

Short Communication

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Visitor restriction during the COVID-19 pandemic did not impact rates of *Staphylococcus aureus* colonization in the NICU patients

<https://doi.org/10.1515/jpm-2022-0299>

Received June 23, 2022; accepted September 11, 2022;

published online October 4, 2022

Abstract

Objectives: In our neonatal intensive care unit (NICU), patients are screened for colonization with *Staphylococcus aureus* (*S. aureus*) and decolonized if positive. During the COVID-19 pandemic, our NICU significantly limited its visitor policy. We assessed for a difference between *S. aureus* colonization rates before and after the visitor policy change, which coincided with the exponential rise of COVID-19 cases in New York City (NYC).

Methods: We calculated rates of newly *S. aureus* colonized NICU patients during January to June 2020 and compared rates pre- and post-implementation of the new visitor policy. Additionally, we obtained the weekly incidence of COVID-19 in NYC and assessed for a correlation between COVID-19 rates and *S. aureus* colonization.

Results: The number of newly colonized patients per thousand patient days was 4.65 pre- and 3.95 post-implementation of the new visitor policy. The difference was not statistically significant ($p=0.66$). Furthermore, there was no correlation between the incidence of COVID-19 in NYC and the rates of *S. aureus* colonization in our NICU ($R^2=0.02$).

Conclusions: Our results suggest that limiting visitation of patients is not associated with a decrease in *S. aureus*

colonization rate. Hospital unit leaders may need to focus on other strategies in order to reduce colonization.

Keywords: COVID-19; family visitation; *Staphylococcus aureus* colonization.

New York City (NYC) is a metropolitan area with relatively high rates of *Staphylococcus aureus* (*S. aureus*) infection and colonization [1]. In our neonatal intensive care unit (NICU) in NYC, our policy is to test neonates for colonization with *S. aureus* weekly and decolonize them with mupirocin ointment and chlorhexidine baths if positive. This practice has become standard of care in many NICUs and other hospital units across the country, as there is evidence to suggest that decolonization reduces the risk for both methicillin-susceptible *S. aureus* (MSSA) and methicillin-resistant *S. aureus* (MRSA) infections [2, 3]. Furthermore, both clinical and culture-proven infections during neonatal hospitalizations, particularly in extremely low-birthweight infants, are associated with morbidity, including adverse neurodevelopmental outcomes and growth impairment, and mortality [4].

Neonates have the potential to be exposed to *S. aureus* via numerous sources, including direct touch by health-care workers and family members. In particular, early postnatal maternal-child transmission is thought to be a key mechanism of neonatal *S. aureus* colonization [5], though father-to-neonate transmission has also been described [6]. There is some data to suggest that decolonizing parents colonized with *S. aureus* may reduce risk of colonization in their newborns [7].

NYC was an epicenter of the novel coronavirus (COVID-19) global pandemic, especially during the period of March through June 2020. During the time of the COVID-19 pandemic, behaviors in our NICU changed. Our hospital required symptom screening prior to entering the facility and all visitors and staff were adhering to government-mandated social distancing and wearing face coverings. Throughout the city, people

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were more likely to be attending work and school from home and less likely to be gathering with individuals outside their households or taking public transportation. Additionally, our NICU implemented a strict visitation policy on March 16, 2020 that limited each patient to two visitors for the entirety of their NICU stay, only one of whom could visit the patient at a time. These two visitors had to be parents or other designated caregivers and could not be children below the age of 18 (unless they were the patient's parent). This was a major change from our prior visitor policy, which had no restrictions limiting the number of people on each patient's visitor list and had very few limitations on the type of visitors allowed. Any family member, friend, or sibling older than 13 years of age was permitted on the list. It also allowed two visitors to be present at the bedside at any given time. Our objective with this study was to assess for a difference between the rates of *S. aureus* colonization in our NICU before and after implementation of visitor restriction, which coincided with the exponential rise of COVID-19 cases in NYC.

This study was Institutional Review Board (IRB) approved and met the IRB standards of ethical conduction of research. All authors completed Collaborative Institutional Training Initiative (CITI) modules on research ethics

through NYU and complied with the World Medical Association Declaration of Helsinki regarding ethical conduct of research involving human subjects and/or animals.

