Category :**Sepsis/septic shock: management**
A180 - *Machine learning-guided early treatment of sepsis*

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Introduction:
Sepsis, dysregulated host immune response to infection resulting in organ dysfunction, accounts for more than 1 in 5 deaths worldwide. Evidence suggests a precision treatment approach of IV fluids and vasopressors may improve early sepsis care.

Methods:
We developed a precision treatment policy for IV fluids and vasopressors in early sepsis using Q-learning in clinical Electronic Health Record data. We identified patients with Sepsis-3 features within the first 6 hours of presentation at 14 academic and community UPMC hospitals in Pennsylvania, USA from 2013-2017. We organized 38 model features into 4-hour timesteps from hospital arrival until 48-hours after sepsis onset. We defined the state space using K-means clustering. The action space was a 5 x 5 matrix of IV fluid and vasopressor doses, including no drug administered then doses divided into quartiles. Awards and penalties were applied, maximizing 90-day patient survival. We compared AI and Clinician policy performance using weighted importance sampling with bootstrapped confidence intervals and determined absolute risk difference in predicted 90-day mortality across patient- and hospital- level subgroups.

Results:
We studied 30,687 early sepsis patients (mean age 64 (SD, 16) years; mean SOFA 3.5 (SD, 2.9)). The value of the AI treatment policy was significantly higher than the Clinician policy value (41.9, 95% CI: 41.2-42.7 vs 40.8, 95% CI 39.9-41.6). Predicted risk of 90-day mortality was lower among subgroups with advanced age, higher SOFA scores and non-surgical sepsis treated per the AI policy (**Fig** 1A). The AI policy value exceeded the Clinician policy across all study hospitals and predicted mortality risk difference ranged from 0.01-1.18% (**Fig** 1B).

Conclusion:
Precision treatment using IV fluids and vasopressors is associated with lower 90-day mortality risk among early sepsis patients compared to patients treated per Clinician policy, particularly among patients with advanced age, surgical sepsis and severe organ dysfunction.

Image :
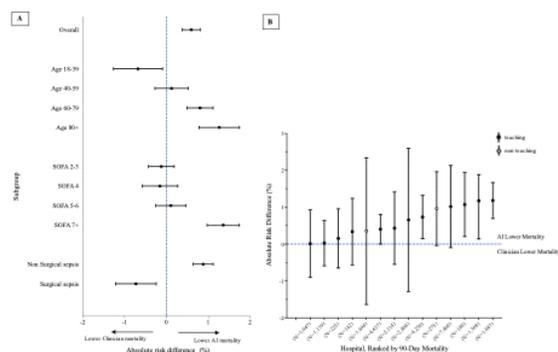
(A) Forest plot of absolute risk difference (95% CI) in predicted 90-day mortality between AI and Clinician policies by patient subgroup. X-axis corresponds to absolute risk difference (B) Caterpillar plot of absolute risk difference (95% CI) in predicted 90-day mortality between AI and Clinician policies by hospital. X-axis is hospital with corresponding sepsis patient count (N). Y-

axis is absolute risk difference.