. This study characterizes hospital readmissions for dermatologic disease by using the largest data set and the most years available in the United States.

CAPSULE SUMMARY

- Long-term readmissions for skin diseases are poorly understood. We found high and stable rates and costs of readmissions, with $508 million per year spent on same-cause readmissions.
- Identification of diseases with a high risk of readmissions should guide further efforts to reduce readmissions and costs.

METHODS

Study design and patient sample

A cross-sectional observational study was performed by using the Nationwide Readmissions Database (NRD) from 2010 through 2014. The NRD is a national sample of hospital discharges from 18 participating states in 2010-2012, 21 states in 2013, and 22 states in 2014, comprising about 50% of all hospitalizations in the United States.[9] The database includes uninsured patients and enrollees of all payer types, including Medicare, privately insured, and both fee-for-service and managed care Medicaid. Sample weights are provided for each admission, allowing for estimates of national admission numbers. Each admission contains a patient identification number, allowing linkage to all readmissions in the same state within the calendar year (CY). Each data entry also contains principal and secondary diagnoses, patient demographics, hospital characteristics, and hospital charges. All data are de-identified and publicly available; thus, the study was exempt from review by institutional review board.

Disease selection

Admissions for dermatologic diseases were extracted by using codes from the *International Classification of Diseases, Ninth Revision* (ICD-9), and diagnosis-related groups (DRGs). We first extracted all admissions from 2010 to 2014 with dermatology-specific DRGs 595, 596, 602, 603, 606, and 607 (major skin disorders, minor skin disorders, and cellulitis). We then compiled a list of all ICD-9 codes that were used in the principal diagnosis of these admissions. We also added ICD-9 codes for mycosis fungoides, Sézary syndrome, graft-versus-host disease, vasculitis with cutaneous involvement, systemic lupus erythematosus, systemic sclerosis, dermatomyositis, and eosinophilia myalgia syndrome; these were not covered under dermatology DRGs but were included in this study because of the importance of dermatologists in the management and comanagement of these diseases, including in specialty clinics and targeted fellowships such as cutaneous oncology and dermatology-rheumatology. The final set of dermatology-related hospitalizations was taken as any discharge with 1 of these ICD-9 codes as the principal diagnosis. ICD-9 codes for specifying different locations of the same disease were combined (ie, the category cellulitis included codes for head, trunk, and extremities).

Outcomes of interest

The primary outcomes were readmission rates, frequencies, and costs for each disease. Readmission rate were defined as the percentage of admissions with a repeat hospitalization within 30 days of discharge for short-term evaluation or within the CY for long-term evaluation. Only the first readmission was counted toward readmission frequencies. Only admissions before December were used in the calculation of 30-day readmission rates. Readmission numbers were calculated for both all-cause (any diagnosis) and same-cause readmissions (principal diagnosis of readmission was the same as that of the original hospitalization).

Statistical analysis

Data processing and statistical analysis were performed by using MATLAB software (version 76 R2017a, MathWorks, Natick, MA). Association of patient or hospital characteristics with readmission was evaluated by using bivariate logistic regression with unadjusted odds ratios. The 10 most common comorbidities were also evaluated for association with readmission. Costs were calculated from hospital charges by using the cost-to-charge ratio files provided in the NRD and adjusted for inflation to the year 2014 by using the Consumer Price Index from the US Bureau of Labor Statistics.[10] Readmission frequencies, rates, and costs were plotted against year to examine trends over time. Simple linear regression against time was used to determine P values and significance of trends.

RESULTS

For all dermatologic diagnoses examined from 2010 to 2014, there were 3,602,599 hospitalizations,

Abbreviations used:

CY: calendar year
DRG: diagnosis-related-group
ICD-9: *International Classification of Diseases, Ninth Revision*
NRD: Nationwide Readmissions Database

337,714 all-cause readmissions within 30 days (9.8%), 115,164 same-cause readmissions within 30 days (3.3%), and 282,320 same-cause readmissions within CY (7.8%). The inflation-adjusted cost of all dermatology-related hospitalizations form 2010 to 2014 was $27.8 billion, and the cost of all CY same-cause readmissions was $2.54 billion. The mean costs of each hospitalization and readmission were $7841 (standard deviation, $12,941) and $8995 (standard deviation, $12,901), respectively.

