



Discovering Higher-Order relationships from Multi-Modal EHR Data

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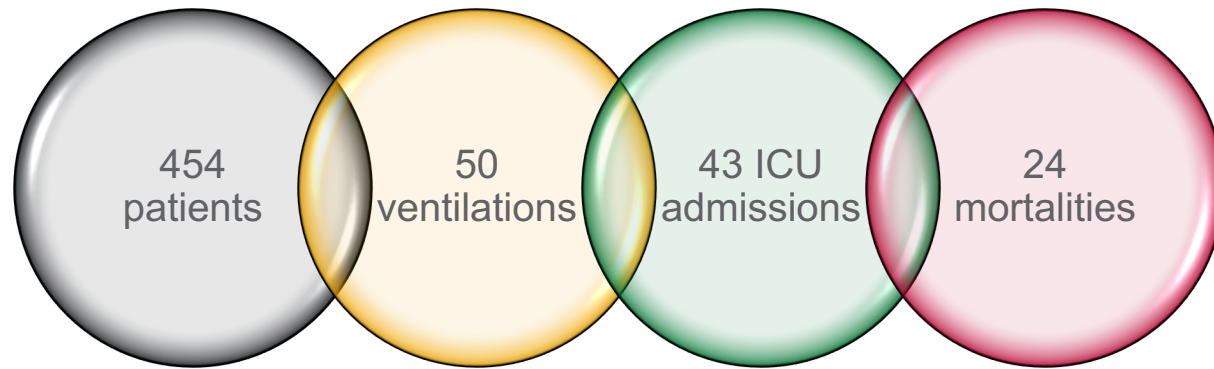
Suzanne Tamang, Pritam Mukherjee, Siyi Tang, (Stanford University), Khushbu Agarwal, Colby Ham (PNNL), Sindhu Tipirneni, Chandan Reddy (Virginia Tech.), Veysel Kocaman (John Snow Labs)



