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Patient Sex and Physician Adherence to Treatment Guidelines for Non-Purulent Cellulitis

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Patient Sex and Physician Adherence to Treatment Guidelines for Non-Purulent Cellulitis

A Thesis Presented

by

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ABSTRACT

PATIENT SEX AND PHYSICIAN ADHERENCE TO TREATMENT GUIDELINES FOR NON-PURULENT CELLULITIS

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In 2015, participating US Emergency Departments (EDs) reported approximately 2.8 million visits related to skin and soft tissue infections (SSTIs). Studies indicate that there may be disparities by patient sex in physician treatment guideline adherence rates as a result of a gender bias during physician-patient interactions; however, only two epidemiologic studies have investigated the role of patient sex in guideline adherence rates for SSTIs. These prior studies were limited in size and covariate assessment. Thus, the magnitude and direction of the effect of patient sex is uncertain, warranting further research. Therefore, we conducted a large prospective study to elucidate the role that patient sex plays in guideline adherence rates among physicians for non-purulent cellulitis at two UMass Memorial Health Care Group EDs in 2017. Data on treatment and sex was abstracted from electronic medical records. Compliance with treatment guidelines was based on 2014 Infectious Disease Society of America (IDSA) guidelines. Adjusted multinomial regressions indicated that female patient sex was associated with lower prevalence of overtreatment (POR=0.72, 95%CI: 0.57-0.92). In contrast, female physician sex was significantly associated with higher prevalence of overtreatment (POR=1.48, 95%CI: 1.16-1.87), but did not affect the relationship of patient sex with

overtreatment (P-interaction=0.80). Awareness of differential treatment by patient sex may improve physician adherence to guidelines. This study contributes to a growing body of literature elucidating the role of sex in medical decision making and is the first to account for both patient and physician sex as well as relevant covariates in studies regarding cellulitis treatment.

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CHAPTER I

INTRODUCTION

Non-purulent cellulitis is a common type of skin and soft tissue infection (SSTI) that is characterized by redness, warmth, and tenderness.[1] In 2015, the National Hospital Ambulatory Medical Care Survey, including data from 267 United States (US) Emergency Departments (EDs), reported approximately 2.8 million visits related to cellulitis and abscess.[2] Among females ages 15-64, 1.007 million visits to the ED were made for cellulitis and abscess as compared to 1.049 million visits among males.[3] Studies have indicated that treatment adherence rates for SSTIs are about 40%.[4,5]

Cellulitis can resolve quickly if treated with antibiotics early, but if left untreated, treated late, or treated with the incorrect antibiotics, the infection can spread and in rare cases become fatal.[3] Inappropriate treatment, or treatment that does not adhere to guidelines, can lead to the overuse of antibiotics and the development of bacterial resistance.[4] Overuse of stronger antibiotics can result in antibiotic resistance or negative side effects, while prescription of antibiotics that are too weak may not treat the infection.[6] The treatment course for cellulitis is determined by the Infectious Disease Society of America (IDSA)[6] which denotes guidelines that rank infections as mild, moderate, and severe, with corresponding treatment protocols. These criteria use objective signs and symptoms such as systemic signs of infection, evidence of MRSA, IVDU, history of infection, or treatment for malignancy to make treatment decisions.[6] The protocols emphasize the importance of timely assessment and antibiotic administration.[6]

The risk factors for physicians failing to adhere to treatment guidelines include

patient age[4]; a lack of awareness of specific guideline-recommendations[7]; tension between adhering to guidelines and the desire to individualize patient care[7]; physician skepticism of certain guideline- recommendations[7]; patient comorbidities[5]; need for antibiotic administration[4,5]; purulence (which requires alternative treatment protocols)[5,6]; and sex.[4,5] Sex and race are known risk factors for treatment disparities for other diseases, such as acute coronary syndromes[8] or Non-Hodgkin's Lymphoma.[9] Therefore, we evaluated the relationship between patient sex and physician guideline adherence for cellulitis. Physician sex can contribute to differences in physician-patient interactions through a gender bias during doctor-patient interactions.[10,11] Three psychological mechanisms have been proposed to explain this bias: 1) gender stereotypes, 2) gender concordant or discordant pairings, and 3) approachability.[10] Physicians may apply their own biases regarding certain patient sexes to treatment protocols, which could impact guideline adherence, despite objective measures of the infection. In addition, patients who feel less comfortable with their physician may provide less information (e.g. medical history) during visits. These poor interactions could translate to worse care and thus a lack of guideline adherence among physicians.

