



Implementing and Evaluating an Evidence-Based Intervention from the ICU Setting into Primary Care Using Promotoras to Reduce CA-MRSA Recurrence and Household Transmission

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ABSTRACT

BACKGROUND: Community-Associated Methicillin-Resistant *Staphylococcus aureus* (CA-MRSA) skin and soft tissue infections (SSTIs) recurrence ranges from 16% to 43% and presents significant challenges to clinicians, patients, and families. This comparative effectiveness research (CER) study aims to disseminate, implement and evaluate whether an existing intervention, consisting of decolonization and decontamination procedures, which has been determined to be effective in hospital intensive care unit (ICU) settings, can be implemented by Community Health Workers (CHWs) or "promotoras" conducting home visits prevent recurrence of CA-MRSA and transmission within their households for patients presenting to primary care with SSTIs.

INTRODUCTION

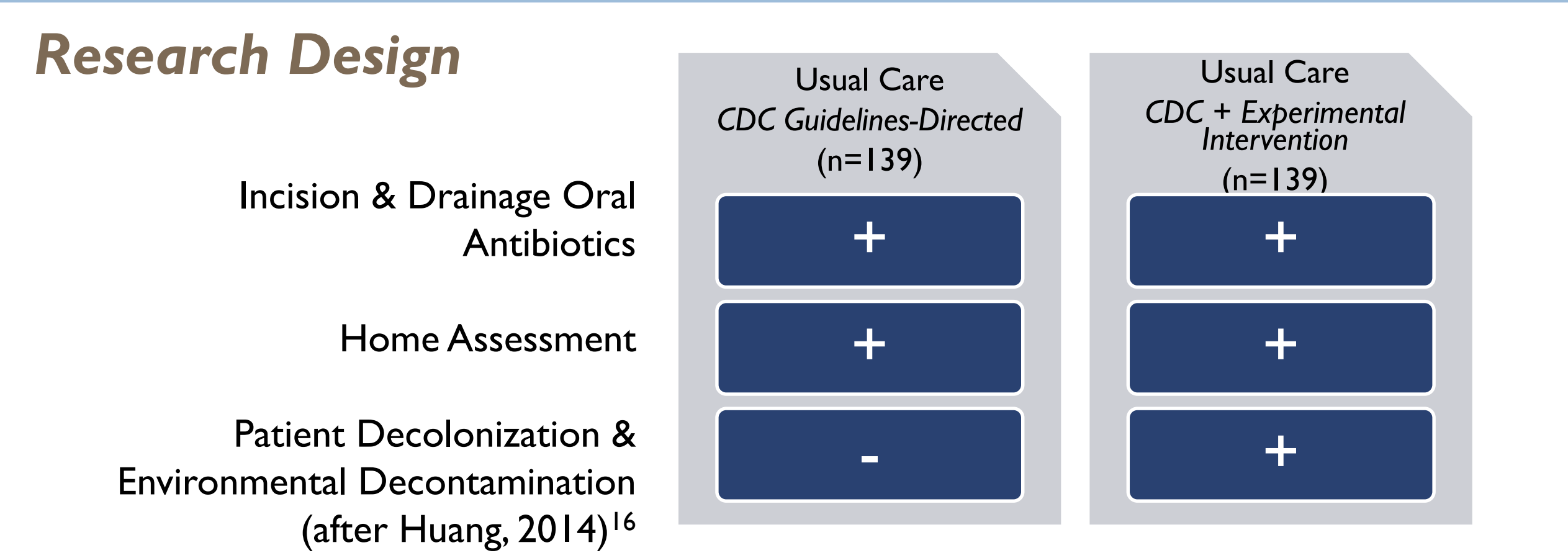
Our previous studies built a community-engaged research and learning collaborative among Community Health Centers (CHCs), Community Hospitals, The Rockefeller University Center for Clinical and Translational Science, Clinical Directors Network (CDN), a practice-based research network (PBRN), and PBRN partners. We developed infrastructure to conduct comparative effectiveness research (CER) and patient-centered outcomes research (PCOR) with embedded mechanistic studies of treatment, prevention, and molecular epidemiology. Our current focus is whether interventions routinely applied in the hospital intensive care unit (ICU) setting to prevent the transmission of MRSA can be successfully applied in the home environment, and whether molecular analyses can predict recurrence and strategies to prevent recurrence. This study will also explore the profile and impact of the microbiome of participants and their home environment on the treatment, transmission and recurrence of CA-MRSA skin and soft tissue infections.

The household has been established as an important persistent community reservoir for *S. aureus*.^{1,4} Family members of index cases may be asymptomatic carriers with identical or closely related strains^{4,6}, and MRSA colonization in the outpatient setting may recur due to the presence of concurrently colonized household members.⁷ Studies conducted in hospital ICU settings have identified effective strategies for decolonization/decontamination that reduce recurrence,⁸⁻¹³ but have not been tested in primary care settings such as FQHCs.^{14,15} This study aims to test the effectiveness of employing these techniques in the primary care setting.

