

**Summary Statement Title:**

**Risk of infection after nasal colonization: Evidence and implications for public health**

**Quality Assessment Rating: 8 (strong)**

**Review on which this summary statement is based:**

Safdar, N., & Bradley, E.A. (2008). The risk of infection after colonization with *Staphylococcus aureus*. *The American Journal of Medicine*, 121, 310-315.

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*This is a summary statement written to condense the work of the authors of this systematic review, referenced above. The intent of this summary is to provide an overview of the findings and implications of the full review. For more information on individual studies included in the review, please see the review itself.*

**Review content summary**

This systematic review assessed the findings of ten observational studies to provide an overall estimate of the risk of infection following nasal or inguinal colonization with methicillin-resistant *Staphylococcus aureus* (MRSA) compared with colonization by methicillin-susceptible *Staphylococcus aureus* (MSSA). A total of 1170 adult patients were included, and studies were conducted in long-term care settings, intensive care units, and general medical inpatient units. The primary outcome measures were acquisition of a MRSA infection in those colonized with MRSA, and MSSA infection following colonization with MSSA. All the studies examined nosocomial (healthcare-acquired) infection. Overall, colonization by MRSA, compared to colonization with MSSA was associated with a 4-fold increase in the risk of developing invasive MRSA infection. Review authors highlighted the importance of research focused on identifying effective methods for sustained eradication of MRSA colonization to reduce the high risk of subsequent infection.

**Comments on this review's methodology**

This was a methodologically strong review. To be included studies had to be an RCT or observational study and provide, or allow for, calculation of data on nasal colonization and infection by MRSA and MSSA. Table 1 outlines the characteristics of included studies. Electronic searches of PubMed, MEDLINE, EMBASE, and the Cochrane Library databases (inception - December 2006), were supplemented with reference list searches, and identification of unpublished studies. Authors independently evaluated studies, where applicable, for randomization procedure, blinding, and description of eligible participants including assessment of illness severity. It is somewhat unclear whether disagreements were resolved by discussion for data extraction alone, or included quality assessment. Study-specific outcomes of the methodological assessment, however, were not disclosed. Heterogeneity was assessed and a random effects model was appropriately used to obtain odds ratios with a 95% confidence interval. Review authors further examined potential sources of heterogeneity by testing the sensitivity of results to the exclusion of each study (see Table 2). Results show that no single study was responsible for all the heterogeneity. The test for publication bias was not significant. The forest plot (figure 2) was adequately weighted based on study sample size.

**Why this issue is of interest to public health**

While the systematic review described above examined nosocomial MRSA infections, MRSA is no longer an issue isolated to hospitals and long-term care facilities. Its rising prevalence as a community-acquired infection warrants the attention of public health practitioners and policy makers. Data from the United States demonstrate that MRSA is now the main cause of community-acquired skin and soft tissue infections.<sup>1</sup> At any given time, 20% - 30% of the Canadian population carry *Staphylococcus aureus* bacteria (resistant and non) but are not ill.<sup>2</sup> The bacteria, however, can still be spread to others who may subsequently become ill. MRSA infections may progress to infections of the bloodstream, bones and/or lungs, thus preventive measures are key.<sup>2</sup> Surveillance of Canadian MRSA (CMRSA) collected since 1995 has identified 10 epidemic strains and various sporadic strains. Of the epidemic strains, CMRSA 7 and 10 are associated with the community, while the other 8 strains are hospital-associated.<sup>3</sup> Ultimately, MRSA colonization and infection are linked to the broader public health issue of antimicrobial resistance fueled by antibiotic misuse in both hospital and community settings.<sup>2,4</sup> The Public Health Agency of Canada supports the Canadian Nosocomial Infection Surveillance Program (CNISP), which provides data that can be used to identify trends and develop national guidelines to help reduce the transmission of infections like MRSA.<sup>2</sup> Recent data suggest a slight overall increase in MRSA cases between 2006 and 2007 (5867 to 5955).<sup>5</sup> The number of cases of MRSA acquired in the reporting CNISP (n=47) hospitals decreased in 2007 by 8%; however, there was an increase in the number of community-associated MRSA (CA-MRSA) of 6%, from 15% to 21% of total cases of MRSA.<sup>5</sup>

## Evidence and implications

Evidence points are weighted or ranked according to strength.

