

PCR Screening for MRSA Active Surveillance: Experience at Mission Hospital

Mission Hospital is a 750-bed regional tertiary care center in Asheville, North Carolina. We are the regional referral center for all of western North Carolina and the surrounding region. We have 40,000 annual inpatient admissions and perform 40,000 annual surgeries.

Team. The MRSA IHI Committee formed in 2006 as one of several initiatives launched from the IHI 5 Million Lives Campaign. It is a multi-disciplinary team chaired by Dr. David McClain with representation from several areas of the hospital, including: Infectious Disease, Infection Control, Nursing, Performance Improvement, Public Health, Microbiology, Materials Management, and Environmental Services.

Background. In early 2006, the MRSA team saw that our nosocomial MRSA infection rate was steadily increasing and had peaked at 8.0 per 10,000 patient days of care. IHI and APIC were recommending that active surveillance may be an effective way of reducing MRSA infections. Studies showed that 8-10% of hospitalized patients are colonized with MRSA on admission and serve as a reservoir for spread to other hospitalized patients.

Aim. The team decided to pilot active surveillance in the ICUs.

- Identify patients colonized with MRSA
- Place MRSA-colonized patients on contact isolation in a *timely manner* to prevent nosocomial spread
- Reduce nosocomial MRSA infections by 50%

PCR Testing. PCR (polymerase chain reaction) testing produces fast results and has been shown to have higher sensitivity and efficacy. The PCR test is more expensive, but may pay for itself. Some hospitals that use slower tests taking 48 hours to produce results put patients pending results on preemptive isolation. The faster PCR test makes this step unnecessary and produces results in as soon as two hours. The faster PCR test may also reduce risk of transmission because patients with positive results can be identified sooner and placed on isolation sooner.

Change. On admission, the nursing staff takes a nasal swab of the patient and sends to the lab. The lab performs rapid PCR testing within 24 hours. On average results are available in 8 hours, and they can be available in as soon as two hours. When a patient is positive for MRSA colonization, it is automatically charted, and an order for an

isolation cart is automatically fired. The patient is then placed on contact isolation for the remainder of stay. Negative patients are re-screened every 7 days for nosocomial transmission. The decision was made not to decolonize patients prior to discharge based on current evidence that it is ineffective.