Participating Sites	Clinician Stakeholders
Open Door Family Medical Center Mt. Kisco, NY	Daren Wu, MD Asaf Cohen, MD
Urban Health Plan Bronx, NY Corona, NY	Claude Parola, MD Tracie Urban, RN, BSN
Community HealthCare Network Bronx, NY Jamaica, NY	Satoko Kanahara, MD Getaw Worku Hassen, MD, PhD
Metropolitan Hospital New York, NY	Barry Kohn, MD, PhD Paula Clemmons, PA
Lutheran Medical Center Brooklyn, NY	Regina Hammock, DO Slava Gladstein, DO Jessica Padron, PA Glenn Donovan, DPM Mark Trezia, DPM Rosalee Nguyen, DO, MS

METHODS

Research Design



METHODS (cont.)

In collaboration with the Laboratory of Microbiology and Infectious Diseases (Alexander Tomasz, PhD) at The Rockefeller University and the Institute for Computational Biomedicine/PathoMap of Weill Cornell Medical College (Christopher Mason, PhD), we will collect and analyze samples at two timepoints (pre- and post-intervention) from (1) patients with wounds testing positive for MRSA/MSSA, (2) consenting household contacts, and (3) household environmental surfaces.

Surveillance Swabs

Collected from index patients (n=186), consenting household members, and home environment surfaces.

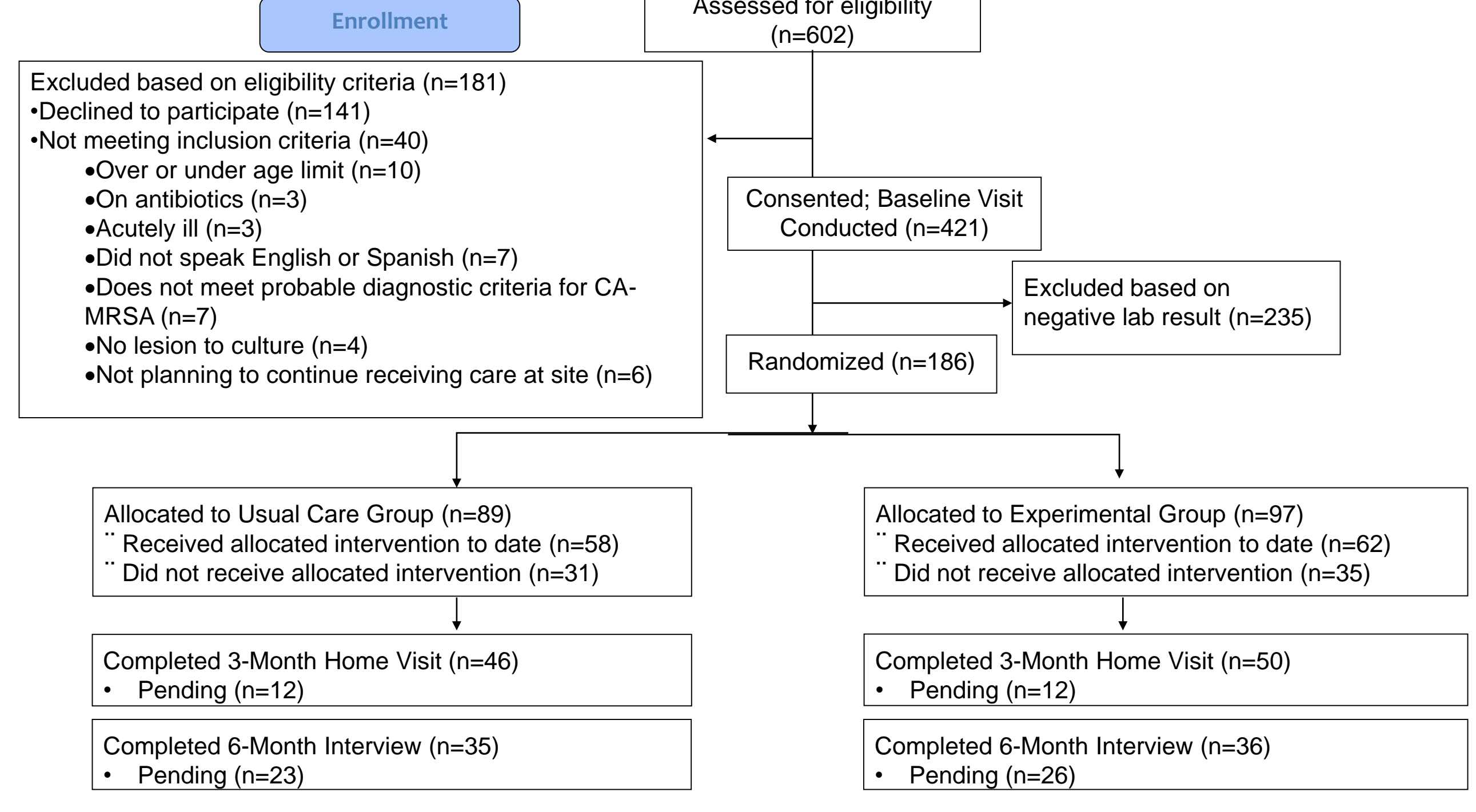
Index Patients and Household Members (n=3 per participant, Baseline and 3-Months)	Environment (n=13 per household, Baseline and 3-Months)
Axilla	Swab Category
Nares	Front doorknob
Groin	Kitchen floor
	TV remote
	Bathroom sink handle
	Telephone
	Hair brush
	Kitchen light switch
	Toilet seat
	Kitchen countertop
	Bedroom floor
	Refrigerator door handle
	Favorite child's toy (non-plush)
	Kitchen sink handle

