August 27, 2010

Dear Members of the HAI-AC,

It appears that the need for MRSA surveillance testing among neonates born and admitted to the NICU within the same birth hospital is on the agenda for the 8/30/10 HAI-AC meeting. I am glad that there will be further discussion on this topic because I feel it is important to weigh this decision carefully. During the last HAI-AC meeting, I was concerned that a vote on this issue was somewhat premature given the limited data presented. Since then, I have reviewed the medical literature further on the questions that I believe are relevant to this issue and have summarized my findings in this letter for your consideration. I apologize that I will not be able to present this in person or to participate directly in the discussion. I also understand that Dr. John Bradley will be speaking on this topic, and I certainly would value his perspective as I'm sure that it will be a thoughtful one.

1) If neonatal MRSA colonization within 24 hours of birth occurs, then acquisition most likely is the result of vertical transmission from exposure to the maternal rectovaginal colonization. Are there data about the rate of maternal MRSA rectovaginal colonization?

Several studies have looked at maternal rectovaginal colonization with MRSA and rates have ranged from 0.5% (Chen et al. 2006) and 0.6% (Karina et al. 2010) up to 3.5% (Andrews et al. 2008) and 10.4% (Creech et al. 2010). Two other studies (Beigi et al. 2007 and Andrews et al. 2009) looked at maternal *S. aureus* colonization but from the available abstracts, it is unclear what percentage of rectovaginal cultures was positive for MRSA. In any case, the available data, in particular more recent publications, show disparate rates of rectovaginal MRSA colonization among pregnant women (as low as 0.6% and as high as 10.4%). Nevertheless, several studies identified a rate of colonization that exceeds the 1.8% nasal MRSA colonization rate among adults in the U.S. Early neonatal acquisition of MRSA via exposure to the birth canal is therefore quite plausible.

2) What then is the rate of MRSA colonization among neonates within 24 hours of birth, particularly in the context of the epidemic of community-associated MRSA strain (USA300)?

Based on what was presented at the last HAI-AC meeting, the answer to this question would appear to be that the rate of MRSA colonization is exceedingly low. However, this was based primarily based on survey data that was voluntarily submitted by a number of hospitals around California. These data were not systematically collected, were unverified, and are subject to reporting bias, leaving their validity questionable. Only one published article was reviewed - the article by Gregory et al. from Boston which found that only 0.075% of babies tested in the first 3 days of life were colonized with MRSA (based on sampling from nares and rectum).

On further review of the literature, I was able to find a several additional articles that address this question and their findings are summarized in this table (see appendix for the abstracts):

Authors	Location	Study Years	Timing of cultures	Sites cultured	# of neonates	% with MRSA
	Non-US					
Huang et al.	Taiwan	2005-7	within 24 hrs	nares, umbilicus	501	0.6%
	US					
Reusch et al.	Orlando	2005-6	within 24 hrs	nares, umbilicus	288	0.7%
Pinter et al.	Brooklyn	2005	at birth & 48 hrs	nares, skin	252	0.8% at birth (3% at 48 hrs)
Seybold et al.	Atlanta	2004-6	day of admit ("usually" the day of birth)	nares	996	1.2%
Gregory et al.	Boston	2000-7	within 3 days	Nares, rectum	7997	0.075%

From these data, the rate of MRSA colonization within the first 24 hours of life appears to be in the 0.075%-1.2% range. The largest study was clearly the one by Gregory et al. presented previously. As a point of comparison, the nasal colonization rate for MRSA in adults in the U.S. is approximately 1.8%, so from the current data in the literature, the rates of MRSA colonization among neonates within 24 hours of birth are clearly lower than this. However, another way to look at this is that in some settings, the rates may also be as high as 1.2%, which is approaching the rate among adults.

2) What is (are) the optimal site(s) for determining MRSA colonization in the neonatal population? In other words, do the reported rates of MRSA colonization among neonates represent reality or do they underestimate the true colonization rates because of suboptimal sampling?