The breakdowns of patient demographics, hospital characteristics, and most common comorbidities are shown in Table I. Unadjusted bivariate logistic regression showed that the highest 30-day all-cause readmission rates were associated with increased age, female sex, Medicare insurance, large teaching hospitals in populous metropolitan areas, and congestive heart failure as a comorbidity. The highest same-cause readmission rates (both 30-day and CY) were associated with middle-age (range, 18-64 years), female sex, Medicaid insurance, large teaching hospitals in populous metropolitan areas, and morbid obesity.

Table II shows readmission rates each year for the 10 most common dermatologic causes for hospitalization. Cellulitis was the most common diagnosis, comprising 83.6% of all admissions for dermatologic conditions. Table III lists the diseases with the highest readmission rates and highest total CY same-cause readmission costs, excluding those with fewer than 100 total hospitalizations from 2010 to 2014. Mycosis fungoides, Sézary syndrome, and graft-versus-host disease had the highest 30-day all-cause readmission rates (32%, 29%, and 28% respectively). Vascular hamartomas, dermatomyositis, and thrombotic microangiopathy had the highest 30-day same-cause readmission rates (21%, 18%, and 14% respectively). Dermatomyositis, systemic lupus erythematosus, and vascular hamartomas had the highest CY same-cause readmission rates (31%, 24%, and 23% respectively). Cellulitis and systemic lupus erythematosus had the highest CY same-cause readmission costs—$1.94 billion and $221 million, respectively, over the years 2010 to 2014.

The trends in readmissions for all diseases from year to year are shown in Fig 1. Readmission frequencies for all 3 measures exhibited a general decrease over time (range, 3%-7% decreases from 2010 to 2014), but the rates of readmission stayed stable (increases of 0% to 0.2% from 2010 to 2014). Trends in total and mean CY readmission costs for the 5 most costly diseases are also shown in Fig 1. All-disease total costs showed a decreasing trend (a 7% decrease from 2010 to 2014). Systemic lupus erythematosus was the only disease to show a decreasing trend in total cost (a 29% decrease from 2010 to 2014). The total cost of hidradenitis showed an increasing trend (a 39% increase from 2010 to 2014). There were no clear trends in total costs of cellulitis, thrombotic microangiopathy, or mycosis fungoides. Mean cost per CY readmission for all diseases decreased 5% from 2010 to 2011 but remained stable from 2011 to 2014 (<1.2% variation). The mean costs of single diseases fluctuated from year to year with no clear trend.

DISCUSSION

Of 721,000 mean hospitalizations per year for dermatologic diagnoses from 2010 to 2014, 9.8% were readmissions within 30 days for any cause and 3.3% were readmissions for the same diagnosis as the initial admission; 7.8% were readmissions for the same diagnosis within the CY, costing $508 million per year.

There are very few prior studies of readmissions for skin disease. A recent study by Arnold et al examined readmissions in the context of all-cause readmissions within 30 days in 2014.[11] Their finding of cutaneous lymphoma having the highest 30-day all-cause readmission rate is consistent with ours. We also found that graft-versus-host disease, which was not examined by Arnold et al, had the next highest 30-day all-cause readmissions rate after cutaneous lymphoma. To our knowledge, dermatologic readmissions for the same cause and over a longer term and disease-specific readmission costs have not been previously studied. The disease profiles for highest same-cause readmission rates were different, with connective tissue diseases, vasculitides/vasculopathies, hidradenitis, and pemphigus having higher readmission rates than mycosis fungoides. Demographics associated with same-cause and all-cause readmissions were also different.

