



Discovering Higher-Order relationships from Multi-Modal EHR Data

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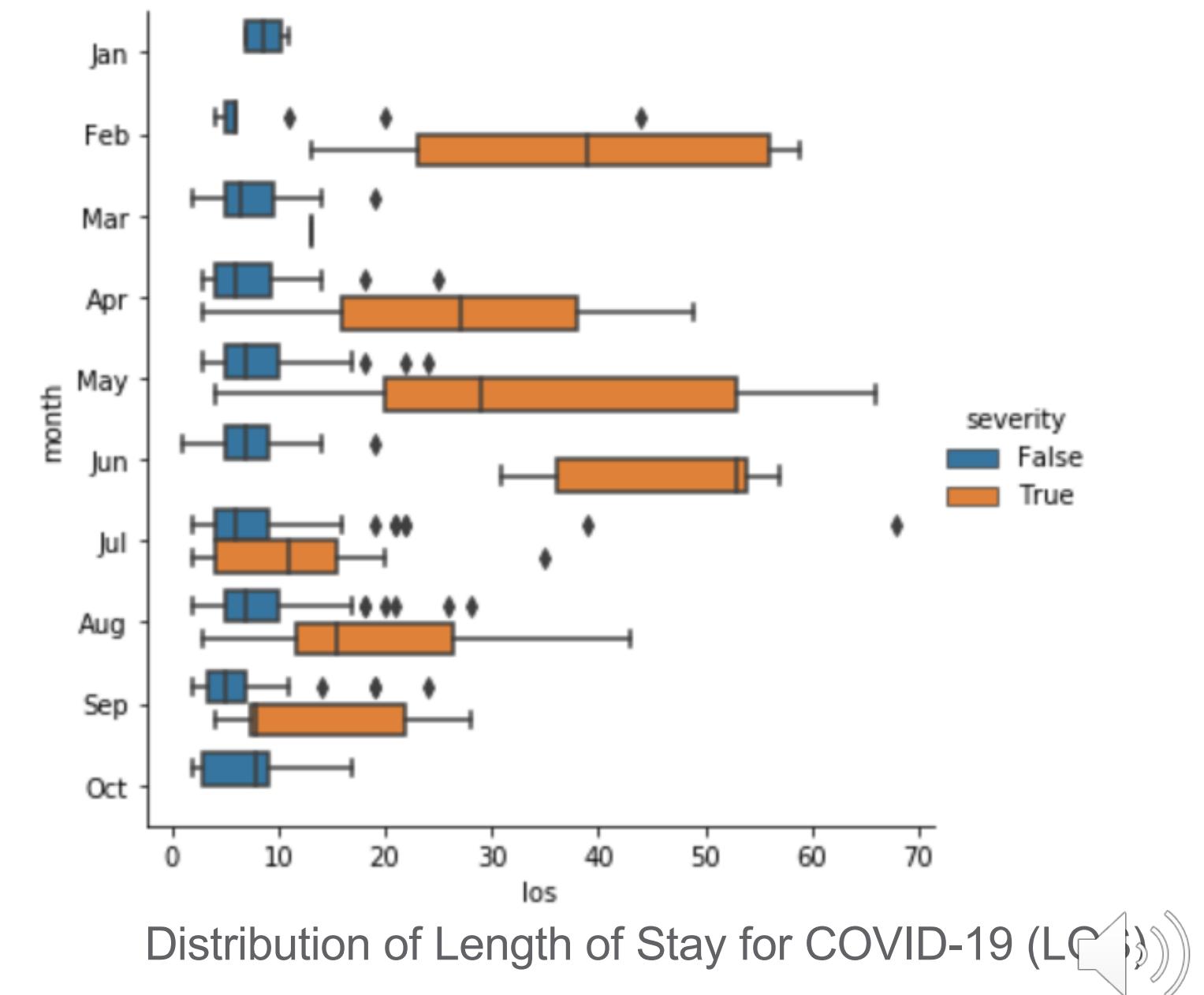