I was able to find 3 articles in the recent literature that attempt to answer this question. The earliest article by Singh et al. concluded that nasal surveillance cultures alone were sufficiently sensitive for the detection of MRSA in neonates. Although there were no positive umbilical cultures, only a small minority of patients actually had umbilical testing (<10%). In contrast, an article by Huang et al. examining MRSA colonization among NICU patients found that the nares and umbilicus were the two most common sites of initial colonization with a sensitivity of 71% and 60% respectively. The sensitivity reached 90% if both nares and umbilicus were sampled. More recently, Rosenthal et al. also found that sampling of the nares alone was suboptimal with a sensitivity of only 68-72%, whereas the combination of nasal and umbilical swabs achieved a sensitivity of >90% (92-100%).

Although the data are somewhat conflicting, two of these studies certainly raise the concern of whether the low reported rates of MRSA colonization detected in newborns is at least in part due to suboptimal sampling.

From my review of the literature, it is clear that there remains much that we don't know about MRSA, particularly as it relates to the neonate. However, I believe that these data demonstrate that we should exercise caution before deciding to carve out an exception from the MRSA surveillance testing requirement for the inborn neonatal population admitted to the NICU. I ask you to consider the following points:

1) Although there is a wide range for colonization rates reported in the literature, there nevertheless is evidence that in some settings, neonatal MRSA colonization rates may approach that of adults. Creating this exception across the board in California would mean that in those settings with higher neonatal colonization rates (possibly those hospitals that did not voluntarily submit their data), there will be an increased risk of MRSA transmission and thus disease among these very vulnerable NICU patients.

2) I have concern that the low reported colonization rates might simply reflect suboptimal testing. This reminds me of the use of the acronym "wnl" by some clinicians to indicate "within normal limits" on a patient's physical exam. The other interpretation for this acronym is "we never looked". If we don't look for MRSA in the right places, then clearly we won't find it. Given that there is evidence that nasal sampling alone may be suboptimal for determining MRSA colonization in neonates, I would be reluctant to carve out this exception. SB1058 doesn't prescribe how testing should be performed, and this really puts a responsibility on hospitals (and those involved with the CDPH/HAI-AC) to determine what is the appropriate method of testing for each population. Shouldn't we make sure that we're looking for MRSA in the right places among neonates before we assume that colonization rates are negligible and that surveillance testing is unnecessary?

3) Even if we assume that the MRSA colonization rates among inborn neonates admitted to the NICU is currently "negligible", thus making testing unnecessary, then I would also ask the question: exactly what threshold must be exceeded to justify MRSA surveillance cultures in this population? The epidemiology of MRSA (particularly the USA300 strain) continues to evolve. If we decide now that we aren't going to culture the inborn neonatal population, then I believe that we have a responsibility to define what threshold we would require to justify MRSA surveillance in this population and then to put in place a process to monitor for when this threshold is exceeded. My concern is that we would be doing a disservice to NICU patients around California if we simply carve out this exemption and then never revisit this issue again. As MRSA has already shown us, it can evolve in ways that we sometimes cannot anticipate. If not already the case, vertical transmission of MRSA from maternal vaginal colonization may yet become a significant source of neonatal colonization. If we allow this exception today, will we then be able to identify and respond to changing epidemiology quickly enough to protect our highly vulnerable NICU population?

I anticipate that the argument will be made that MRSA surveillance testing in this population is a waste of hospital resources. While I am sympathetic to this argument given how strapped all hospitals are, I would also caution that this should not be the main criteria by which to decide this issue. If we were to apply the same cost argument to other populations required under SB 1058 to have MRSA surveillance testing, then other

aspects of this law arguably would also NOT be found cost-effective. However, this was not the purpose of SB 1058; the purpose was/is to protect vulnerable patients from acquiring MRSA as this acquisition increases risk of subsequent disease. My primary concern (and the reason for my wanting to think through this issue more thoroughly) is that neonates admitted to the NICU, particularly the premature/low birth weight infants, are arguably the most vulnerable, at-risk patients cared for in the hospital setting, and so extra caution must be exercised as we decide whether or not to allow inborn neonates admitted to the NICU to be exempted from MRSA surveillance testing.

I thank you for your thoughtful consideration of the issues presented here.

