comparing intralesional with the multiple puncture technique were found.

Two nonrandomized trials investigated bleomycin in a total of 96 patients with plantar warts.[4,5] Study characteristics are detailed in Table I.[1,4] Complete cure was significantly higher in the microneedling group compared with the intralesional group (85.5% vs 76.5%, respectively; $P < .001$). Pain was significantly more common with the intralesional method (50% vs 100%, $P < .001$). Gamil et al[4] reported hemorrhagic blisters in 33% of the intralesional group and in 0% of the microneedling group. Edema and erythema were not significantly different ($P = .06$). Nail dystrophy, Raynaud phenomenon, gangrene, or sclerodermatous changes were not observed in any patient. No systemic adverse effects were reported. There was no recurrence at the 6-month follow-up in any of the patients who achieved complete clearance by either method.

Our systematic search revealed 2 head-to-head trials comparing the microneedling method with the traditional intralesional injection for bleomycin delivery in plantar warts. We found that topical bleomycin with microneedling of the wart surface was associated with a higher cure rate than intralesional injection. A possible explanation may be perilesional extravasation with direct injection in contrast to the controlled drug delivery to the entire wart lesion ensured by the microneedling technique.[1] In addition, adverse effects, such as pain and hemorrhagic blisters, were more common with intralesional injection.

This review is limited by the paucity of trials conducted on the subject. There were also considerable differences in the microneedling process used in the trials.

In conclusion, microneedling as a modality of bleomycin delivery may be superior to intralesional injection in patient comfort, safety, and efficacy in plantar warts. There is a need for further research, especially to standardize the microneedling method and to compare the related multiple puncture technique with intralesional injection in head-to-head trials. Furthermore, adequately powered studies are needed to bring about practice change.

Subuhi Kaul, MD,[a] Elena Gonzalez Caldito, MD,[a] Deepak Jakhar, MD,[b] Ishmeet Kaur, MD,[b] Shawn G. Kwatra, MD,[c] and Shilpa Mehta, MD[d]

From the Department of Internal Medicine, John H. Stroger Hospital of Cook County, Chicago, Illinois[a]; the Department of Dermatology, North Delhi Municipal Corporation Medical College & Hindu Rao Hospital, New Delhi, India[b]; Department of Dermatology, Johns Hopkins University School of Medicine, Baltimore, Maryland[c]; and the Division of Dermatology, John H. Stroger Hospital of Cook County, Chicago, Illinois[d]

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Correspondence and reprint requests to: Subuhi Kaul, MD, 1950 W Polk St, 6th Floor, Professional Bldg, Chicago, IL 606012

E-mail: subuhi.kaul@cookcountyhhs.org

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Financial burden in US patients with melanoma from 1997 to 2015: Racial disparities, trends, and predictors of high expenditures

To the Editor: The incidence of melanoma has increased at a rate faster than that of most other cancers.[1] The cost of melanoma treatment has likewise significantly increased.[2] Although prior studies have examined racial/socioeconomic disparities in melanoma outcomes, disparities in health care costs and use have not yet been fully characterized. We used the nationally representative Medical Expenditure Panel Survey database to assess the individual and systemic financial burden in US patients with melanoma from 1997 to 2015 and identify trends, racial disparities, and predictors of high health care expenditures.

Of 221.5 million adult patients (weighted), 653,779 patients reported a diagnosis of melanoma and 13,151,022 reported a nonmelanoma cancer (Supplemental Methods; available via Mendeley at

Table I. Melanoma expenditures (average per year) and use stratification by race*