We utilized surveillance data that is routinely collected each week by the Department of Infection Prevention and Control to obtain a list of NICU patients colonized with *S. aureus* during a period between January and June 2020. We performed retrospective chart review of these infants to gather more data, including verifying completion of proper decolonization and information about previous colonization. We combined MRSA and MSSA colonized patients, as new MRSA colonization occurred only three times in the time period studied. We also only included patients who were colonized for the first time, as it was very common for patients to become recolonized even after proper decolonization. Unit census data allowed us to calculate the rate of newly *S. aureus* colonized NICU patients per 1,000 patient-days. All samples collected prior to March 16th were compared to the samples collected after March 16th (when visitation policy was changed). We chose to study a time period from January 2020 to June 2020, which encompasses approximately ten weeks prior to and 14 weeks following the visitor policy change and the initial rise and fall of COVID-19 in NYC.

Table 1: Newly *S. aureus* colonized patients per 1,000 patient days pre- and post-visitor policy change.

2-week period in 2020	Patient-days	Newly <i>S. aureus</i> colonized patients	Newly colonized patients per 1,000 patient-days
January 6–19	566	1	1.77
January 20–February 2	623	3	4.82
February 3–16	620	3	4.84
February 17–March 1	573	3	5.24
March 2–15	626	4	6.39
March 16–29	608	3	4.93
March 30–April 12	560	2	3.57
April 13–26	581	2	3.44
April 27–May 10	473	2	4.23
May 11–24	502	5	9.96
May 25–June 7	498	1	2.01
June 8–21	573	0	0
Total pre- and post- visitor policy			
January 6–March 15	3,008	14	4.65 ^a
March 16–June 21	3,795	15	3.95 ^a

We modeled the number of biweekly colonization cases pre- and post-intervention using negative-binomial regression with a logistic link with SAS 9.04. The outcome was generated as a count variable representing a number of cases falling into each of the weeks over time. An alpha of 0.05 was used. The average number of newly colonized patients per thousand patient days was 4.65 from pre- and 3.95 post-visitation policy change. There was no significant difference between the pre- and post-colonization rates when they were modeled biweekly as discussed above (^ap=0.66).

We had a unique opportunity to assess for change in rates of *S. aureus* colonization after a visitor policy change in response to a global pandemic, which to our knowledge, has not been previously studied. Our results suggest that limiting visitation of NICU patients may not significantly affect colonization rates (Table 1) and that healthcare facilities may need to focus on other strategies to decrease *S. aureus* colonization among vulnerable patient populations. If limiting visitation has no impact on colonization rates, it is possible that primary caregivers, hospital staff, or both are the primary sources of *S. aureus* exposure for NICU patients.

With our strict visitor policy, only two caregivers were allowed to visit the patient, and the most commonly chosen caregivers were the parents. However, there were no restrictions on the length of time that could be spent with the patient. Visitors were required to wash their hands prior to entering the NICU, which is not a new policy, and all visitors and staff were required to wear a face covering at all times in the NICU. There were no other restrictions regarding handling the NICU patients. Some caregivers opted to wear gloves, but they were not required to do so. Additionally, skin-to-skin (kangaroo) care was still allowed and encouraged. Furthermore, our patient population encompasses several zip codes in Brooklyn where colonization and infection with *S. aureus* are very common [8].

Primary caregivers as a source of *S. aureus* exposure has been explored by other investigators [5, 6]. Maternal colonization with *S. aureus* was shown to increase the likelihood of neonatal colonization at birth by nearly five-fold and by two-fold later in infancy [5]. Paternal colonization with *S. aureus* has been less studied but still reported as a probable source [6]. Additionally, a randomized clinical trial demonstrated that decolonizing parents of NICU patients significantly reduces the likelihood of neonatal colonization with a *S. aureus* strain that matches their parents' [7]. Thus, it is reasonable to conclude that limiting visitation of NICU patients may not significantly impact the rates of *S. aureus* colonization, so long as primary caretakers are allowed to visit and physically interact with their children.

It is also highly plausible that hospital staff members are a primary source of *S. aureus* colonization. There are case reports that suggest patients who are cared for by a *S. aureus* colonized healthcare provider are more likely to develop colonization and even infection [9, 10]. This may highlight the importance of staff cleanliness practices, including hand hygiene, in reducing *S. aureus* colonization and infection.