Respectfully submitted,

Brian Lee, MD, FAAP
Co-Director, Division of Infectious Diseases
Children's Hospital & Research Center Oakland

Appendix: Abstracts

Maternal rectovaginal colonization and vertical transmission

Chen KT, Huard RC, Della-Latta P, Saiman L
Prevalence of methicillin-sensitive and methicillin-resistant Staphylococcus aureus in pregnant women. [Journal Article, Research Support, N.I.H., Extramural, Research Support, Non-U.S. Gov't]
Obstet Gynecol 2006 Sep; 108(3 Pt 1):482-7.

OBJECTIVE: To estimate the extent of Staphylococcus aureus vaginal-rectal colonization among pregnant women as severe S aureus infections have emerged in pregnant and postpartum women and infants. **METHODS:** We conducted a prospective surveillance study for methicillin-sensitive S aureus and methicillin-resistant S aureus on all routine de-identified vaginal-rectal prenatal group B streptococcus (GBS) screening cultures submitted to the microbiology laboratory of a tertiary-care facility from January to July 2005. Standard microbiologic techniques and molecular analyses were used to detect community-associated methicillin-resistant S aureus strains. As opposed to health care-associated methicillin-resistant S aureus isolates, community-associated methicillin-resistant S aureus isolates were defined as those possessing the type IV or type V staphylococcal chromosomal cassette mec element and usually lacking a multidrug-resistant phenotype. **RESULTS:** A total of 2,963 GBS screening cultures were analyzed, from which 743 (25.1%, 95% confidence interval [CI] 23.5-26.7%) GBS isolates and 507 (17.1%, 95% CI 15.7-18.5%) S aureus isolates were identified. Group B streptococcus colonization was significantly associated with S aureus colonization (prevalence odds ratio 2.1, 95% CI 1.7-2.5, P < .001). Of the S aureus isolates, 14 (2.8%, 95% CI 1.4-4.2%) were methicillin-resistant, and 13 of these were determined to be community-associated methicillin-resistant S aureus. **CONCLUSION:** The prevalence of S aureus colonization identified in GBS screening cultures from pregnant women was substantial and associated with GBS co-colonization. Although we do not advocate routine screening of pregnant women for methicillin-sensitive S aureus and methicillin-resistant S aureus colonization, we recommend continued monitoring of both methicillin-sensitive S aureus and methicillin-resistant S aureus infections in this population and their infants.

Andrews WW, Schelonka R, Waites K, Stamm A, Cliver SP, Moser S
Genital tract methicillin-resistant Staphylococcus aureus: risk of vertical transmission in pregnant women. [Journal Article, Research Support, Non-U.S. Gov't]
Obstet Gynecol 2008 Jan; 111(1):113-8.

OBJECTIVE: To estimate the frequency of genital tract colonization by methicillin-resistant Staphylococcus aureus (MRSA) among pregnant women and evaluate the association of such colonization with infant outcome. **METHODS:** Between July 2003 and July 2006, anovaginal screening cultures for group B Streptococcus (GBS) were

prospectively obtained in the third trimester (35 to less than 37 weeks of gestation) and were also processed for identification of Staphylococcus aureus including methicillin-resistant strains. Maternal colonization by MRSA was linked to a computerized database of invasive neonatal infections that occurred at our center during the study period. **RESULTS:** Among 5,732 mothers (who delivered 5,804 infants) with GBS screening cultures and infant infection data available, 22.9% were GBS-positive and 14.5% were positive for Staphylococcus aureus. A total of 24.3% of the Staphylococcus aureus isolates were MRSA. The overall MRSA colonization rate was 3.5%. Colonization by any Staphylococcus aureus (relative risk 1.6, 95% confidence interval 1.4-1.9) as well as MRSA (relative risk 2.2, 95% confidence interval 1.6-2.8) was significantly more common among GBS-positive than among GBS-negative women. No cases of early-onset invasive neonatal infection by MRSA occurred among infants in the study. **CONCLUSION:** Genital tract colonization with MRSA affected 3.5% of pregnant women. Such MRSA colonization is associated with colonization by GBS but does not predispose to a high risk of early-onset neonatal MRSA infection.

