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Funding sources: Supported by the National Research Agency (ANR-17-CE14-0025-03 Tfh Atopy and ANR-19-CE17-0017-01TARGET-NS) and Imagine Institute (Cross-Lab Project). State funding from the Agence Nationale de la Recherche under "Investissements d'avenir" program (ANR-10-IAHU-01).

Conflicts of interest: None disclosed.

IRB approval status: Reviewed and approved by the IRB of Assistance Publique, Hôpitaux de Paris, France.

Reprints not available from the authors.

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https://doi.org/10.1016/j.jaad.2020.07.054

Dermatology in the emergency department: Prescriptions, rates of inpatient admission, and predictors of high utilization in the United States from 1996 to 2012

To the Editor: Use of emergency department (ED) services for skin conditions has increased significantly at a rate outpacing that of general ED use.[1,2] Prior studies of skin conditions in the ED find that infections represent half of dermatologic ED diagnoses.[3] In this study, we aimed to identify common ED prescriptions, rates of inpatient admission, and factors associated with high ED use the Medical Expenditure Panel Survey, a nationally representative database of health care expenditures and use.

We identified all patients who visited an ED for skin conditions from 1996 to 2012 using the clinical classification system. Among patients with dermatologic clinical classification system codes, we included patients with International Classification of Diseases, Ninth Revision, Clinical Modification codes 172-173, 232, and 680-709 as their primary diagnosis to ensure identification of dermatology-specific visits (Supplemental Methods; available via Mendeley at https://doi.org/10.17632/2f8yj776x5.1). To identify factors associated with high ED use, defined as 2 or more dermatologic ED visits per year, we created multivariable regressions using SAS 9.4 (SAS Institute, Cary, NC) survey methods to model high utilization (binomial dependent variable) against socioeconomic characteristics.

We identified 2377 ED visits with a primary dermatologic diagnosis, reflective of 1.22 million visits nationwide (weighted). Of these visits, 67,090 (5.5%) led to inpatient admission; 1.16 million (95.0%) had only 1 diagnosis (no comorbidities). Infections and antibiotics accounted for the most common diagnoses, prescriptions, and causes of inpatient admission from the ED (Table I). Factors predictive of high dermatologic ED use included use of the ED more frequently than outpatient offices for all conditions (odds ratio [OR], 3.3; 95% confidence interval [CI], 2.2-4.8; $P < .0001$), age 65 years or older (OR, 2.5; 95% CI, 1.0-6.0; $P = .042$) and age 18 to 64 years (OR, 2.4; 95% CI, 1.2-4.7); $P = .014$) (relative to age <18 y), income below the federal poverty level (OR, 2.2; 95% CI, 1.2-4.0; $P = .013$), and insurance status (OR, 1.7; 95% CI, 1.1-2.5; $P = .034$) (relative to being uninsured) (Table II). Of patients with high dermatologic ED use, 40.9% visited EDs more frequently than outpatient offices, compared to 18.0% in nonfrequent ED users (Supplemental Table I; available via Mendeley at https://doi.org/10.17632/2f8yj776x5.1).

Table I. Most common ED diagnoses, percentage admitted, and common prescriptions

ICD-9	Condition	ED visits	%	Admitted*	Admission rate (%)†	Most common ED prescriptions‡
172	Malignant melanoma	3494	0.29	—	—	—
173	Other skin cancer	9548	0.78	—	—	—
232	Carcinoma in situ, skin	995	0.08	—	—	—
680	Carbuncle/furuncle	73,459	6	3083	4.2	Antibiotics
681	Cellulitis/abscess	15,169	1.24	—	—	Antibiotics
682	Other cellulitis/abscess	212,049	17.3	23,579	11.1	Antibiotics
683	Acute lymphadenitis	14,198	1.16	—	—	Antibiotics, analgesics§
684	Impetigo	6245	0.51	—	—	Cephalexin
685	Pilonidal cyst	9331	0.76	—	—	Antibiotics
686	Other local infections	239,823	19.6	22,115	9.2	Antibiotics
691	Atopic dermatitis	11,114	0.91	—	—	Antifungals
692	Contact dermatitis	199,390	16.3	1542	0.8	Topical/systemic steroids
693	Dermatitis due to internal substance	49,611	4.1	1432	2.9	Systemic steroids, antihistamines
694	Bullous dermatoses	1022	0.1	—	—	—
695	Erythematous conditions	8360	0.7	—	—	Antihistamines
696	Psoriasis	8253	0.7	—	—	Topical/systemic steroids
698	Pruritic disorders	5229	0.4	—	—	Antihistamines
700	Corns/callouses	2416	0.2	—	—	—
701	Hypertrophic/atrophic	4820	0.4	—	—	—
703	Diseases of nail	25,680	2.1	—	—	Antibiotics, analgesics
704	Disease of hair/follicles	5628	0.5	—	—	Antibiotics, analgesics
705	Disorders of sweat glands	5376	0.4	—	—	Analgesics
706	Diseases of sebaceous glands	90,919	7.4	3049	3.4	Antibiotics
707	Chronic ulcer of skin	89,747	7.3	7740	8.6	Antacids
708	Urticaria	98,949	8.1	—	—	Antihistamines
709	Other disorders of skin	32,949	2.7	1999	6.1	—

