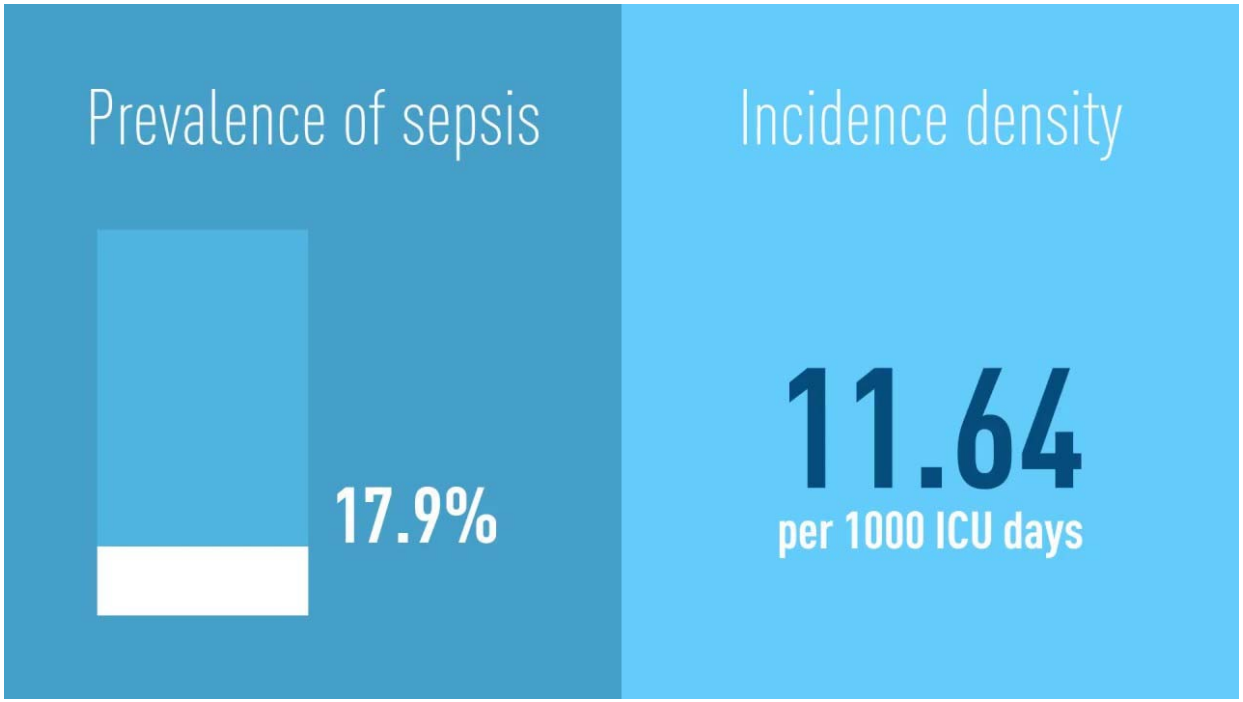
Team 14

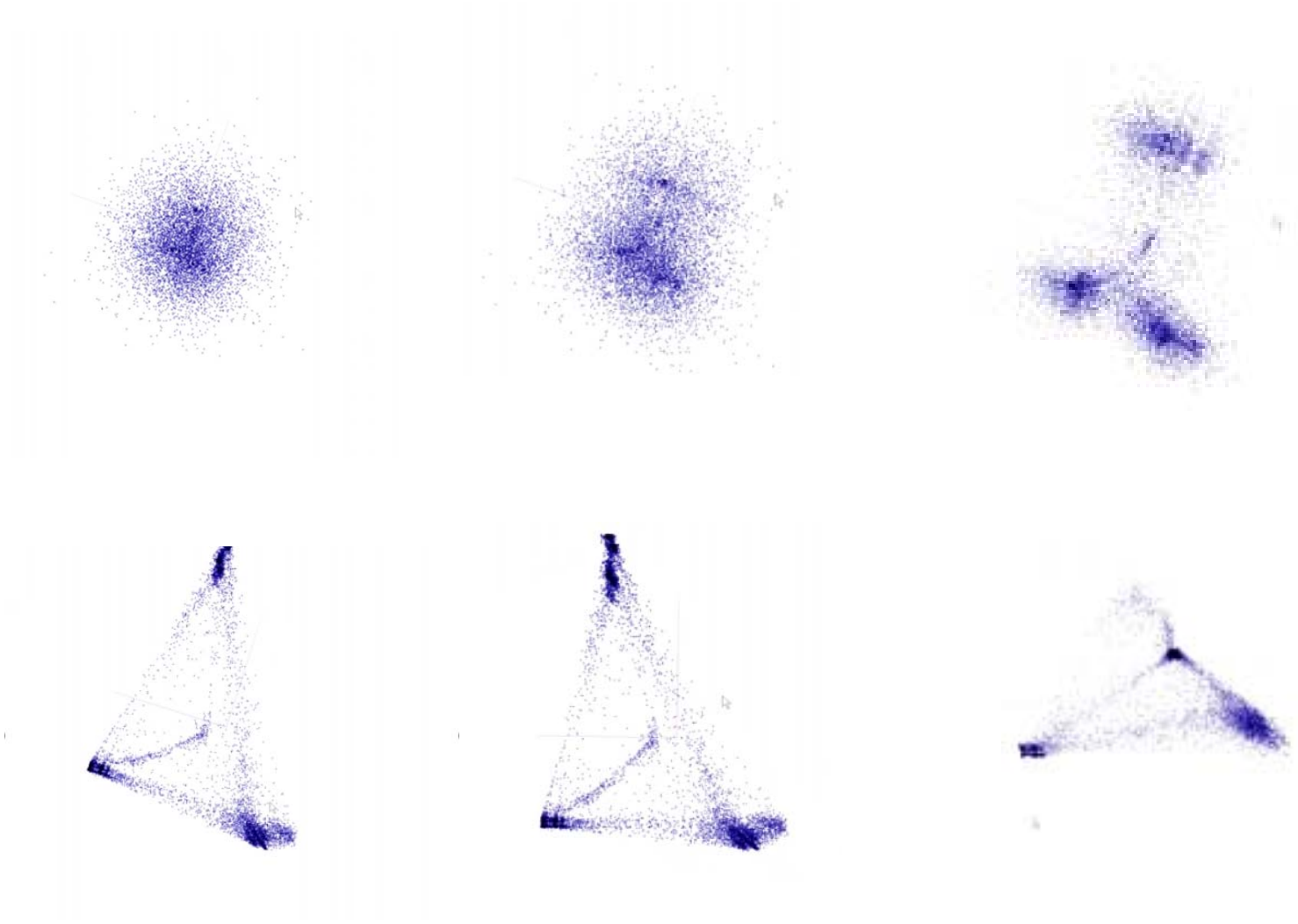
Development and validation of risk prediction model on novel clinical sepsis phenotype for personalized management and precise care for sepsis

Sepsis



- **Sepsis is defined as a dysregulated response infection that leads to acute organ dysfunction (Sepsis-3)**
- **Sepsis is the leading cause of death in ICUs**
- **Sepsis accounts for $17 billion in direct U.S. healthcare expenditures each year**
- **Sepsis is a syndrome, not a disease and diagnosis is challenging**