Beigi R, Hanrahan J
Staphylococcus aureus and MRSA colonization rates among gravidas admitted to labor and delivery: a pilot study. [Journal Article, Research Support, Non-U.S. Gov't]
Infect Dis Obstet Gynecol 2007.:70876.

OBJECTIVE: To determine colonization rates of Staphylococcus aureus given the potential for future intervention trials aimed at reducing surgical-site infectious morbidity, and to estimate methicillin-resistant Staphylococcus aureus (MRSA) rates in our patient population. **STUDY DESIGN:** Prospective pilot investigation comprising data from 104 gravidas admitted to an urban labor and delivery unit. All underwent anterior nares culture collection with a subset also undergoing vaginal culture collection. **RESULTS:** Twenty-two percent of women were colonized in the anterior nares. Of the 28 women who had vaginal cultures collected, 4/28 (14.2%) demonstrated Staphylococcus aureus colonization. There was 82% concordance between the nares and vagina. Nine percent of isolates were MRSA strains. Overall, 2/96 (2.1%) of women were MRSA-colonized. **CONCLUSIONS:** Rates of Staphylococcus aureus colonization among gravidas entering labor and delivery are modest and consistent with the general population. MRSA rates among gravidas appear to be reassuringly low in this pilot study.

Andrews JI, Fleener DK, Messer SA, Kroeger JS, Diekema DJ
Screening for Staphylococcus aureus carriage in pregnancy: usefulness of novel sampling and culture strategies. [Journal Article]
Am J Obstet Gynecol 2009 Oct; 201(4):396.e1-5.

OBJECTIVE: The purpose of this study was to determine the most sensitive strategy for the detection of Staphylococcus aureus among pregnant women and newborn infants. **STUDY DESIGN:** We obtained cultures for S aureus from 5 body sites of women at

35-37 weeks' gestation. We obtained cultures from their newborn infants before hospital discharge. **RESULTS:** Of 209 women who were screened, 29% of the women had at least 1 culture that was positive for S aureus; 5% of infants were S aureus carriers. The sensitivities of each site for S aureus detection were 52% nares, 50% throat, 13% rectum, 8% vagina, and 10% skin. The most sensitive combination of 2 sites was nares and throat (88%). Perinatal transmission of S aureus occurred in 4 women. Maternal methicillin-resistant S aureus carriage rate was 1%. Two infants carried the USA300 methicillin-resistant S aureus. **CONCLUSION:** Screening single body sites is insensitive for the detection of S aureus carriage in pregnancy. Sampling nares and throat is essential to the identification of S aureus carriers.

Creech CB, Litzner B, Talbot TR, Schaffner W
Frequency of detection of methicillin-resistant Staphylococcus aureus from rectovaginal swabs in pregnant women. [Journal Article, Research Support, Non-U.S. Gov't, Research Support, U.S. Gov't, P.H.S.]
Am J Infect Control 2010 Feb; 38(1):72-4.

Clinical samples from 250 pregnant women undergoing screening for rectovaginal group B streptococcus colonization were evaluated concurrently for the presence of methicillin-resistant Staphylococcus aureus (MRSA). Overall, S aureus was detected in 21.6% of the women; 53.7% of the isolates were MRSA. Despite a lack of risk factors for MRSA colonization, rectovaginal MRSA was detected in 10.4% of pregnant women in this study.

Trends in Methicillin-Resistant *Staphylococcus aureus* (MRSA) Anovaginal Colonization in Pregnant Women: 2005 vs. 2009
Karina A. Top, Richard C. Huard, Zachary Fox, Fann Wu, Susan Whittier, Phyllis Della-Latta, Lisa Saiman, and Adam J. Ratner*
Departments of Pediatrics, Pathology and Microbiology & Immunology, Columbia University Medical Center, New York, NY; Department of Infection Prevention and Control, NewYork-Presbyterian Hospital, New York, NY