What's the evidence?	Implications for practice and policy:
<p><b>1. Risk of infection after colonization with methicillin-resistant <i>Staphylococcus aureus</i> (MRSA) versus methicillin susceptible <i>Staphylococcus aureus</i> (MSSA) (10 studies)</b></p> <p>1.1. Overall, there is a four-fold higher risk of patient infection following MRSA colonization compared to MSSA colonization</p> <p>1.2. Because study results varied significantly a random effects model for combining the data was the most appropriate procedure to use. The odds ratio was 4.08, meaning the risk of invasive infection following MRSA colonization was just over four times higher compared to MSSA colonization. However the 95% confidence interval ranged from 2.09 to 7.94, meaning the true risk ranged from just over two times greater risk to 8 times greater risk for an invasive infection following MRSA colonization compared to MSSA colonization.</p>	<p><b>1. Risk of infection after colonization with methicillin-resistant <i>Staphylococcus aureus</i> (MRSA) versus methicillin susceptible <i>Staphylococcus aureus</i> (MSSA)</b></p> <p>1.1. Patients colonized with MRSA are much more likely to develop an invasive infection than those colonized with MSSA.</p> <p>1.2. Patients with more severe illness are more likely to acquire MRSA than MSSA due to prolonged hospital stays, greater antimicrobial use, and more invasive procedures.</p> <p>1.3. Patients colonized with MRSA should be closely monitored for signs of subsequent infection.</p>
<p><b>2. Cost Benefit or Cost-effectiveness Information</b></p> <p>2.1. No cost related information was included in the review</p>	<p><b>2. Cost Benefit or Cost-effectiveness Information</b></p> <p>2.1. Future research should assess cost benefit or cost-effectiveness of the interventions</p>
<p><b>General Implications</b></p> <ul style="list-style-type: none"><li>• Patients colonized with MRSA are much more likely to develop an invasive infection than those colonized with MSSA.</li><li>• Patients colonized with MRSA should be closely monitored for signs of subsequent infection.</li></ul>	
<p><b>Legend:</b> CI – Confidence Interval; OR – Odds Ratio; RR – Relative Risk **please see the <a href="http://www.health-evidence.ca">health-evidence.ca</a> glossary of terms (found under 'How to Use This Site') for definitions</p>	

## References used to outline issue

1. Safdar, N., & Bradley, E.A. (2008). The risk of infection after colonization with *Staphylococcus aureus*. *The American Journal of Medicine*, 121, 310-315.
2. Public Health Agency of Canada. (2008). *Infectious diseases: Fact sheet - Methicillin resistant Staphylococcus aureus*. Retrieved from <http://www.phac-aspc.gc.ca/id-mi/mrsa-eng.php>
3. Christianson, S., & Mulvey MR. A comparative genomic hybridization study of Methicillin Resistant *Staphylococcus aureus* in Canada. The 1st Annual Public Health Agency of Canada Research Forum. Fort Gary Hotel, Winnipeg, MB. March 20 – 21, 2006. Retrieved from <http://www.nml-lnm.gc.ca/eb-be/assets/pdf/MRSA/Christianson%202006%20PHAC-eng.pdf>
4. Birnbaum, D. (2002). *Antimicrobial resistance – a deadly burden no country can afford to ignore [report]*. Canadian Committee on Antibiotic Resistance. Retrieved from <http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/03vol29/dr2918eb.html>
5. Canadian Nosocomial Infection Surveillance Program. (2007). *Surveillance for Methicillin-resistant Staphylococcus aureus (MRSA) in patients hospitalized in Canadian acute-care hospitals participating in CNISP 2006-2007 preliminary results*. Retrieved from <http://www.phac-aspc.gc.ca/nois-sinp/pdf/mrsa-sarm-eng.pdf>

## Other quality reviews on this topic

- Abubakar, I., Irvine, L., Aldus, C.F., Wyatt, G.M., Fordham, R., Schelenz, S., et al. (2007). A systematic review of the clinical, public health, and cost-effectiveness of rapid diagnostic tests for the detection and identification of bacterial intestinal pathogens in faeces and food. *Health Technology Assessment*, 11(36).
- Wilton, P., Smith, R., Coast, J., & Millar, M. (2002). Strategies to contain the emergence of antimicrobial resistance: A systematic review of effectiveness and cost-effectiveness. *Journal of Health Services & Research Policy*, 7(2), 111-117.

## Related links

- The Canadian Antimicrobial Resistance Alliance (CAN-R) <http://www.canr.info/index.php>
- Canadian Committee on Antibiotic Resistance <http://www.ccar-ccra.com/>
- Canadian Nosocomial Infection Surveillance Program (CNISP) <http://www.phac-aspc.gc.ca/nois-sinp/survprog-eng.php>
- Gorwitz RJ, Jernigan DB, Powers JH, Jernigan JA. (2006). *Strategies for clinical management of MRSA in the community: Summary of an experts' meeting convened by the Centers for Disease Control and Prevention*. Available from [http://www.cdc.gov/ncidod/dhqp/pdf/ar/CAMRSA\\_ExpMtgStrategies.pdf](http://www.cdc.gov/ncidod/dhqp/pdf/ar/CAMRSA_ExpMtgStrategies.pdf)

- Northern Antibiotic Resistance Partnership <http://www.narp.ca/>
- Public Health Agency of Canada – Centre for Infectious Disease Prevention and Control (CIDPC) <http://www.phac-aspc.gc.ca/centres-eng.php#cidpc>
- Public Health Agency of Canada: National Microbiology Laboratory. *Enterics and bacteriology, nosocomial and antimicrobial resistance – MRSA*. Available from <http://www.nml-inm.gc.ca/eb-be/ARNI-RAIN-MRSA-eng.htm>

### **Summary statement authors**

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Greco, L., McRae, L., & Boyko, J. (2010). Risk of infection after nasal colonization: Evidence and implications for public health. Hamilton, ON: McMaster University. Retrieved March 10, 2010, from *health-evidence.ca*: [http://www.health-evidence.ca/documents/18759/Safdar\\_2008\\_Summary\\_Statement\\_-\\_English.pdf](http://www.health-evidence.ca/documents/18759/Safdar_2008_Summary_Statement_-_English.pdf)

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