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Letter to the Editor

The continued effect of routine surveillance and targeted decolonization on the rate of *Staphylococcus aureus* infection in a level IV neonatal intensive care unit

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To the Editor—Staphylococcus aureus is a leading pathogen in infants in a neonatal intensive care unit (NICU).[1] Colonization is an important risk factor for methicillin-susceptible (MSSA) and methicillin-resistant (MRSA) infections[2] in the NICU and identifying and decolonizing infants may reduce *S. aureus* infections.[3,4] Weekly active surveillance cultures of the anterior nares, umbilicus and inguinal region for *S. aureus* was implemented, contact precautions were used for MRSA colonized infants, and *S. aureus*–colonized neonates were treated with mupirocin ointment applied to both nares, the umbilicus and any abraded skin, twice daily for 10 doses. Thereafter, we reported a significant 43% reduction in rate of NICU-wide *S. aureus* infection per 1,000 hospital days over an observation period of 23 months.[5] The study was conducted in a 57-bed, level IV NICU. *S. aureus* infection was defined as recovery of *S. aureus* from a normally sterile site or nonsterile site (excluding respiratory) if the patient was treated with 5 or more days of systemic antibiotics.[5] Infections with an onset 48 hours or more after admission to the NICU were included. Infection rates in a comparison level III NICU with the same faculty, fellows, and residents but with an infant population that did not include infants requiring surgery or subspecialty surgical care were unchanged.[5] In this study, we evaluated the continued impact of *S. aureus* screening and decolonization on the incidence of *S. aureus* infections in a NICU during an additional 25-month period.

The Northwell Health Institutional Review Board approved this study with a waiver of informed consent.

Infection rates were compared using the incidence density ratio method.[6] In this method, the null hypothesis is that the proportion of nosocomial infections will be proportional to the number of inpatient days at risk for each period.

Compared to the 27-month preintervention period, the rates of clinical *S. aureus* infection during intervention period 2 decreased by 54% ($P = .0086$), including 46% ($P = .068$) and 72% ($P = .039$) decreases in the rates of MSSA and MRSA infections, respectively (Table 1). During the preintervention period and intervention periods 1 and 2, bacteremia was detected in 67%, 53%, and 63% of infections, respectively. The proportion of *S. aureus* infections caused by MRSA during the preintervention, intervention 1, and intervention 2 periods were 31%, 61%, and 19%, respectively. During the last 2 months of the preintervention period and during intervention period 1, there was a prolonged outbreak of infection with clonally related isolates of mupirocin-resistant MRSA.[7]

At an affiliated level III NICU where the interventions were not implemented, there were no significant changes in the rates of *S. aureus* infections or MSSA infections during intervention periods 1 and 2 or in the rate of MRSA infections during intervention period 1. The rate of MRSA infection was significantly reduced during intervention period 2 (Table 1).

The principal finding of this study is that weekly surveillance cultures and topical mupirocin-based decolonization for *S. aureus* in a NICU along with contact isolation precautions for infants colonized with MRSA was associated with a significant unitwide decrease in *S. aureus* clinical infections with an effect that persisted for 4 years after implementation. Although this was a single-center study, the sustained reduction in the rate of *S. aureus* infection during an additional follow-up period without a significant change in the *S. aureus* infection rate at the comparison NICU further supports the effectiveness of the intervention and indicates that a secular trend in infection rate is an unlikely explanation for the lower rates during the intervention periods. This observed rate reduction is relevant to the entire NICU population and provides "real world" data because infections occurring in all infants were included in the infection rate calculation without regard to whether they underwent surveillance cultures and decolonization. An intervention program should target both MSSA and MRSA because both are important pathogens in NICUs that can be affected by this intervention.[2,4,7,8]

The lack of a significant impact of the intervention on MRSA rate during intervention period 1 can likely be explained by an outbreak of infection with a mupirocin-resistant clone during that period and the lack of effectiveness of mupirocin-based decolonization.[7] The rates of MSSA infection tended to be lower during periods with higher MRSA infection rates and higher during periods of lower MRSA infection rates. These findings are consistent with a competition between MSSA and MRSA for colonization in the nares[9,10] and may explain the apparent inverse relationship between the rates of MRSA and MSSA infections during each study period (Table 1).