ED, Emergency department; *ICD-9*, International Classification of Diseases, Ninth Revision.
*Inpatient admissions were excluded if only 1 patient (unweighted) represented the only inpatient admission.
†Proportion of ED admissions that led to inpatient admission.
‡A specific drug or a drug class was listed only if more than 15% of patients received the prescription and was excluded if only 1 patient (unweighted) represented the only medication prescription.
§Analgesics include acetaminophen, nonsteroidal anti-inflammatory drugs, and/or opioid-containing prescriptions.

Understanding ED use is important because of its increasing use and role as a source of inpatient admissions. Studies in cellulitis, often misdiagnosed for pseudocellulitis, illustrate this point, showing that early dermatology consults in the ED lead to discontinuation of unnecessary antibiotics, reversal of decisions to admit inpatients, and lower health care costs.[4,5] Our finding that dermatology patients with high ED use visit EDs more frequently than ambulatory clinics suggests a need to better understand how to triage patients into the most appropriate care settings. Further research is needed to distinguish necessary versus unnecessary high ED use and identify how to provide better outpatient care and facilitate access such that patients do not require such frequent ED visits if they could appropriately be treated in outpatient settings.

Our study may help dermatologists educate patients about appropriate ED use and guide future studies on the effectiveness of ED dermatology consults. Limitations include those inherent to survey-based databases, such as recall bias or weighted design, and the Medical Expenditure Panel Survey truncation of ICD-9 codes to 3 digits to protect patient privacy. Future studies, with greater diagnostic granularity, are needed to explore the mechanisms behind our findings.

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Funding sources: None.

Conflicts of interest: None disclosed.

IRB approval status: The Medical Expenditures Panel Survey is approved by the Westat IRB

Table II. Patient characteristics associated with multiple ED uses within a single year

			Multivariable regression*	
Characteristic	**Frequency (thousands)**	**% (95% CI)**	**OR (95% CI)**	***P* value**
Age, y				
≤18	247.3	20.4 (18.2-22.6)	1 (reference)	
19-64	810.6	67.0 (64.0-70.0)	2.4 (1.2-4.7)	.014
≥65	152.6	12.6 (10.4-14.8)	2.5 (1.0-6.0)	.042
Unknown	13.2			
Use				
EDV ≤ OPV†	922.7	75.4 (72.6-78.4)	1 (reference)	
EDV > OPV	301.0	24.6 (21.6-27.7)	3.3 (2.2-4.8)	<.0001
Sex				
Male	604.6	49.4 (46.2-52.6)	1 (reference)	
Female	619.1	50.6 (47.4-53.8)	0.9 (0.61-1.2)	.87
Education				
No degree	223.7	18.3 (15.8-20.8)	1 (reference)	
High school	445.8	36.4 (33.2-39.6)	0.9 (0.6-1.3)	.50
Bachelor's	117.1	9.6 (7.5-11.7)	1.2 (0.5-2.4)	.77
Graduate degree	36.9	3.0 (2.0-4.0)	1.0 (0.3-3.5)	.99
Younger than 16 y or other	355.1	29.1 (26.5-31.7)	1.0 (0.6-1.7)	.98
Unknown	45			
Marriage status				
Married	420.6	34.4 (31.4-37.4)	1 (reference)	
Never married	556.3	45.4 (42.1-48.7)	0.8 (0.3-1.9)	.56
Other‡	245.7	20.0 (17.4-22.6)	1.0 (0.7-4.7)	.86
Unknown	1.1			
US census region				
Northeast	238.0	19.5 (16.8-22.2)	1 (reference)	
Midwest	294.4	24.1 (21.3-26.9)	0.8 (0.4-1.4)	.41
South	448.6	36.7 (33.5-39.9)	1.4 (0.9-2.3)	.13
West	229.5	18.8 (15.8-21.8)5	1.7 (1.0-3.0)	.07
Unknown	13.3			
Insurance type				
Uninsured	169.6	13.9 (11.7-16.1)	1 (reference)	
Any private	706.1	57.7 (54.5-60.9)	1.7 (1.1-2.5)	.034
Public only	348.1	28.4 (25.5-31.3)	1.9 (1.5-2.4)	.021
Employment status				
Employed	510.0	53.3 (50.0-56.6)	1 (reference)	
Unemployed§	389.2	40.7 (37.5-43.8)	1.0 (0.6-1.6)	.98
Other	57.6	6.0 (4.0-8.0)	0.6 (0.3-1.1)	.07
Unknown	267			
Income, % FPL				
>400	289.9	23.7 (20.9-26.5)	1 (reference)	
200-400	360.4	29.5 (26.5-32.5)	1.7 (0.9-2.9)	.06
125-200	203.6	16.6 (14.5-18.7)	1.4 (0.7-2.7)	.30
100-124	72.0	5.9 (4.6-7.2)	1.4 (0.7-4.1)	.21
<100	297.9	24.3 (21.4-27.2)	2.2 (1.2-4.0)	.013
Race/ethnicity (%)				
White	812.6	66.4 (63.5-69.3)	1 (reference)	
African American	206.2	16.9 (14.3-19.5)	0.9 (0.6-1.5)	.79
Hispanic	157.5	12.9 (11.1-14.7)	0.8 (0.5-1.3)	.37
AANAPI	28.2	2.3 (1.6-3.0)	0.6 (0.3-1.2)	.26
Multiple	19.2	1.6 (0.9-2.2)	0.7 (0.2-1.5)	.35

