We identified distinct groups of CO-MRSA and MSSA infection rate trajectories by grouping census tracts of the 20 county Atlanta Metropolitan Statistical Area (MSA) between 2002 to 2016 with similar temporal trajectories.

Methods. This is a retrospective study from 2002-2016, using electronic health records of children living in Atlanta, Georgia with S. aureus infections and relevant US census data (at the census tract level). A group based trajectory model was applied to generate community onset S. aureus trajectory infection groups (low, high, very high) by census tract and were mapped using ArcGIS.

Results. Three CO-MSSA infection groups (low, high, very high) and two CO-MRSA infection groups (low, high) were detected among 909 census tracts in the 20 counties. We found ~74% of all the census tracts with infection groups (low, high) were detected among 909 census tracts in the 20 counties.

Spatial patterns for CO-MRSA and CO-MSSA Trajectory Trends in the Atlanta Metropolitan Area Between 2002 to 2016

Conclusion. Trends of S. aureus infection patterns, stratified by antibiotic resistance over geographic areas and time, identify communities with higher risks for MRSA infection compared to MSSA infection. Further investigation of the determinants of the trajectory groupings and the geographic outliers identified by this study may be a way to target prevention strategies aimed to prevent S. aureus infections.

Disclosures. All Authors: No reported disclosures

3. Stopping Hospital Infections with Environmental Services (SHINE): A Cluster-Randomized Trial of Intensive Monitoring Methods for Terminal Room Cleaning on Rates of Multidrug-Resistant Organisms (MDROs) in the Intensive Care Unit (ICU)

Methods. Six medical and surgical ICUs at three medical centers received both intensive monitoring interventions sequentially, in a randomized order. The intervention included surveying a minimum of 10 surfaces each in 5 rooms weekly, after terminal cleaning, with failing surfaces recleaned. The primary study outcome was the monthly rate of infection or colonization with MDROs within ICUs.

Results. The primary outcome rate varied by hospital and ICU (Figure 1). The ATP method was associated with a relative reduction in the incidence rate of infection or colonization with MDROs, including methicillin-resistant Staphylococcus aureus, Clostridioides difficile, vancomycin-resistant Enterococcus, and multidrug-resistant gram-negative bacilli (MDR-GNB), assessed during a 12-month baseline comparison period and sequential 6-month intervention periods, separated by a 2-month washout. Outcomes during each intervention period were compared to the combined baseline period plus the alternative intervention period using mixed-effects Poisson regression, with study hospital as a random effect.

Figure 1. MDRO infection or colonization per 1000 patient days by study month

NOTE. MDRO, multi-drug resistant organism; MICU, medical intensive care unit; SICU, surgical intensive care unit; UV/F, ultraviolet fluorescent marker; ATP, adenosine triphosphate
Table 1. Mixed-effects Poisson regression analysis for MDRO infection or colonization

| Variable                  | Bivariable IRR (95%) CI | P-Value | Multivariable IRR (95%) CI | P-Value |
|---------------------------|--------------------------|---------|----------------------------|---------|
| UV/ Fluor       | 1.103 (0.955 - 1.274)   | 0.18    |                             |         |
| ATP                      | 0.923 (0.863 - 0.988)   | 0.02    | 0.887 (0.811 - 0.969)       | 0.008   |
| SICP                     | 1.229 (1.031 - 1.466)   | 0.02    | 1.128 (1.031 - 1.466)       | 0.02    |
| Time from study start    | 1.001 (0.999 - 1.013)   | 0.88    |                             |         |
| Time from intervention start | 0.983 (0.967 - 1.000) | 0.047   | 0.979 (0.961 - 0.997)       | 0.03    |
| Contact precautions       | 0.869 (0.843 - 0.896)   | 0.71    |                             |         |

NOTE. MDRO, multidrug-resistant organisms; IR, incidence rate; CI, confidence interval.

Iodophor-Chlorhexidine

Methods. We conducted a cluster randomized non-inferiority trial in ICUs, comparing universal decolonization with: 1) Mupirocin-CHG: daily CHG baths and 5 days of twice daily nasal mupirocin, to 2) Iodophor-CHG: same regimen, substituting twice daily 10% povidone-iodine for mupirocin. All ICUs in a hospital were assigned to the same strategy. We compared each hospital's outcomes during the 16-month intervention (Nov 2017-Apr 2019) to its own baseline (May 2015-Apr 2017), during which all hospitals used mupirocin-CHG. The primary outcome was ICU-attributable S. aureus clinical isolates. Secondary outcomes included ICU-attributable MRSA clinical isolates and all-cause BSI. As randomized and as treated analyses used unadjusted Poisson hazard models assessing differences in outcomes between baseline and intervention periods across the two groups, accounting for clustering by hospital and patient.