Eight studies in the United States from the past five years have evaluated the association between patient sex and treatment guideline adherence among physicians for a variety of diseases[4,5,12-16] or antibiotic administration,[17] a core tenet of infection treatment guidelines.[6] Only two studies evaluated treatment guideline adherence for skin and soft tissue infections, including cellulitis.[4,5] Most of these studies, regardless of exposure and disease, demonstrate a significant difference in guideline adherence depending on patient sex.[4,5,13,15-17] Two prior studies published in recent years examined

the specific relationship between patient sex and guideline adherence for non-purulent cellulitis,[4,5] but these were limited in sample size, included purulent cases, and did not adjust for covariates.

This study will adjust for known risk factors, such as age, and other potential confounders including race, comorbidities, and IVDU in the analysis. There is conflicting information regarding the direction of the SSTI treatment disparity between male and female patient.[4,5] Despite this discrepancy, the overall literature indicates a negative association between female patient sex and physician guideline adherence. This study will be significant because it will contribute to a growing body of literature elucidating the role of sex in medical decision making, and it will be the first, to our knowledge, to evaluate this association with a large sample size and multivariable adjustment in relation to non-purulent cellulitis treatment.

CHAPTER II

METHODS

A. Study Design

This study includes data from a parent study aimed at determining the effectiveness of a treatment algorithm intervention based on IDSA guidelines in improving physician adherence to guidelines. Physicians were provided educational materials and personalized data regarding prior adherence rates with the goal of improving physician adherence rates over time. The intervention was implemented in June 2017, so visits prior to this date were considered pre-intervention and those after were considered post-intervention. Data for both studies included records of patients that presented to two EDs belonging to the UMass Memorial Health Care Group (UMMHC) between January 1 and December 31, 2017. One of the selected EDs is an urban tertiary care teaching hospital and the other is a community site, both serving a diverse population in Worcester, MA. Eligible individuals consisted of those over 18 years old who were diagnosed with non-purulent cellulitis in the ED during the 2017 calendar year. Subjects were ascertained by searching for cellulitis diagnoses among all electronic medical records (EMRs). Exclusion criteria consisted of: 1) incision and drainage with expression of purulent material, 2) incomplete medical record or 3) a repeat visit within four weeks for treatment of the same SSTI. Individuals could be included multiple times for different SSTIs. A total of 1,360 individuals met the criteria for enrollment. Guideline adherence of prescribed treatment to standard guidelines was defined as compliance with treatment guidelines published by the 2014 Infectious Disease Society of America (IDSA).[6]

B. Exposure Assessment

EMRs provided information on participant sex. Sex is a dichotomous variable defined as either male or female. Sex was defined by patients while filling out demographic surveys for the hospital and was confirmed during ED visits by nurses.

C. Outcome Assessment

EMRs were also consulted for description of infection and treatment course. Guideline adherence was assessed using diagnostic criteria defined by the 2014 Infectious Disease Society of America.[6] To determine if treatment outcome was correctly assigned, two physicians assigned scores and compared them for agreement. If there was a discrepancy, a third physician was consulted to make an evaluation. Following the IDSA guidelines, patients were assigned a severity score for their non-purulent SSTI infection at the following levels: mild, moderate, or severe.[6] These protocols involve different classes of antibiotics depending on the severity.[6] Based on this classification, an anticipated treatment course was determined using corresponding treatment protocols from the IDSA for mild, moderate, and severe cases.[6] The observed antibiotic course was similarly classified using these same levels. Finally, the anticipated and observed antibiotic courses were compared. A three-level outcome variable was created as follows: those with higher anticipated than observed antibiotic courses were considered undertreated; those with lower anticipated than observed were considered overtreated; and those with scores that matched were considered adherent. A two-level outcome classification was also assigned to reflect whether treatment was adherent to guidelines or not adherent (including undertreated and overtreated). Though variables collected from

EMRs regarding inpatient or ED care, such as treatment course, are more complex than those from outpatient care, and are more susceptible to inaccuracies,[18] this multiple-physician review system of EMRs was conducted to maximize the validity of this assessment.

