



Comparing Dermatology Referral Patterns and Diagnostic Accuracy Between Non-Physician Providers, Physician Trainees, and Attending Physicians

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Scholarly Report submitted in partial fulfillment of the MD Degree at Harvard Medical School

Date: February 1st 2016

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Scholarly Report Title:

Comparing Dermatology Referral Patterns and Diagnostic Accuracy Between Non-Physician Providers, Physician Trainees, and Attending Physicians.

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Title: Comparing Dermatology Referral Patterns and Diagnostic Accuracy Between Non-Physician Providers, Physician Trainees, and Attending Physicians.

Authors: Gordon H Bae, Rebecca I. Hartman, Cara Joyce, Arash Mostaghimi

Purpose: With an increasing shortage of physicians in the US, non-physician providers (physician assistants and nurse practitioners) are increasingly serving as primary care providers. We examined the diagnostic accuracy of dermatological conditions by NPPs in contrast to attending physicians (AP) and resident physicians (RPs) using evaluation by board-certified dermatologists.

Methods: We analyzed adult patients referred by PCPs at Brigham and Women's Hospital (BWH) for dermatology consultation at BWH between 01/01/2014 and 03/01/2015. Provider type, patient demographics, and referral reasons were extracted from a referral database. The referral diagnosis was compared to the dermatology diagnosis. Diagnoses were grouped into five major categories: common non-malignant conditions, cancer or suspected cancer, inflammatory, lesion not otherwise specified (NOS), and other.

Results: A total of 7,023 patients were referred; 5,448 (77.6%) patients ultimately scheduled an appointment. Of these, all patients referred by NPPs (316) and RPs (214) were analyzed. Of the remaining 4958 patients, 1,008 were randomly selected. The patient populations of the three provider groups differed. NPPs saw more females (71.2%) compared to APs and RPs (57.7% and 63.1%, $p<0.001$). RPs saw fewer white patients (34.1%) than APs and NPPs (61.1% and 52.8%, $p<0.001$).

Diagnostic accuracy was highest for APs diagnosing common non-malignant conditions (90.8%) compared to RPs and NPPs (78.9% and 76.0%; $p=0.002$). APs and RPs demonstrated better accuracy in diagnosing cancer or suspected cancer compared to NPPs, although this finding was not statistically significant (37.3% and 39.1% vs. 23.3%, $p=0.511$).

Conclusions:

Our data suggests that NPPs in primary care are less accurate in diagnosing common dermatologic conditions and may be less accurate in diagnosing skin cancer (23.3%) compared to attending physicians (39.1%). As dermatologists have diagnostic accuracy rates of 60-80% for melanomas and sensitivity and specificity of 56-90% and 75-90% for non-melanoma skin cancers, there may be room for improvement in the diagnosis of cutaneous malignancies.

Description of your contribution to the work:

Design: Gordon Bae: Creation of list of all possible dermatologic diagnosis. Randomization of patients to be selected for the study. **Gordon Bae and Rebecca Hartman:** Trial and development of referral diagnosis extraction from the electronic database. **Arash Mostaghimi:** Obtained electronic database of all dermatologic referrals to BWH. Writing of the IRB and submission for approval of the study. **Cara Joyce:** Determination of statistical methods to be used for analysis.

Execution: Gordon Bae: Chart review of 1500 patients and extraction of referral diagnosis and the dermatologist diagnosis of patient condition. **Rebecca Hartman:** Chart review of 100 patients and extraction of referral diagnosis and the dermatologist diagnosis of patient condition. **Gordon Bae and Rebecca Hartman:** Standardization of extraction of referral and dermatologist diagnosis of patient condition. **Arash Mostaghimi:** Review of referral and final diagnosis of patients. Extraction of demographic data from electronic database.

Analysis: Gordon Bae and Rebecca Hartman: Grouping of diagnosis into 5 major subgroups (common and non-malignant conditions, cancer or suspected cancer, inflammatory, lesion not otherwise specified, other) **Cara Joyce:** Statistical analysis of the data gathered.