A limitation of this study is the before-and-after design because confounding factors or regression to the mean could have accounted for the observed differences in rates, but the extended follow-up period and the inclusion of a control NICU where the intervention was not implemented help mitigate this limitation. The comparison NICU was not equivalent to the intervention NICU because it is a

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Table 1. Rates of *Staphylococcus aureus* Infection During the Preintervention Period and Intervention Periods 1 and 2

Infection Type	Study Period[a]	Patient Days	Confirmed Infections	Rate per 1,000 Patient Days	Incidence Density Ratio[b]	*P* Value[b,c]
Intervention NICU						
Total *S. aureus* infections	Preintervention period	38,208	36	0.942		
	Intervention period 1	33,587	18	0.536	0.57	.0476
	Intervention period 2	36,703	16	0.436	0.46	.0086
MSSA infections	Preintervention period	38,208	25	0.654		
	Intervention period 1	33,587	7	0.208	0.32	.0047
	Intervention period 2	36,703	13	0.354	0.54	.0683
MRSA infections	Preintervention period	38,208	11	0.288		
	Intervention period 1	33,587	11	0.328	1.14	.7623
	Intervention period 2	36,703	3	0.082	0.28	.0391
Control NICU						
Total *S. aureus* infections	Preintervention period	21,172	11	0.52		
	Intervention period 1	19,024	9	0.473	0.91	.8348
	Intervention period 2	17,917	10	0.558	1.07	.8698
MSSA infections	Preintervention period	21,172	6	0.283		
	Intervention period 1	19,024	7	0.368	1.3	.6379
	Intervention period 2	17,917	10	0.558	1.97	.181
MRSA infections	Preintervention period	21,172	5	0.236		
	Intervention period 1	19,024	2	0.105	0.45	.3203
	Intervention period 2	17,917	0	0	0	.0397

Notes: NICU, neonatal intensive care unit; MSSA, methicillin-susceptible *Staphylococcus aureus*; MRSA, methicillin-resistant *Staphylococcus aureus*.
[a]Duration and dates of study periods: preintervention, January 2015 through March 2017 (27 months); intervention 1, May 2017 through March 2019 (23 months); intervention 2, April 2019 through May 2021 (25 months).
[b]Compared to the preintervention period.
[c]Results for the preintervention and intervention period 1 were reported previously.[5]

lower-acuity NICU and had lower baseline rates of *S. aureus* infection. However, the absence of change in the rates of *S. aureus* infection in the comparison NICU provides supportive evidence that the rate reduction in the intervention NICU was not related to a secular trend. This was a single-center study, and these findings may not be applicable to other centers. In conclusion, a screening and decolonization program was associated with sustained reduction in *S. aureus* infections over a 4-year period.

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References

1. Greenberg RG, Kandelfer S, Do BT, *et al.* Eunice Kennedy Shriver National Institute of Child Health and Human Development Neonatal Research Network. Late-onset sepsis in extremely premature infants: 2000–2011. *Pediatr Infect Dis J* 2017;36:774–779.
2. Akinboyo IC, Zangwill KM, Berg WM, Cantey JB, Huizinga B, Milstone AM. SHEA neonatal intensive care unit (NICU) white paper series: practical approaches to *Staphylococcus aureus* disease prevention. *Infect Control Hosp Epidemiol* 2020;41:1251–1257.
3. Nelson MU, Shaw J, Gross SJ. Randomized placebo-controlled trial of topical mupirocin to reduce *Staphylococcus aureus* colonization in infants in the neonatal intensive care unit. *J Pediatr* 2021;236:70–77.
4. Voskertchtein A, Akinboyo IC, Colantuoni E, *et al.* Association of an active surveillance and decolonization program on incidence of clinical cultures growing *Staphylococcus aureus* in the neonatal intensive care unit. *Infect Control Hosp Epidemiol* 2018;39:882–883.
5. Balamohan A, Beachy J, Kohn N, Rubin L. The effect of routine surveillance and decolonization on the rate of *Staphylococcus aureus* infections in a level IV neonatal intensive care unit. *J Perinatol* 2020;40:1644–1651.
6. Kleinbaum DG, Kupper LL, Morgenstern H. *Epidemiologic Research: Principles and Quantitative Methods*. Belmont, CA: Lifetime Learning; 1982.
7. Rubin LG, Beachy J, Matz T, Balamohan A, Jendresky L, Zembera J, Annavajhala MK, Uhlemann A-C. Prolonged outbreak of clonal, mupirocin-resistant methicillin-resistant *Staphylococcus aureus* in a neonatal intensive care unit: association with personnel and a possible environmental reservoir, analyzed using whole genome sequencing. *Amer J Infect Control* 2022;50:680–685.
8. Wisgrill L, Zizka J, Untaerasinger L, *et al.* Active surveillance cultures and targeted decolonization are associated with reduced methicillin-susceptible *Staphylococcus aureus* infections in VLBW Infants. *Neonatology* 2017;112:267–273.
9. Dall'Antonia M, Coen PG, Wilks M, Whiley A, Millar M. Competition between methicillin-sensitive and -resistant *Staphylococcus aureus* in the anterior nares. *J Hosp Infect* 2005;61:62–67.
10. Huang SS, Datta R, Rifas-Shiman S, *et al.* Colonization with antibiotic-susceptible strains protects against methicillin-resistant *Staphylococcus aureus* but not vancomycin-resistant enterococci acquisition: a nested case–control study. *Crit Care* 2011;15(5):R210.

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