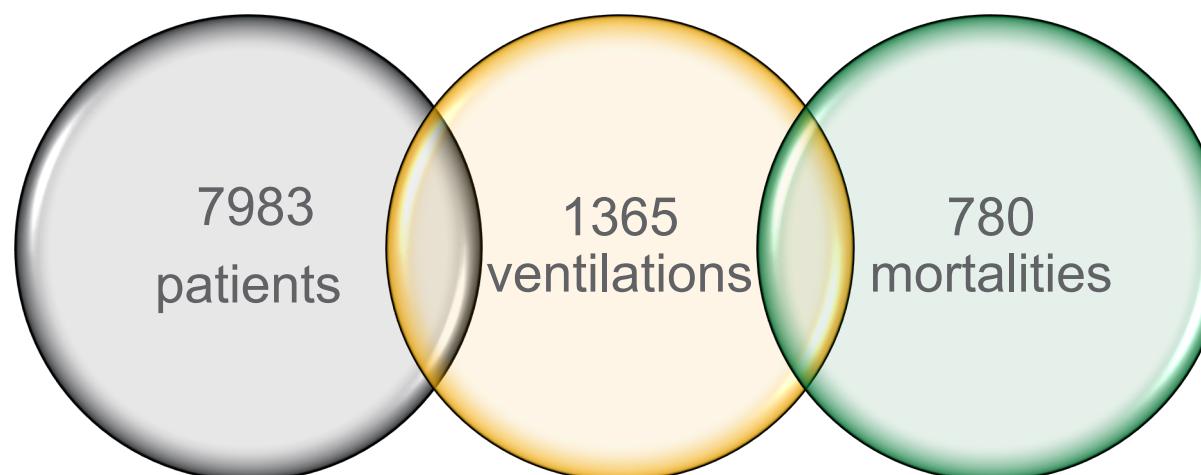
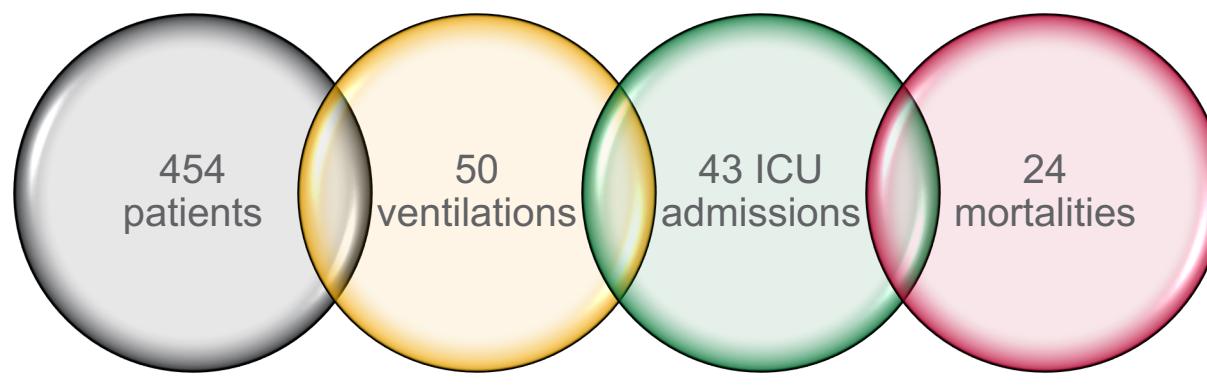
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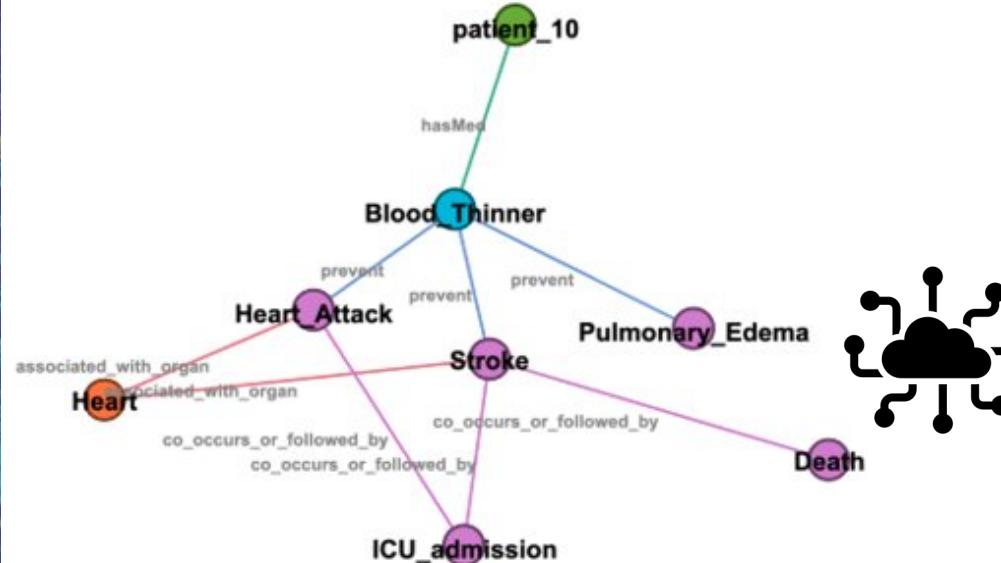