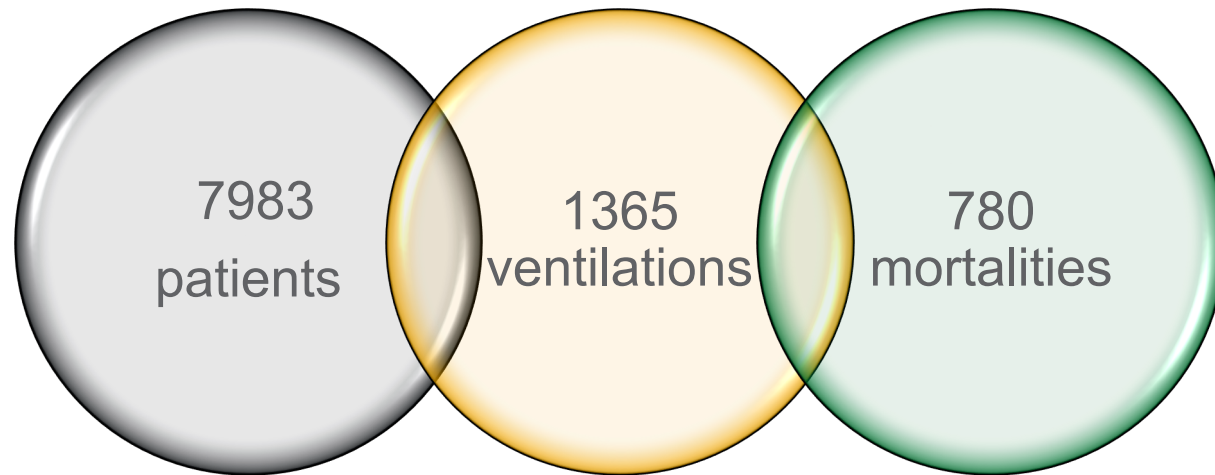
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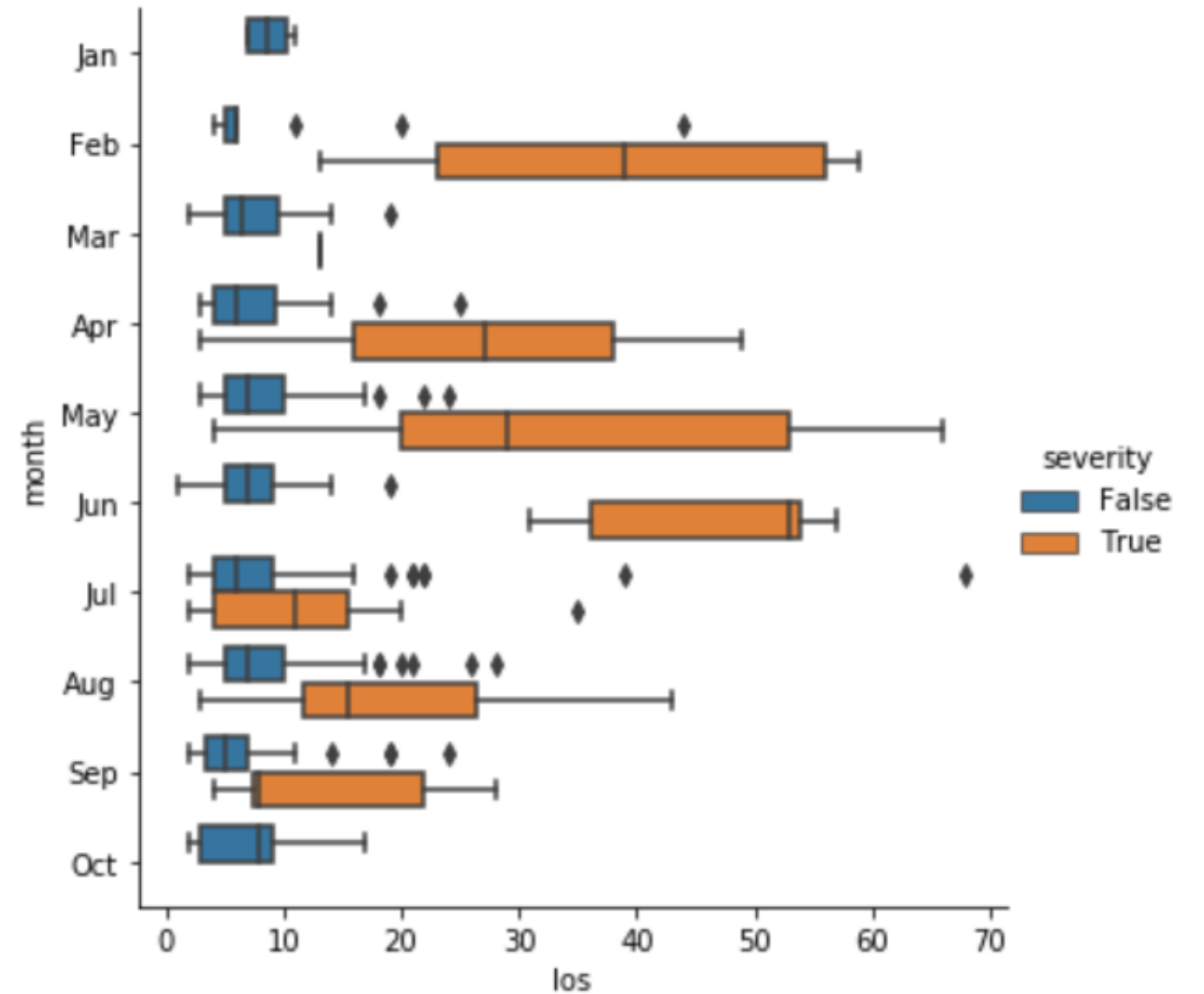
Our Data



COVID-19



Acute Respiratory Distress Syndrome (ARDS)