Abstract
In 2005, the prevalence of methicillin-resistant *Staphylococcus aureus* (MRSA) anovaginal colonization in pregnant women at our center was 0.5%, and MRSA-colonized women were less likely to carry group B streptococcus (GBS). In this study, our objectives were to identify changing trends in the prevalence of MRSA and methicillin-susceptible *S. aureus* (MSSA) anovaginal colonization in pregnant women, to assess the association between MRSA and GBS colonization, and to characterize the MRSA strains. From February to July 2009, Lim broths from GBS surveillance samples were cultured for *S. aureus*. MRSA strains were identified by resistance to cefoxitin and characterized by MicroScan, staphylococcal chromosomal cassette (SCC)*mec* typing, pulsed-field gel electrophoresis (PFGE), *spa*-typing and Panton-Valentine leukocidin PCR. A total of 2,921 specimens from unique patients were analyzed. The prevalence of MSSA, MRSA and GBS colonization were 11.8%, 0.6% and 23.3%, respectively. GBS

colonization was associated with *S. aureus* colonization (OR 1.9, 95% CI: 1.5-2.4). The frequency of GBS colonization was similar in MRSA-positive (34.2%) versus MRSA-negative patients (21.8%) (*P*=0.4). All MRSA isolates from 2009 and 13/14 isolates from 2005 were SCC*mec* types IV or V, consistent with community-associated MRSA; 12/18 (2009) and 0/14 (2005) isolates were the USA300 clone. Panton-Valentine leukocidin and *spa*-typing were consistent with these results. Levofloxacin resistance increased from 14.3% (2005) to 55.6% (2009) (*P*=0.028). In conclusion, the prevalence of MRSA anovaginal colonization in pregnant women in New York City remained stable from 2005 to 2009, and USA300 emerged as the predominant clone with a significant increase in levofloxacin-resistant isolates.

MRSA colonization in newborns

Reusch M, Ghosh P, Ham C, Klotchko A, Singapuri S, Everett G
Prevalence of MRSA colonization in peripartum mothers and their newborn infants. [Journal Article, Research Support, Non-U.S. Gov't]
Scand J Infect Dis 2008; 40(8):667-71.

Methicillin-resistant Staphylococcus aureus (MRSA) cultures were obtained from 288 mother-infant pairs. A questionnaire given to mothers and medical record review assessed risk factors for colonization. Only 2.1% of mothers and 0.7% of infants carried MRSA. There were no identical MRSA mother-newborn pairs. MRSA colonization by expectant mothers is uncommon and transmission to newborns from vaginal delivery did not occur.

Seybold U, Halvosa JS, White N, Voris V, Ray SM, Blumberg HM
Emergence of and risk factors for methicillin-resistant Staphylococcus aureus of community origin in intensive care nurseries. [Journal Article]
Pediatrics 2008 Nov; 122(5):1039-46.

OBJECTIVE: The goal of this study was to define more clearly the impact of community-acquired methicillin-resistant Staphylococcus aureus clones (eg, USA300 and USA400) on colonization and infection in infants in intensive care nurseries and potential modes of transmission of community-acquired methicillin-resistant S aureus clones. **METHODS:** Prospective surveillance for methicillin-resistant S aureus colonization and infection was performed among infants in the intensive care nurseries at Grady Memorial Hospital (Atlanta, GA) between 1993 and 2006. Beginning in September 2004, nares surveillance cultures were collected at admission. Methicillin-resistant S aureus isolates were genotyped by using pulsed-field gel electrophoresis and multiplex polymerase chain reaction assays for staphylococcal chromosomal cassette mec gene complex type and Panton-Valentine leukocidin genes. Prevalence of and risk factors for colonization with community-acquired versus health care-associated methicillin-resistant S aureus clones (eg, USA100) were assessed. **RESULTS:** Between 1993 and 2006, 130 (3.5%) of 3707 infants were identified to be colonized with methicillin-resistant S

aureus. Twelve (1.2%) of 996 admission nares cultures were positive for methicillin-resistant S aureus (since initiation of admission cultures in September 2004). Community-acquired methicillin-resistant S aureus clones were first recovered in 1998; the proportion of methicillin-resistant S aureus clones of community origin increased significantly between 1998 and 2004. Multivariate analysis identified vaginal delivery and maternal smoking, both among infants of mothers receiving systemic antibiotic treatment before delivery, as independent predictors for neonatal colonization with community-acquired methicillin-resistant S aureus. Systemic antibiotic therapy before delivery for nonsmoking mothers delivering through cesarean section and possibly endotracheal intubation were associated with the recovery of health care-associated methicillin-resistant S aureus clones. **CONCLUSIONS:** Community-acquired methicillin-resistant S aureus clones have emerged as a major cause of methicillin-resistant S aureus colonization in high-risk newborns. Community-acquired methicillin-resistant S aureus recovery was associated with acquisition during birth, whereas health care-associated methicillin-resistant S aureus clones seemed to be transmitted nosocomially.