Intervention: Decolonization and Decontamination

- Decolonization:**
 - Mupirocin ointment, Nasal application, twice per day
 - Chlorhexidine wash, Shower application, daily
- Household Environmental Decontamination:**
 - Household surface disinfection (Clorox wipes provided)
 - Participant education (hand-washing techniques, sharing of personal items)
 - Laundrying sheets and towels once per week

- Definitions:**
 - Infection:** MRSA+ or MSSA+ detected in the wound sample
 - Colonization:** MRSA+ or MSSA+ detected in one or more of the patient or household member surveillance samples
 - Colonization Level:** It is a count of infection and colonized surveillance cultures. (e.g. Level =4 if MRSA infection in the wound and colonized in Groin, Axilla and Nares)
 - Contamination:** MRSA+ or MSSA+ detected on one or more of the household environmental samples
 - Burden:** Percentage of Contaminated Surfaces in the household (Number of Contaminated Surfaces/Number of Surfaces tested in the household)
 - Household Density:** Number of household residents / Number of Rooms

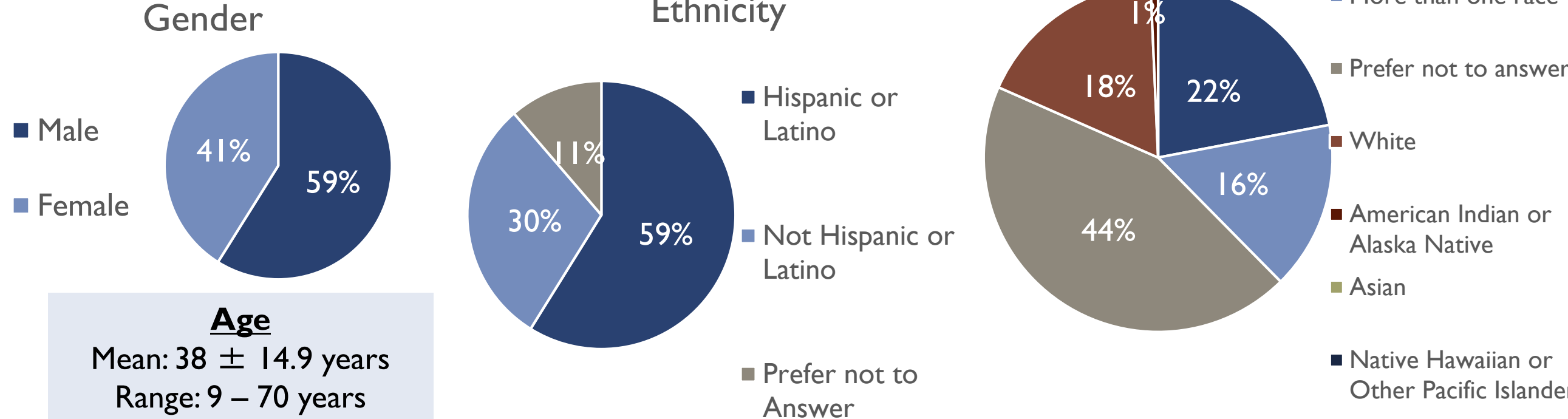
CONSORT Diagram



RESULTS

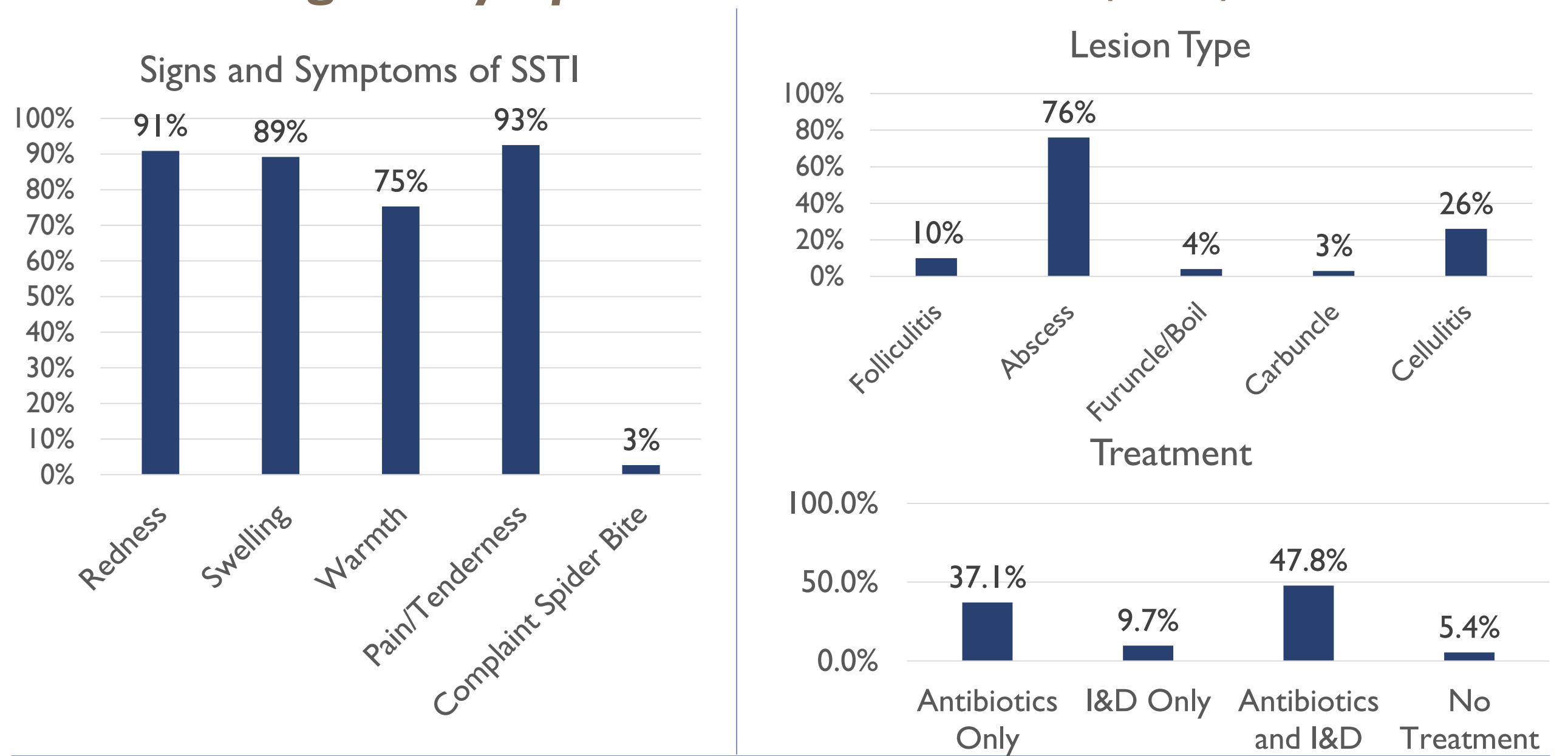
We recruited 421 patients with SSTIs to participate; 44.1% (n=186) were eligible for the study [wound culture positive for MRSA (22.3%), MSSA (22.3%)]; 120 baseline home visits and 95 three-month follow-up home visits have been completed.

Demographics (n=141)