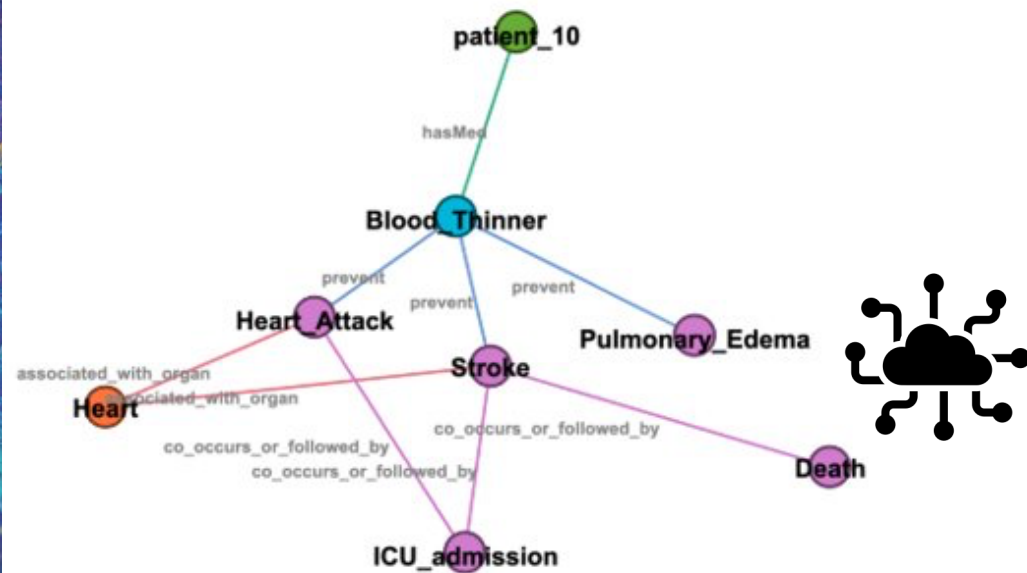
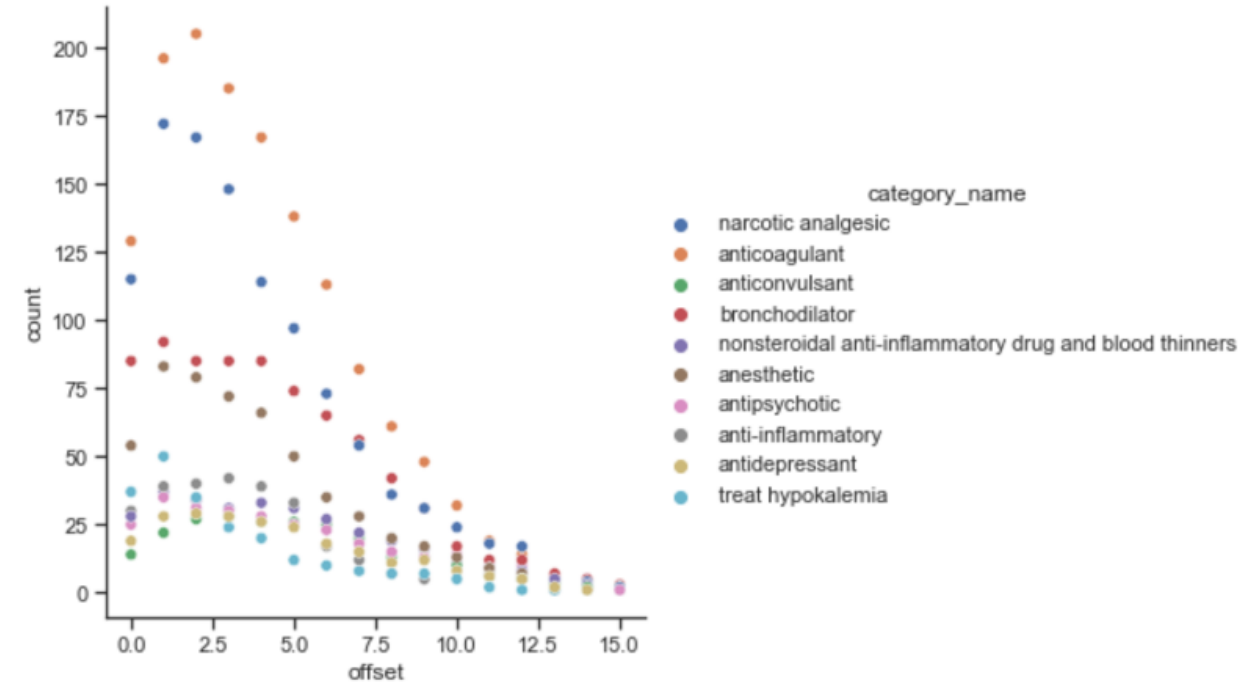
Distribution of Length of Stay for COVID-19 (LOS)