D. Covariate Assessment

Covariates were selected *a priori* due to demonstrated relationships in the literature. Data for these covariates were gathered from EMRs. These include age,[4] IVDU,[5] race,[8] and Charlson Comorbidity Index (CCI), a scale that predicts mortality given medical history.[4] Medical history was captured from the EMR by trained research assistants and used to calculate CCI. CCI Score was converted into a categorical variable (Mild: ≤2, Moderate: 3-4, Severe: 5+) as established by the Index literature.[19] Physician sex was also taken from the EMR using the name of the prescribing physician. If no prescribing physician was included in the EMR, the attending physician was used to classify physician sex.

E. Statistical Analysis

Bivariate analyses cross-tabulated both sex and covariates with treatment adherence level. Covariates include age category, CCI Score, race/ethnicity, history of IVDU, and physician sex. All covariates are categorical variables, and therefore were analyzed using chi-square tests, or Fisher's exact test, given small sample sizes, with p-values reported. Two-sided p-values ≤ 0.05 were considered statistically significant.

The association between sex and both the two-level and three-level treatment guideline adherence outcomes were modeled using binomial and multinomial logistic regression with odds ratios and 95% CI's reported. Covariates selected *a priori* were considered for inclusion in multivariable models. Any covariate that was significantly associated with the outcome at the 0.10 level was retained; similarly, if inclusion of a covariate resulted in a change of at least 15% to the coefficient estimate for the primary exposure (i.e., patient sex or physician sex), it was retained in the model.

The association of prescribing physician sex with guideline adherence was also investigated in a series of analyses. The association between physician sex and the three-level outcome was assessed using a multinomial model and adjusted for covariates, as previously described. In order to evaluate both patient sex and physician sex with regard to guideline adherence, both physician and patient sex were then included in one model adjusting for each other. Admittance and IV drug administration were also analyzed as representations of more aggressive treatment methods that may have been differential by sex. To account for differences in adherence as a result of an intervention related to a different study outcome, the adjusted multinomial analyses of both physician and patient sex were stratified by intervention status. Finally, in order to evaluate physician sex as a modifier of the association of patient sex with physician guideline adherence, a multiplicative interaction term was included in models as physician sex*patient sex, and tested for statistical significance. Similarly, modification of associations of both patient sex and physician sex with outcomes by the trial intervention were considered; these were evaluated by inclusion of multiplicative interaction terms, patient sex*intervention status and physician sex*intervention status, and tested for statistical significance.

CHAPTER III

RESULTS

A. Study Population Characteristics

The original study population consisted of 1,524 patients diagnosed with a non-purulent SSTI at one of the two ED sites (Table 1). Of this group, 36 were removed due to a documented incision and drainage for an abscess and 128 were repeat visits. The final study sample included 1,360 patients (Table 1). Minimal data was captured to characterize physicians.

The patient population was 53.9% male with an average age of 50.82 (standard deviation (SD) = 18.16) (Table 2). The majority of patients was White (75.6%) and seen at the University campus (54.3%). Individuals were most likely to be discharged after treatment (69.3%), with fewer admitted (28.5%) or sent to the Clinical Decision Unit (CDU) (2.2%). Fevers occurred in 17% of patients, and the majority of patients had a mild CCI Score (Table 2).

