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Antibiotic utilization in Medicare beneficiaries receiving Mohs micrographic surgery

To the Editor: Antibiotic overuse can lead to bacterial resistance and place patients at risk of complications.[1,2] Dermatologists frequently prescribe oral antibiotics, and antibiotic use is increasing among visits associated with dermatologic procedures.[3] There is significant geographic variation in this use.[4] Although prior studies have evaluated geographic variation at the level of census division among commercially insured patients, little is known about physician-level variation in antibiotic prescribing associated with Mohs micrographic surgery among patients receiving Medicare benefits.

To evaluate antibiotic prescribing among surgeons performing Mohs surgery in Medicare beneficiaries, we merged data from the 2013-2016 Medicare Public Use File With Physician Compare.[5] *Mohs surgeons* were defined as dermatologists with at least 200 annual claims for Current Procedural Terminology codes 17311/17312. Antibiotic claims included amoxicillin, cephalexin, clindamycin, doxycycline, minocycline, and trimethoprim-sulfamethoxazole. Median (interquartile range [IQR]) annual Mohs stage 1 claims, antibiotic claims, total days' supply of antibiotics, and antibiotic claims per Mohs procedure were recorded. Results were stratified by Mohs surgeons in the top 5% of antibiotic prescribers by volume versus all Mohs surgeons. Geographic variation in mean annual antibiotic claims per Mohs procedure per clinician was plotted by US state. Moran's *I* was used to assess for spatial autocorrelation (nonrandom association by geographic location).

A total of 2,923,028 Medicare beneficiaries received Mohs procedures from 2013 through 2016 (Table I). The top 5% of antibiotic prescribers had a median of 469 (IQR, 359-674) antibiotic claims compared with 101 (IQR, 49-200) among all Mohs surgeons. The top 5% of antibiotic prescribers had significantly more antibiotic claims per Mohs stage 1 claim (median, 0.8; IQR, 0.5-1.2) than all Mohs surgeons (median, 0.2; IQR, 0.1-0.5). Median course duration was similar between the top 5% of prescribers (8.7 days; IQR, 6.9-11.9) and all Mohs surgeons (10.2 days; IQR, 7.3-17.8). The top 5% of prescribers were higher-volume surgeons (median, 819 cases; IQR, 508-1251) than all Mohs surgeons (median, 543 cases; IQR, 337-859).

Table I. Antibiotic prescribing patterns of Mohs surgeons, 2013-2016*

Characteristic	All Mohs surgeons (n = 1559)	Top 5% of prescribers (n = 258)	Ratio
Annual antibiotic claims per clinician, median (IQR)	101 (49-200)	469 (359-674)	4.6
Annual antibiotic claims per Mohs stage 1 claim, median (IQR)	0.2 (0.01-0.4)	0.7 (0.4-1.0)	3.5
Annual antibiotics per unique Mohs stage 1 beneficiary, median (IQR)	0.2 (0.1-0.5)	0.8 (0.5-1.2)	4.0
Total beneficiaries attributed to Mohs stage 1 claims	2,923,028	220,822	0.1
Annual Mohs stage 1 claims per clinician, median (IQR)	543 (337-859)	819 (508-1251)	1.5
Annual Mohs stage 1 beneficiaries per clinician, median (IQR)	443 (274-692)	687 (438-1056)	1.6
Annual days' supply per antibiotic claim, median (IQR)	10.2 (7.3-17.8)	8.7 (6.9-11.9)	0.9
Type of antibiotic, total claims (%)			
Amoxicillin	27,399 (3.1)	5095 (3.1)	1.0
Cephalexin	506,245 (56.7)	90,105 (54.1)	1.0
Clindamycin	59,999 (6.7)	10,492 (6.3)	0.9
Doxycycline	181,386 (20.3)	30,305 (18.2)	0.9
Minocycline	74,960 (8.4)	19,507 (11.7)	1.4
Trimethoprim-sulfamethoxazole	43,241 (4.8)	11,180 (6.7)	1.4

IQR, Interquartile range.

*Shown are median (IQR) values of Mohs stage 1 and antibiotic claims. The breakdown of particular oral antibiotics is shown further, and all statistics are stratified by the top 5% of antibiotic prescribers. Ratios of statistics between stratifications (top 5%: all surgeons) are shown in the third column.

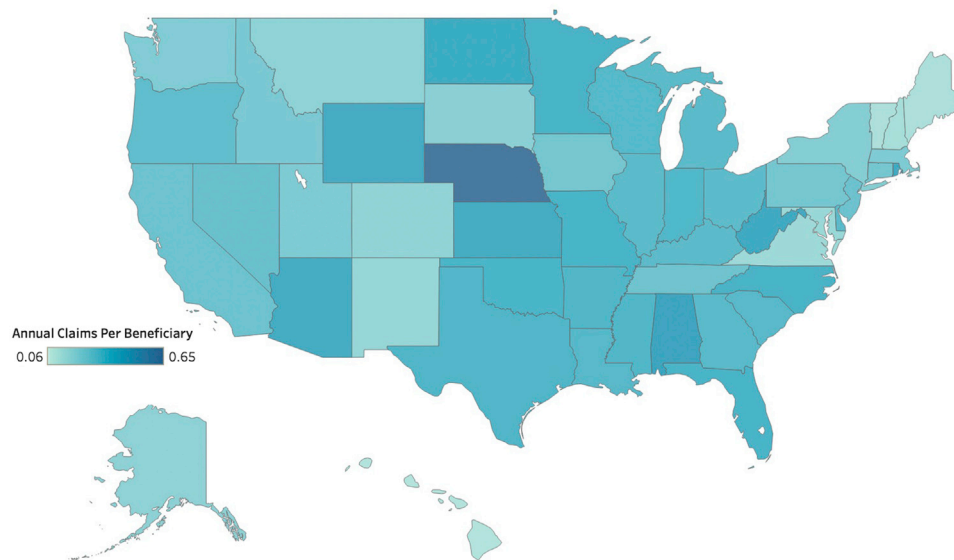## Mean Annual Antibiotic Claims Per Mohs Patient

Fig 1. Mean antibiotic claims per Mohs stage 1 claim. Shown is a geographic representation of mean annual antibiotic prescriptions per Mohs stage 1 procedure. States with greater frequency of antibiotic prescription are shaded in darker blue.

