

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 In collaboration with the Laboratory of Microbiology and Infectious Diseases (Alexander Tomasz (SSTIs) recurrence ranges from 16% to 43% and presents significant challenges to clinicians, patients, and families. This comparative PhD) at The Rockefeller University and the Institute for Computational Biomedicine/PathoMap of effectiveness research (CER) study aims to disseminate, implement and evaluate whether an existing intervention, consisting of Weill Cornell Medical College (Christopher Mason, PhD), we will collect and analyze samples at 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 two timepoints (pre- and post-intervention) from (1) patients with wounds testing positive for of CA-MRSA and transmission within their households for patients presenting to primary care with SSTIs. MRSA/MSSA, (2) consenting household contacts, and (3) household environmental surfaces. METHODS/STUDY POPULATION: In partnership with three Community Health Centers and four community hospitals i

NYC, this study will recruit patients (n=186) with confirmed MRSA SSTIs and their household members. Participants are randomized to receive either a CHW/Promotora-delivered decolonization-decontamination intervention or Usual Care, which includes hygiene education. The highly engaged stakeholder team meets monthly to review interim results, identify areas for refinement and new research

FINDINGS: Participants (n=186) were 58.9% male, with a mean age of 38.1 (SD: 14.9, range: 9-70 years), majority Hispanic or Latino/a (58.9%), had Medicaid (50.4%) or uninsured (22.7%). Index patients had on average three co-residents in their households (range: 0-10). There were no differences between treatment groups at baseline in terms of demographics or clinical comorbidities. Two thirds of eligible participants completed their baseline home visit (n=120). MRSA and MSSA were found equally in wound cultures (22% respectively). Wounds were primarily abscesses (73.7%), with cellulitis (14.5%), folliculitis (9.7%), carbuncle (1.6%), and furuncle (0.5%) seen less frequently. Positive surveillance cultures were seen in 44.6% of participants with MRSA+ wounds 55.3% of participants with MSSA+ wounds. Baseline home visits have demonstrated that 53.8% of households had ≥ 1 surfaces contaminated with S. aureus. MRSA and MSSA surface contamination showed similar patterns, most common in the kitchen (38.5%) and bathroom (23.3%), followed by bedroom (15.4%), living room (15.4%) and entryway (7.7%). 38.1% of household members had ≥ 1 positive surveillance culture (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.

DISCUSSION/SIGNIFICANCE OF IMPACT: This study aims to understand the systems-, patient- and environmental-level factors associated with SSTI recurrence and household transmission, and to examine the interactions between bacterial genotypic and clinical/phenotypic factors on decontamination, decolonization, SSTI recurrence and household transmission. This study will evaluate the barriers and facilitators of implementation of home visits by CHWs in underserved populations, and aims to strengthen the weak evidence base for implementation of strategies to reduce SSTI recurrence and household transmission.

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 strains⁴⁻⁶ 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	
Metropolitan Hospital <i>New York, NY</i>	Getaw Worku Hassen, MD, PhD	
Lutheran Medical Center Brooklyn, NY	Barry Kohn, MD, PhD Paula Clemons, PA	
Coney Island Hospital Brooklyn, NY	Regina Hammock, DO Slava Gladstein, DO Jessica Padron, PA Glenn Donovan, DPM Mark Trezia, DPM Rosalie Nguyen, DO, MS	

• Community Health Centers **Community** Hospitals

* Participated in Previous MRSA Studies

Figure I. Map and corresponding list of the geographical locations of the participating CHCs and Hospitals

METHODS

Research Design

Incision & Drainage Oral Antibiotics

Home Assessment

Patient Decolonization & **Environmental Decontamination** (after Huang, 2014)¹⁶





METHODS (cont.)

Surveillance Swabs

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

Index Patients and Household Members

(n=3 per participant, Baseline and 3-Months)



(n=13 per household, Baseline and 3-Months)

Swab Category Front doorknob TV remote Telephone Kitchen light switch Kitchen countertop Refrigerator door handle Kitchen sink handle

Kitchen floor Bathroom sink handle Hair brush Toilet seat Bedroom floor Favorite child's toy (non-plush)

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)
- •Laundering 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



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%)]; I20 baseline home visits and 95 threemonth follow-up home visits have been completed. Black or African

Demographics (n=141) Kace American More than one race Ethnicity Gender Prefer not to answer 8% 22% Hispanic or Male Latino Female American Indian or 44% Not Hispanic or Alaska Native _atino Asian <u>Age</u> Mean: 38 ± 14.9 years Native Hawaiian or Prefer not to Other Pacific Islander Range: 9 – 70 years Answer

RESULTS (cont.)

Dermatological Symptoms and Treatment (n=186)



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



Home Visits (n=120)

Contamination with MRSA or MSSA by Surface Material





CLINICAL•**DIRECTORS**•**NETWORK**

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 $1.5 \pm 0.72.53.8\%$ 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).



Household Contamination Score (n=120)					
No Contamination (0 surfaces)			46.2%		
Moderate Contamination (1-3 surfaces)			36.1%		
High Contamination (>4 surfaces)			17.6%		
Mean: Range:			1.64 ± 2.36 (0, 12)		
are Positivity and Household Contamination					
	N (%)	Chi-Squared P-value			
	15 (12.7)		0.46		

 \geq I HH Member colonized with S. *aureus*, \geq I Surface contaminated with S. *aureus* 10 (8.5) ≥1 HH Member colonized with *S. aureus*, 0 Surfaces contaminated with *S. aureus* No HH Member colonized with S. aureus, $\geq I$ Surface contaminated with S. aureus 48 (40.7)

Household Density vs. Surface Contamination Household Density and Wound Infection Type



	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%

Household Density= # residents/# rooms; median=1.37 Birthplace vs. Infection Type: P=0.0502 Household Density vs. Infection Type, controlling for Birthplace:

MRSA: P=0.56; MSSA: P=0.55

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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