Pinter DM, Mandel J, Hulten KG, Minkoff H, Tosi MF

Maternal-infant perinatal transmission of methicillin-resistant and methicillin-sensitive Staphylococcus aureus. [Journal Article, Research Support, Non-U.S. Gov't]
Am J Perinatol 2009 Feb; 26(2):145-51.

Because of the increasing importance of Staphylococcus aureus (SA), including methicillin-resistant SA (MRSA) in serious neonatal infections, we studied the contribution of perinatal maternal-infant transmission of SA to the colonization and infection of newborn infants. Cultures for SA, including MRSA, were obtained from nares and vagina of women in labor at term. Each mother's infant, if delivered vaginally, was cultured from nares and skin at delivery and again after 48 hours (at discharge). All MRSA and selected SA isolates were studied by pulsed field gel electrophoresis (PFGE). Infants were monitored after discharge for staphylococcal infection for 4 weeks. Of 304 women completing the study, 43 were colonized with SA, and 9/43 had MRSA. Of 252 evaluable infants, 25 were colonized with SA, and 9/25 had MRSA. Six of 252 mother-infant pairs were concordant for SA colonization, and one of these for MRSA. Isolates from five of these six infants were indistinguishable from their mother's isolates by PFGE, including the pair with MRSA. One SA-colonized infant and four noncolonized infants subsequently developed staphylococcal infections during the monitoring period. About 20% of SA isolates in this maternal population were MRSA. Perinatal maternal-infant transmission accounted for 20% of instances of perinatal colonization of infants with SA. Molecular confirmation of perinatal maternal-infant transmission of MRSA was first documented. In this population of term infants, most SA infections in the first 4 weeks of life appeared to result from colonization that occurred after discharge from the nursery.

Huang YC, Chao AS, Chang SD, Chen YJ, Peng MT, Sung JH, Chen CJ
Association of Staphylococcus aureus colonization in parturient mothers and their babies. [Journal Article, Research Support, Non-U.S. Gov't]
Pediatr Infect Dis J 2009 Aug; 28(8):742-4.

We recruited a total of 499 mothers and their 501 newborn babies to investigate whether infants acquire Staphylococcus aureus from their mothers. Of the 22 mother-baby paired S. aureus isolates, 11 (50%) paired isolates were unrelated, 1 pair related, and 10 pairs (45%) indistinguishable. Newborn babies acquire S. aureus colonization soon after birth either from the environment or their mothers.

Optimal sampling for MRSA colonization in neonates

Huang YC, Chou YH, Su LH, Lien RI, Lin TY
Methicillin-resistant Staphylococcus aureus colonization and its association with infection among infants hospitalized in neonatal intensive care units. [Comparative Study, Journal Article, Research Support, Non-U.S. Gov't]
Pediatrics 2006 Aug; 118(2):469-74.