The states with the greatest number of mean annual antibiotic claims per Mohs stage 1 claim were Nebraska (0.65), Alabama (0.43), and Rhode Island (0.40), and the states with the fewest annual antibiotic claims per Mohs stage 1 claim were Hawaii (0.06), Vermont (0.11), and Maine (0.11). Overall, there was significant geospatial clustering of antibiotic prescribing (Moran's $I = 0.06$; $P < .001$, Fig 1).

These findings highlight substantial variation in antibiotic use among Mohs surgeons, with the top 5% of prescribers using antibiotics greater than 3 times more frequently than the national average. These results suggest that there is a subset of Mohs surgeons accounting for significant oral antibiotic prescribing volume in the Medicare population. Furthermore, there is substantial geographic variation in prescribing practices, with nearly 9-fold differences in prescribing between the highest- and lowest-use states. In addition, the median antibiotic duration of 10 days observed in our study is longer than what is recommended in the guidelines, suggesting that there may be opportunities to decrease the duration of antibiotics prescribed for postoperative prophylaxis.[6] Together, these results show that there are likely opportunities to optimize antibiotic use among Medicare beneficiaries undergoing Mohs surgery, including perhaps a quality metric incorporated into the Improving Wisely campaign. Although there is the potential for misclassification bias,

because antibiotic claims were not directly linked to surgical procedures in this data set, by selecting for high-volume Mohs surgeons, we attempted to reduce the potential for bias. In addition, prescribing patterns observed in our study were similar to those in other studies of prophylactic antibiotic prescriptions associated with Mohs surgery.[3] Further studies are needed to identify the value of antibiotic use associated with Mohs surgery to inform clinical practice and guideline development.

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Palm reading and water divining: A cross-sectional study of the accuracy of palmar hyperlinearity and transepidermal water loss to identify individuals with a filaggrin gene null mutation

To the Editor: Loss-of-function filaggrin (*FLG*) gene mutations are strongly associated with early-onset, severe, and persistent atopic dermatitis (AD) and impaired skin barrier function.[1] The impact of various environmental exposures[2,3] is greater in those with *FLG*-null mutations, and these mutations are likely to influence the effectiveness of primary and secondary prevention strategies for AD. Definitive genetic tests remain expensive. Although both trans-epidermal water loss (TEWL)[1] and palmar hyperlinearity (increased number of prominent palm lines)[4] have been associated with *FLG*-null mutation, the accuracy of these measures in identifying individuals with *FLG*-null mutations remains unclear.

Palmar line data, TEWL, and DNA were prospectively collected from probands and siblings during the 18-year follow-up of the Melbourne Atopy

Table I. Distribution of age, sex, degree of palmar lines, number of vertical and horizontal lines, and current AD and TEWL in a cohort of 311 probands and siblings from 157 families

Variable	*FLG* null mutation carrier (n = 38)	*FLG* wild type (n = 273)
Mean age, y (SD)*	19.7 (4.3)	18.2 (3.4)
Sex, % female (n)*	47.4 (18)	50 (136)
Palmar hyperlinearity, % (n)		
None	19.4 (7)	69.5 (189)
Mild	55.6 (20)	28.3 (77)
Moderate/severe	25.0 (9)	2.2 (6)
Palmar lines, mean (SD)		
Vertical	12.6 (5.1)	8.9 (7.71)
Horizontal	16.7 (9.8)	9.3 (8.9)
Current AD, % (n)†	44.4 (16)	23.3 (61)
Mean TEWL, g/m²/h, (SD)‡	7.2 (2.2)	6.5 (3.1)

AD, Atopic dermatitis; *SD*, standard deviation; *TEWL*, transepidermal water loss.
*Age and sex were missing for 1 participant.
†Data were missing on current AD for 13 participants; defined as either an episode of AD or medication for AD in the past 12 months.
‡TEWL data were missing for 8 participants.

Cohort Study[5] (all had family history of allergic disease) from late 2009. The 5 most common *FLG*-null mutations in white populations were genotyped by using the Taqman platform (Roche Molecular Systems, Inc, CA, USA). TEWL was measured on the flexor forearm with a Tewameter T300 (Courage & Khazaka, Cologne, Germany). Palmar hyperlinearity was defined by the prominence and quantity of lines on the thenar eminence and was classified as normal, mild, or moderate/severe (Supplemental Figure 1; available via Mendeley at https://data.mendeley.com/datasets/7cbkrbpv3v/1). Palm lines were counted by using a standardized protocol (Supplemental Figure 2; available via Mendeley at https://data.mendeley.com/datasets/7cbkrbpv3v/1). Associations were assessed with logistic regression, with generalized estimation equations to account for clustering by family. Sensitivity and specificity were calculated, and receiver operator curves were developed using Stata, version 15 (StataCorp, College Station, TX). Potential interactions and no-linearity were assessed (see supplemental materials via Mendeley at https://data.mendeley.com/datasets/7cbkrbpv3v/1).

FLG-null mutations were detected in 12.2% (38/311) of participants. The average age was 18.4 years, 25.8% reported current AD symptoms (Table I), and 36.4% had evidence of hyperlinearity (Table II). Hyperlinearity was associated with increased