AANAPI, Asian American, Native American, Pacific Islander; *CI*, confidence interval; *EDV*, ED visits; *FPL*, federal poverty level; *OPV*, outpatient visits; *OR*, odds ratio.

*High dermatologic ED use (binomial dependent variable) modeled against the patient characteristics listed (independent variables).

†Total outpatient visits = number of office-based visits + number of outpatient department visits for all conditions.

‡Includes widowed, separated, or divorced.

§The Medical Expenditure Panel Survey includes retired persons as unemployed.

(multiproject assurance M-1531) granted by the Office for Protection from Research Risks; thus, our project does not require specific review by an IRB.

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https://doi.org/10.1016/j.jaad.2020.07.055

Evaluation of the cost and efficacy of home-formulated sunscreens

To the Editor: For some, the cost of commercial sunscreens may contribute to poor adherence to sunscreen application guidelines.[1] The availability of effective sunscreens at significantly reduced costs could lead to improved compliance and help mitigate the harmful effects of ultraviolet (UV) radiation (UVR). Our study shows that home-formulated sunscreens may be an economical and possibly effective alternative to commercial sunscreens for consumers unable to afford commercial sunscreens.

Twenty-four home-formulated sunscreens varying in zinc oxide (ZnO) and titanium dioxide (TiO_2) content (Table I) were compared to 4 sun protection factor (SPF) 30 commercial mineral sunscreens (Table II). All sunscreens were prepared in the kitchen as a consumer would, by heating together a base of ½ cup sweet almond oil, ¼ cup coconut oil, ¼ cup beeswax, and 10 drops red raspberry seed oil.[2] Non-nanosized ZnO and/or TiO_2 were added after cooling (Supplementary Materials; available via Mendeley at https://dx.doi.org/10.17632/yfw6m4pcpw.1).

Preparations were tested in a laboratory setting. Consistent with US Food and Drug Administration requirements for in vivo SPF testing,[3] each product was applied to UV-transparent quartz glass in an amount equating to 2 mg/cm^2. A Newport Oriel (Irvine, CA) SOL-UV-6 solar simulator was the UV source, and UVR transmittance through samples was measured with a Solarmeter (Solar Light Company, Glenside, PA) Model 5.0 Standard UVA + B Meter digital radiometer. Mean UVR transmittances and costs for home-formulated and commercial sunscreens are shown in Tables I and II.

Home-formulated sunscreens with higher ZnO and/or TiO_2 content (designated by asterisks) had mean UV transmittance values lower than 3 of the 4 tested commercial sunscreens (C2, C3, C4). These had significantly higher mineral filter content than recommended by most recipes found online. Formulations with lower filter content (similar to online recipes) did not perform well.

All home-formulated sunscreens were significantly less expensive than the commercial sunscreens. The cost of 8 ounces of the 12 best-performing homemade sunscreens was $4.12 to $6.97. The cost of 8 ounces of the commercial sunscreens was $21.04 to $58.00. The median weekly cost of applying commercial sunscreen per recommended guidelines for a family of 4 at the beach has been estimated to be $238.40.[1] The same quantity of home-formulated sunscreen number 19 would cost $25.61. Initially, there would be a greater expenditure for the purchase of all ingredients in large quantities.

A recent study on the online popularity of home-formulated sunscreens suggests that consumers already use homemade sunscreens, with recipes being shared up to 21,000 times.[4,5] However, most of these recipes were thought by the investigators of the study to provide inadequate UVR protection.[5] Although still appealing to those desiring homemade products, the 12 best-performing sunscreens in this study show UVR-blocking capabilities comparable to those of commercial sunscreens. However, the efficacy of homemade sunscreen may potentially vary between batches because of inconsistencies in consumer preparation.

Our data suggests that some home-formulated sunscreens might provide an economical and effective alternative to commercial sunscreens, especially