

# Supporting COVID-19 patient management with data

Standing up a clinical data science team and getting answers in 2 weeks

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**Stanford**  
MEDICINE

# The team

- Faculty sponsor: Nigam Shah
- EMR Data specialists
  - Gomathi Krishnan
  - Jose Posada
- Data scientists
  - Alison Callahan
  - Birju Patel
- Informatics fellows
  - Dev Dash
  - Arjun Gokhale
- Requesting Clinicians
  - Ron Li
  - Kevin Schulman
  - Will Collins
- End users: Department of Medicine Task Force on COVID clinical guidelines
  - Kevin Schulman
  - Lisa Shieh
  - Ron Li
  - Charles Liao
  - Jingkun (Ginger) Yang

# Using practice based evidence to guide how we respond to the COVID surge

- Fast paced changes in patient care needs call for quick but informed decision making
- Key challenge during COVID surge: how to safely manage and discharge patients while preserving hospital capacity
- Evidence needed to assess
  - 1) is it safe to discharge patients on home O<sub>2</sub>,
  - 2) is it safe to manage patients with HFNC on the floor, and
  - 3) how can we better risk stratify for complications such as VTE?

## The process

- Formalize questions using the PICO format
- Define cohort and variable definitions for each question
- Pull the data corresponding to each cohort and variable from STARR-OMOP and Clarity
- Sanity check the data by chart review and preliminary analyses
- Conduct the analyses to answer the question
- Write a report summarizing our findings

## Questions tackled so far

- Compared to patients not discharged on oxygen, are patients discharged with home oxygen more likely to be readmitted within 30 days?
- Among adult COVID+ patients with high oxygen needs, what is the rate of transfer to the ICU? What is the rate of intubation/mechanical ventilation?
- DO COVID+ patients with elevated admission D-dimer have a higher rate of DVT/PE or transfer to ICU compared to those with normal D-dimer?
- DO COVID+ patients with elevated admission CRP have a higher rate of DVT/PE or transfer to ICU compared to those with normal CRP?