Heterogeneous Datasets



Diagnosis codes
and drug codes
over time



Clinical Knowledge Graph
(OMOP + Drug Information)



Natural language
clinical notes

82yo female with hx cad,chf,htn who was recently at [**Hospital1 **] with PE presented to ew with fever/hypoxia/sob. Pt was being tx at rehab for PNAX3 days. See admission fhpa for details pmh/hpi.

R.O.S.

Resp- Chest xray with b/l lower lobe infiltrates. Admitted on 100%nr with sats 94-98%. **Pt will desat to 80's very quickly when O2 off.** Pt becoming sob with minimal activity with rr 30's. **Lungs with crackles half up bilaterally.** To relieve daily lasix in am. Abg on 100% nr 92/29/7.40.

[**Name (NI) **] Pt receiving 2l ns in ew. Bp and hr stable with adequate uo. Pt denies cp. Does c/o back pain. Ekg done without change.

[**Name (NI) **] Pt alert and orientedx3. Cooperative with care.

Id- T-max 102.6 in ew. Now down to 100.1. Cont on zosyn/vanco. Cultures pending.

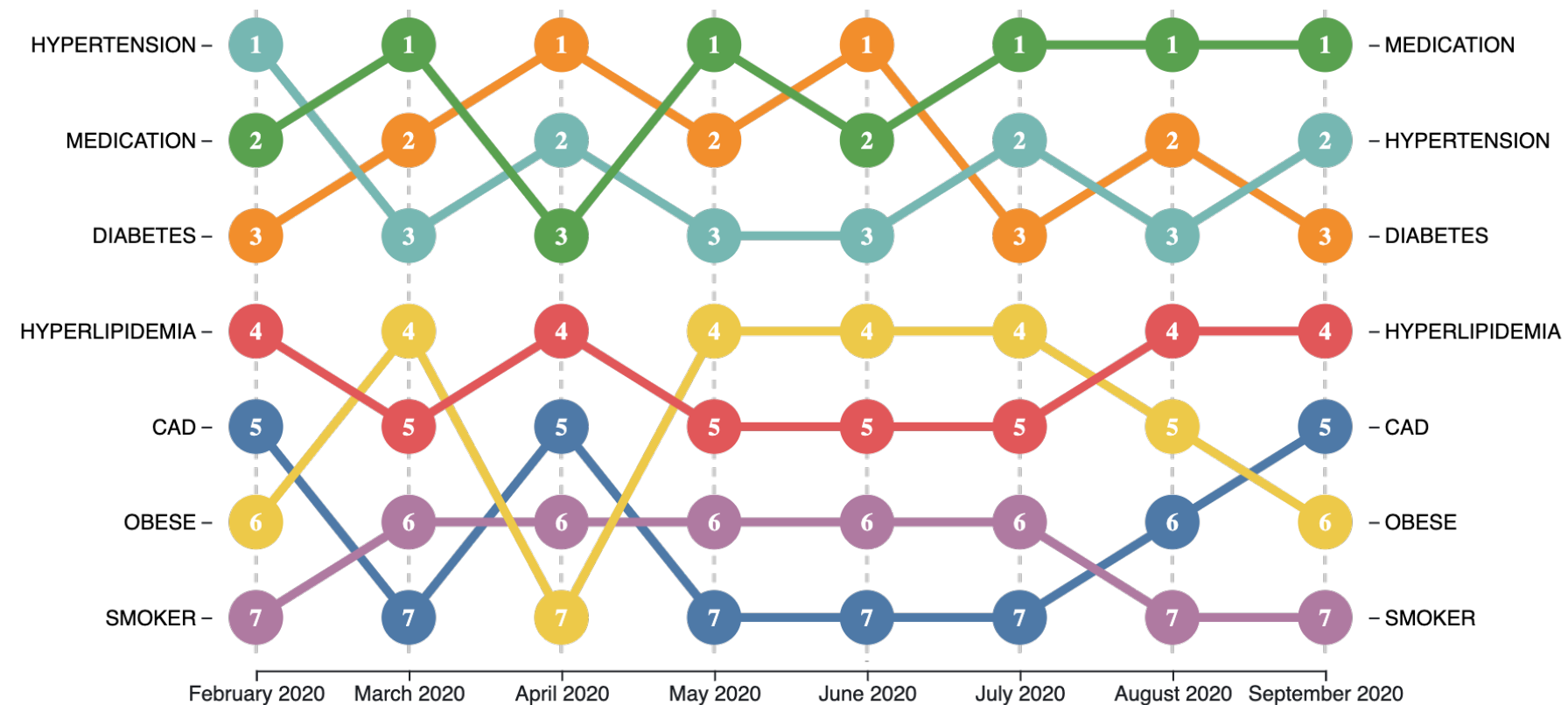
Gi- Taking liquids without problem. **Abdomen soft with good bowel sounds.** No s/s active bleeding. Pt with elevated inr on coumadine.

