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State of the science review

## Degowning the controversies of contact precautions for methicillin-resistant *Staphylococcus aureus*: A review



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Methicillin-resistant *Staphylococcus aureus*  
Contact precautions  
Contact isolation  
Hand hygiene  
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Barrier precautions  
Gowning  
Gloves  
Standard precautions  
Transmission-based precautions

**Background:** Contact precautions (CPs) are recommended to prevent methicillin-resistant *Staphylococcus aureus* (MRSA) transmission in institutions. Rising doubts about CP effectiveness and recognition of unintended consequences for patients have raised questions about the benefit. The objective of this study was to evaluate the effectiveness and adverse outcomes associated with CPs for prevention of MRSA transmission.

**Methods:** We searched PubMed, Embase, and the Cochrane Library for articles related to effectiveness and adverse outcomes of CPs in patients with MRSA. Criteria for inclusion included the following: articles conducted in the United States, articles performed in an acute care setting, articles that were not a case series or review, and those with standardized collection of data or inclusion of case and control groups. Results were summarized and examined for potential limitations. Recommendations were based on our findings.

**Results:** CPs reduced MRSA transmission in epidemic settings and in instances with high compliance, but a decrease in infection rates was not shown. Unintended consequences of CPs include decreased health care provider (HCP) time spent with patients, low HCP compliance, decreased perceptions of comfort from patients, and greater likelihood of patient complaints and negative psychologic implications.

**Conclusion:** In endemic settings, there are few data to support routine use of CPs to control the spread of MRSA. Education should be performed in hospitals to improve patients' perception of care and understanding of CPs when implemented and HCPs' adherence to good hand hygiene and standard precautions practices.

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The annual societal cost-of-illness attributable to antimicrobial resistance totals >\$50 billion for the United States alone.<sup>1</sup> Compared with infections caused by methicillin-susceptible

*Staphylococcus aureus*, infections caused by methicillin-resistant *S aureus* (MRSA) are associated with higher costs, longer and more complex hospitalization courses, and higher morbidity and mortality.<sup>2</sup> The Centers for Disease Control and Prevention (CDC) released its first ever report on antibiotic resistance threats in the United States<sup>3</sup> in 2013, highlighting that every year, >2 million individuals acquire infections caused by multidrug resistant organisms (MDROs) and at least 23,000 die as a result of these infections.

To curb the spread of MDROs such as MRSA, infection prevention policies have been developed. Contact precautions (CPs) are one strategy recommended by the CDC to control the spread of MDROs such as MRSA.<sup>4</sup> CPs, falling under the category of transmission-based precautions, require health care providers

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(HCPs) to use gloves and gowns and to isolate patients in private rooms to prevent the transmission of microorganisms.<sup>4,5</sup> Approximately 15% of patients in hospitals are under CPs at any given time.<sup>6,7</sup> It is important to determine whether there is truly a benefit in this high percentage of patients on CPs.

Although the CDC recommends standard precautions and CPs for patients with MDROs, hospitals may choose to isolate patients with specific bacteria based on local surveillance data; therefore, isolation practices may vary from institution to institution. Findings of recent studies have further raised questions about the benefits of CPs in preventing MRSA transmission in nonoutbreak settings,<sup>8</sup> particularly when weighing them against their unintended consequences.

## OBJECTIVE AND METHODS

The objectives of this article are to perform an integrative review of literature surrounding the efficacy of standard precautions and CPs in the United States for patients with MRSA in the acute care setting and to provide our recommendations based on these findings. This article also discusses outcomes, quality of care, and psychologic implications associated with CPs and weighs the results against the findings of effectiveness. Infection prevention efforts are often bundled together with improvements in hand hygiene, active surveillance, decolonization, and CPs. To understand the true effect of isolation, we focused this review on the effects of CPs.

Peer-reviewed articles from January 1, 1996–May 1, 2015, were included that evaluated the effectiveness, quality of care, and adverse outcomes of CPs in patients with MRSA. Various articles also included vancomycin-resistant *Enterococcus* (VRE); however, we focused only on MRSA. Further, we evaluated the quality of care and psychologic implications of CP for all organisms because none of the studies focused strictly on MRSA. Articles were identified through PubMed, Embase, and the Cochrane Library with the following criteria: articles conducted in the United States (because health care delivery systems vary widely across countries), articles performed in acute care settings, articles not a case series or review, and those with standardized collection of data or inclusion of case and control groups. Search results were limited to English-language studies. The references of included studies were also reviewed. Finally, 2 reviewers independently extracted data on study characteristics and results. The search terms included *contact, precautions, MRSA, outcomes, transmission, quality of care, adverse effects, depression, anxiety, psychiatric, isolation, and barrier*. The results of these studies were summarized and examined for potential limitations.<sup>9</sup>