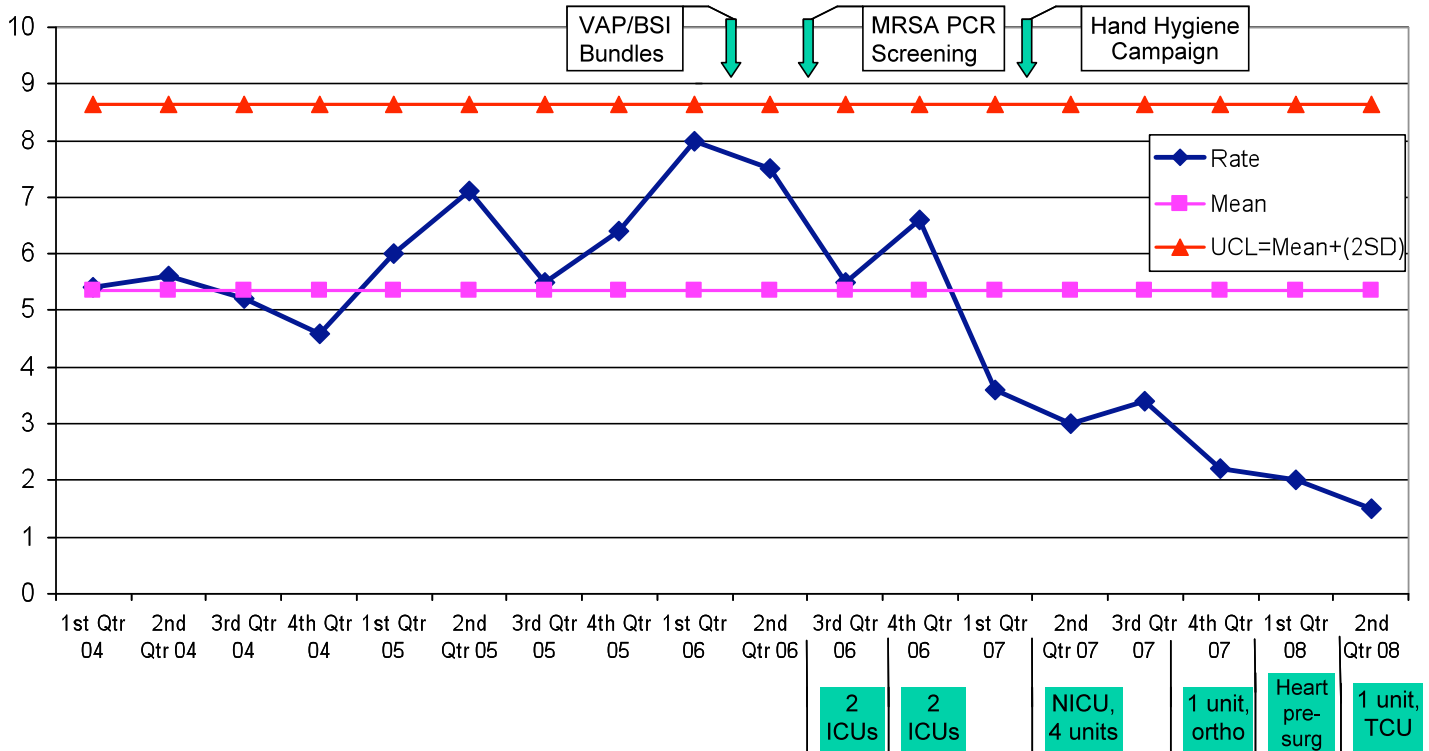
Implementation. MRSA PCR screening was implemented in a stepwise fashion, unit by unit. It started in the ICUs in September 2006 and was expanded to the NICU and floors throughout 2007. The MRSA team quarterly reviewed the nosocomial MRSA infection rate and incidence by unit to decide where screening should occur. The following is considered each time screening is implemented on a new unit:

- Lab technician and equipment. Two GeneOhm smart cyclers were purchased, and a dedicated lab technician is required to run the tests.
- Isolation supplies are purchased up front when a unit begins screening to ensure there are enough carts available for the increase in isolated patients. 2-5 carts per unit were purchased depending on the type and size of the patient population.
- Automatic computer order is built to ensure compliance. This order is fired when a patient is admitted to a unit that is screening and again every seven days.
- Education for staff and families. Infection control specialists educate staff on how to do the nasal swab and how to educate patients and families.
- Data collection and reporting. Infection Control Specialists spend significant time tracking % MRSA-positive patients and infection data and reporting to the MRSA team so informed decisions are made.

Current Program:

- MRSA PCR testing on admission in 4 adult ICUs, NICU, 7 high-incidence units, and pre-admissions for heart surgery.
 - 22,000 annual screens, 50% of all inpatient admissions
- 8% of patients have asymptomatic MRSA colonization and are placed on isolation to prevent nosocomial spread.
 - Varies by unit 2% (NICU) to 12% (MSICU & GenMed) in 2007
- Pre-admission surgical patients are decolonized prior to surgery when possible.

Nosocomial MRSA Infection Rate per 10,000 Patient Days of Care



Success. The graph above shows Mission’s nosocomial MRSA infection rate with IHI quality initiatives shown at the top and the timeline of active surveillance implementation across the bottom.

- The nosocomial MRSA infection rate has been reduced from 7.5 infections per 10,000 patient days in the 2nd quarter 2006 (before the first implementation of PCR screening) to 1.5 infections per 10,000 patient days in the 2nd quarter 2008.
- The nosocomial MRSA infection rate ranged from 4.6 to 8.2 in the years previous to implementing PCR screening, three to five times higher than the current rate.