When we assessed for correlation between the incidence of COVID-19 in NYC and *S. aureus* colonization in our NICU, we did not find a significant association (Figure 1). This could suggest that pandemic-related

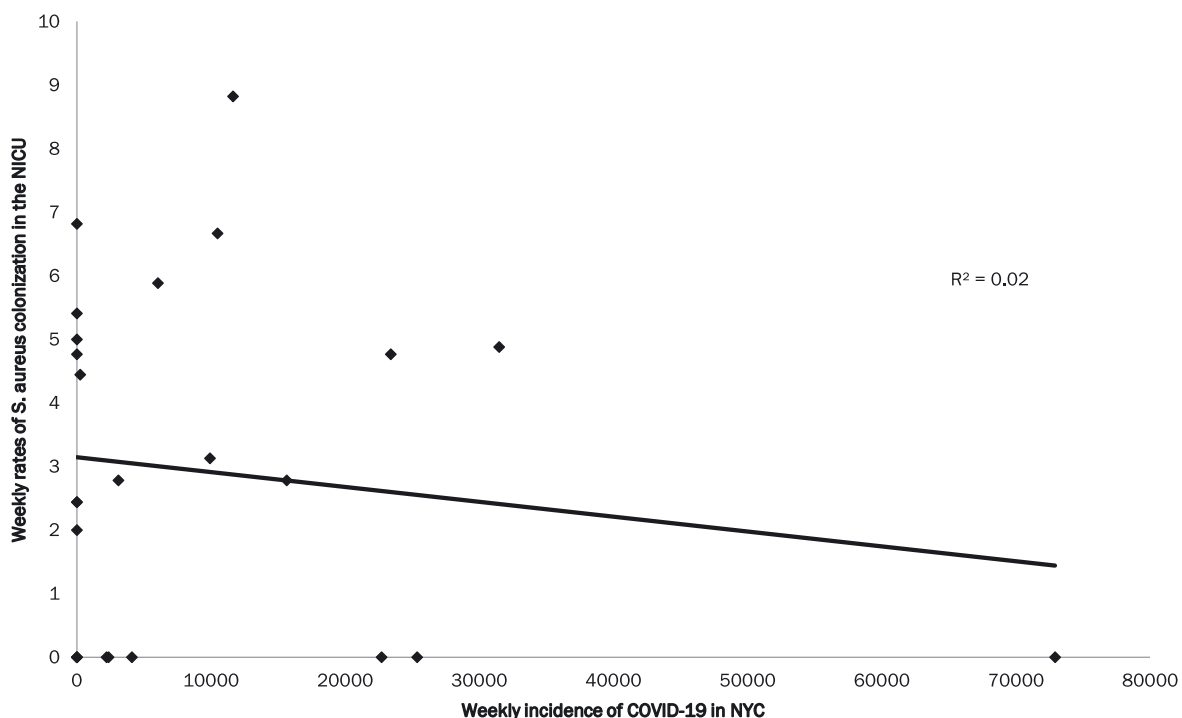


Figure 1: We collected data from the New York city department of health website and used linear regression to assess for a correlation between the number of new COVID-19 cases in NYC per week and weekly rates of *S. aureus* colonization in our NICU from January-June 2020. When we plotted weekly rates of *S. Aureus* colonization in the NICU vs. weekly incidence of COVID-19 cases in NYC, there was no correlation ($R^2=0.02$).

changes in behavior (attending work and school from home, avoiding public transportation, wearing face coverings, social distancing, etc.) may not significantly reduce the likelihood of primary caregivers and hospital staff exposing hospitalized patients to *S. aureus*.

This study has limitations, most notably lack of power. We have baseline low rates of *S. aureus* colonization in our NICU, as evidenced by multiple weeks when there were zero newly colonized patients during our study period. Additionally, the study was designed with a single center approach and assessed a limited time period of approximately 5 months. We chose this time period to focus on the first several weeks of the pandemic when COVID-19 transmission and related behavior changes were most prominent. Additionally, this helped in minimizing impact of any confounding factors such as fluctuating rates of COVID-19 in the region and further changes to our evolving visitor and infection control policies.

Our study suggests that limiting visitation does not affect *S. aureus* colonization rates among NICU patients. Further directions could include assessing other hospital units, including those at other institutions. It also seems worthwhile to assess other potential strategies to reduce *S. aureus* colonization, including improving parent and staff hand hygiene and decolonizing primary caregivers.

Research funding: None declared.

Author contributions: Drs. Evans and Cicalese conceptualized and designed this study, wrote and submitted the IRB, performed data collection and analysis, drafted the initial manuscript, and reviewed and revised the manuscript. Drs. Bailey and Verma assisted with data collection and analysis and critically reviewed and suggested edits to the manuscript. All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work. There are no additional acknowledgements for this study. All authors have accepted responsibility for the entire content of this manuscript and approved its submission.

Competing interests: Authors state no conflict of interest.

Informed consent: Not applicable.

Ethical approval: The local Institutional Review Board deemed the study exempt from review.

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