# Translating a question into a cohort definition

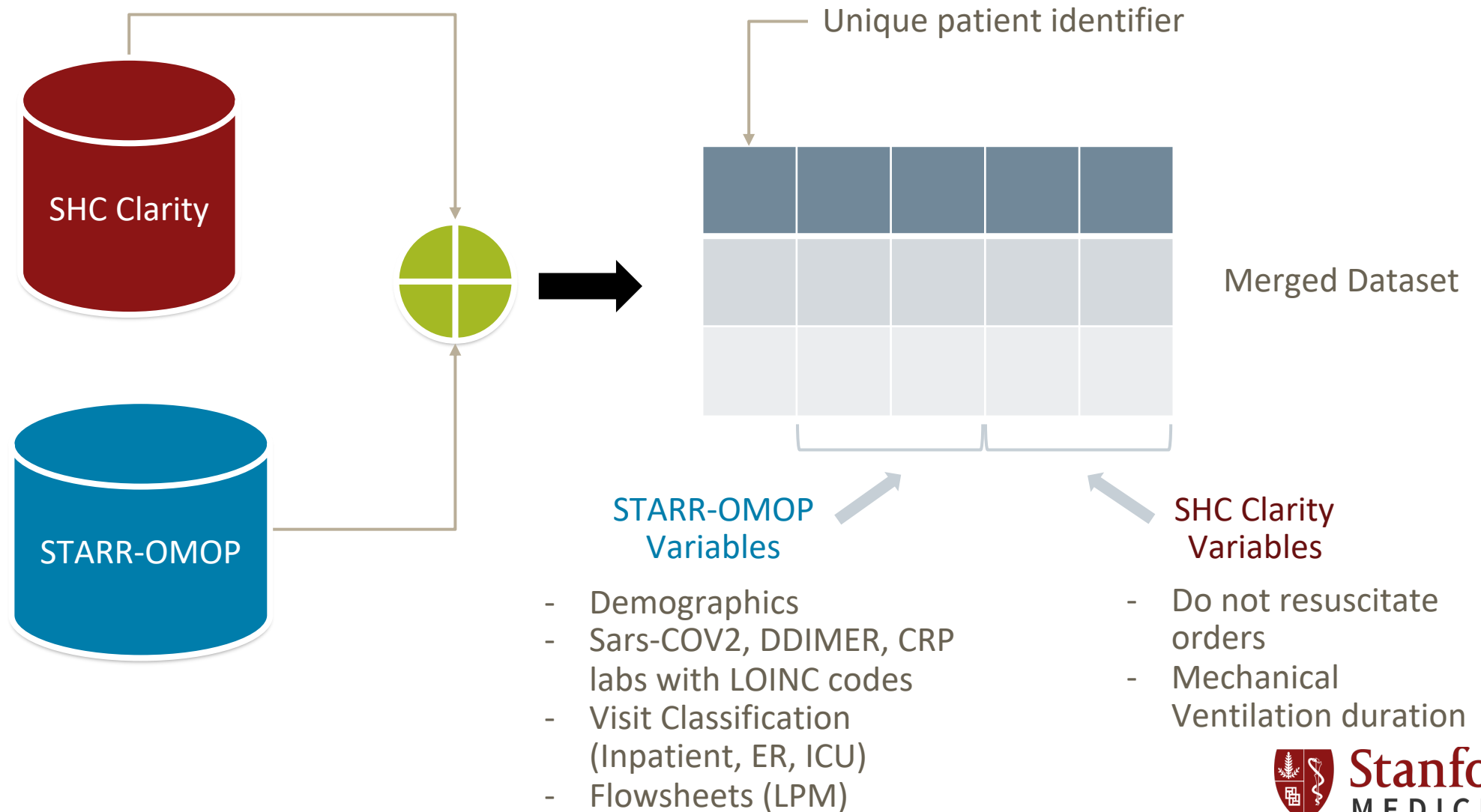
- Question

Among adult COVID+ patients with high oxygen needs, what is the rate of transfer to the ICU? What is the rate of intubation/mechanical ventilation?

- Our formulation

Among adult patients ( $\geq 18$  years old) admitted with a COVID-19 diagnosis (within 1 day before date of admission or during inpatient stay) or positive SARS-CoV-2 test result (within 14 days before date of admission, or during inpatient stay), and who did not have a DNR order and received at least 6 LPM O<sub>2</sub> at any time, how many were transferred to the ICU? How many of those patients were intubated and/or placed on mechanical ventilation?

# OMOP-CDM linked with Stanford internal Databases



# We reused CHARYBDIS Phenotypes

The screenshot displays the ATLAS web interface for defining a cohort. The left sidebar contains navigation options: Home, Data Sources, Search, Concept Sets, Cohort Definitions (highlighted), Characterizations, Cohort Pathways, Incidence Rates, Profiles, Estimation, Prediction, Jobs, Configuration, and Feedback. The main content area shows the details for Cohort #1379, defined as 'Persons hospitalized with a COVID-19 diagnosis record or a SARS-CoV-2 positive test'. The 'Definition' tab is active, showing a warning: 'Do not modify, instead copy to make any change to this cohort'. Below this, the 'Cohort Entry Events' section is visible, detailing the criteria for cohort entry. The criteria include: a visit occurrence of 'Inpatient Visit Only' starting after 2020-01-01, with age greater than 18. Additionally, there are settings for continuous observation (0 days before and 0 days after), limiting initial events to 'all events' per person, and restricting initial events to 'any' of the following criteria: a measurement of 'SARS-CoV-2 test measureme...' with values 'Detected', 'Positive', or 'Present'. The interface also includes options to restrict to the same visit occurrence and allow events from outside the observation period.

**ATLAS**

Home  
Data Sources  
Search  
Concept Sets  
**Cohort Definitions**  
Characterizations  
Cohort Pathways  
Incidence Rates  
Profiles  
Estimation  
Prediction  
Jobs  
Configuration  
Feedback

**Cohort #1379**

Persons hospitalized with a COVID-19 diagnosis record or a SARS-CoV-2 positive test

Definition **?** Concept Sets Generation Reporting Export Messages **2**

Do not modify, instead copy to make any change to this cohort

**Cohort Entry Events**

Events having any of the following criteria:

a visit occurrence of **Inpatient Visit Only**

**✗** occurrence start is: **After** 2020-01-01

**✗** with age **Greater Than** 18

with continuous observation of at least **0** days before and **0** days after event index date

Limit initial events to: **all events** per person.

**Restrict initial events to:**

having **any** of the following criteria:

with **at least** 1 using all occurrences of:

a measurement of **SARS-CoV-2 test measureme...**

**✗** Value as Concept is: **✗ Detected** **✗ Detected** **✗ Positive** **✗ Positive** **✗ Present** **✗ Present** **Add** **Import**

where **event starts** between **14** days **Before** and **All** days **After** **index start date** [add additional constraint](#)

restrict to the same visit occurrence

allow events from outside observation period



# Results from our descriptive analyses

Interpretation: Relatively low (14%) of patients requiring > 6L O<sub>2</sub> end up needing intubation, suggesting 6L O<sub>2</sub> threshold for ICU transfer may be relaxed if ICU capacity is constrained.

**14% of patients with high oxygen need (31% of those transferred to the ICU) were intubated and placed on mechanical ventilation.**

	Transferred to ICU	Not transferred to ICU	Total
Intubated	42	0	42
Not intubated	93	111	204
Total	135	111	246

# Challenges

- Identifying patients with a COVID diagnosis code who were not really COVID patients
  - Only apparent after chart review
- Effectively processing flowsheet data
  - Millions of rows!
- Pulling the relevant ventilation details from procedure orders
  - Relies on temporality and duration of orders
- Excluding clinically implausible oxygen records
  - Clinical expertise + deep familiarity with the data
- Tracking down and managing data anomalies
  - e.g. patients with a DNI/DNR order “look” different in the data

## Take-aways

- Data summaries are helpful, independent of statistical analyses
- 80% of our effort was in getting the data pulls done, and done correctly
  - The analyses were the easy part!
- > 300 hours of collective effort in a very short period
  - Amazing collaboration and communication: the team's diversity of skills and willingness to participate in long working calls and Slack threads were essential to making this happen.
- Use of both STARR-OMOP and Clarity data was essential