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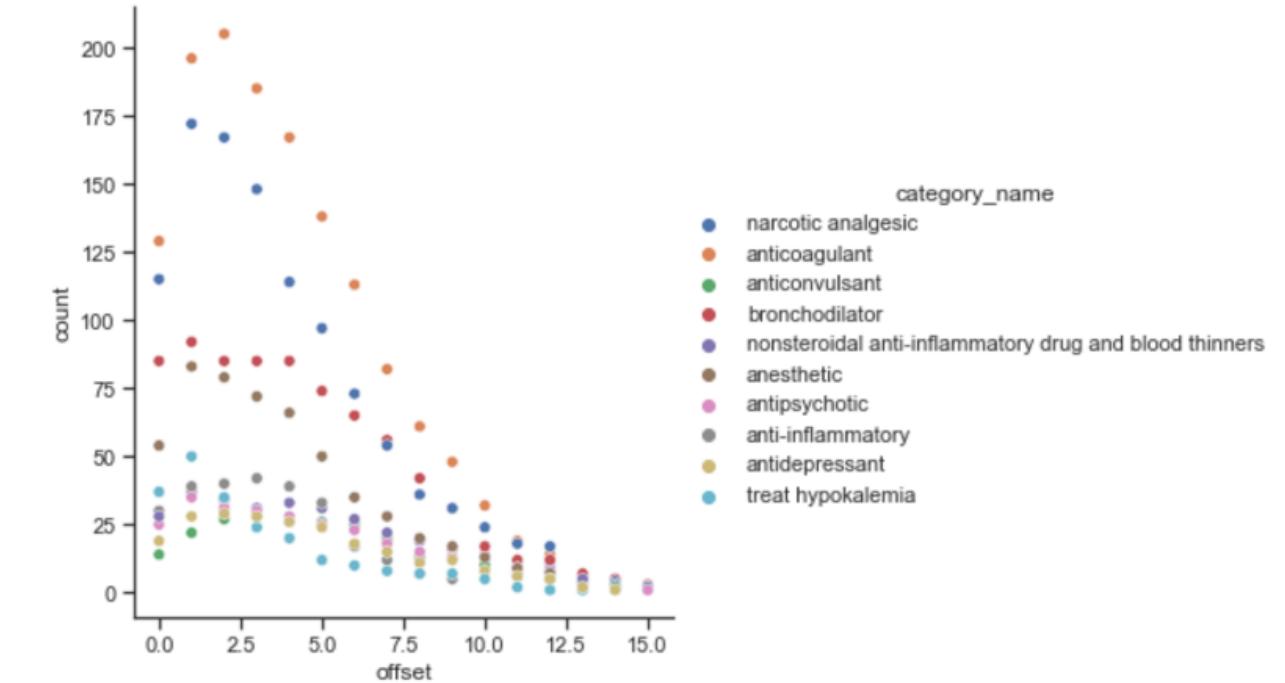
Our Data



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 PNx3 days. See admission fhp for details pmh/hpi.

R.O.S.

Resp- Chest xray with bl/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 receive 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 oriented x3. Cooperative with care.