B. Patient Sex and Physician Adherence

Bivariate analysis of patient sex and treatment adherence type demonstrated a significant association (p=0.01). The largest percentage of males were overtreated (45.43%) while the largest percentage of females were appropriately treated (51.04%). An analysis of two-level treatment adherence demonstrated that female patient sex is associated with lower odds of physicians failing to adhere to guidelines after adjusting for CCI Score, race, and IVDU (POR = 0.75, 95%CI: 0.61-0.94) (Table 3). Other treatment outcomes such as disposition or IV antibiotic administration were not significantly

associated with sex (data not shown). Given these results, the three-level outcome and multinomial regression were used to differentiate between those over- and undertreated. Chi square analysis of the three-level outcome indicated that patient sex was a significant predictor of treatment adherence (p=0.01) (Table 4). In the multinomial regression adjusted for age over 65, CCI Score, race and IVDU, the protective effect was slightly attenuated though still significant among overtreated female patients (POR=0.72. 95%CI: 0.57-0.91), but not statistically significant among undertreated (POR=0.89, 95%CI: 0.61-1.29) (Table 4). Among male patients, 45% were overtreated, which is 7% higher than the percent of women who were overtreated.

C. Patient Sex and Physician Adherence, Stratified by Intervention Status

An adjusted multinomial model of patient sex and treatment adherence was also stratified by intervention status in order to compare the association between the two time periods (Table 5). Comparing physician treatment adherence in female patients to that in male patients, similar results were observed regarding overtreatment for pre- (POR=0.77, 95%CI: 0.55-1.08) and post-intervention (POR=0.67, 95%CI: 0.48-0.93). Point estimates for undertreatment varied between pre- and post-intervention, but results from adjusted models were not statistically significant for pre- (POR=1.09, 95%CI: 0.61-1.94) or post-intervention (POR=0.78, 95%CI: 0.48-1.29), and the test for interaction was non-significant (P-interaction=0.5), supporting no significant difference in the relationship between pre- and post-intervention periods.

D. Physician Sex and Physician Adherence, Stratified by Intervention

To explore alternative explanations for these observations, additional sensitivity analyses were conducted. We first investigated the role that physician sex may have played as a confounder or effect modifier of the association between patient sex and physician adherence. We then explored whether the relationships observed for both patient sex and physician sex were modified by the parent study intervention. In a multinomial model adjusted for categorical age, CCI Score, race, and IVDU, female physician sex was significantly associated with higher prevalence of overtreatment (POR=1.48, 95%CI: 1.16-1.88), but not with undertreatment (Table 4). Analysis stratified on intervention status was conducted to evaluate the association of physician sex with adherence separately pre- and post-intervention. In this analysis, higher odds of overtreatment were observed in both the pre-intervention period (POR=1.79, 95%CI: 1.26-2.55) and post-intervention period (POR=1.28, 95%CI: 0.91-1.79); based on a test of interaction, these estimates were not statistically significantly different (P-interaction=0.4) (Table 5). Comparison of estimates from the pre- and post-intervention periods suggest that implementation of the intervention reduced female physician overtreatment so that physician sex was not a significant predictor of guideline adherence in the post-intervention group (p=0.34).

E. Patient Sex and Physician Sex Interaction

Further analyses to test the role of physician sex were conducted in a model that included both patient sex and physician sex. To address the possibility that adherence might vary by combinations of physician and patient sex (e.g., concordant vs. discordant

pairings), models including an interaction term were evaluated. There was no significant interaction between physician sex and patient sex (P-interaction=0.80), suggesting that associations of patient sex with treatment adherence were similar regardless of physician sex (Figure 1). A multinomial model (adjusted for age category, CCI Score, race and IVDU) that includes physician sex without the interaction term indicated that female patient sex was significantly protective against overtreatment (POR=0.72, 95%CI: 0.57-0.92), and female physician sex increased the odds of overtreatment (POR=1.47, 95%CI: 1.16-1.87) (Table 4).

CHAPTER IV

DISCUSSION

In this study, we observed that treatment guideline adherence varied by patient sex and physician sex. Analysis of the two-level adherence outcome demonstrated that female patients were more likely to be treated according to guidelines, which is consistent in direction with literature concerning SSTI treatment. One prior study by Ezebuenyi et al. reported that the odds of males being treated according to guidelines as compared to females was 0.495, or 50.5% reduced odds.[5] The stronger association seen in this prior study could be attributed to the relatively small sample size, which also included many purulent cases.[5] In fact, half of the sample size in the study consisted of purulent infections, which is independently related to both male sex and physician failure to adhere to treatment guidelines.[4,5] Of note, the direction of association demonstrated in both our study and the prior by Ezebuenyi et al. is opposite to results shown in literature for other health issues.[13,15,16,17] The cause of this disparity is unclear.