All-cause readmissions were associated with increased age and Medicare insurance, which may reflect increased comorbidities and fragility and potential loss of social support in elderly patients. On the other hand, readmission for the same skin disease was associated with middle age (range, 18-64 years), which may suggest increased prevalence

of chronic and autoimmune skin diseases in this age group. Same-cause readmission was also associated with Medicaid insurance. This may be due to barriers to outpatient access and posthospitalization follow-up. Studies have found that only 1.4% of Medicaid enrollees see a dermatologist annually versus 5.5% of patients with private insurance.[12] Medicaid patients were also shown to have a lower acceptance rate (30% vs 91% for privately insured) and longer wait time (66 days vs 31 days for privately insured) to a dermatologist.[13] The single characteristic associated with highest same-cause readmission rate was morbid obesity. This may be related to the incidence of cellulitis in this data set, for which obesity is a known risk factor, as well as to coexisting secondary lymphedema, venous insufficiency, and delayed healing.[14-16] The high rates of misdiagnosis of cellulitis may also contribute; studies have found that 31% of cellulitis diagnoses are misdiagnosed and 74% of dermatology consultations for cellulitis were actually pseudocellulitis.[7,17] Pseudocellulitis—which includes mimickers of cellulitis, such as stasis dermatitis and lymphedema—is often associated with obesity and does not require admission but will persist and result in unnecessary readmissions if incorrectly treated as cellulitis.[18] The higher all-cause and same-cause readmission rates for females may be attributed to the high readmission frequencies of patients with systemic lupus erythematosus and dermatomyositis, which are more common in females.[19,20] The increased rate of all readmission types at large metropolitan teaching hospitals is likely due to increased complexity of patients at these hospitals.

Mycosis fungoides, SLE, and dermatomyositis had high short- and long-term same-cause and all-cause readmission rates. Vascular hamartomas had the highest 30-day same-cause readmission rate. The corresponding ICD-9 code (757.32) is a subcategory of congenital skin anomalies. Prior studies have shown that this code is used for port-wine stains and hemangiomas in the pediatric inpatient setting,[21] as well as for cutis marmorata telangiectatica congenita.[22] A recent study showed delayed presentation to specialists for infantile hemangiomas in patients with Medicaid or assisted insurance programs, which again highlights the need to address barriers to access.[23] Along with many other diseases with high readmission rates in Table III, these conditions with frequent readmissions should lower the threshold for obtaining dermatology consultation, which has been shown to decrease readmission[8] and alter diagnosis and management (eg, changing diagnosis in 45% of cases and stopping unnecessary antibiotics).[3,6,7] Knowledge of the high readmission rates for these diseases can also inform efforts to keep these patients out of the hospital. Many of the skin diseases with the highest rates of CY readmissions—such as morphea, hidradenitis suppurativa, pityriasis rubra pilaris, pemphigus, pyoderma gangrenosum, and psoriasis—are generally managed in the outpatient setting, again highlighting the importance of addressing barriers to access. Urgent care dermatology clinics have been shown to circumvent referral to the emergency department and result in shorter visit times and lower health care and patient costs than those of emergency department visits.[24-26] Provision of same-day appointments for patients with flares in cutaneous lymphoma or connective tissue disease, dermatology involvement in multidisciplinary clinics, or utilization of teledermatology to improve access to medically underserved populations[27] may reduce readmissions and costs.

Although total readmissions showed a general decreasing trend from 2010 to 2014, the rates of readmission have remained constant. This implies that total admissions are decreasing but readmission rates are not, suggesting potential improvements in outpatient management of skin diseases but room for improvement in inpatient care. The cost of readmissions for cellulitis alone was $389 million per year and shows no sign of decreasing. Although some diseases such as systemic lupus erythematosus show a decreasing trend in yearly costs, those of other diseases such as hidradenitis show increases. These high costs highlight the importance of investment in inpatient dermatology services and coordination between inpatient and outpatient dermatology care in an effort to reduce readmissions and save health care dollars.

