

# **Prevention of Methicillin-resistant Staphylococcus aureus In Acute Care Facilities**

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**July 18, 2010**

## **Abstract:**

Methicillin-resistant *Staphylococcus aureus* (MRSA) is the most common hospital acquired infection causing approximately 17,000 patient deaths annually. Despite the disease reaching epidemic proportions in the United States a coordinated effort to address the problem has not been undertaken. Numerous studies have produced significant reduction in MRSA infections using a combination of interventions. Carrier identification using screening tests is key to allow environmental decontamination, identification of contacts and the prevention of over antibiotic usage along with the risks of fostering antibiotic resistance. Whether targeted or universal screening is adopted depends upon the carrier rate of MRSA in the general population. In the United States the carrier rate appears to be between 3% and 10% which places all individuals admitted to the hospital in a high-risk category.

## **Literature Review**

Over the past decade MRSA infections have become increasing more common<sup>1</sup> and are one of the most dreaded hospital acquired conditions. MRSA is the most frequent cause of the over 1.7 million hospital acquired infections (HAI) which are estimated by the CDC to occur annually.<sup>2</sup> In addition, each year HAI causes 99,000 deaths and costs the US economy approximately 35 to 45 billion dollars.<sup>3</sup> Hospital acquired MRSA has been estimated to cause 17,000 deaths annually.<sup>4</sup>

Various MRSA prevention protocols have been developed. At some facilities, prevention is centered on universal precautions, with the treating of all patients the same. The rationale given for this, is a comparison to protocols used in the initial management of AIDS and the high prevalence of MRSA in the environment.

Comparison of the MRSA epidemic to that of AIDS is not valid because major differences exist. In the AIDS epidemic, the recommendation to not screen and identify patients along with the use of universal precautions was made because initially there was no treatment available for the disease and

there was significant discrimination in our society for those who were identified as having the affliction. AIDS, as compared to MRSA, was not nearly as contagious, with virtually no spread to the general public without intimate contact with the carrier.

A treatment for AIDS now exists and the Secretary of the Dept of HHS currently recommends that all persons between the ages of 13 and 64 be tested as part of their routine medical care.<sup>5</sup> Although universal AIDS testing is recommended once in a lifetime, as opposed to every hospital admission, the MRSA conversion rate in the general population is much higher than that for AIDS.

Some healthcare facilities, identify and focus in on high-risk groups. Barrier precautions are highly effective in preventing MRSA spread when used on high-risk patients.<sup>6</sup> Surveillance testing that has been targeted on high risk populations and healthcare workers has also been shown to reduce the incidence of MRSA infection.<sup>7</sup>

However, data is emerging that in the US we are all high risk. The rate of MRSA colonization in healthcare workers has been reported to be between 4% and 6.6%<sup>8, 9</sup> and the incidence of MRSA positive patients admitted to an acute care hospital varies between 3% to 10%. With reports of carrier rates of 3% in the US population over the age of 60<sup>10</sup>, 3.2% of patients admitted to an orthopedic trauma unit,<sup>11</sup> 3.6% of all patients admitted to a surgical ward,<sup>12</sup> 6.6% of patients admitted to a pediatric ICU<sup>13</sup> and 10% of all patients admitted to the Lexington, KY Veterans Administration Hospital.<sup>14</sup>

Another approach is the use of surveillance testing on all patients admitted to a facility. For those with scheduled surgery, this should be done on an outpatient basis. Surveillance MRSA testing has been found to be costeffective<sup>15</sup> with the rapid polymerase chain reaction (PCR) test costing a facility under \$30 and a standard culture under \$10.<sup>4</sup>

MRSA screening can be used both on the patient and to aggressively identify community contacts for those that are found to be positive. This latter approach was one of the key interventions

that the country of Norway followed to bring their MRSA epidemic under control. They tracked each individual case of MRSA and identified and tested the carrier's contacts.<sup>16</sup>

The vast majority of research studies and reports have found that protocols which use universal MRSA screening of all admitted patients are effective in preventing MRSA infections. Community-associated strains of MRSA (CA-MRSA) have become a major cause of hospital acquired infections.<sup>17</sup> The CA-MRSA strains are adding to the overall presence of MRSA in the hospitals and outpatients coming into the hospital are fast becoming a significant reservoir for HAIs. Other studies which support universal screening for MRSA are listed below:

2007 Feb: The Pittsburg Veterans Administration Hospital reported a 70% decrease of MRSA using universal surveillance testing, contact precautions and increased hand hygiene.<sup>4</sup>

2008 Mar: A large study from Northwest University<sup>18</sup> which found that universal surveillance for MRSA on all admitted patients was associated with a large reduction in MRSA infections. Total MRSA infections in the three studied facilities decreased by 69.6% with universal surveillance.