The three-level analysis demonstrated that female patient sex was protective against overtreatment for cellulitis compared to male patient sex. This result also indicates that males received more aggressive treatments compared to females. Steps taken to adjust for possible confounders and effect modifiers did little to change these findings. This result is consistent with prior literature in this setting, although our findings did not replicate prior findings of increased risk of undertreatment.[4]

Physician sex is also known to contribute to differences in physician-patient interactions,[10,11] which could impact guideline adherence. The findings of this study indicated that female physician sex was associated with decreased odds of adherence to

guidelines. The association between physician sex and adherence is understudied in literature; thus, there is little evidence to support or contradict this finding. Prior literature has indicated that improved physician-patient relationships are associated with female physicians due to more thorough conversations and amiable actions, which could manifest as improved treatment and guideline adherence.[10,11] Our analysis indicates that there was no interaction between patient and physician sex, although there is a lack of literature to compare this finding with regarding the role of interaction in adherence.

This research indicates that differential care by sex remains an issue in healthcare, though interventions aimed at improving care are effective. As seen in this analysis, the parent study intervention reduced rates of over- and undertreatment, and uptake of the intervention was not significantly different among physician or patient sexes. These findings are significant because they identify more specific disparities in treatment, with implications for targeted interventions.

This study is part of a larger one involving an intervention aimed at lowering rates of overtreatment, which contributed to the lowered measures of association seen among both physician and patient sex after stratification. Physicians, regardless of sex, may be much more conscious of overtreatment after the intervention, although changes in adherence after the intervention do not significantly differ by patient sex. In addition, stratifying the three-level outcome may have resulted in cell sizes that were too small to accurately represent adherence trends.

A few potential limitations that might impact inferences from the study are of note. There is the potential for non-differential misclassification of exposure due to the fact that although sex is patient reported, this sex may not be representative of the sex

used by the physician in medical decision making. This occurrence is unlikely, and the impact on our study would be minimal. Related to outcome, the original infection may have been misclassified due to the withholding of factors relevant to treatment by the patient or physician, which would not have been captured in the EMR, but this occurrence is unlikely given rigorous documentation processes required by the EMR. Therefore, the potential for any misclassification to alter measures of association is extremely small. There are few scenarios that would have permitted selection or information bias. Selection was not related to exposure or outcome and, although our evaluation is subject to the contents of the EMR, for reasons mentioned before, it is unlikely that patient sex resulted in differences in data collection or judgments regarding guideline adherence assignment. Despite a very short follow up time, there is also no concern for temporality, because sex could not have changed at any point during the very short duration between seeking and receipt of treatment. Confounders were widely assessed for this study, which supports prior history which did not account for any and provides information for future studies regarding relevant covariates.[4,5]

This study was conducted in a setting that is accessible to a diverse population and investigated a disease for which all individuals are at risk. It is unclear how generalizable the results of this study are because mechanisms through which a sex-based differential occurred were unobserved or were not measured in this study.[10,11] Because of lower risk associated with female patient sex, employment of gender stereotypes is unlikely. There was no significant interaction between patient and physician sex, thus effects of concordant or discordant pairing are also unlikely. Finally, we were unable to

evaluate mechanistic factors such as approachability because there was limited data on physician behavior in the charts.

Physicians within one hospital often have similar practices as a result of being affiliated with the same association. There may be clustering by hospital type or by physician. Further research should gather physician-related data and adjust for clustering effects. It should also gather a wider variety of physician-related factors or include a larger sample size to allow for further detection of mechanisms or use a different setting.