Limitations of this study include the use of ICD-9 codes, which could potentially be entered by non-dermatologists, to identify diseases. However, this is a descriptive study of many diseases as a whole and is not intended to present or test hypotheses for individual skin diseases. Furthermore, ICD-9 codes are examined only in the context of principal discharge diagnoses, which are generally entered with greater attention than secondary diagnoses. Given the analysis of principal diagnoses only, the readmission rates for skin disease may be underestimated on account of the omission of events for which the skin disease was coded as a secondary diagnosis. Sampling error is another limitation that comes with using the NRD. Although the NRD provides weights to estimate national frequencies, it is collected from about half of all hospitalizations and states and may not be nationally representative, particularly for rare diseases. In addition, the use of CY readmissions underestimates the total number of

Table I. Patient demographics, hospital characteristics, and most common comorbidities in patients admitted for skin disease

		30-Day all-cause readmission			30-Day same-cause readmission			CY same-cause readmission		
Variable	**Hosp, N**	**RR, %**	**OR (99% CI)**	***P* value**	**RR, %**	**OR (99% CI)**	***P* value**	**RR, %**	**OR (99% CI)**	***P* value**
All	3,602,599	9.8			3.3			8.4		
Age, y										
0-17 (Ref)	353,009	4.8	1	Ref	2.5	1	Ref	4.4	1	Ref
18-44	960,053	8.1	1.75 (1.71, 1.79)	<.001	3.7	1.49 (1.45, 1.54)	<.001	8.4	2.00 (1.96, 2.05)	<.001
45-64	1,197,423	10.4	2.29 (2.24, 2.34)	<.001	3.7	1.48 (1.44, 1.53)	<.001	9.0	2.16 (2.11, 2.21)	<.001
65-84	827,838	12.0	2.70 (2.64, 2.77)	<.001	2.9	1.14 (1.10, 1.18)	<.001	7.4	1.74 (1.70, 1.79)	<.001
≥85	264,276	13.3	3.03 (2.95, 3.11)	<.001	2.7	1.05 (1.00, 1.09)	.0073	6.4	1.50 (1.45, 1.54)	<.001
Sex										
Male (Ref)	1,852,428	8.9	1	Ref	3.1	1	Ref	7.1	1	Ref
Female	1,750,171	10.8	1.23 (1.22, 1.24)	<.001	3.6	1.20 (1.18, 1.22)	<.001	8.6	1.23 (1.22, 1.25)	<.001
Insurance										
Private (Ref)	923,454	6.8	1	Ref	2.6	1	Ref	5.7	1	Ref
Medicare	1,395,910	13.0	2.04 (2.01, 2.07)	<.001	3.4	1.31 (1.28, 1.34)	<.001	8.7	1.57 (1.55, 1.59)	<.001
Medicaid	721,926	10.2	1.55 (1.52, 1.57)	<.001	4.4	1.73 (1.69, 1.77)	<.001	9.7	1.77 (1.74, 1.80)	<.001
Self-pay	346,045	5.8	0.85 (0.83, 0.87)	<.001	2.9	1.11 (1.08, 1.15)	<.001	6.5	1.14 (1.12, 1.17)	<.001
Other	205,647	7.4	1.09 (1.07, 1.12)	<.001	3.2	1.24 (1.19, 1.29)	<.001	7.2	1.27 (1.24, 1.30)	<.001
Zip code income quartile										
Fourth (Ref)	654,372	9.9	1	Ref	3.3	1	Ref	7.6	1	Ref
Third	795,949	9.9	1.01 (0.99, 1.02)	.21	3.4	1.03 (1.01, 1.06)	.0019	7.8	1.03 (1.02, 1.05)	<.001
Second	902,011	9.8	0.99 (0.98, 1.01)	.12	3.3	1.00 (0.97, 1.02)	.63	7.8	1.04 (1.02, 1.06)	<.001
First	1,187,259	9.7	0.98 (0.97, 1.00)	.0042	3.3	1.01 (0.99, 1.04)	.13	8.0	1.07 (1.05, 1.08)	<.001
Hospital bed size										
Small (Ref)	526,826	8.7	1	Ref	3.3	1	Ref	7.8	1	Ref
Medium	893,008	9.5	1.10 (1.09, 1.12)	<.001	3.2	1.00 (0.97, 1.02)	.63	7.7	0.99 (0.97, 1.00)	.045
Large	2,182,765	10.2	1.20 (1.18, 1.22)	<.001	3.4	1.05 (1.02, 1.07)	<.001	7.9	1.02 (1.01, 1.04)	<.001
Hospital location										
Nonurban (Ref)	161,905	7.5	1	Ref	2.7	1	Ref	7.0	1	Ref
Micropolitan	336,703	8.7	1.17 (1.14, 1.21)	<.001	2.8	1.05 (1.00, 1.10)	.015	7.1	1.00 (0.97, 1.03)	.93
Small metropolitan	1,106,347	9.7	1.33 (1.30, 1.37)	<.001	3.1	1.18 (1.13, 1.23)	<.001	7.3	1.04 (1.01, 1.07)	<.001
Large metropolitan	1,997,645	10.3	1.42 (1.38, 1.45)	<.001	3.6	1.36 (1.31, 1.42)	<.001	8.3	1.20 (1.17, 1.23)	<.001
Hospital teaching status										
Nonmetropolitan (Ref)	498,608	8.3	1	Ref	2.8	1	Ref	7.1	1	Ref
Metropolitan nonteaching	1,337,382	9.7	1.19 (1.17, 1.21)	<.001	3.2	1.17 (1.14, 1.21)	<.001	7.8	1.12 (1.10, 1.14)	<.001
Metropolitan teaching	1,766,609	10.4	1.28 (1.26, 1.30)	<.001	3.6	1.32 (1.28, 1.35)	<.001	8.1	1.16 (1.14, 1.18)	<.001
Comorbidities										
Hypertension	1,271,067	10.5	1.12 (1.11, 1.13)	<.001	3.5	1.09 (1.07, 1.10)	<.001	8.6	1.18 (1.17, 1.19)	<.001
Hyperlipidemia	682,989	11.3	1.21 (1.20, 1.22)	<.001	3.2	0.94 (0.92, 0.96)	<.001	7.9	1.00 (0.99, 1.02)	.61
Smoking	676,758	8.9	0.88 (0.87, 0.89)	<.001	3.8	1.17 (1.14, 1.19)	<.001	8.7	1.15 (1.13, 1.16)	<.001