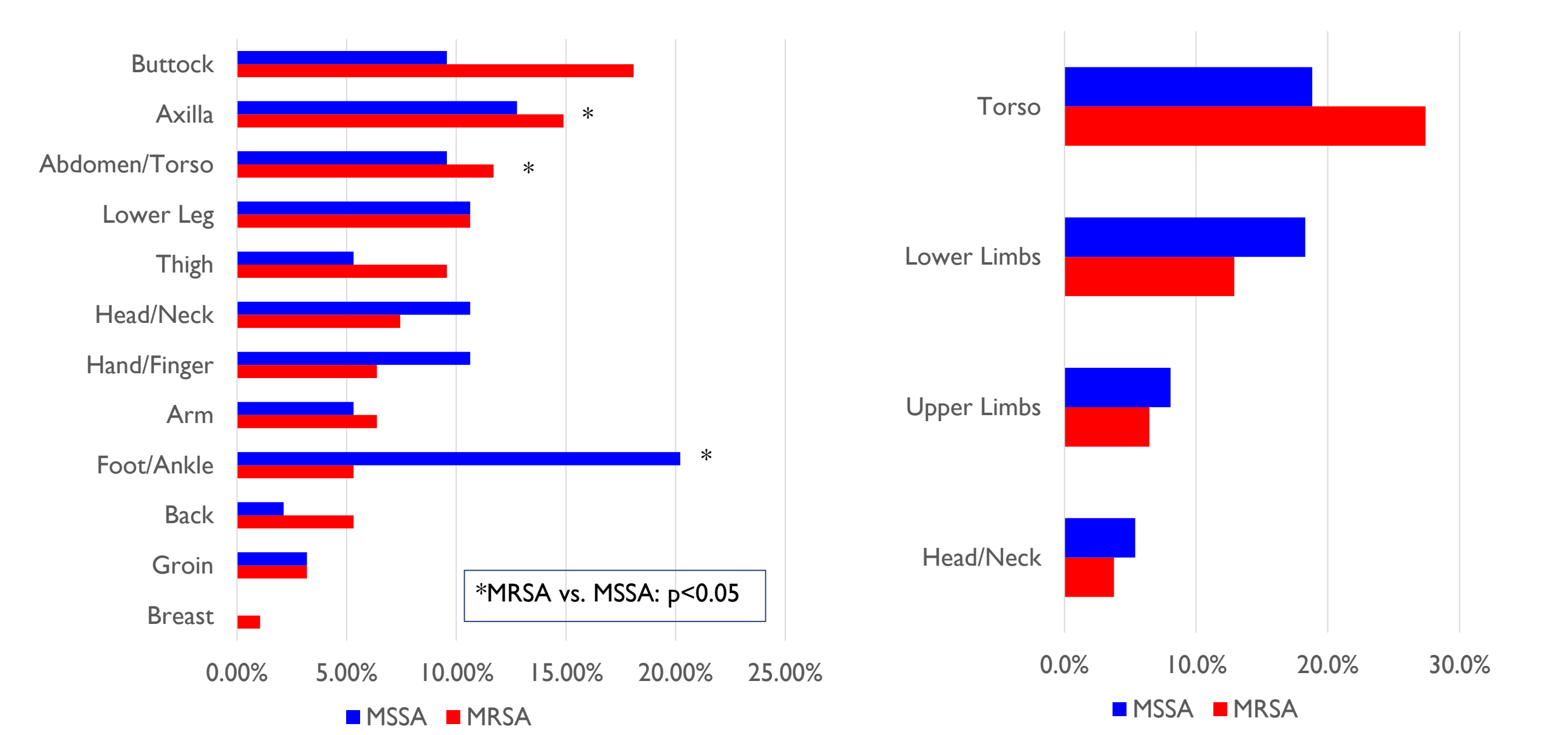


RESULTS (cont.)

Dermatological Symptoms and Treatment (n=186)