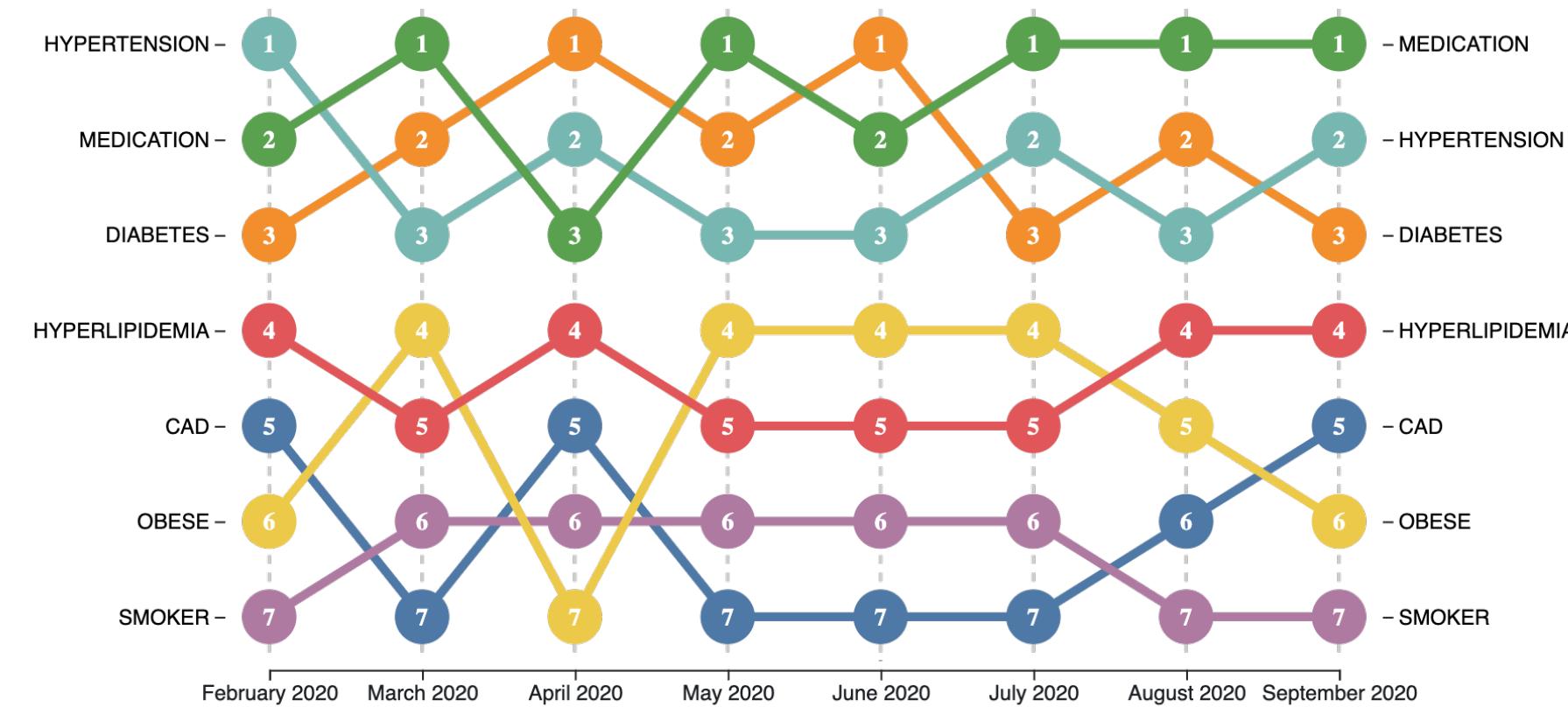
Id- T-max 102.6 in ew. Now down to 100.1. Cont on zosyn/vanco. Cultures pending.

Gi- Taking liquids without problem. Abdomen soft with good bowel sounds. No s/s active bleeding. Pt with elevated iinr 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) 3**] involved and are health care proxy. 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