This research has implications for more tailored interventions aimed at reducing rates of treatment that does not adhere to guidelines by identifying which populations are affected by which adherence type. More widespread implementation of interventions aimed at reducing these disparities could increase guideline adherence and improve outcomes for patients. In some cases, guideline adherence may not directly correlate with improved care, especially when provisions of the guidelines conflict with each other and physicians must weigh multiple factors in making medical judgments. It is also possible that decisions made regarding the weighing of these factors is not indicated in the EMR, which would then not be visible to the researchers. Thus, care should be taken when equating adherence with beneficial care. This investigation also strengthens current literature that did not adjust for covariates by demonstrating that adjusting for covariates did not impact point estimates. Finally, these relationships warrant further research because no literature exists to our knowledge regarding the role of physician sex and cellulitis treatment or analysis of mechanisms directly impacting adherence for cellulitis treatment, thus there is limited prior knowledge to which we can compare these results.

Table 1. Number and Percent in Final Sample; Cellulitis Study, 2017.

	N	(%)
Original Study Sample	1524	--
Excluded	164	10.8
Incision & Drainage (Purulence)	36	2.4
Repeat Visit	128	8.4
Final Study Sample	1360	89.2

Table 2. Distribution of Covariates According to Physician Treatment Guideline Adherence; Cellulitis Study, 2017.

		Undertreated		Adherent		Overtreated		P-value
		N (%)		N(%)		N(%)		
Patient Sex	Male	84	11.46	316	43.11	333	45.43	0.01
N=1360	Female	68	10.85	320	51.04	239	38.12	
CCI								
N= 1360	Mild	131	11.05	578	48.74	477	40.22	0.0003
	Moderate	20	14.93	45	33.58	69	51.49	
	Severe	1	2.5	13	32.5	26	65	
Age								
N=1360	<65	137	13.06	508	48.43	404	38.51	<0.0001
	65+	15	4.82	128	41.16	168	54.02	
Age, Continuous		42.86	15.7	48.69	18.54	55.29	17.2	<0.0001
N=1360								
Race/Ethnicity								
N= 1345	White	110	10.82	445	43.76	462	45.43	<0.0001
	Non-White	40	12.2	184	56.1	104	31.71	
History of IVDU								
N= 1360	No	98	8.09	598	49.38	515	42.53	<0.0001
	Yes	54	36.24	38	25.5	57	38.26	
Disposition								
N=1360	Discharge	145	15.38	565	59.92	233	24.71	<0.0001
	Admit	7	1.81	69	17.83	311	80.36	fisher: <0.0001
	CDU	0	0	2	6.67	28	93.33	
Fever								
N=1360	No	84	7.45	569	50.44	475	42.11	<0.0001
	Yes	68	29.31	67	28.88	97	41.81	
Location								
N=1360	University	77	10.43	319	43.22	342	46.34	0.0023
	Memorial	75	12.06	317	50.96	230	36.98	
Physician Sex								
N=1357	Male	97	11.66	413	49.64	322	38.7	0.0078
	Female	55	10.48	222	42.29	248	47.24	

Abbreviations: CCI - Charlson Comorbidity Index; CDU - Clinical Decision Unit; IVDU - Intravenous Drug Use

Table 3. Unadjusted and Adjusted Odds Ratios and 95% Confidence Intervals for Patient Sex and Physician Treatment Guideline Adherence (Two-Level Outcome); Cellulitis Study, 2017.

	Guideline Non-Adherence			
	Unadjusted		Adjusted *	
	OR	95% CI	OR	95% CI
Patient Sex				
Male	1.00	Referent	1.00	Referent
Female	0.73	0.59-0.90	0.75	0.61-0.94

*Adjusted for CCI Score, Race, IVDU

Abbreviations: CCI - Charlson Comorbidity Index; IVDU - Intravenous Drug Use

Table 4. Unadjusted and Adjusted Odds Ratios and 95% Confidence Intervals for Sex and Physician Treatment Guideline Adherence (Three-Level Outcome); Cellulitis Study, 2017.