Type 2 diabetes	605,064	11.8	1.29 (1.27, 1.30)	<.001	3.5	1.08 (1.06, 1.10)	<.001	9.2	1.23 (1.21, 1.24)	<.001
Methicillin-resistant *Staphylococcus aureus*	454,470	6.5	0.60 (0.59, 0.61)	<.001	2.1	0.57 (0.56, 0.59)	<.001	6.0	0.72 (0.71, 0.73)	<.001
Reflux	422,415	12.3	1.34 (1.32, 1.36)	<.001	3.8	1.15 (1.12, 1.17)	<.001	9.1	1.20 (1.19, 1.22)	<.001
Morbid obesity	364,720	12.5	1.37 (1.35, 1.39)	<.001	4.9	1.59 (1.56, 1.63)	<.001	13.8	2.07 (2.04, 2.10)	<.001
Hypothyroidism	342,772	12.9	1.41 (1.39, 1.43)	<.001	3.8	1.15 (1.12, 1.18)	<.001	9.4	1.24 (1.22, 1.26)	<.001
Depression	323,816	12.5	1.35 (1.33, 1.37)	<.001	4.1	1.27 (1.24, 1.31)	<.001	10.3	1.39 (1.37, 1.41)	<.001
Congestive heart failure	318,282	17.5	2.13 (2.10, 2.16)	<.001	3.8	1.17 (1.14, 1.20)	<.001	10.3	1.39 (1.37, 1.41)	<.001

Odds ratios presented are unadjusted from bivariate logistic regression.
CI, Confidence interval; *CY*, calendar year; *Hosp*, hospitalizations; *OR*, odds ratio; *Ref*, reference variable; *RR*, readmission rate.