2009 Feb: Shukla, et al.,<sup>11</sup> found that the MRSA carrier state produced an increased risk of surgical site infections (8.8% of positive patients). That identification of these patients allowed the preoperative use of glycopeptide antibiotics and increased vigilance for wound infection post-operatively.

2009 Feb: Dr. Walter Pofahl reported that MRSA preoperative screening resulted in a significantly decreased infection rate in patients who underwent orthopedic surgery.<sup>19</sup>

2010 May: Data from the National US Veterans Administration's MRSA Reduction Initiative became available through a Congressional inquiry.<sup>20</sup> Using an intervention "Bundle" which included universal surveillance testing, contact precautions, and increased hand hygiene, MRSA infection rates at the nation's VA Hospitals fell 76% in the ICU (from 1.62/1,000 bed days of care to 0.39/1,000 bed days) and 28% in non-ICU patients (from 0.46/1,000 bed days of care to 0.33/1,000 bed days of care).

Despite the demonstration of significant reduction of surgical MRSA infections with protocols that use universal surveillance testing, there is resistance in the medical community on adopting this intervention. Many cite the work of Dr. Stephan Harbarth. In 2006, Harbarth, et al., reported that rapid screening and pre-emptive contact isolation substantially reduced MRSA cross-infections in the medical but not the surgical ICU.<sup>21</sup>

In 2008, Harbarth, et al., reported a widely publicized study showing that universal surveillance testing did not "reduce nosocomial MRSA infection in a surgical department...".<sup>22</sup> However, less than a third of the surgical patients were given pre-operative antibiotics and positive patients were isolated in a "flagged side or single rooms whenever available." In addition, the study reported that 5.1% of patients were MRSA positive and that these patients made up 41% of all MRSA infections ( $p < 0.0001$  chi square).

It is not enough to just identify patients, effective intervention must then be implemented. For elective admissions, MRSA surveillance testing should be performed on an outpatient basis since MRSA is highly infectious and by the time screening results are obtained as high as 45% of patients may have contaminated their environment.<sup>23</sup> Hardy, et al.,<sup>12</sup> reported a 3.6% carrier rate in admitted patients to a surgical ward and another 2.2% acquired MRSA after admission. Positive patients were treated with isolation and decolonization. Rapid Screening (PCR) for MRSA was found to be more effective than the culture method in the prevention of MRSA acquisition. Thus, patients need to be identified as quickly as

possible and once identified, the environment of the patient, whether in the hospital or at home, needs to be decontaminated and contacts dealt with appropriately.

Identifying and treating only those who have MRSA is also important in the prevention of bacterial antibiotic resistance. Another one of Norway's interventions in the prevention of antibiotic resistance was the limitation of antibiotic usage.<sup>16</sup> Institutions who routinely treat all of their patients' nares with Mupirocin (Bactoban) are at risk of developing resistant strains to this antibiotic that are being reported in the literature.<sup>24,25</sup>

The use of pre-operative antibiotics on all patients undergoing surgery is performed in some institutions to lower post-operative infection rates. However, implementation of this protocol comes at a risk of producing bacterial resistance; an example of short term good results for long-term poor ones.. Super resistant strains such as USA600 are being reported which have a mortality rate for bloodstream infections of 60%.<sup>26</sup> The high mortality rate has been attributed to Vancomycin tolerance with MRSA strains having the hVISA phenotype.<sup>27</sup>

Prophylactic antibiotics should not be given to all patients but reserved for those who are immunocompromised or undergoing surgeries that have a risk of infection. For example, for outpatient surgery performed in the head and neck region only open jaw fractures and diverticulectomy of the hypopharynx or esophagus are included in CMS's quality measures on pre-operative antibiotic usage.<sup>28</sup>

## **Conclusion**

Despite abundant evidence which can be used to chart a successful course in addressing the MRSA epidemic, the United State healthcare system lacks uniform national guidelines for controlling the spread of MRSA. The CDC has been criticized by the OIG<sup>29</sup> in finding that the CDC has "almost 1200 recommended practices, but activities across HHS to promote implementation of these practices are not guided by a prioritization of the practices."

MRSA carrier identification is one of the keys to addressing this epidemic. It is known that MRSA carriers are at a higher risk for infection and can rapidly spread MRSA to their environment. Isolation of all admitted patients is not practical and is cost prohibitive. In addition, the universal use of antibiotics will foster antibiotic resistance. Whether universal or targeted surveillance testing should be performed, depends upon the carrier rate in the general population. In many areas of the United States this rate is above 3% which argues strongly for universal screening.

As a surgeon who has undergone multiple cervical fusions, I insisted on pre-operative screening of MRSA before my procedure. I cannot in good conscience make treatment recommendations for patients which are different from that which I recommend for myself.

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