	White		African American		Hispanic	
Expenditures and Utilization	**Mean**	**95% CI**	**Mean**	**95% CI**	**Mean**	**95% CI**
Age at diagnosis, y†	55.1	53.0 to 57.2	62.0	57.1 to 66.9	55.5	23.16 to 87.84
Inpatient visits, n‡	0.1	0.0 to 0.2	0	0 to 0	0.1	0.0 to 0.2
Outpatient visits, n‡	3.3	1.6 to 5.0	1.0	0.9 to 1.1	2.0	-1.0 to 5.1
Total expenditures	12,419	10,921 to 13,917	24,361	15,464 to 33,257	20,035	11,540 to 28,529
Total charges	23,932	20,168 to 27,695	54,928	30,785 to 79,070	49,064	26,073 to 72,054
Total out of pocket	1757	1596 to 1918	669	308 to 1032	1697	775 to 2619
Total expenditures, private insurance§	6232	4893 to 7571	12,635	2357 to 22,913	8860	839 to 16,880
Total expenditures, Medicare§	9335	7590 to 11,080	13,583	6086 to 21,080	14,322	6534 to 22,109
Total expenditures, Medicaid§	4428	2360 to 6496	12,436	2579 to 22,293	10,228	961 to 19,495
Total inpatient expenditures‡	27,250	17,311 to 37,189	NA	NA	12,217	4902 to 19,533
Total inpatient charges‡	67,040	51,128 to 82,952	NA	NA	20,298	535 to 40,061
Total outpatient expenditures‡	432	382 to 482	839	241 to 1436	763	153 to 1375
Total outpatient charges‡	1133	939 to 1327	1916	932 to 2900	2404	1125 to 3682

CI, Confidence interval; *NA,* not applicable.

*All monetary values are in units of 2015 US dollars. Nonoverlapping 95% confidence intervals indicates statistical significance between races at $\alpha = 0.05$.

†Excluded cases where age of diagnosis was unknown.

‡Provider visits/year and expenditures/year are specific for the diagnosis of melanoma, not overall visits/expenditures.

§Excluded cases where expenditures were equal to 0 or unknown.

Table II. Factors associated with high medical expenses

	Multivariable regression, all variables included*,†		Multivariable regression, forward step selection†,‡		Out-of-pocket expenditures§	
Characteristics	**OR (95% CI)**	***P* value**	**OR (95% CI)**	***P* value**	**OR (95% CI)**	***P* value**
Age < 50 y	1 (reference)					
Age ≥ 50 y	2.7 (1.3-7.1)	.042			2.5 (1.1-5.2)	.026
Female	1 (reference)					
Male	1.8 (1.1-2.8)	.019	1.59 (1.1-2.3)†	.015	1.8 (1.1-3.0)	.013
White	1 (reference)		0.35 (0.21-0.61)†	.0001		
African American	4.3 (2.3-8.1)	<.0001	4.5 (1.65-12.4)‡	.0034		
Hispanic	1.9 (1.1-3.3)	.026				
Other race/ethnicity	0.9 (0.13-6.5)	.93				
Employed	1 (reference)		0.48 (0.32-0.72)†	.0005		
Unemployed	1.7 (1.0-2.9)	.059			2.8 (1.1-7.6)	.040
Other employment	2.4 (0.88-6.6)	.085				
US Northeast	1 (reference)					
US Midwest	0.74 (0.36-1.5)	.42				
US South	1.0 (0.6-1.8)	.99				
US West	0.79 (0.43-1.8)	.45			2.3 (1.4-3.6)	.0004
No degree	1 (reference)		2.8 (1.36-5.69)‡	.0049		
High school	0.51 (0.37-1.6)	.12				
Bachelor's	0.66 (0.28-1.7)	.43				
Master's	0.39 (0.29-2.1)	.10				
Doctorate	0.17 (0.05-0.55)	.003				
<100% FPL	1 (reference)		2.01 (1.17-3.46)†	.011		
100%-125% FPL	0.31 (0.05-1.81)	.19				
125%-200% FPL	0.57 (0.22-1.49)	.25				
200%-400% FPL	0.76 (0.37-1.56)	.45				
>400% FPL	0.70 (0.33-1.44)	.33				

CI, Confidence interval; *FPL,* federal poverty level; *OR,* odds ratio.

*Multivariate regression was performed with high total or out-of-pocket expenses (binomial dependent variable) modeled against all patient characteristics (independent variables). Case deletion for missing variables led to the deletion of 16 unweighted observations (1.76%). Only significant variables are shown. (Marriage status is omitted from the table.)

†The top 15th percentile of spenders (60% of total expenditures) was designated as patients with high total expenditures.