Writing: Gordon Bae: Drafting of the initial manuscript. Performing revisions on editor's and reviewer's comments from the Journal of American Academy of Dermatology. **Rebecca Hartman and Arash Mostaghimi:** Reviewing and editing of the initial manuscript. Reviewing and editing the revision of the manuscript. **Cara Joyce:** Creation of summary tables and review of statistical portion of the manuscript.

Comparing dermatology referral patterns and diagnostic accuracy between non-physician providers, physician trainees, and attending physicians.

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To the Editor:

Non-physician providers (NPPs), including physician assistants and nurse practitioners, are increasingly serving as primary care providers (PCPs). Although skin disease is frequently encountered by PCPs, they exhibit low diagnostic concordance with dermatologists.^{1,2} We examined the dermatologic diagnostic accuracy of PCPs, comparing NPPs to attending physicians (AP) and resident physicians (RPs), with board-certified dermatologists as the referent gold standard.

Methods:

This retrospective, cross-sectional study analyzed adult patients referred by PCPs at Brigham and Women's Hospital (BWH) to BWH dermatology between 01/01/2014 and 03/01/2015. Provider type, patient demographics, and referral reasons were extracted from a referral database. The referral diagnosis was compared to the dermatology diagnosis. Diagnoses were grouped into five major categories: common non-malignant conditions, cancer or suspected cancer, inflammatory, lesion not otherwise specified (NOS), and other.

Results:

Of the 7,023 patients referred, 5,448 (77.6%) patients scheduled an appointment. Of these, all patients referred by NPPs (316) and RPs (214) were analyzed. Of the remaining 4,958 patients, 1,008 were randomly selected. The patient populations of the three provider groups differed. NPPs saw more females (71.2%) compared to APs and RPs (57.7% and 63.1%, $p < 0.001$, **Table 1**). RPs saw fewer white patients (34.1%) than APs and NPPs (61.1% and 52.8%, $p < 0.001$, **Table 1**).

Diagnostic accuracy was highest for APs diagnosing common non-malignant conditions (90.8%) compared to RPs and NPPs (78.9% and 76.0%; $p=0.002$, **Table 2**). APs and RPs demonstrated better accuracy in diagnosing cancer or suspected cancer compared to NPPs, although this finding was not statistically significant (37.3% and 39.1% vs. 23.3%, $p=0.511$).

Discussion:

Research has shown that NPPs can perform similarly in a primary care setting to APs with respect to referrals, patient satisfaction, and productivity.³ The substitution of NPPs for physicians in primary care has therefore been proposed to reduce costs while maintaining quality. Our data suggests that NPPs are less accurate in diagnosing common dermatologic conditions and may be less accurate in diagnosing skin cancer (23.3%) versus APs (39.1%). In comparison, dermatologists have diagnostic accuracy rates of 60-80% for melanoma and sensitivities and specificities of 56-90% and 75-90%, respectively, for non-melanoma skin cancers.^{4,5}

Since one-third of primary care visits address a dermatologic concern, even small differences in diagnostic accuracy may result in significant misdiagnoses and adversely impact patient care. Furthermore, because 1.8% of all patients seen in primary care visits are referred to dermatology, better diagnostic accuracy may improve patient triage, resulting in enhanced access for patients in need.⁶

Our findings must be interpreted in the context of the study design. This is a single center retrospective study in a tertiary academic center, reflecting limited patient and provider populations. Additionally, the demographics of patient populations differed between provider groups.

Improving the quality of dermatologic care among PCPs may improve access and reduce unnecessary referrals. Research has shown that brief interventions can significantly improve the diagnosis of skin cancers by physician trainees.⁷ Similarly, non-physician providers have shown to rapidly improve their quality of care with targeted training.⁸ Future studies should evaluate whether similar interventions for PCPs, in particular NPPs, can improve diagnostic accuracy rates of dermatologic diseases, especially skin cancer.