K-means clustering



Baseline Characteristics

category	α (N=1878)	β (N=3302)	γ (N=1451)	δ (N=1836)	Pvalue
Age	70.1 ± 45.5	87.6 ± 72.4	66.7 ± 35.8	69.8 ± 46.2	<0.001
Male	906 (48.2%)	1913 (57.9%)	828 (57.1%)	1092 (59.5%)	<0.001
Vital sign					
Heart rate	115.3 ± 24.3	117.3 ± 24.3	121.4 ± 28.0	131.1 ± 33.5	<0.001
Respiration rate	32.6 ± 12.3	33.6 ± 10.3	35.7 ± 13.0	1327.7 ± 54973.1	0.132
Renal					
BUN	32.4 ± 22.9	39.4 ± 25.5	56.5 ± 35.8	62.8 ± 39.8	<0.001
Creatinine	1.7 ± 1.8	2.0 ± 1.9	2.9 ± 2.6	3.0 ± 4.4	0.002
Chloride	107.8 ± 5.6	110.2 ± 5.9	111.6 ± 7.1	112.0 ± 9.3	0.559
ABGA					
PaO2	46.3 ± 42.4	70.3 ± 60.8	48.2 ± 33.0	50.9 ± 32.9	<0.001
PaCO2	34.1 ± 28.3	46.8 ± 24.8	47.2 ± 25.9	47.8 ± 23.2	<0.001
HCO3	21.8 ± 4.5	20.9 ± 4.6	17.6 ± 5.4	17.5 ± 4.9	0.003
Liver					
Total_Bilirubin	0.8 ± 1.8	1.2 ± 3.0	2.8 ± 6.5	5.7 ± 9.9	<0.001
INR	1.9 ± 2.4	2.1 ± 3.1	2.8 ± 5.8	3.0 ± 4.3	0.061
Albumin	2.0 ± 1.4	2.2 ± 1.4	2.2 ± 1.1	2.3 ± 0.9	0.269
Hematologic					
Hemoglobin	9.2 ± 1.7	9.2 ± 1.7	8.4 ± 1.7	8.0 ± 1.6	<0.001
Platelet	296.7 ± 100.4	162.3 ± 43.9	128.1 ± 76.4	60.8 ± 34.0	<0.001
Glucose	167.6 ± 55.6	191.0 ± 54.8	482.0 ± 284.5	206.4 ± 55.6	<0.001
Lactate	1.9 ± 1.8	2.6 ± 2.3	4.4 ± 4.2	4.5 ± 3.9	0.038
Diagnosis					<0.001
Sepsis	525 (28.0%)	865 (26.2%)	446 (30.7%)	623 (33.9%)	
Cardio-Respiratory	128 (6.8%)	161 (4.9%)	78 (5.4%)	132 (7.2%)	
Neurologic	50 (2.7%)	60 (1.8%)	19 (1.3%)	17 (0.9%)	
Renal	48 (2.6%)	65 (2.0%)	43 (3.0%)	44 (2.4%)	
Cancer	763 (40.6%)	1477 (44.7%)	526 (36.3%)	523 (28.5%)	
Other	364 (19.4%)	674 (20.4%)	339 (23.4%)	497 (27.1%)	
In Hospital Mortality	546 (29.1%)	1043 (31.6%)	638 (44.0%)	949 (51.7%)	<0.001