[**Name (NI) **] Pt had lived alone. Has been at rehab for past month. Daughters [**First Name8 (NamePattern2) **] [**Last Name (NamePattern1) 9173**] and [**First Name4 (NamePattern1) 6626**] [**Last Name (NamePattern1) **] involved and are health care proxys. **Although pt had been dnr in past is now full code and would be intubated.**



Studying Temporal Evaluation via Risk Factors

- We looked at most frequent risk factors each month of hospital admission
- Top-3 remain consistent over time



Turning towards Analysis with Higher Order Relations

Example of multiple factors: comorbidities, set of concomitant drugs, demographics

Studying relationships between co-morbidity and concomitant drugs are an obvious step

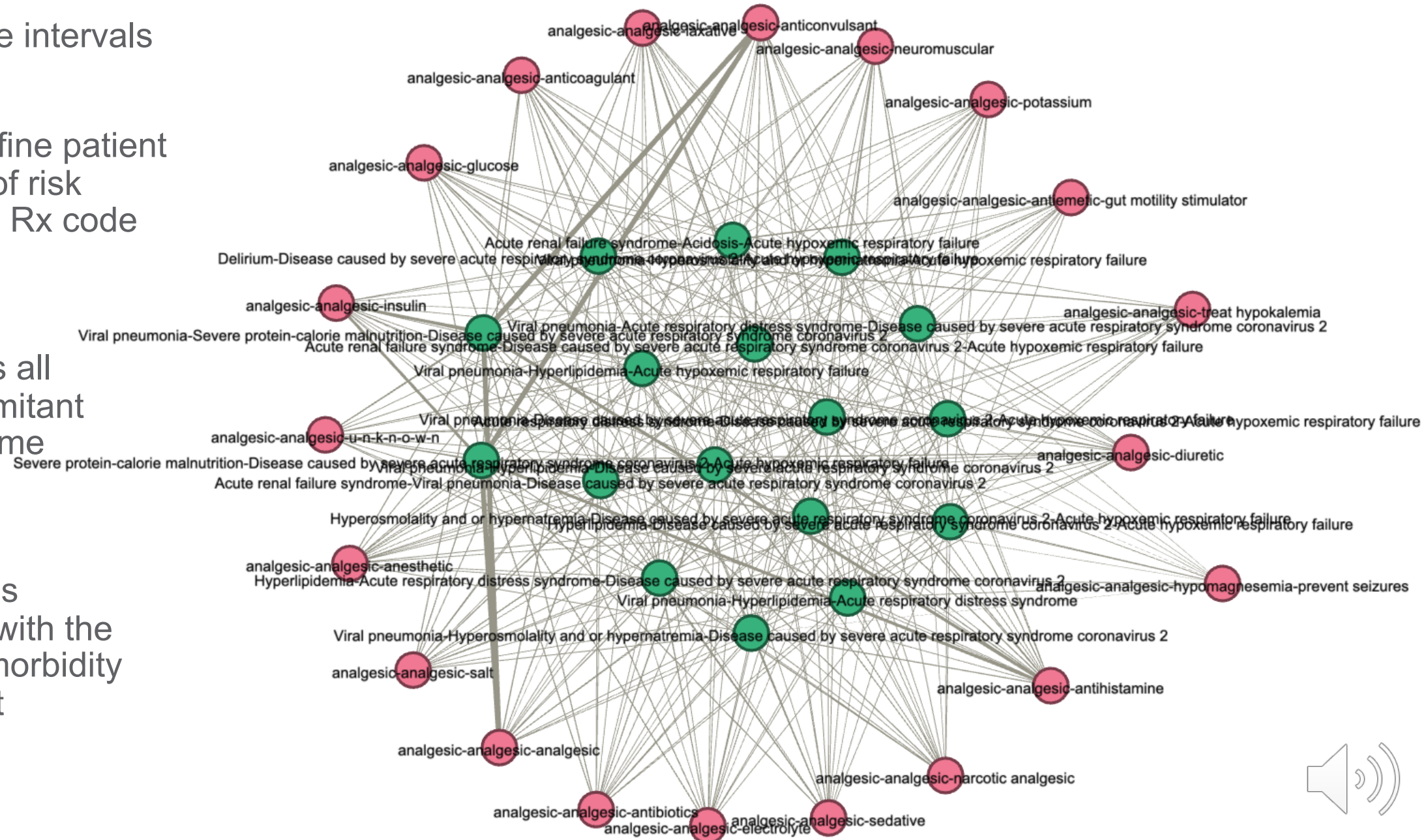
Reality of data:

- Sparse coverage of condition codes (maybe logged only during change)
- High-resolution coverage of drugs



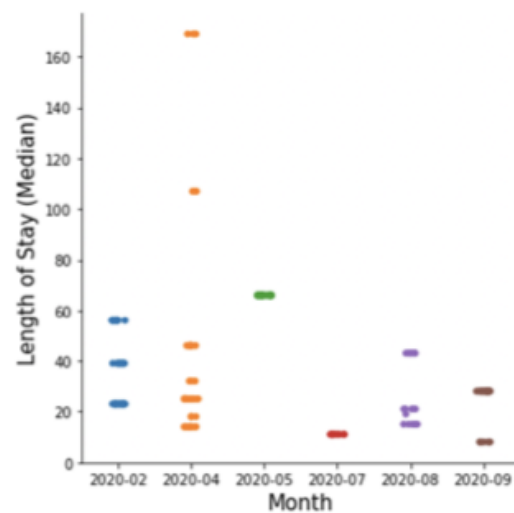
Building frequent comorbidity and concomitant drug Interaction graph

- Map patient data into time intervals
- For each time interval define patient state using combination of risk factors and observed Dx, Rx code categories
- The graph edge indicates all comorbidities and concomitant drugs that occurred in same interval.
- The edge weight indicates median LOS associated with the patients who had the comorbidity pattern and the treatment