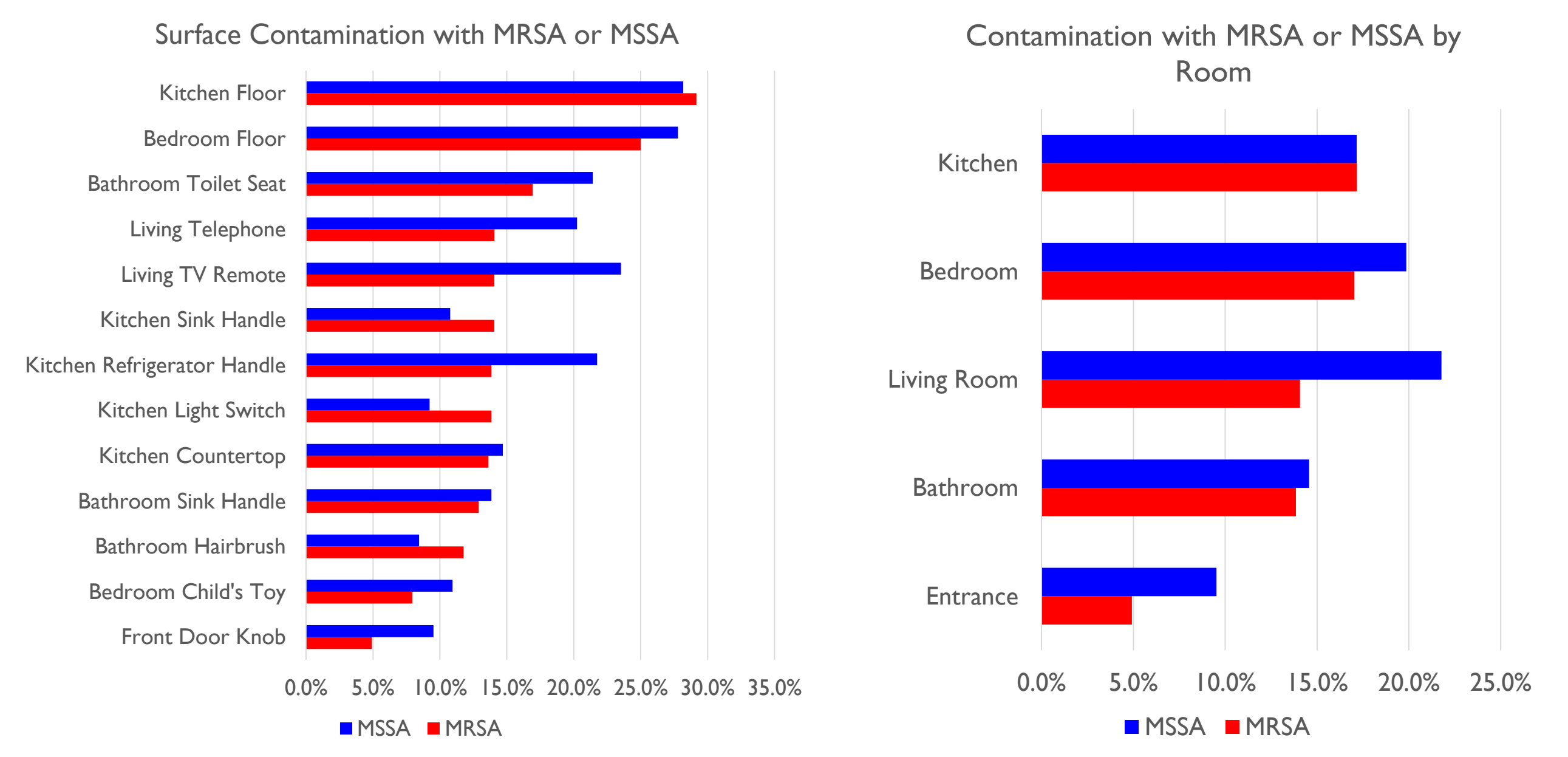


Comparison of Proportions of Infected Body Sites between MRSA and MSSA Infection

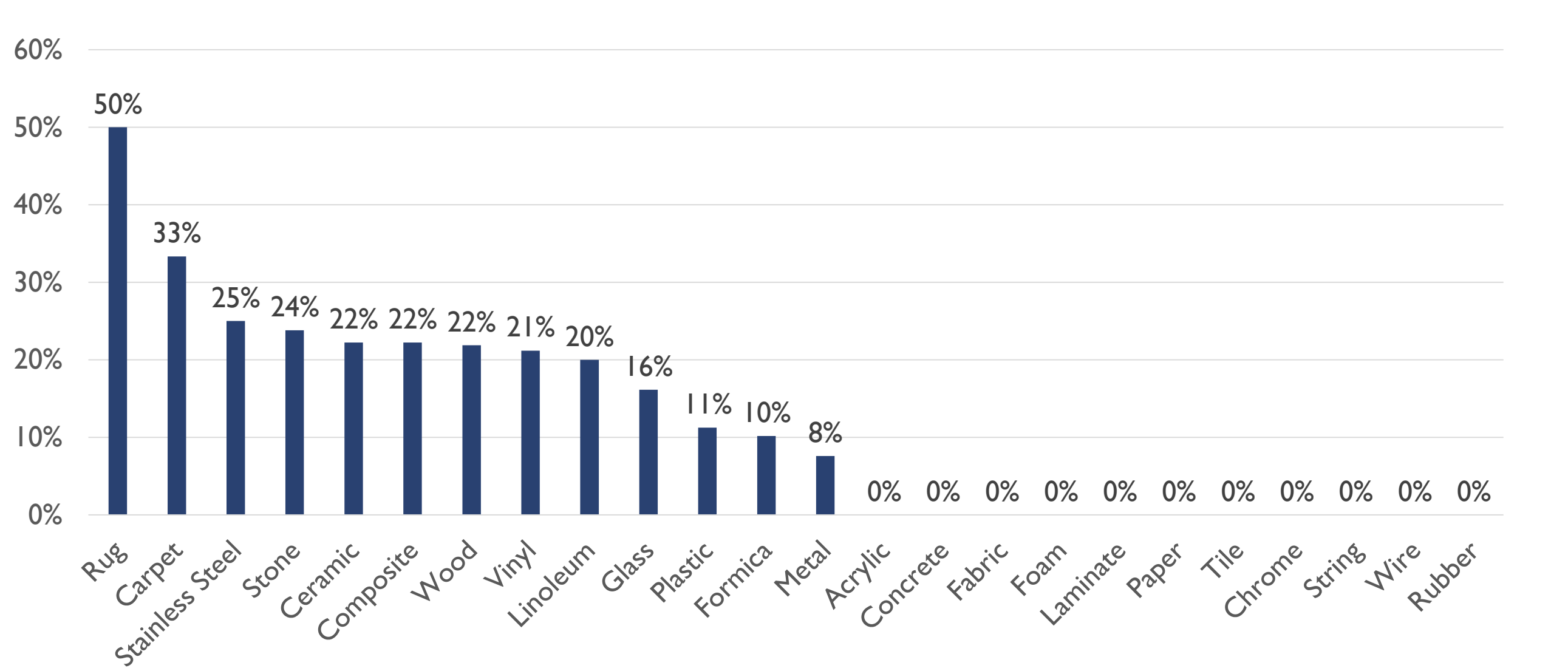


Home Visits (n=120)

Surface contamination similar between MRSA and MSSA (15% vs 17.2%, respectively; p=0.22). MRSA and MSSA contamination were most prevalent on the Kitchen Floor, Bedroom Floor, and Toilet Seat.

