MetroHealth Medical Center
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Abstract Submission Form

Poster Title: **Quantifying diagnostic uncertainty in sepsis: Towards a real-time clinical decision support system**

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Location of Laboratory:

Category: **Clinical Research**

Background: Clinicians make empiric decisions regarding sepsis diagnosis and treatment in uncertain circumstances. Sepsis-3 criteria for sepsis onset combine criteria for suspected infection and end-organ dysfunction, but both risk of infection and risk of clinical deterioration are distinct continuous probabilities weighed by providers in real time. A clinical decision support construct considering both infection risk and disease severity in tandem has been proposed but has not been validated on real-world clinical data.

Methods: Electronic medical record data from 133,524 emergency department visits were used to generate modified Early Warning Scores (MEWS) as a measure of disease severity and fit an internally developed machine learning model for infection (based on Sepsis-3 criteria) at 3-hours after patient arrival. To explore a 2-axis decision support construct, the impact of both variables on time to antibiotics was assessed both visually by construction of a heatmap and statistically by way of a multivariable linear regression. To assess the clinical impact of delayed antibiotics using this construct, we compared outcomes for patients that received antibiotics earlier than predicted to those that got antibiotics afterwards.

Results: Utilization and time to antibiotics varied across all strata of MEWS and predicted infection risk. In a multivariable regression, both risk scores and their interaction were significant predictors of time to antibiotics in practice. Patients that received relatively delayed antibiotics after adjusting for differential risks of infection and deterioration had a higher rate of ICU stay or death (9.4% vs 4.8%, $p<0.001$). Patients that had antibiotics discontinued within 3-days of arrival had lower initial infection risk probabilities (0.13 vs 0.23, $p < 0.001$).

Conclusions: A composite decision support model for sepsis that incorporates risk of infection along with risk of deterioration correlates with real-world practice variations in antibiotic utilization, timing, and clinical outcomes. This tool could be a useful construct for identifying potentially missed opportunities for timely antibiotic administration as well as early de-escalation when antibiotics are used empirically.