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Table 1: Sample characteristics among the three primary care provider groups

	Overall	Non-Physician Providers	Attending Physicians	Resident Physicians	p-value*
	1538 (100.0)	316 (20.5)	1008 (65.5)	214 (13.9)	
Age, mean (SD)	48.3 (16.6)	43.9 (16.2)	49.3 (16.2)	49.8 (17.9)	<0.001
Gender					
Female	942 (61.2)	225 (71.2)	582 (57.7)	135 (63.1)	<0.001
Male	596 (38.8)	91 (28.8)	426 (42.3)	79 (36.9)	
Race					
White	856 (55.7)	167 (52.8)	616 (61.1)	73 (34.1)	<0.001
Hispanic	298 (19.4)	74 (23.4)	165 (16.4)	59 (27.6)	
Black	219 (14.2)	36 (14.2)	121 (12.0)	62 (29.0)	
Asian	65 (4.2)	13 (4.1)	44 (4.4)	8 (3.7)	
Other	35 (2.3)	11 (3.5)	17 (1.7)	7 (3.3)	
Unknown	65 (4.2)	15 (4.7)	45 (4.5)	5 (2.3)	
Final Diagnosis					
Non-malignant	794 (51.6)	149 (47.2)	547 (54.3)	98 (45.8)	<0.001
Cancer	230 (15.0)	32 (10.1)	170 (16.9)	28 (13.1)	
Inflammatory	292 (19.0)	75 (23.8)	173 (17.2)	44 (20.6)	
Lesion NOS	10 (0.7)	2 (0.6)	7 (0.7)	1 (0.4)	
Other/Unspecified	212 (13.8)	58 (18.4)	111 (11.0)	43 (20.1)	

*ANOVA was used to determine the p-value for age. Chi-square tests were used to determine the p-values for gender, race, and final diagnosis.

Table 2: Accuracy in dermatologic diagnosis among the three primary care provider groups Non-Physician Providers

	Non-Physician Providers		Attending Physicians		Resident Physicians		
Referral category	n	% correct	n	% correct	n	% correct	Adjusted p-value*
Common non-malignant conditions	96	76.0	273	90.8	76	78.9	0.002
Cancer or suspected cancer	60	23.3	284	37.3	46	39.1	0.511
Inflammatory	90	68.9	205	71.2	53	71.7	1.000
Lesion NOS	46	0.0	175	2.3	15	6.7	1.000
Other	24	54.2	71	60.6	24	75.0	1.000
	Non-Physician Providers		Attending and Resident Physicians				
Referral category	n	% correct	n	% correct			Adjusted p-value*

Common non-malignant conditions	96	76.0	349	88.3	0.013
Cancer or suspected cancer	60	23.3	330	37.6	0.169
Inflammatory	90	68.9	258	71.3	1.000
Lesion NOS	46	0.0	190	2.6	1.000
Other	24	54.2	95	64.2	1.000

*All p-values were derived by using a Fisher's exact test with a Bonferroni adjustment.

Supplemental Table 1: Grouping of dermatologic diagnosis into subgroups

Category	Subcategory	Specific Diagnosis
Common non-malignant conditions	Benign cutaneous proliferation	Benign lesion
		Cherry angioma/other benign vascular lesion
		Dermatofibroma
		Keloid
		Seborrheic keratosis
		Skin tag
		Benign nevus
	Acne/rosacea	Acne
		Rosacea
	Alopecia	
	Viral wart	
	Tinea and other fungal infections	
	Cyst	
	Bacterial infection	Cellulitis/abscess
		Folliculitis/boils
Cancer	Actinic keratosis	
	Melanoma/suspected melanoma	
	NMSC/suspected NMSC	
Inflammatory	Rash	
	Pigmentation	Hyperpigmentation
		Hypopigmentation
		Melasma
		Vitiligo
	Allergies	Allergic reaction
		Atopy (atopic eczema, allergic rhinitis, allergic asthma)
		Contact dermatitis
	Psoriasis	
Lesion NOS	Lesion NOS	
Other	Chilblains	
	Dermatomyositis	
	Granuloma annulare	
	Hidradentis suppurativa	
	Hyperhidrosis	
	Ingrown toenail	
	Lichen sclerosus	
	Lipoma	
	Lupus	
	Photodermatosis	
	Pityriasis rosea	
	Pruritus	

	Pyogenic granuloma
	Raynaud's phenomenon
	Scabies
	Seborrheic dermatitis
	Self-induced scars
	Stasis dermatitis
	Non-healing wound or ulcer
	Xerosis
	Varicose veins
	Other
	Arthropod assault
	Lentigo
	Lichen simplex chronicus
	Normal skin