

# Factors and Trends in the Antibiotic Management of Skin and Soft Tissue Infections

Michael Storandt, MSIV<sup>a</sup>, Christopher Walden, MSIV, Ph.D.<sup>a</sup>, Abe Sahnoun, Ph.D.<sup>a</sup>, and James Beal, Ph.D.<sup>a</sup>

<sup>a</sup>University of North Dakota School of Medicine & Health Sciences, Grand Forks ND



## Introduction

Community-acquired methicillin-resistant *Staphylococcus aureus* (CA-MRSA) has emerged as a common inciting pathogen of skin and soft tissue infection (SSTI) [1]. This emergence has posed a problem regarding appropriate prescription practices and an uncertainty as to what physicians should be utilizing to empirically treat SSTIs [2]. One study demonstrated that between 1997-2002 and 2003-2008, rates of antibiotic prescriptions targeting methicillin-sensitive *Staphylococcus aureus* (MSSA) for SSTIs decreased, while rates of antibiotics targeting MRSA increased [3]. An additional study correlated antibiotic prescription patterns in the treatment of abscesses and cellulitis to patient age, region of residence, and hospital department prescribing the antibiotic [4]

In recent years, there is a push within the medical community to have better stewardship of these antibiotics to limit resistant microbials [5,6]. Limiting use of these antibiotics has shown to decrease inappropriate antibiotic use without increasing harm to patients, but what remains unclear is whether the prescribing relationships previously studied have continued in recent years; or with the advent of stewardship programs across the nation, this paradigm has shifted [7].

## Methods

We conducted a retrospective analysis of visits for the diagnosis of SSTI utilizing the 2011-2016 National Ambulatory Medical Care Survey (NAMCS). Data analyzed included sex, age, race, insurance type, metropolitan statistical area status, type of infection, geographic region, provider training level, insurance type, and antibiotic used for treatment.

## Results

Characteristics	Percent of Total Visits	Prescribed at Least 1 Antibiotic (63.0% of patient encounters)	Not Prescribed an Antibiotic (37.0% of patient encounters)	P-value
<b>Sex</b>				0.266
Male	45.9%	44.4%	45.9%	
Female	54.1%	55.6%	51.6%	
<b>Age, mean±SE</b>				0.055
	53.9±0.7	52.7±0.8	55.1±1.0	
<b>Race</b>				0.121
White	83.2%	81.4%	86.3%	
Non-White	16.8%	18.6%	13.7%	
<b>Insurance</b>				0.992
Private	60.1%	60.1%	60.1%	
Other	39.9%	39.9%	39.9%	
<b>Region Where Visit Occurred</b>				0.95
Northeast	17.1%	16.6%	18.0%	
Midwest	19.1%	19.5%	18.5%	
South	38.6%	38.8%	38.2%	
West	25.2%	25.1%	25.3%	
<b>Metropolitan Statistical Area Status</b>				0.507
MSA	88.2%	88.7%	87.2%	
Non-MSA	11.8%	11.3%	12.8%	

Table 1: Characteristics of visits receiving antibiotic prescription by selected patient and visit characteristics from 2011-2016

Characteristics	Total Visits	Prescribed Only an MSSA Antibiotic	Prescribed at Least 1 MRSA Antibiotic	P-value
<b>Total</b>	-	40.4%	59.6%	0.045
<b>Sex</b>				0.803
Male	44.5%	45.2%	44.0%	
Female	55.5%	54.8%	56.0%	
<b>Age, mean±SE</b>				0.045
	52.4±0.8	53.8±1.2	50.9±0.9	
<b>Race</b>				0.548
White	80.9%	83.3%	79.3%	
Non-White	19.1%	16.7%	20.7%	
<b>Insurance</b>				0.684
Private	60.5%	59.0%	61.5%	
Other	39.5%	41.0%	38.5%	
<b>Region Where Visit Occurred</b>				0.013
Northeast	16.3%	15.7%	16.7%	
Midwest	18.7%	21.4%	16.9%	
South	40.2%	30.8%	46.5%	
West	24.8%	32.1%	19.9%	
<b>Metropolitan Statistical Area Status</b>				0.791
MSA	88.6%	89.1%	88.3%	
Non-MSA	11.4%	10.9%	11.7%	
<b># of Antibiotics Received, mean±SE</b>				<0.000
	1.4±0.02	1.1±0.2	1.7±0.0	

Table 3: Characteristics of visits receiving MSSA vs MRSA antibiotic for SSTI by patient and their visit characteristics from 2011-2016