OBJECTIVES: We conducted this study to assess the rate of methicillin-resistant Staphylococcus aureus colonization and its association with infection among infants hospitalized in methicillin-resistant S aureus-endemic NICUs. **METHODS:** Between March 2003 and February 2004, surveillance culture specimens from the nares, postauricular areas, axillae, and umbilicus of infants admitted to the NICUs at a children's hospital in Taiwan were obtained weekly for the detection of methicillin-resistant S aureus. All colonized and clinical isolates from each study infant with methicillin-resistant S aureus infection were genotyped with pulsed-field gel electrophoresis, with Sma1 digestion, and compared. **RESULTS:** A total of 783 infants were included in this study. Methicillin-resistant S aureus colonization was detected for 323 infants during their NICU stays, with detection with the first 2 samples for 89%. Nares and umbilicus were the 2 most common sites of initial colonization. Methicillin-resistant S aureus colonization was associated significantly with premature birth (< or = 28 weeks) and low birth weight (< or = 1500 g), and infants with colonization had a significantly higher rate of methicillin-resistant S aureus infection, compared with those without colonization (26% vs 2%). Methicillin-resistant S aureus colonization was noted for 84 of 92 infants with methicillin-resistant S aureus infections. Of the 68 episodes with previous colonization and isolates available for genotyping analysis, colonized and clinical isolates were indistinguishable in 63 episodes, highly related in 2 episodes, and distinct in 3 episodes. **CONCLUSIONS:** More than 40% of the hospitalized infants were colonized with methicillin-resistant S aureus during their stay in methicillin-resistant S aureus-endemic NICUs; this was associated significantly with methicillin-resistant S aureus infection. Most infants with methicillin-resistant S aureus infections had previous colonization with an indistinguishable strain.

Rosenthal A, White D, Churilla S, Brodie S, Katz KC
Optimal surveillance culture sites for detection of methicillin-resistant Staphylococcus aureus in newborns. [Journal Article]
J Clin Microbiol 2006 Nov; 44(11):4234-6.

We describe two outbreaks among newborns, one caused by community-associated methicillin-resistant Staphylococcus aureus (MRSA) and the other by hospital-associated MRSA. The umbilicus, rectum, and nares were tested for colonization. We found that no single body site had optimal sensitivity when tested alone. The combination of umbilical and nasal swabs achieved a sensitivity of >90%.

Singh K, Gavin PJ, Vescio T, Thomson Jr RB, Deddish RB, Fisher A, Noskin GA, Peterson LR
Microbiologic surveillance using nasal cultures alone is sufficient for detection of methicillin-resistant Staphylococcus aureus isolates in neonates. [Journal Article]
J Clin Microbiol 2003 Jun; 41(6):2755-7.

During an outbreak of methicillin-resistant Staphylococcus aureus (MRSA) in the neonatal intensive care units at two hospitals, we assessed several sites for detection of MRSA colonization. Nasal cultures found 32 of 33 MRSA-colonized patients (97%). Rectal cultures detected 29% of 24 MRSA-colonized patients identified by paired rectal and nasal samples and axillary samples found 22% of 9 MRSA-colonized patients identified by axillary samples paired with nasal swabs. There were no positive umbilical samples.

Vertical transmission of MRSA & neonatal disease

Carey AJ, Duchon J, Della-Latta P, Saiman L
The epidemiology of methicillin-susceptible and methicillin-resistant Staphylococcus aureus in a neonatal intensive care unit, 2000-2007. [Journal Article]
J Perinatol 2010 Feb; 30(2):135-9.

OBJECTIVE: To assess the epidemiology of methicillin-susceptible Staphylococcus aureus (MSSA) and methicillin-resistant S. aureus (MRSA) infections in a neonatal intensive care unit (NICU). **Study Design:** A retrospective chart review was conducted from 2000-2007; demographic and clinical characteristics of infected infants and crude mortality were assessed. **RESULTS:** During the study period, there were 123 infections caused by MSSA and 49 infections caused by MRSA. Although the types of infections caused by MSSA and MRSA were similar, infants with MRSA infections were younger at clinical presentation than infants with MSSA infections (P=0.03). The overall rate of S. aureus infections was approximately 15-30 per 1000 patient-admissions. The

rate of bacteremia and skin and soft tissue infections remained stable over time. Among extremely low birth weight infants (birth weight <1000 g), 4.8 and 1.8% developed an infection caused by MSSA or MRSA, respectively. Infections occurred in a bimodal distribution of birth weight; 53% of infections occurred in extremely low birth weight infants and 27% occurred among term infants birth weight >or=2500 g, many of whom underwent surgical procedures. **CONCLUSIONS:** MSSA and MRSA remain significant pathogens in the NICU, particularly for extremely premature infants and term infants undergoing surgery. Further work should investigate infection control strategies that effectively target the highest risk groups and determine if vertical transmission of MRSA is responsible for the younger age at presentation of infection.