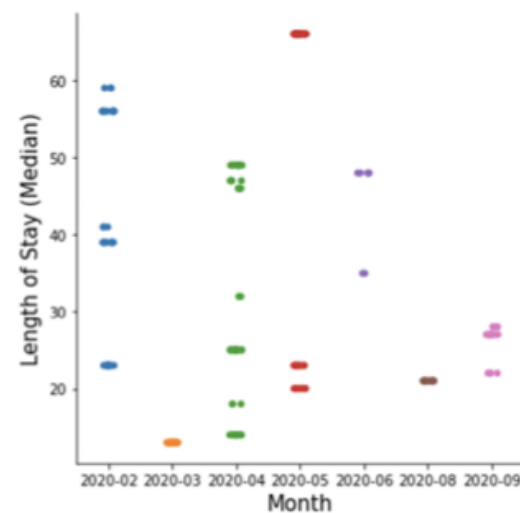


Study Treatment Effectiveness via Comorbidity Patterns

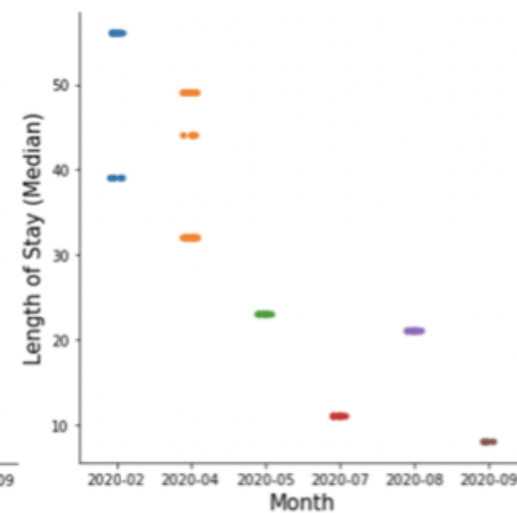
- Comorbidity analysis can shed light on where the medical community has learnt to treat COVID-19 patients better (or as a mix of population adapting to COVID-19)



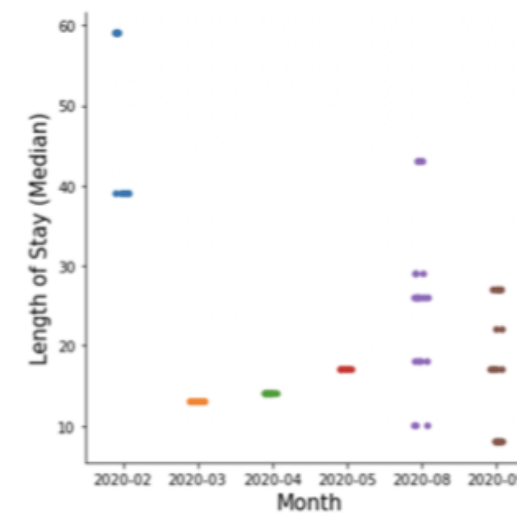
Acute renal failure; acute hypoxemic respiratory failure; disease caused by COVID



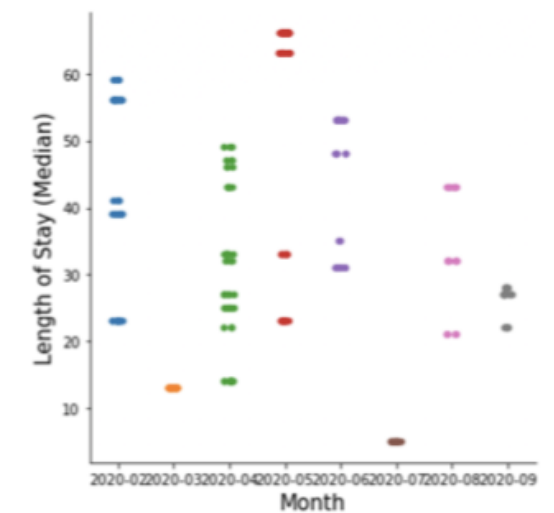
Acute respiratory distress Syndrome; COVID; Acute Hypoxemic respiratory failure



Delirium; COVID; Acute Hypoxemic respiratory failure



Hyperlipidemia; COVID; Acute Hypoxemic respiratory failure



Viral pneumonia; Acute respiratory distress Syndrome; COVID;





Thank you

For questions:

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