Quinupristin/dalfopristin-resistant *Enterococcus faecium* isolated from human stools, retail chicken and retail pork: EIP enterococci project

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Enterococcal Disease

- Third most common cause of nosocomial bacteremia in the past decade\(^1\)

- Although \textit{E. faecalis} is the most common enterococcal species isolated from human blood and urine, \textit{E. faecium} is more frequently associated with resistance to ampicillin and vancomycin\(^2\)

- 26.3\% of enterococci from ICU patients were resistant to vancomycin (NNIS 2000)

3. Am J Infect Control 2001:29;404-21
Streptogramins

Synercid® (quinupristin/dalfopristin)

- Approved in 1999 for the treatment on vancomycin-resistant *E. faecium*

Virginiamycin

- Used since 1974 for growth promotion in poultry, cattle and swine
Streptogramin Structures

**Type A**
(Macrolactones)

- Dalfopristin

**Type B**
(cyclic hexadepsipeptides)

- Quinupristin
- Virginiamycin M
- Virginiamycin S
Emerging Infections Program Survey for Antimicrobial-Resistant Enterococci: July 1998 - June 2000

- **Stools** submitted for routine culture to public health laboratories from outpatients in Oregon, Georgia and Minnesota (n=334, July 1998 to June 1999)

- **Chicken** carcasses purchased from grocery stores near the above sites and a university hospital in Maryland (n=407, July 1998 to June 1999)

- **Ground pork** purchased from the same sites as the chicken study and stores near a university hospital in Michigan (n=585, July 1999-June 2000)
Isolation of *E. faecium* on selective and nonselective plates

After an enrichment in enterococcosseal broth, bacteria were subcultured onto each of the following four plates:

- Quinupristin/Dalfopristin (4 µg/ml)
- Gentamicin (100 µg/ml)
- Vancomycin (10 µg/ml)
- Nonselective (no antimicrobial added)
Overall percentage of *E. faecium* from retail chicken and human stool by Quinupristin/Dalfopristin MIC (July 1998 to June 1999)

Percentage of isolates

<table>
<thead>
<tr>
<th>Quinupristin/Dalfopristin MIC (µg/ml)</th>
<th>Percentage of isolates</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;0.5</td>
<td>12</td>
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<tr>
<td>0.5</td>
<td>3</td>
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<tr>
<td>1.0</td>
<td>3</td>
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<tr>
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</tr>
<tr>
<td>4.0</td>
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<tr>
<td>8</td>
<td>127</td>
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<tr>
<td>16</td>
<td>128</td>
</tr>
<tr>
<td>≥32</td>
<td>2</td>
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</tbody>
</table>

Chicken samples (n=387)

Stool samples (n=104)
Quinupristin/Dalfopristin MICs of *E. faecium* from retail chicken isolated on different plates

![Graph showing the percentage of isolates with different MICs for Quinupristin/Dalfopristin on different plates. The x-axis represents Quinupristin/Dalfopristin MIC (µg/ml) and the y-axis represents the percentage of isolates. The graph indicates varying levels of resistance across different MIC values for each plate type.](image-url)
Quinupristin/Dalfopristin MICs of *E. faecium* from human stool isolated on different plates

No *E. faecium* from stool were isolated on vancomycin or gentamicin plates
Preliminary Results from Retail Ground Pork (July 1999-June 2000)

- Of 897 enterococcal isolates from pork, species identification was only performed on quinupristin/dalfopristin-resistant strains (n=348)

- 7/348 (2.0%) of the quinupristin/dalfopristin-resistant isolates were identified as *E. faecium*

- 1/7 had a quinupristin/dalfopristin MIC of 16 µg/ml

- 6/7 had a quinupristin/dalfopristin MIC of 8 µg/ml

- All 7 quinupristin/dalfopristin-resistant *E. faecium* from pork were isolated on nonselective plates
Gentamicin MICs of Quinupristin/Dalfopristin-resistant *E. faecium* from retail chicken, pork and human stool
Conclusions:

• Quinupristin/dalfopristin-resistant *E. faecium* are more common in retail chicken than pork and human populations.

• Quinupristin/dalfopristin-resistant *E. faecium* from retail chickens are more likely than isolates from pork or human stools to also express high-level gentamicin resistance.

• Quinupristin/dalfopristin-resistant *E. faecium* from retail chicken could potentially colonize humans.

• The possibility that genetic determinants of quinupristin/dalfopristin resistance could be transferred to human pathogens poses a serious threat to public health.
Mechanisms of Streptogramin Resistance in *E. faecium*

Streptogramin A
acetyltransferases- vatD/E

Streptogramin B
lactonases- vgb
target modification- ermA/B
efflux- *not described in enterococci*