Comparison of antibiotic susceptibility across Minnesota hospitals in 2019 and 2020 using a new statewide antibiogram

Jadyn C. Anderson[1], Elizabeth B. Hirsch[2], Alicen B. Spaulding[3], Jennifer Rivers[4], Amanda Beaudoin[4]

[1]University of Minnesota School of Public Health, Minneapolis, MN, USA
[2]University of Minnesota College of Pharmacy, Minneapolis, MN, USA
[3]National Institutes of Allergy and Infectious Diseases, Vaccine Research Center, Bethesda, MD, USA
[4]Minnesota Department of Health, St. Paul, MN, USA

Contact: Amanda Beaudoin, DVM, PhD
Minnesota Department of Health
Email: amanda.beaudoin@state.mn.us

942

REVISED ABSTRACT

Background: Surveillance is critical to measuring the impact of programs intended to combat antimicrobial resistance, but active surveillance is resource-intensive. Regional antibiograms provide a supplementary method of surveillance while conserving resources. We developed statewide antibiograms to track susceptibility across the state of Minnesota and compared 2019 and 2020 data.

Methods: Hospital antibiograms for 2019 and 2020 were submitted to the Minnesota Department of Health in January 2022. Twelve organisms (*Enterococcus faecalis*, *Enterococcus faecium*, methicillin-resistant *Staphylococcus aureus*, methicillin-susceptible *S. aureus*, *S. aureus*, *Acinetobacter* spp., *Enterobacter* spp., *Escherichia coli*, *Klebsiella aerogenes*, *K. oxytoca*, *K. pneumoniae*, and *Pseudomonas aeruginosa*) were selected for analysis against 32 drugs, leading to a total of 142 unique organism/agent combinations. The number of isolates and percent susceptibility from each antibiogram were used to calculate a weighted average percent susceptibility as the state-level susceptibility. Chi-square analysis compared the proportion of susceptible to non-susceptible isolates between the years.

Results: Submitted antibiograms (n=40) represented 30% of Minnesota hospitals. The total number of isolates reported decreased by 5% from 2019 (n=85,010) to 2020 (n=80,781), with *E. coli* having the greatest proportion (2019=41.7%, 2020=39.5%) of the total isolates for each year. Significant changes in susceptibility proportions occurred in 33% of analyzed organism/agent combinations, with 68% of these showing increased susceptibility in 2020 compared to 2019. All antibiotics tested against *P. aeruginosa* demonstrated a statistical increase in susceptibility from 2019 to 2020 (Figure 2).

Conclusions: Analysis of statewide antibiograms for 2019 and 2020 demonstrated overall stability in antimicrobial susceptibility, with two-thirds of organism/agent combinations showing no significant changes. In those with significant changes, the majority exhibited an increase in susceptibility. Susceptibility changed more frequently in gram-negative organisms than gram-positive organisms. Ongoing collection of antibiograms will be used to assess regional and statewide susceptibility trends across Minnesota.

BACKGROUND

- Statewide antibiograms provide an alternative method to active surveillance at a lower cost and higher feasibility.
- Regional antibiograms identify the overall profile of susceptibility but cannot be used for clinical decision-making.
- Minnesota One Health Antibiotic Stewardship Collaborative (MOHASC) aims to collect hospital antibiograms annually to track susceptibility trends of major organisms.

OBJECTIVE

- To compare susceptibility changes in clinically-relevant pathogens from 2019 to 2020 across Minnesota hospitals.

METHODS

- 2019 and 2020 hospital antibiograms were requested in January 2022 from all 134 Minnesota hospitals
- 12 clinically-relevant organisms were selected for analysis
- Weighted-average percent susceptibility for each organism/agent combination were calculated for each year
- Comparisons between years were made using chi-square analysis of the proportion of susceptible to non-susceptible isolates for each combination