Other quality initiatives may have contributed to the decline in the infection rate. A comprehensive hand hygiene campaign was launched at the beginning of 2007, and compliance reached 90% in early 2008. These other interventions have likely created a “bundling effect” on the MRSA infection rate, but the team is fairly confident that screening made the largest impact. The sharpest decline in the infection rate at Mission occurred after MRSA screening began in the ICUs as shown in the graph above. Also, most of the decrease in infections occurred only in the units participating in screening.

- Total nosocomial MRSA infections decreased by 50% from 2006 to 2007.
 - 67% decrease in the units participating in PCR screening
 - 10% decrease in all other areas not participating in PCR screening
- ***93% of total potentially avoided nosocomial MRSA infections occurred in participating units.***

Considering Hospital-wide Screening. We reached the goal of reducing nosocomial MRSA infections by 50% by the end of 2007. The team began discussing plans to expand screening hospital-wide. At the same time, any further expansion would require significant investment in resources from areas including Microbiology, Materials Management, and Environmental Services. Mission's chief medical officer requested a business plan with cost-benefit analysis to help the team decide whether to expand screening hospital-wide.

PCR Costs. The cost per test for labor and materials is currently \$26. This cost decreases with increasing volume and was closer to \$30 per test when we first began screening. The annual cost of PCR screening is roughly \$600,000.

Isolation Costs. This is a significant cost often overlooked in other studies. We spent roughly \$100,000 in 2007 to initially purchase stocked isolation carts. Patient isolation days have increased over 60% since we began screening, and we calculated the cost to restock supplies based on cart usage at \$58.50 per patient isolation day. The total increased annual isolation cost attributed to MRSA screening is roughly \$500,000. This does not include additional nursing time spent for isolated patients.

Cost Savings. We estimate over \$2 million annual cost savings based on the nosocomial MRSA infection rate at the end of 2007 and an estimated \$26,000 cost savings per avoided MRSA infection. Net annual cost savings are approximately \$925,000.

Options. The MRSA team was presented with three options: continue the current program and maintain successful results and significant cost savings; expand screening into units with incidence of nosocomial MRSA infections where there is cost-benefit; or expand screening hospital-wide. Any expanded screening would require a significant investment in resources. Also there was

concern about the impact of increased isolation both on nursing workload and patients.

Decision. It was decided that the benefits did not justify the costs of expanding screening hospital-wide. The team looked at the % MRSA-positive tests per unit and found that two units, NICU and orthopedics, represented a large patient population being screened but had a low percent-positive rate. The decision was made to stop PCR screening in these units and shift those resources and costs to two surgical units where it may be more effective. We were not seeing that screening had an effect on surgical site infections. (The greatest decline is in respiratory infections, including pneumonias.) The MRSA team would continue monitoring the nosocomial MRSA infection rate, determine where screening is most effective, and shift resources if necessary rather than add them.

(This change did not take effect until June 1, 2008, so the graph on page 3 does not show any results from this decision.)

Barriers and Lessons Learned.

- NICU experience. Although it was decided to stop PCR screening in the NICU, this did not occur. The lab is preparing to offer the Chromagar test instead, which costs \$5 per test and has 24-48 hours turn-around time. PCR testing will continue until the Chromagar test is available. Although the NICU has the lowest positive MRSA colonization rate, it has the highest *nosocomial* MRSA colonization rate. There was also a large outbreak just prior to the start of PCR screening and none since then, so there was evidence that PCR screening was effective.
- The % MRSA-positive rate combined with nosocomial MRSA infection rate are important measures and should be continually monitored to make informed decisions.
- Monitor cost-benefit from the beginning. Increased isolation has a profound organizational impact that is easily overlooked.
- Educating staff and patients/families is a constant task. Because of the incremental implementation, Infection Control is constantly educating staff. Also, because some units do screening while others do not, floating nurses must be trained. It is difficult at first for nurses to explain to patients and their families what it means to be colonized with MRSA, why they are on contact isolation, and why we do not decolonize them. They need to be trained and provided with educational materials such as brochures.

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