Table II. Readmission rates for the most common principal diagnoses in dermatology-related hospitalizations by year

	2010				2011				2012				2013				2014			
Diagnosis	Hosp, N	30-Day AC, %	30-Day SC, %	CY-SC, %	Hosp, N	30-Day AC, %	30-Day SC, %	CY-SC, %	Hosp, N	30-Day AC, %	30-Day SC, %	CY-SC, %	Hosp, N	30-Day AC, %	30-Day SC, %	CY-SC, %	Hosp, N	30-Day AC, %	30-Day SC, %	CY-SC, %
All	744,617	9.8	3.3	7.7	736,241	9.8	3.3	7.8	729,310	9.9	3.3	7.9	699,159	9.7	3.4	7.9	693,272	9.8	3.4	7.9
Cellulitis	618,571	9.2	3.1	7.7	613,230	9.2	3.2	7.9	611,208	9.3	3.2	8.1	587,030	9.1	3.3	8.1	582,711	9.2	3.3	8.0
SLE	14,900	24.9	13.0	26.0	14,700	24.4	13.1	24.5	14,358	25.5	13.8	25.3	13,453	23.9	12.9	23.1	12,933	23.1	11.2	22.4
Drug rash	7672	11.7	1.1	1.3	7634	11.3	0.9	1.0	7638	10.7	0.7	0.8	6929	11.9	1.1	1.3	7098	11.3	0.9	1.1
Herpes zoster	7784	12.2	0.5	0.6	7707	12.0	0.6	0.8	7458	11.8	0.9	1.2	6200	12.4	0.7	1.0	6164	11.5	0.7	0.9
Hidradenitis	3740	12.6	6.1	18.2	3992	11.1	5.5	17.5	4242	14.7	7.4	20.5	4077	12.7	6.4	17.1	4398	13.6	6.8	19.9
Kawasaki	4804	12.8	9.1	8.8	3857	6.7	5.3	5.3	3008	5.3	4.3	4.8	3560	7.7	5.7	5.5	4198	8.2	5.3	5.6
Pilonidal cyst	4259	3.2	0.6	1.8	3904	3.8	0.7	1.9	3928	3.4	0.7	2.1	3722	3.9	1.3	3.5	3502	4.7	0.8	3.4
Melanoma	3573	9.2	1.5	3.9	3458	11.4	3.0	4.5	3157	8.2	1.7	4.0	2976	8.8	1.6	3.8	2751	9.1	1.6	3.8
Urticaria	3392	6.5	0.8	1.1	3418	6.3	1.2	1.5	2918	5.1	0.4	0.6	2612	6.2	0.5	1.1	2397	7.0	0.3	0.7
Swelling in head and neck	3156	9.8	0.1	0.5	2892	12.4	0.5	1.0	2869	11.3	0.4	0.6	2641	12.0	0.3	0.6	2422	12.2	0.6	0.6

30-Day AC, 30-Day all-cause readmission rate; *CY-SC*, calendar year same-cause readmission rate; *Hosp*, hospitalizations; *30-Day SC*, 30-day same-cause readmission rate; *SLE*, systemic lupus erythematosus.