RESULTS

Figure 1. Species distribution of bacterial isolates included in antibiograms

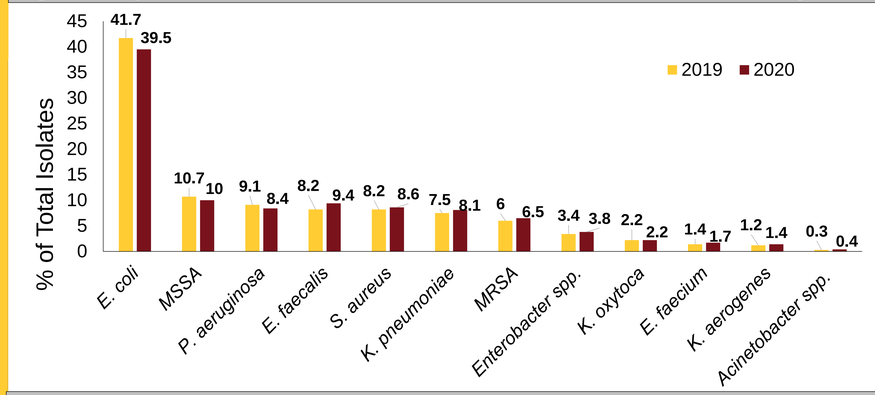
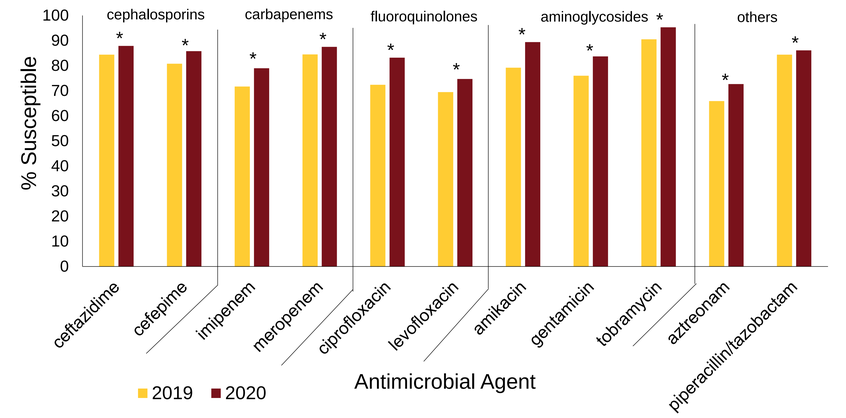


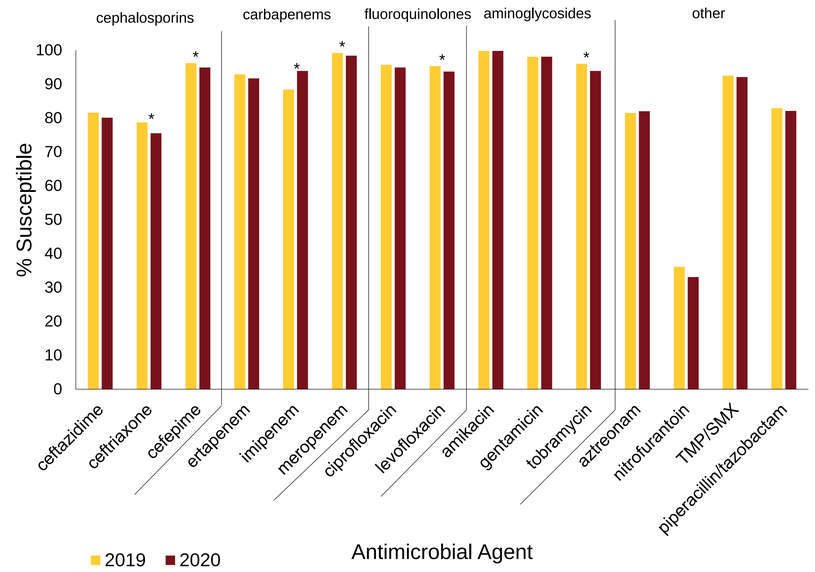
Figure 2. Statewide susceptibility profile of *P. aeruginosa*



*Statistical difference in the percent of isolates susceptible
Number of isolates differed for each agent. 2019: 2,776-7,715
2020: 1,911-6,769

RESULTS

Figure 3. Statewide susceptibility profile of *Enterobacter* spp.



*Statistical difference in the percent of isolates susceptible
Number of isolates differed for each agent. 2019: 904-2,918
2020: 960-3,066

Conclusions

- Antimicrobial susceptibility rates remained relatively stable across Minnesota between 2019 and 2020.
- Proportions of susceptible to non-susceptible isolates changed significantly in 33% (47/142) of analyzed combinations, with 68% of these demonstrating at increase in susceptibility
- *Enterobacter* spp. susceptibility increased to 1 and decreased to 5 antibiotics
- *P. aeruginosa* susceptibility increased to all 11 antibiotics
- Only 30% of Minnesota facilities were included in the analysis
- Antibiogram methodology eliminates the ‘intermediate susceptibility’ category and only allows for analysis of ‘susceptible’ and ‘non-susceptible’ rates.
- This is the first antibiogram comparison in Minnesota and results can provide insight into the susceptibility patterns of inpatient bacterial infections across the state.

SCHOOL OF PUBLIC HEALTH
UNIVERSITY OF MINNESOTA