‡A secondary forward-step regression was performed in which the top 10th percentile of spenders (50% of total expenditures) were designated as patients with high total expenditures, which identified two additional significant parameters.

§The top 10th percentile of spenders (40% of total out-of-pocket expenditures) was designated as patients with high out-of-pocket expenditures. Significant variables were identical when setting the cutoff as the top 20th percentile or top fifth percentile.

https://dx.doi.org/10.17632/x9ccmnnxyp.1). Patients with melanoma were more likely to be white, privately insured, and male, with higher income and educational attainment than patients with other cancers; out-of-pocket and total expenditures were comparable (Supplemental Table I; available via Mendeley at https://dx.doi.org/10.17632/x9ccmnnxyp.1). Adjusting all financial variables for inflation into 2015 US dollars, the total expenditures for melanoma increased at a rate faster than that of other cancers, while out-of-pocket expenditures stayed steady (Supplemental Fig 1; available via Mendeley at https://dx.doi.org/10.17632/x9ccmnnxyp.1).

African American patients, when compared to white patients, incurred higher total expenditures (mean, $24,361 vs $12,419). Among patients admitted as inpatients for melanoma, white patients had significantly higher expenditures than Hispanic patients (mean, $27,250 vs $12,217). White patients visited outpatient providers (3.3 visits per year, 95% confidence interval [CI] 1.6-5.0) for melanoma more often than African American patients (1.0 visits per year, 95% CI 0.9-1.1) (Table I). For stratification of expenditures by factors outside of race, see Supplemental Fig 2 (available via Mendeley at https://dx.doi.org/10.17632/x9ccmnnxyp.1).

In logistic regressions modeling high expenditures (binomial dependent variable) against socioeconomic patient characteristics, forward-step selection of variables to maximize fit identified male sex (odds ratio [OR], 1.6; 95% CI, 1.1-2.3), nonwhite race (OR, 2.9; 95% CI, 1.6-4.8), lack of employment (OR, 2.1; 95% CI, 1.4-3.1), and income below the federal poverty line (OR, 2.0; 95% CI, 1.2-3.5) as predictive of the top 15th percentile of patients with the highest financial burden and male sex (OR, 1.8; 95% CI, 1.1-2.8), African American race (OR, 4.5; 95% CI, 1.7-12.4), lack of employment (OR, 2.2; 95% CI, 1.3-3.8), and low education status (OR, 2.8; 95% CI, 1.4-5.7) as predictive of the top 10th percentile. Multivariable regression with incorporation of all variables yielded similar results. Male sex (OR, 1.8; 95% CI, 1.1-3.0), unemployment (OR, 2.8; 95% CI, 1.1-7.6), age older than 50 years (OR, 2.5; 95% CI, 1.1-5.2), and western US residency (OR, 2.3; 95% CI, 1.4-3.6) were significantly associated with high out-of-pocket expenditures (Table II). In prior studies, such factors have been found to be associated with melanoma outcomes (for an extended discussion, see Supplemental Discussion; available via Mendeley at https://dx.doi.org/10.17632/x9ccmnnxyp.1).

Our findings, using national data spanning nearly 2 decades, indicate significant disparities in the financial burden of melanoma at the individual and societal levels across multiple socioeconomic parameters. Such disparities suggest a need to target melanoma awareness and screening protocols to socioeconomically disadvantaged populations, which may result in significant savings to the health care system. A limitation to our data is lack of melanoma-specific variables such as staging, Breslow thickness, and histologic subtypes. However, prior studies controlling for such variables have shown that socioeconomic factors such as age, sex,[3] income,[4] and race[5] affect outcomes independent of biological factors. Further research, with incorporation of melanoma-specific parameters, is needed to fully evaluate the financial impact of melanoma.

Jason J. Yang, BS, Nolan J. Maloney, MD, Kyle Cheng, MD, and Daniel Q. Bach, MD MPH

From the Division of Dermatology, Department of Medicine, David Geffen School of Medicine at UCLA, Los Angeles, California.

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Correspondence to: Jason J. Yang, BS, Division of Dermatology at UCLA, 200 Medical Plaza, Suite 450, Los Angeles, CA 90095

E-mail: jjyang@mednet.ucla.edu

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