Vivli Project Report - July 13, 2025

Vivli Analysis Team

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1 Step 3: Discovery of Phenotypic Signatures

1.1 Clustering Results

1.1.1 Optimal Number of Clusters

- **Method**: Silhouette score analysis
- **Optimal number**: 7 clusters
- **Silhouette score**: 0.610

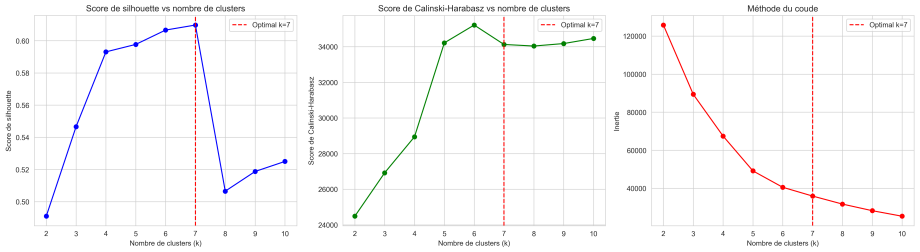

Figure 1: Optimal number of clusters

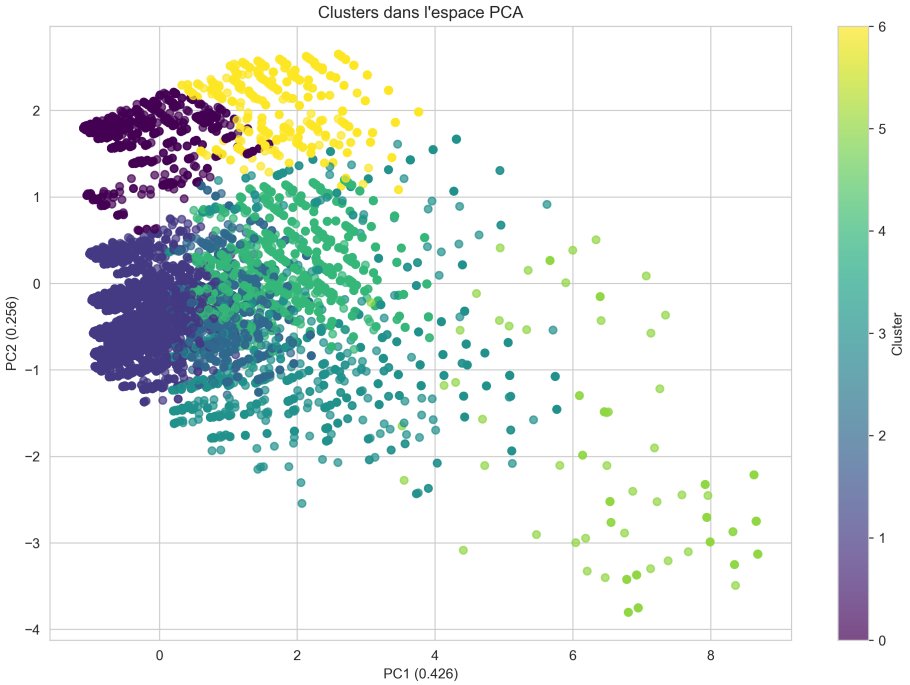

Figure 2: Clusters in PCA space

1.1.2 Cluster Visualization (PCA)

1.1.3 Resistance Signatures Heatmap

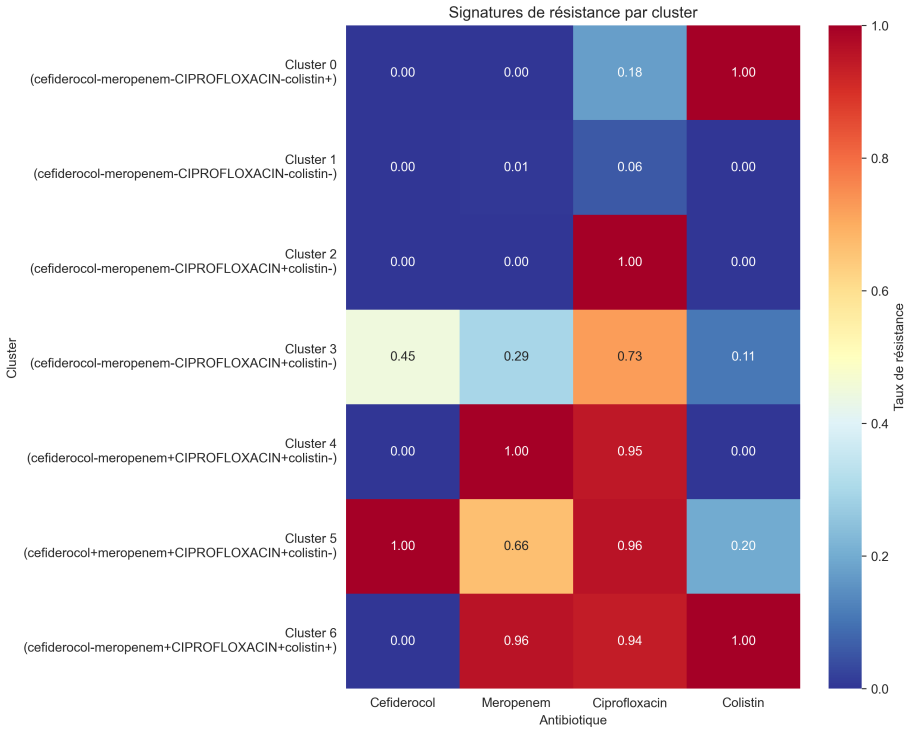

Figure 3: Resistance signatures heatmap

1.1.4 Hierarchical Clustering Dendrogram

1.1.5 PCA Variance Analysis

1.1.6 Cluster Distribution

Cluster 0 (cefiderocol-meropenem-ciprofloxacin-colistin+) - Size: 8,203 samples (17.2%) - Cefiderocol: 0.0% resistance, median MIC = 0.06 - Meropenem: 0.4% resistance, median MIC = 0.06 - Ciprofloxacin: 17.5% resistance, median MIC = 0.12 - Colistin: 100.0% resistance, median MIC = 8.00

Cluster 1 (cefiderocol-meropenem-ciprofloxacin-colistin-) - Size: 26,653 samples (56.0%) - Cefiderocol: 0.0% resistance, median MIC = 0.12