	Guideline Non-Adherence				Guideline Non-Adherence*				Guideline Non-Adherence**			
	Undertreated		Overtreated		Undertreated		Overtreated		Undertreated		Overtreated	
	POR	95% CI	POR	95% CI	POR	95% CI	POR	95% CI	POR	95% CI	POR	95% CI
Patient Sex												
Male	1.00	Referent	1.00	Referent	1.00	Referent	1.00	Referent	1.00	Referent	1.00	Referent
Female	0.80	0.56-1.14	0.71	0.57-0.89	0.89	0.61-1.29	0.72	0.57-0.91	0.89	0.61-1.29	0.72	0.57-0.92
Physician Sex												
Male	1.00	Referent	1.00	Referent	1.00	Referent	1.00	Referent	1.00	Referent	1.00	Referent
Female	1.06	0.73-1.53	1.43	1.14-1.81	1.03	0.70-1.53	1.48	1.16-1.88	1.03	0.70-1.53	1.47	1.16-1.87
										p-interaction:	0.80	

*Adjusted for age category, CCI score, race, IVDU

**Including physican sex and other covariates from prior model

Abbreviations: CCI - Charlson Comorbidity Index; IVDU - Intravenous Drug Use

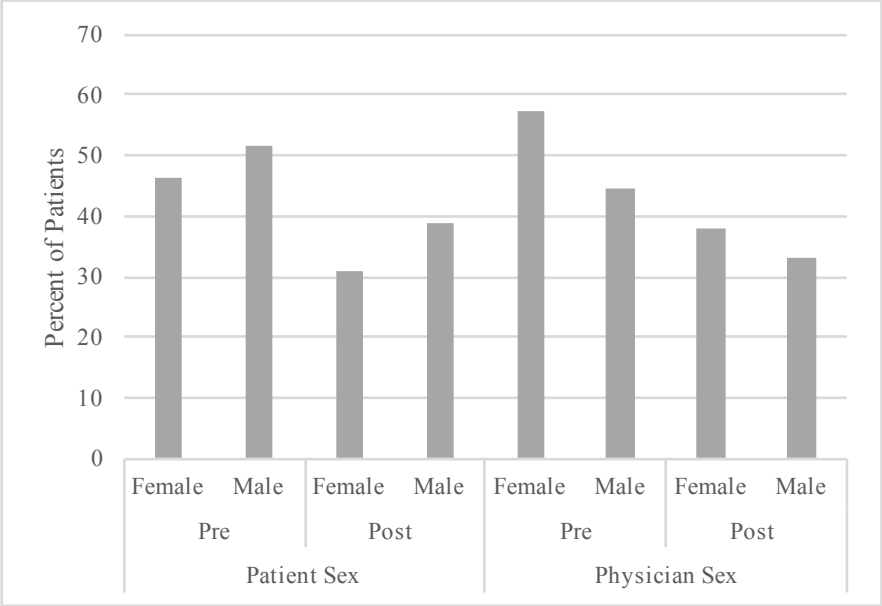
Table 5. Unadjusted and Adjusted Odds Ratios and 95% Confidence Intervals for Sex and Physician Treatment Guideline Adherence (Three-Level Outcome) Stratified by Intervention Status; Cellulitis Study, 2017.

		Guideline Non-Adherence				Guideline Non-Adherence*				
		Undertreated		Overtreated		Undertreated		Overtreated		
		POR	95% CI	POR	95% CI	POR	95% CI	POR	95% CI	p-value interaction
Physician Sex										
										0.4
Pre-Intervention	Female vs. Male	1.27	0.71-2.26	1.77	1.26-2.48	1.08	0.59-2.01	1.79	1.26-2.55	
Post-Intervention	Female vs. Male	0.93	0.57-1.49	1.24	0.89-1.72	1.00	0.60-1.67	1.28	0.91-1.79	
Patient Sex										
										0.54
Pre-Intervention	Female vs. Male	0.67	0.42-1.06	0.65	0.47-0.90	0.78	0.48-1.29	0.67	0.48-0.93	
Post-Intervention	Female vs. Male	1.02	0.59-1.78	0.82	0.59-1.13	1.09	0.61-1.94	0.77	0.55-1.08	

*Adjusted for age category, CCI score, race, IVDU

Abbreviations: CCI - Charlson Comorbidity Index; IVDU - Intravenous Drug Use

Figure 1. Percent of Patients Overtreated by Intervention Status; Cellulitis Study, 2017



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