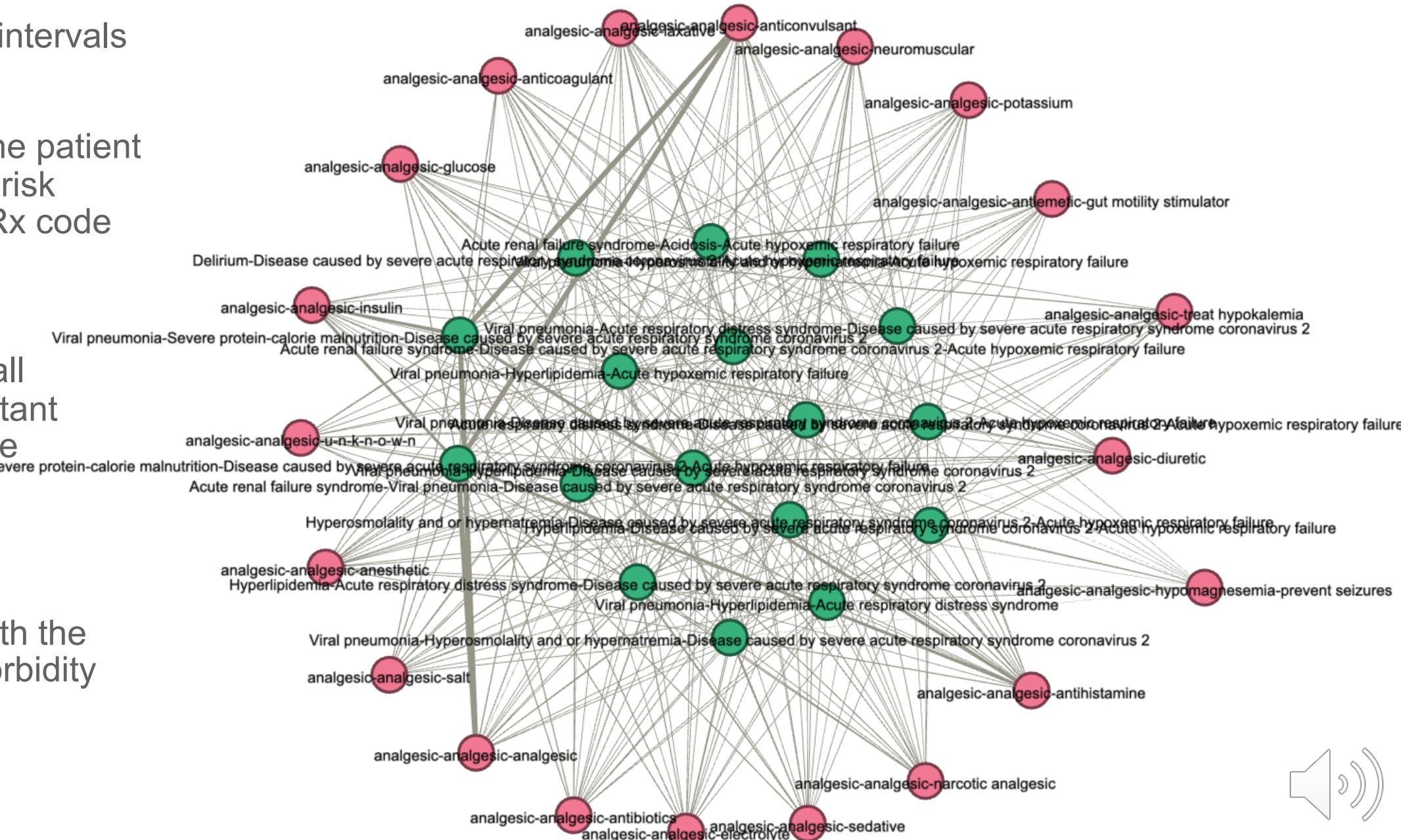


Building frequent comorbidity and concomitant drug interaction graph

- Map patient data into time intervals
 - For each time interval define patient state using combination of risk factors and observed Dx, Rx code categories

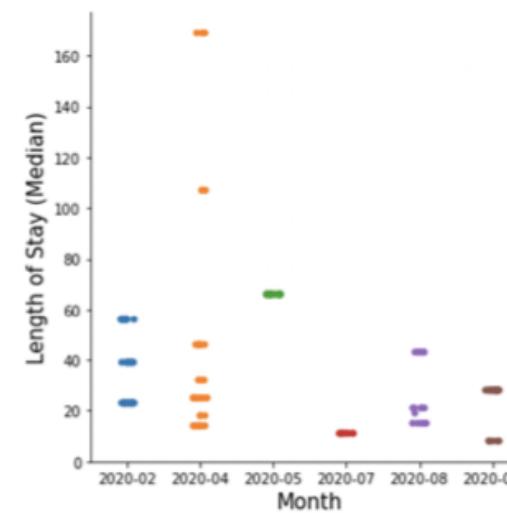
Viral pneumonia
Severe protein-calorie malnutrition