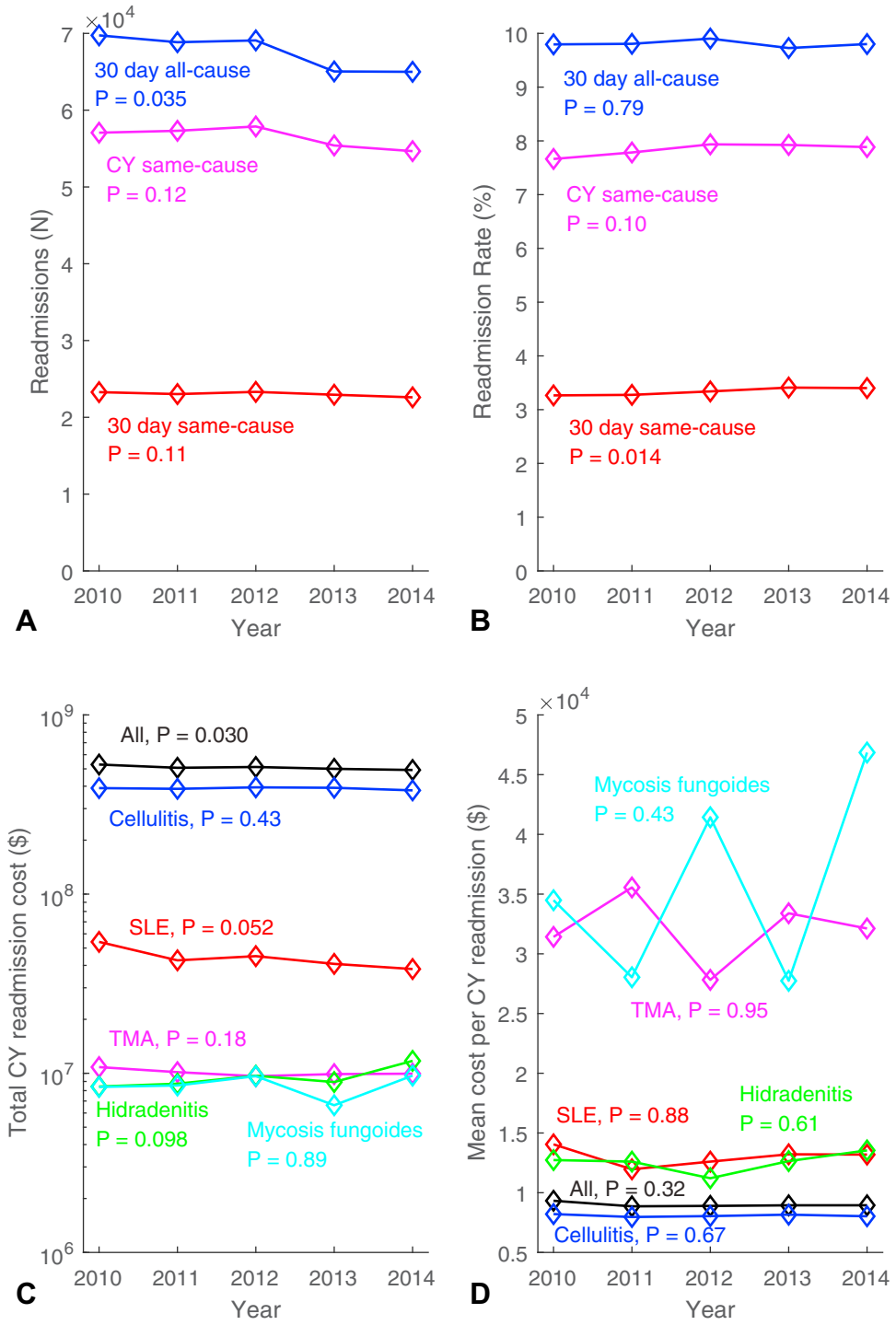

Fig 1. Readmission frequencies, rates, and costs over time from 2010 through 2014. **A**, Yearly readmission frequencies from 2010 to 2014. **B**, Readmission rates from 2010 to 2014. **C**, Total cost of calendar year (CY) same-cause readmissions from 2010 to 2014, plotted on log-linear scale. **D**, Mean cost per CY of same-cause readmission from 2010 to 2014. *SLE*, Systemic lupus erythematosus; *TMA*, thrombotic microangiopathy.

year-long readmissions because patients are reidentified after January 1 of every year. Thus, only 4 months of tracking would be included for a patient with an index hospitalization in September, compared with 12 months for a patient admitted in January. We used an unadjusted bivariate model to

Table III. Principal diagnoses with the highest readmission rates (30-day all-cause, 30-day same-cause, and CY same-cause) and total CY same-cause readmission costs (CY same-cause)

