**Evidence Summary Title:**
Antibiotic exposure and the risk of Methicillin-resistant *Staphylococcus aureus* (MRSA): Evidence and implications for public health

**Quality Assessment Rating:** 7 (moderate)

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

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This is an evidence summary 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**
A systematic review and meta-analysis were performed to determine whether antibiotic exposure acts as a risk factor for the isolation of methicillin-resistant *Staphylococcus aureus* (MRSA). Studies were included if they presented data on the relationship between antibiotic use and MRSA colonization or infection in adult patients. Seventy-six studies (case-control studies, cohort studies, and prevalence surveys) met such inclusion criteria. Thirty-five studies included patients with healthcare-associated MRSA, 26 with community-acquired MRSA (CA-MRSA), and 15 with mixed isolation. Antibiotic therapy studied included beta-lactams, glycopeptides, macrolides and quinolones. Findings suggest that subjects who have been exposed to antibiotic therapy have an increased risk of acquiring MRSA as opposed to non-exposed subjects. Such findings will help inform policy on the appropriate management of antibiotic therapy, with the subsequent hope of decreasing the incidence of MRSA.

**Comments on this review’s methodology**
This is a methodologically moderate systematic review. Using satisfactory inclusion criteria, the authors searched two electronic health databases from December 1976 to June 2007, and reviewed reference lists of retrieved articles. The search strategy could have been more comprehensive. The level of evidence of the primary studies included in the review was clearly outlined. The authors failed to assess the methodological quality of primary studies, but did independently extract data on various study characteristics (including research design and sample size). The authors detected significant heterogeneity among studies, and thus explored potential sources of heterogeneity through subgroup and sensitivity analyses. The authors then computed a summary relative risk (RR) of the effects with a 95% confidence interval (CI) using the inverse variance fixed effects method. Lastly, studies were weighted according to sample size.

**Why is this issue of interest to public health?**
While methicillin is effective in treating most *Staphylococcus aureus* infections, some bacteria have developed resistance to methicillin and can no longer be killed by this antibiotic.¹ In 2006, the Canadian Nosocomial Infection Surveillance Program identified 5787 new cases of MRSA.² Of this number, acute care hospitals and long-term care facilities accounted for 3561 and 452 cases respectively. CA-MRSA accounted for 893 cases and the remaining 404 cases were unknown.² The emergence and spread of MRSA is of concern for several reasons. MRSA may cause life-threatening infections in a substantial number of colonized patients.³ MRSA is typically multi-drug resistant, and thus treatment options are limited. Vancomycin, a potentially more toxic and less effective antibiotic, is the current treatment of choice for serious MRSA infections.³ However, MRSA strains with reduced susceptibility to vancomycin are now being reported.³ Finally, patients harbouring MRSA require prolonged hospitalization, special control measures, costly treatments and extensive surveillance. It is suggested that the direct health care cost attributable to MRSA in Canada averaged $82 million in 2004 and could reach $129 million in 2010.³ MRSA is a costly public health issue that needs to be tackled if the growing burden of this disease in Canadian hospitals, long-term care facilities, and communities is to be limited.³
Evidence and implications

Evidence points are not weighted or ranked according to strength

### What's the evidence?

<table>
<thead>
<tr>
<th>Antibiotic use and MRSA isolation (76 studies)</th>
<th>Implications for practice and policy:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.</strong> Participants who were previously treated with antibiotic therapy were almost twice more likely to acquire MRSA (infection or colonization) than participants who did not receive antibiotics. The true risk ranged from 1.7 to 1.9 times more likely (RR 1.8, 95% CI 1.7 to 1.9, p&lt;0.001).</td>
<td><strong>1.</strong> Public health organizations should collaborate with hospitals and community-based care providers that prescribe antibiotics to:</td>
</tr>
<tr>
<td><strong>1.1.</strong> For specific classes of antibiotics, (18 studies)</td>
<td><strong>1.1.</strong> inform health care providers and the general population of the clear association between exposure to antibiotics and isolation of MRSA (infection or colonization) and evidence-informed prevention strategies</td>
</tr>
<tr>
<td><strong>1.2.</strong> Participants who were previously treated with quinolones were three times more likely to acquire MRSA than participants who did not receive antibiotics. The true risk ranged from 2.5 to 3.5 times more likely (RR 3, 95% CI 2.5 to 3.5).</td>
<td><strong>1.2.</strong> advocate for reductions in the use of antibiotics, especially quinolones and glycopeptides</td>
</tr>
<tr>
<td><strong>1.2.1. Quinolones</strong></td>
<td><strong>1.3.</strong> participate in a MRSA surveillance system to improve recognition of MRSA</td>
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<td><strong>1.2.2. Glycopeptides</strong></td>
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<tr>
<td><strong>1.2.3. Cephalosporins</strong></td>
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<tr>
<td><strong>1.2.4. Other β-lactams</strong></td>
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<td><strong>2.1. Varied control group definition</strong></td>
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<td><strong>2.2. Varied sampling sources</strong></td>
<td><strong>2.2.</strong> Failure to adjust for covariates</td>
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<td><strong>2.3. Failure to state type of infection included</strong></td>
<td><strong>2.3.</strong> Cost benefit or cost-effectiveness information</td>
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<td><strong>2.4. Lack of data on antibiotic use and dosages</strong></td>
<td><strong>3.1. Future research should include the cost-effectiveness of interventions.</strong></td>
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<td><strong>2.5. Varied length of time in which antibiotic exposure was detected</strong></td>
<td><strong>3.1. Cost benefit or cost-effectiveness information</strong></td>
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<td><strong>2.6. Failure to adjust for covariates</strong></td>
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</tbody>
</table>

### Program Evaluation and Research

**2.** High quality research and rigorous program evaluations should be conducted to further investigate the association between antibiotic exposure and development of MRSA.

### Methodological issues of primary studies

- Varied control group definition
- Varied sampling sources
- Failure to state type of infection included
- Lack of data on antibiotic use and dosages
- Varied length of time in which antibiotic exposure was detected
- Failure to adjust for covariates

### Cost benefit or cost-effectiveness information

- Cost benefit and cost-effectiveness information was not included in this review
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### General implications

- There is a clear association between antibiotic use and MRSA isolation.
- There is a role for public health in advocating for reduced antibiotic use among key stakeholder groups.

**Legend:** CI – Confidence Interval; OR – Odds Ratio; RR – Relative Risk  
**For definitions please see the healthevidence.org glossary [http://www.healthevidence.org/glossary.aspx](http://www.healthevidence.org/glossary.aspx)**

### References used to outline issue

Other quality reviews on this topic


Related links

- Canadian Antimicrobial Resistance Alliance [http://www.can-r.com/](http://www.can-r.com/)
- Community Hospital and Infection Control Association [http://www.chica.org/](http://www.chica.org/)

Suggested citation


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