## RESULTS

### *Effects on transmission of MRSA and patient outcomes with CPs*

The effectiveness of CPs as a method to stem the spread of MDROs has been well documented in epidemic outbreaks (Table 1). Jernigan et al<sup>10</sup> described the benefits of CPs during a 7-month outbreak of MRSA in a neonatal intensive care unit (ICU). The authors described a 16-fold reduction in transmission as a result of implementation of CPs. Transmissions were determined by 2 independent observers based on an assessment of time, location, and caretakers. As such, the possibility of misclassification exists; however, the authors used statistical models to show that even if 50% of the transmissions had been misclassified, the rates of transmission among the nonisolated patients would have remained significantly higher. This study supports that CPs remain a mainstay in stemming an epidemic outbreak of MRSA.

Although there may be a reduction in transmission in an outbreak situation because of implementation of CPs, this may not stand true in a nonoutbreak endemic setting. In the Harris et al<sup>8</sup> cluster randomized trial, the primary composite outcome of reducing MRSA or VRE acquisition was not met; however, a secondary outcome of reduction in MRSA acquisition in the intervention arm was achieved ( $P = .046$ ). Consistent with prior studies, a decrease in HCP room entry was noted in the intervention group by 20%. Of note, the authors suggest that fewer visits may benefit patients and may have been associated with their reduced MRSA transmission rates. Strengths of this study include the large sample size and scope and its matched cluster randomization design. Because of this controlled study design with a study coordinator and weekly feedback on compliance, the investigators had 85%–95% compliance with admission and discharge screening and CPs. This may not be applicable to real-world ICUs, where compliance rates have been reported as low as 20%.<sup>11</sup> Overall, this study provides convincing data that the use of CPs can reduce the transmission of MRSA and raises interesting questions regarding whether or not CPs should be tailored to specific organisms or circumstances in the nonoutbreak setting.

Jain et al<sup>7</sup> implemented an MRSA bundle in 2007 at Veterans Affairs health care systems, consisting of universal nasal surveillance for MRSA, CPs for patients colonized or infected with MRSA, hand hygiene, and a change in the institutional culture where infection prevention became the responsibility of everyone who had contact with colonized or infected patients. The investigators found a significant reduction in MRSA transmission (17% and 21%) and health care–associated MRSA infections (63% and 45%) in ICUs and non-ICUs, respectively, with the bundle implementation. A limitation of this study is that there was no assessment of compliance with CPs. Further, CPs were implemented at the same time as other interventions (eg, bundle implementations, reductions in devices, education to improve hand hygiene compliance), making it difficult to determine the independent impact of CPs on MRSA reduction. In fact, a post hoc analysis of this study suggested that hand hygiene, not CPs, was the single most important factor in this bundle.<sup>12</sup> This study does provide evidence that CPs bundled with education and screening can make an impact on endemic transmissions of MRSA.

Recently, Edmond et al<sup>13</sup> evaluated the impact of discontinuing CPs for patients with MRSA and VRE infection-colonization on device-associated hospital-acquired infections. In their institution, historically, all patients with MDROs were placed on CPs. Beginning April 2013, CPs were discontinued for patients infected or colonized with MRSA or VRE unless there was uncontained wound drainage within a dressing or uncontained respiratory secretions for MRSA patients. During the study, 3 interventions were continued, including hand hygiene, daily chlorhexidine bathing of all inpatients, and a recommendation of bare-below-the-elbows protocol for inpatient care. The authors found no change in the rates of MRSA device-associated infections in all patient settings. There was a decrease in central line–associated bloodstream infections in non-ICU patients after CPs were discontinued. Compliance with CPs was 90%, compliance with hand hygiene was >85%, and compliance with the bare-below-the-elbows protocol was 69% for 3 years before discontinuing CPs, which remained unchanged after discontinuation. Of note, discontinuing CPs led to an annual cost savings of \$500,000. Because this study was performed in a single center, the results may not apply to other institutions. Further, there was no evaluation of the impact of discontinuing CPs on colonization rates of MRSA. However, an additional recent study of CP discontinuation using active surveillance revealed no increase in colonization or infection.<sup>14</sup>

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