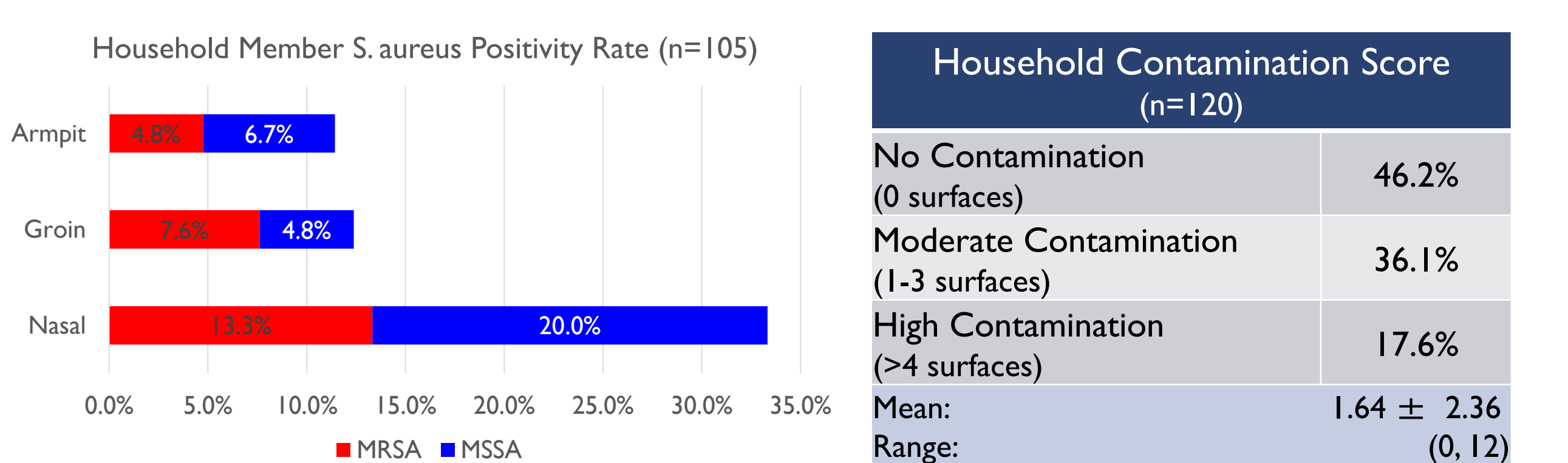


Contamination with MRSA or MSSA by Surface Material



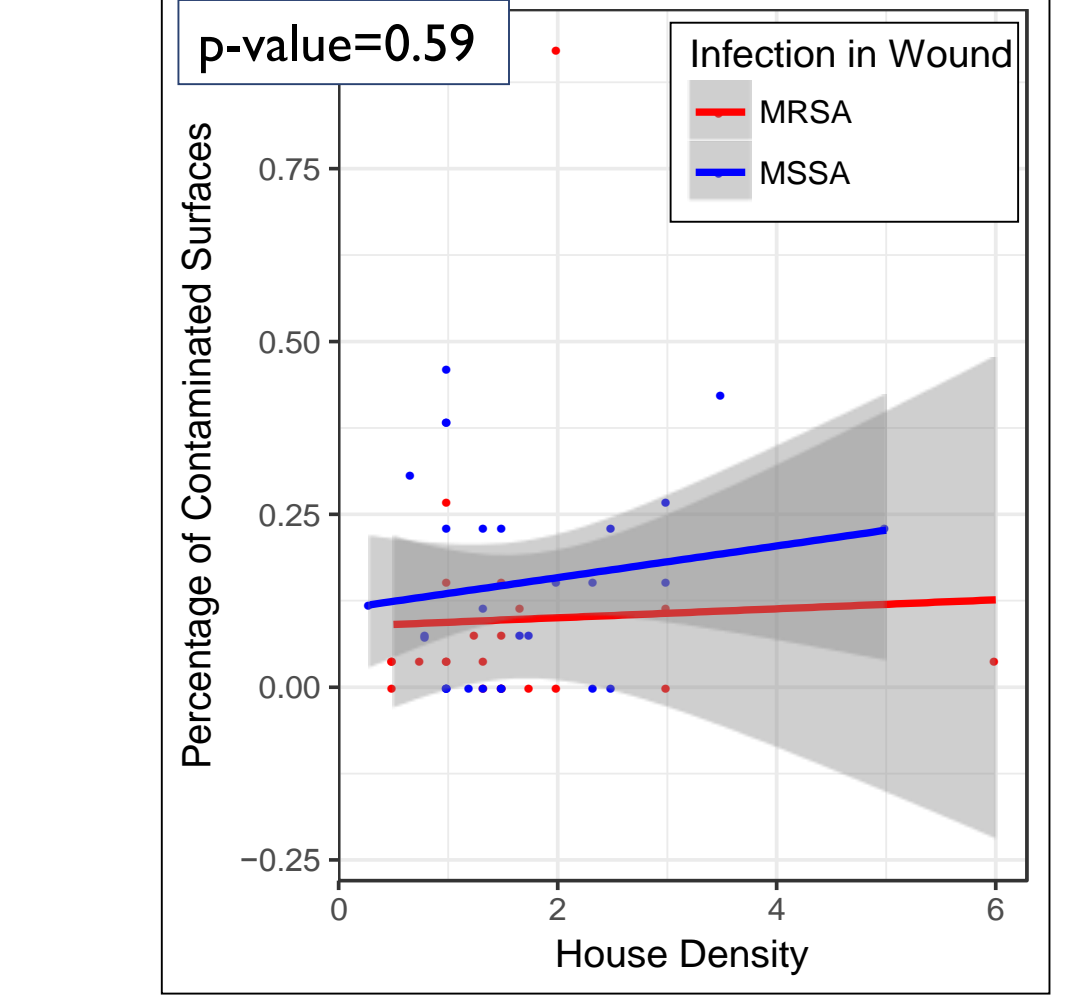
RESULTS (cont.)

38.1% of 105 household members were positive for *S. aureus* colonization in one or more body site. The mean number of colonization sites was 1.5 ± 0.72. 53.8% of households had at least one surface contaminated with *S. aureus* (MRSA: 44.3%, MSSA: 55.7%). Those who were not born in the USA had a higher proportion of MSSA infection as compared to those born in the USA (p=0.05).



Associations Between Household Member Surveillance Culture Positivity and Household Contamination	N (%)	Chi-Squared P-value
≥1 HH Member colonized with <i>S. aureus</i> , ≥1 Surface contaminated with <i>S. aureus</i>	15 (12.7)	0.46
≥1 HH Member colonized with <i>S. aureus</i> , 0 Surfaces contaminated with <i>S. aureus</i>	10 (8.5)	
No HH Member colonized with <i>S. aureus</i> , ≥1 Surface contaminated with <i>S. aureus</i>	48 (40.7)	

Household Density vs. Surface Contamination



Household Density and Wound Infection Type vs. Birthplace

	Household Density		Infection Type	
	Low	High	MRSA	MSSA
Non-USA	58.0%	42.0%	40.0%	60.0%
USA	57.3%	42.7%	57.3%	42.7%

CONCLUSIONS

Colonization of household members and contamination of environmental surfaces are common in households of patients with SSTI confirmed to be MRSA+ or MSSA+. Home visits have revealed that 53.3% of households had at least one surface contaminated with *S. aureus*. Of the surfaces that tested positive in the households, 44.3% were MRSA and 55.7% were MSSA. 38.1% of household members had at least one surveillance culture positive for *S. aureus* (MRSA: 14.3%, MSSA: 85.7%). There was a significant, positive association between level of MSSA colonization and environmental surface contamination in the home (p=0.03), demonstrating the important role that household environmental reservoirs may play in infection recurrence and household transmission.

Surface contamination was most common on the kitchen and bedroom floors, particularly on carpet, and was significantly associated with MSSA wound infection. There was no association between infection type and household density. The relationship between infection type and household density may be confounded by birthplace, since non-USA born participants had significantly higher MSSA positivity¹⁷. There was no association between household member colonization and household contamination. This suggests that transmission may take place between the index patient and both the home environment and through household members.

Targeting the environment and household members to eradicate bacterial reservoirs may reduce infection recurrence and transmission. This study will determine the effectiveness of disseminating and implementing evidence-based infection prevention practices developed in the ICU setting into primary care settings by Promotoras conducting home visits.

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