30-Day all-cause readmissions, N (readmission rate, %)		30-Day same-cause readmissions, N (readmission rate, %)		CY same-cause readmissions, N (readmission rate, %)		Total CY same-cause readmission cost, million	
Mycosis fungoides	2728 (32.3)	Vascular hamartomas	35 (21.1)	Dermatomyositis	2016 (30.8)	Cellulitis	$1942
Sézary syndrome	77 (29.2)	Dermatomyositis	1115 (18.3)	Systemic lupus erythematosus	17,108 (24.3)	Systemic lupus erythematosus	$221
Graft-versus-host disease	44 (28.2)	Thrombotic microangiopathy	1233 (13.7)	Vascular hamartomas	40 (22.7)	Thrombotic microangiopathy	$50.4
Dermatomyositis	1626 (26.6)	Systemic lupus erythematosus	8541 (12.8)	Alopecia NOS	37 (22.6)	Hidradenitis	$47.5
Pityriasis rubra pilaris	40 (26.2)	Pityriasis rubra pilaris	15 (10.6)	Morphea	95 (18.8)	Mycosis fungoides	$42.9
Kaposi sarcoma	47 (25)	Pemphigus	199 (9.2)	Hidradenitis	3822 (18.7)	Dermatomyositis	$29.3
Calcinosis cutis, necrobiosis lipoidica, and other degenerative/ depositional skin disease	369 (24.8)	Henoch-Schönlein purpura	708 (8.1)	Thrombotic microangiopathy	1614 (16.9)	Systemic sclerosis	$21.4
Systemic lupus erythematosus	16,323 (24.4)	Sézary syndrome	20 (7.9)	Pityriasis rubra pilaris	23 (16.3)	Granulomatosis with polyangiitis	$21.4
Vascular hamartomas	40 (24)	Granulomatosis with polyangiitis	582 (7)	Pemphigus	369 (16.2)	Pyoderma	$12.0
Thrombotic microangiopathy	1990 (22.2)	Pyoderma gangrenosum	331 (6.6)	Pyoderma gangrenosum	830 (15.3)	Squamous cell carcinoma	$10.7
Cutaneous small vessel vasculitis NOS	1297 (21.6)	Alopecia NOS	9 (6.6)	Systemic sclerosis	1249 (14.4)	Scar and fibrosis of skin	$10.3
Human herpes virus 6	27 (21.3)	Hidradenitis	1258 (6.5)	Mycosis fungoides	1224 (13.9)	Skin cancer NOS	$10.2
Morphea	94 (19.9)	Mycosis fungoides	536 (6.3)	Congenital skin disorders NOS	135 (12.3)	Cutaneous small vessel vasculitis	$10.1
Polyarteritis nodosa	657 (19.6)	Systemic sclerosis	512 (6.2)	Psoriasis	671 (12.3)	Kawasaki disease	$8.17
Systemic sclerosis	1581 (19.3)	Morphea	29 (6.2)	Granulomatosis with polyangiitis	1067 (12)	Melanoma	$7.48

Readmission frequencies are totaled over the period 2010-2014. Diagnoses with fewer than 100 total hospitalizations from 2010 to 2014 are excluded.
CY, Calendar year; *NOS*, not otherwise specified.

evaluate associations of patient and hospital characteristics with readmission. We did not use a multivariable model owing to the broad nature of this study and large number of diseases being examined. Thus, conclusions cannot be made about causation or independent predictors of readmission. Targeted research on individual diseases is needed to examine predictors of readmission more closely.

CONCLUSION

We have described skin conditions requiring hospitalization accounting for a large number of both short- and long-term readmissions and associated health care costs. Diseases, characteristics, and comorbidities associated with high readmission rates should trigger hospitals to consider dermatology consultation, coordinate outpatient follow-up, and support access for underinsured outpatients. These measures have been shown to reduce readmissions or hospital visits in general dermatologic settings, but outcomes in individual diseases are not well studied. This characterization of readmissions should guide future studies on disease-specific risk factors and mitigation strategies to reduce readmissions.

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