Results. We randomized 137 hospitals with 233 ICUs in 18 states. There were 442,544 admissions in the baseline period and 349,262 in the intervention period. Median ICU length of stay was 4 days. ICU types included mixed medical surgical (56%), medical (9%), surgical (11%), cardiac (15%), and neurologic (9%). CHG adherence was similar in both arms (85%), but adherence was greater for mupirocin (90%) than iodophor (82%). Primary as-randomized results (Table, Figure) exceeded the non-inferiority margin in favor of mupirocin, for S. aureus clinical cultures (21% superiority, P < 0.001) and for MRSA clinical cultures (20% superiority, P < 0.001). The regimens had similar BSI hazards. Analyses of fully adherent cultures (21% superiority, P < 0.001) and for MRSA clinical cultures (20% superiority, P < 0.001) exceeded the non-inferiority margin in favor of mupirocin, for S. aureus clinical cultures (21% superiority, P < 0.001) and for MRSA clinical cultures (20% superiority, P < 0.001). The regimens had similar BSI hazards. Analyses of fully adherent cultures (21% superiority, P < 0.001) and for MRSA clinical cultures (20% superiority, P < 0.001).

Conclusion. Universal iodophor-CHG was equivalent to mupirocin-CHG for ICU BSI prevention. Mupirocin-CHG was superior to iodophor-CHG for S. aureus and MRSA clinical isolates, potentially due to greater adherence to mupirocin.

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CDC Prevention Epicenters

Session: O-01. Addressing MDRO Colonization and Infection

Background. ICU universal decolonization with daily chlorhexidine (CHG) baths plus mupirocin nasal decolonization reduces all-cause bloodstream infections (BSI) and MRSA clinical cultures. We assessed nasal iodophor, an antiseptic less susceptible to resistance, in place of mupirocin.

Methods. We conducted a cluster randomized controlled trial in 137 hospitals with 233 ICUs in 18 states. There were 442,544 admissions in the baseline period and 349,262 in the intervention period. Median ICU length of stay was 4 days. ICU types included mixed medical surgical (56%), medical (9%), surgical (11%), cardiac (15%), and neurologic (9%). CHG adherence was similar in both arms (85%), but adherence was greater for mupirocin (90%) than iodophor (82%). Primary as-randomized results (Table, Figure) exceeded the non-inferiority margin in favor of mupirocin, for S. aureus clinical cultures (21% superiority, P < 0.001) and for MRSA clinical cultures (20% superiority, P < 0.001). The regimens had similar BSI hazards. Analyses of fully adherent patients are in progress.

Table As-Randomized Group Comparisons for Outcomes of Mupirocin Iodophor Swap Out Trial

| Strategy       | Baseline period | Intervention period | Hazard Ratio | Difference in Differences | P-value |
|----------------|-----------------|---------------------|--------------|---------------------------|---------|
| PRIMARY OUTCOME ICU-Attributable Staphylococcus aureus Clinical Cultures | | | | | |
| Mupirocin-CHG | 16.9            | 16.3                | 0.98 (0.94 - 1.03) | Mupirocin-CHG with 21% greater reduction | <0.001 |
| Iodophor-CHG  | 17.9            | 20.7                | 1.19 (1.14 - 1.24) | | |
| SECONDARY OUTCOME ICU-Attributable MRSA Clinical Cultures | | | | | |
| Mupirocin-CHG | 8.8             | 8.1                 | 0.97 (0.91 - 1.04) | Mupirocin-CHG with 5% greater reduction | 0.002   |
| Iodophor-CHG  | 8.9             | 10.0                | 1.16 (1.11 - 1.24) | | |

Figure - Primary and Secondary Outcomes of Mupirocin Iodophor Swap Out Trial
Figure. Group-specific hazard ratios (HR) and 95% confidence intervals (vertical lines) comparing trial outcomes during the intervention versus baseline period. Bubble plots of HRs from individual hospitals relative to their group effects are shown. Bubble size indicates relative number of ICU patients contributing data.