	Total Prescriptions	Estimated Prescriptions	Percentage	95% Confidence Interval
<b>MSSA Antibiotics</b>				
Penicillins	117	2819886.8	6.5%	5.1-8.3
Cephalosporins	341	9310842.0	21.6%	18.2-25.4
<b>MRSA Antibiotics</b>				
Sulfonamides (Trimethoprim-Sulfamethoxazole)	264	7501547.1	17.4%	14.9-20.3
Tetracyclines	169	4581358.6	10.6%	8.6-13.0
Lincomycin derivatives (Clindamycin)	140	3256229.6	7.6%	5.8-9.8
Glycopeptides (Vancomycin)	18	614372.2	1.4%	0.8-2.7
Linezolid	6	120414.9	0.3%	0.1-1.0
Daptomycin	5	134651.2	0.3%	0.1-1.0
Glycylcyclines (Tigecycline)	1	6322.4	0.0%	0.0-0.1
<b>Others</b>				
Miscellaneous Abx	293	7236347.7	16.8%	14.5-19.3
Quinolone derivatives (Fluoroquinolones)	93	1842622.2	4.3%	3.0-6.1
Macrolides	25	381762.4	0.9%	0.5-1.6
Carbapenems	3	108729.8	0.3%	0.1-1.0
Urinary Anti-infectives	3	69432.4	0.2%	0.0-0.6
Aminoglycosides	1	20507.1	0.0%	0.0-0.3

Table 2: Frequency and percentage of antibiotic drugs at ambulatory care visits for SSTIs from 2011-2016

## Discussion

- Providers in the West prescribe antibiotics with MSSA coverage over MRSA coverage, similar to previous work from visits between 1993-2005 [8]. Providers in the Midwest also utilize MSSA coverage more frequently.
- Providers in the South had higher utilization of MRSA class drugs, consistent with a study of visits between 1997 and 2005 [4].
- Providers in the Northeast utilized roughly equivalent prescriptions between the two classes
  - Prior data had suggested providers in the Northeast were more likely to prescribe MRSA class antibiotics [8]
- Patient visits treated with antibiotics with MRSA coverage on average received a greater number of antibiotics per visit
  - May indicate providers are treating empirically then shifting to appropriate antibiotic classes derived from cultures or are stepping up coverage due to lack of response to initial therapy.
- Patients treated for SSTI with MSSA class antibiotics had a higher mean age
  - It is unclear if age is a risk factor for MRSA SSTI [9]

## Conclusions

- Providers more frequently utilize antibiotics with MRSA coverage for SSTIs.
- Antibiotic class chosen was correlated with region, with providers in the South more likely to utilize antibiotics with MRSA coverage.
- Visits receiving at least one antibiotic with MRSA coverage received more antibiotics on average
- Individuals receiving antibiotics with MSSA coverage alone were older than those receiving antibiotics with MRSA coverage.

## Future Directives

- Investigate regional practice differences and correlate regional fauna with these differences
- Define the temporal relationship in patient visits receiving multiple prescriptions for SSTI
- Determine if age is a risk factor for MRSA infection

## References

- Carleton HA, Diep BA, Charlebois ED, et al. Community-Adapted Methicillin-Resistant *Staphylococcus aureus* (MRSA): Population Dynamics of an Expanding Community Reservoir of MRSA. *J Infect Dis* 2004;190:1730-8.
- Khan A, Wilson B, Gould IM. Current and future treatment options for community-associated MRSA infection. *Expert Opin Pharmacother* 2018;19:457-70.
- Meddles-Torres C, Hu S, Jurgens C. Changes in prescriptive practices in skin and soft tissue infections associated with the increased occurrence of community acquired methicillin resistant *Staphylococcus aureus*. *J Infect Public Health* 2013;6:423-30.
- Hersh AL, Chambers HF, Maselli JH, et al. National trends in ambulatory visits and antibiotic prescribing for skin and soft-tissue infections. *Arch Intern Med* 2008;168:1585-91.
- Dobson EL, Klepser ME, Pogue JM, et al. Outpatient antibiotic stewardship: Interventions and opportunities. *J Am Pharm Assoc* 2017;57:464-73.
- Klepser ME, Dobson EL, Pogue JM, et al. A call to action for outpatient antibiotic stewardship. *J Am Pharm Assoc* 2017;57:457-63.
- Cole KA, Rivard KR, Dumkow LE. Antimicrobial Stewardship Interventions to Combat Antibiotic Resistance: an Update on Targeted Strategies. *Curr Infect Dis Rep* 2019;21:33.
- Wetzel M, Fleischer A. Factors Affecting the Rise of Treatment of Resistant Bacteria in Skin and Soft Tissue Infections in the United States: 1993-2012. *J Dermatolog Treat* 2017;28.
- Ibrahim F, Khan T, Pujalte G. Bacterial Skin Infections. *Prim Care* 2015;42.