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 *E. faecalis* is the most common enterococcal species isolated from human blood and urine, *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 \textit{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>Chicken samples (n =387)</th>
<th>Stool samples (n =104)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;0.5</td>
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<tr>
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<td>8</td>
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<tr>
<td>16</td>
<td>128</td>
<td>128</td>
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<tr>
<td>≥32</td>
<td>2</td>
<td>2</td>
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</tbody>
</table>
Quinupristin/Dalfopristin MICs of *E. faecium* from retail chicken isolated on different plates

![Graph showing Quinupristin/Dalfopristin MICs](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

![Bar chart showing the percentage of isolates of *E. faecium* with different Gentamicin MICs (µg/ml) from chicken, pork, and human stool samples.](image)

- **Chicken samples (n = 299):**
  - MIC <500: 3 isolates
  - MIC 500: 6 isolates
  - MIC 100: 198 isolates
  - MIC ≥1000: 1 isolate

- **Pork samples (n = 7):**
  - MIC 500: 2 isolates
  - MIC 100: 1 isolate

- **Human samples (n = 3):**
  - MIC 500: 1 isolate

The chart shows a notable higher percentage of isolates with MIC <500 in chicken samples compared to pork and human stool samples.
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- *vat*D/E

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