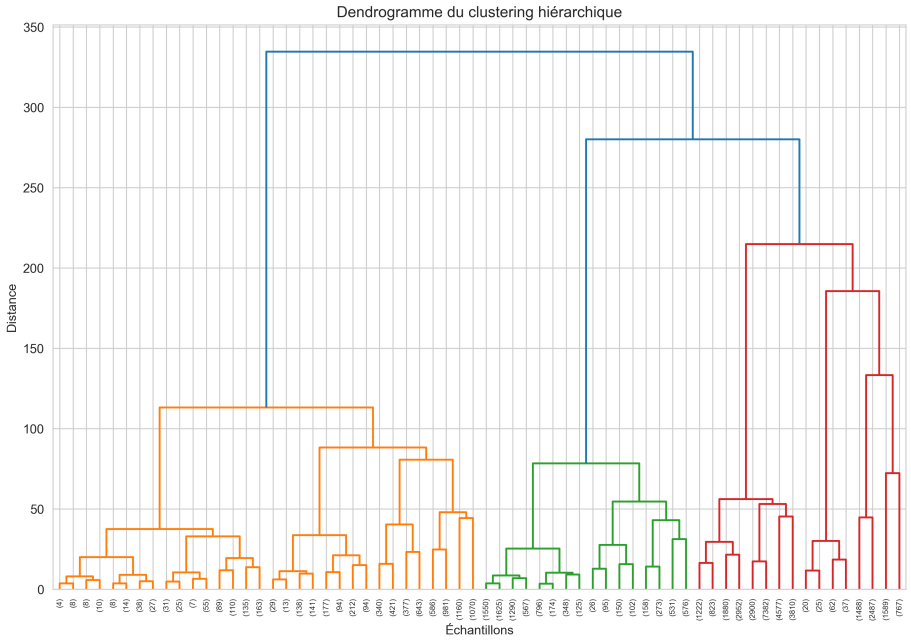

Figure 4: Hierarchical clustering dendrogram

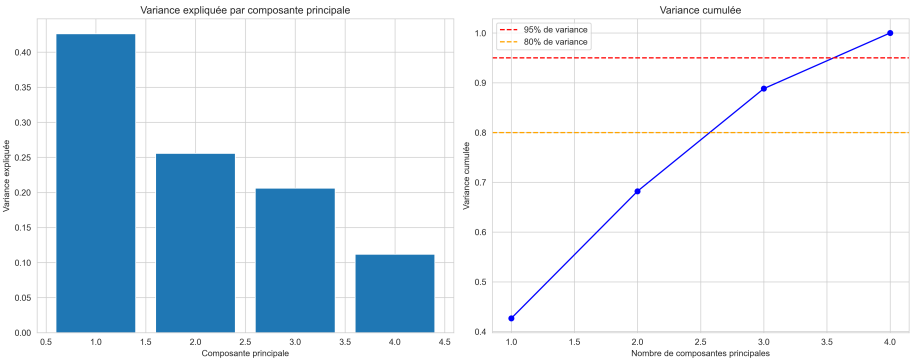

Figure 5: PCA variance analysis

- Meropenem: 0.7% resistance, median MIC = 0.06 - Ciprofloxacin: 5.7% resistance, median MIC = 0.12 - Colistin: 0.0% resistance, median MIC = 0.50

Cluster 2 (cefiderocol-meropenem-ciprofloxacin+colistin-) - Size: 4,601 samples (9.7%) - Cefiderocol: 0.0% resistance, median MIC = 0.25 - Meropenem: 0.0% resistance, median MIC = 0.06 - Ciprofloxacin: 100.0% resistance, median MIC = 8.00 - Colistin: 0.4% resistance, median MIC = 0.50

Cluster 3 (cefiderocol-meropenem-ciprofloxacin+colistin-) - Size: 1,780 samples (3.7%) - Cefiderocol: 44.6% resistance, median MIC = 2.00 - Meropenem: 29.4% resistance, median MIC = 0.12 - Ciprofloxacin: 72.6% resistance, median MIC = 8.00 - Colistin: 10.7% resistance, median MIC = 0.50

Cluster 4 (cefiderocol-meropenem+ciprofloxacin+colistin-) - Size: 4,882 samples (10.3%) - Cefiderocol: 0.0% resistance, median MIC = 0.12 - Meropenem: 100.0% resistance, median MIC = 64.00 - Ciprofloxacin: 94.8% resistance, median MIC = 8.00 - Colistin: 0.0% resistance, median MIC = 1.00

Cluster 5 (cefiderocol+meropenem+ciprofloxacin+colistin-) - Size: 146 samples (0.3%) - Cefiderocol: 100.0% resistance, median MIC = 256.00 - Meropenem: 66.4% resistance, median MIC = 24.00 - Ciprofloxacin: 95.9% resistance, median MIC = 8.00 - Colistin: 19.9% resistance, median MIC = 1.00

Cluster 6 (cefiderocol-meropenem+ciprofloxacin+colistin+) - Size: 1,350 samples (2.8%) - Cefiderocol: 0.0% resistance, median MIC = 0.12 - Meropenem: 95.9% resistance, median MIC = 64.00 - Ciprofloxacin: 93.9% resistance, median MIC = 8.00 - Colistin: 100.0% resistance, median MIC = 8.00

1.2 Identified Phenotypic Signatures

1.2.1 Clinical Interpretation

1. **Multidrug-resistant profiles**: Clusters with resistance to multiple antibiotics
2. **Specific profiles**: Selective resistance to certain antibiotics
3. **Sensitive profiles**: Susceptibility to most tested antibiotics

1.2.2 Applications

- Treatment guidance based on signatures
- Epidemiological surveillance of resistance profiles
- Development of rapid diagnostic tests

1.3 Conclusions

The clustering analysis revealed distinct patterns in resistance profiles, allowing categorization of isolates according to their phenotypic signatures and identification of high-risk groups for antibiotic resistance.