Results – Clustering

α

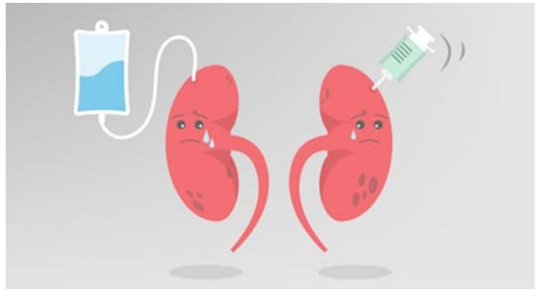
- Highest survival
- Normal lactate

- Lowest mortality↓

β

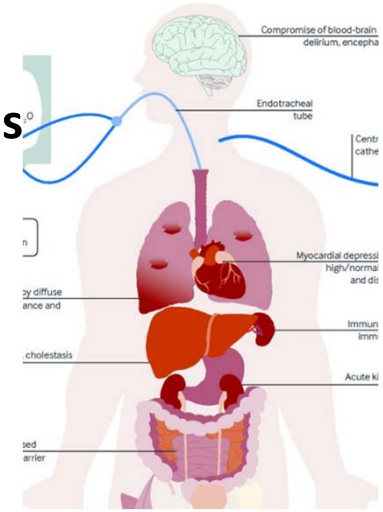
- Oldest
- Cancer

γ



- Metabolic acidosis
- High glucose
- Renal disease

δ



- Multi-organ failure
- Hemodynamic instability

- Highest mortality↑

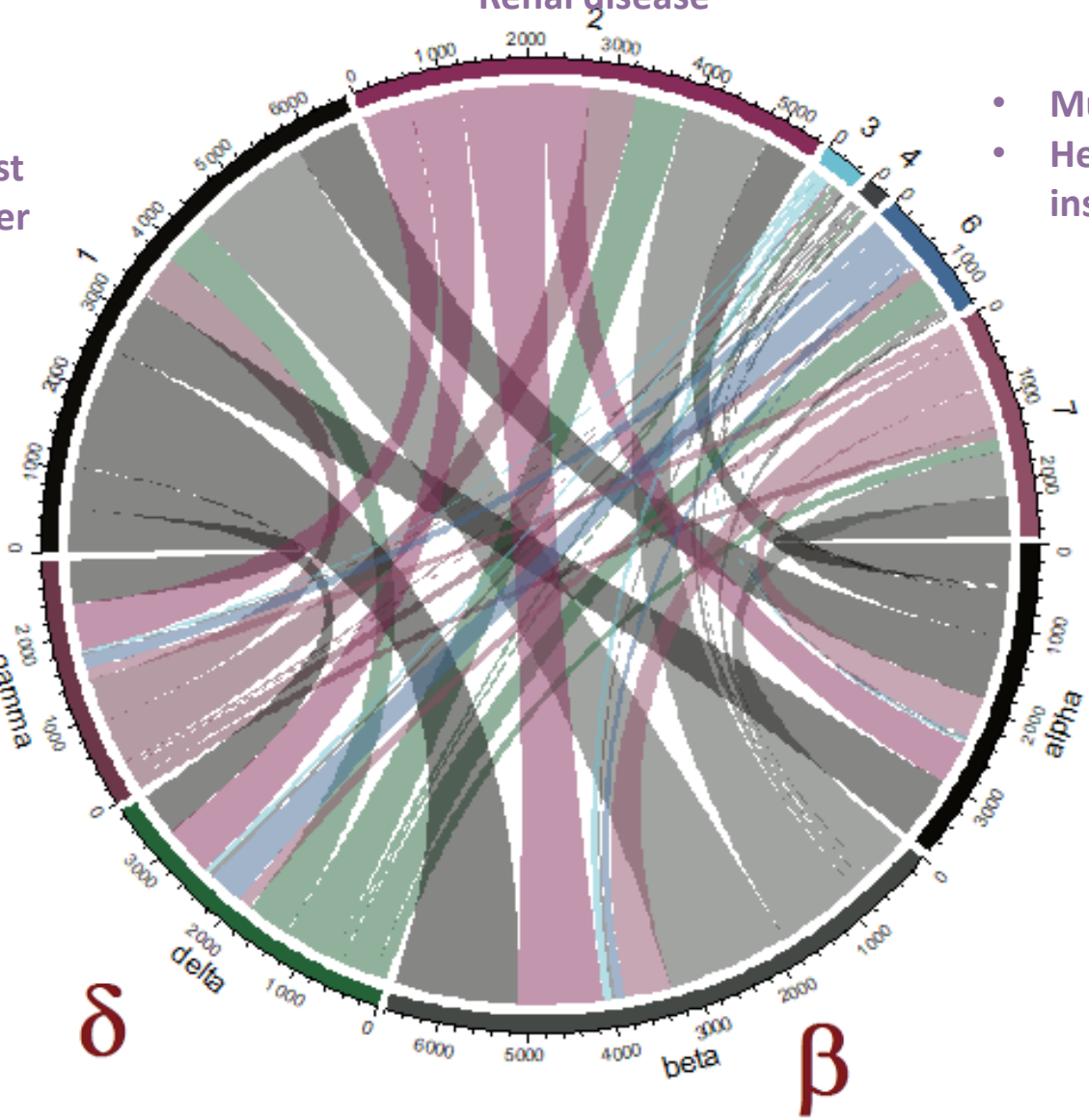
Results – Cord Diagram

- Metabolic acidosis
- High glucose
- Renal disease

- Multi-organ failure
- Hemodynamic instability

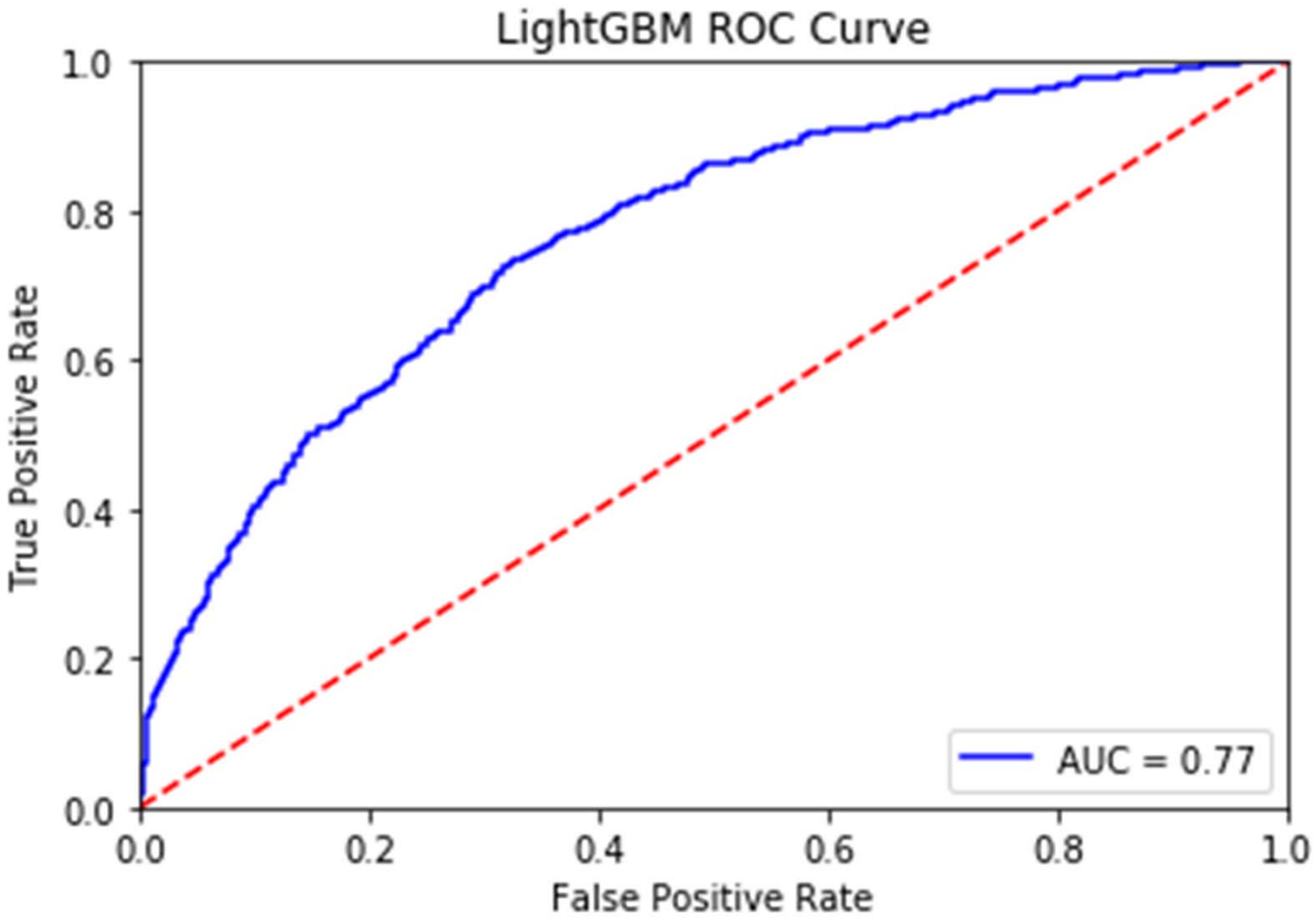
- Highest survival
- Normal lactate

- Oldest
- Cancer



α β δ γ

Results – ROC Curve



Conclusion

- In this large-scaled clustering analysis of MIMIC-3 data with sepsis, novel four clinical phenotypes of sepsis were identified.

- Novel four phenotypes were multi-demensional, differed in their demographics and laboratory abnormalities, patterns of organ dysfunction, and were not homologous with traditional sepsis grouping by severity of illness.

- Novel four clinical phenotypes were identified that correlated with clinical outcomes (mortality) and suggested these phenotypes may help in understanding heterogenic pathophysiology of treatment effects and strategy.