 - 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

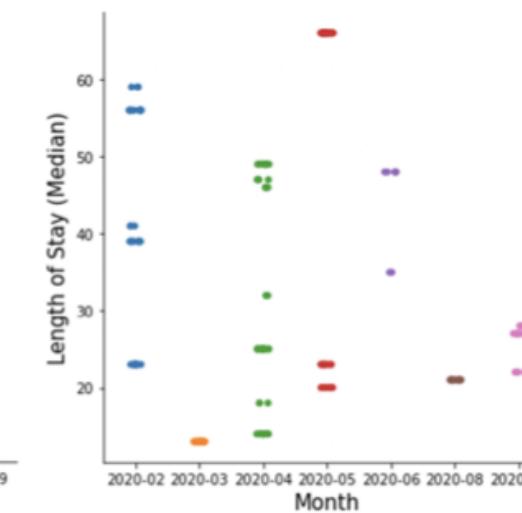


Study Treatment Effectiveness via Comorbidity Patterns

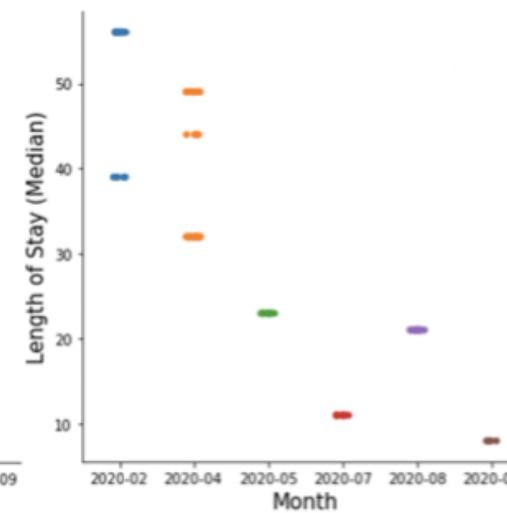
- Comorbidity analysis can shed light on where the medical community has learnt to treat COVID-19 patients better (or as a mix of population adapting to COVID-19)



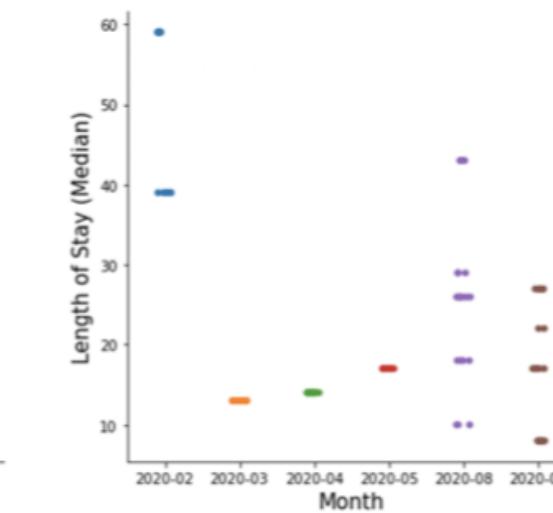
Acute renal failure; acute hypoxemic respiratory failure; disease caused by COVID



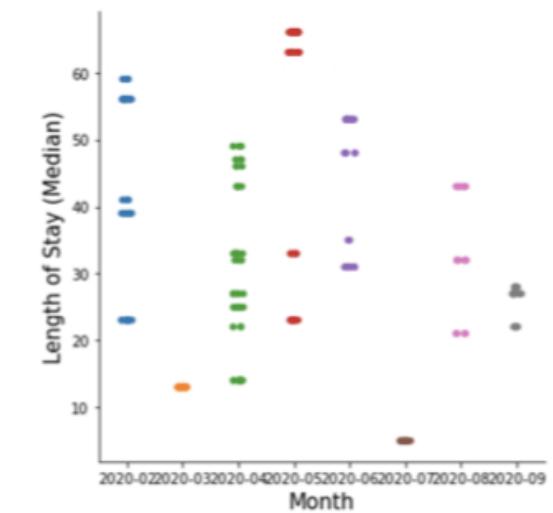
Acute respiratory distress Syndrome; COVID; Acute Hypoxemic respiratory failure



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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