



# Coagulopathy Assessment in Patients with COVID-19: A TriNetX Analysis

Sentinel Operations Center

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June 24th, 2020

# Motivation and Regulatory Setting

- COVID-19 infection may predispose to both venous and arterial thromboembolic disease
- Observational studies have reported incidence of venous thromboembolic complications ranging between 3-35% in COVID-19 patients<sup>1,2,3</sup>
- The purpose of this ongoing assessment is to characterize hospitalized COVID-19 patients in TriNetX database; expect to repeat and modify the assessment as new data and information arrive
- To inform ongoing and future work understanding the natural history of coagulopathies in COVID-19 patients

<sup>1</sup> Levi M, Thachil J, Iba T, Levy JH. Coagulation abnormalities and thrombosis in patients with COVID-19, Lancet Volume 7, Issue 6, E438-E440, June 1, 2020

<sup>2</sup> Bompard F, Monnier H, Saab I, Tordjman M, Abdoul H, Fournier L, Sanchez O, Lorut C, Chassagnon G, Revel M. Pulmonary embolism in patients with Covid-19 pneumonia. European Respiratory Journal 2020

<sup>3</sup> Moores LK, Tritschler T, Brosnahan S, Carrier M, Collen JF, Doerschug K, Holley AB, Jimenez D, LeGal G, Rali P, Wells P, Prevention, diagnosis and treatment of venous thromboembolism in patients with COVID-19: CHEST Guideline and Expert Panel Report, CHEST (2020), doi: <https://doi.org/10.1016/j.chest.2020.05.559>.

# TRINETX: THE GLOBAL RESEARCH NETWORK

Largest network of healthcare organizations, biopharmaceutical companies and contract research organizations working together to improve clinical research

### REAL-WORLD DATA

Real-time access to patient populations, driven and refreshed by electronic medical record (EMR) data, to determine protocol feasibility, cohort analysis and site identification

Demographics	Lab Results	Genomics	Medications
Diagnoses	Patient Location	Provider Notes (NLP)	Vitals
Mortality	Oncology	Tumor Registry	Procedures
Longitudinal Patient History	Data Linking		

### Federated Model Attracting Leading Healthcare Organizations (HCOs)

#### USA NETWORK

- Academic and community health systems
- Primary through tertiary care for adults and children
- Rounded patient counts

<b>90M</b> PATIENTS	<b>67</b> HCOs	<b>27</b> STATES
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### Real-World Evidence Generation

**89+**  
TRINETX CITATIONS IN  
GOOGLE SCHOLAR

# TriNetX Process Flow

## VARIOUS AND DISPARATE DATA

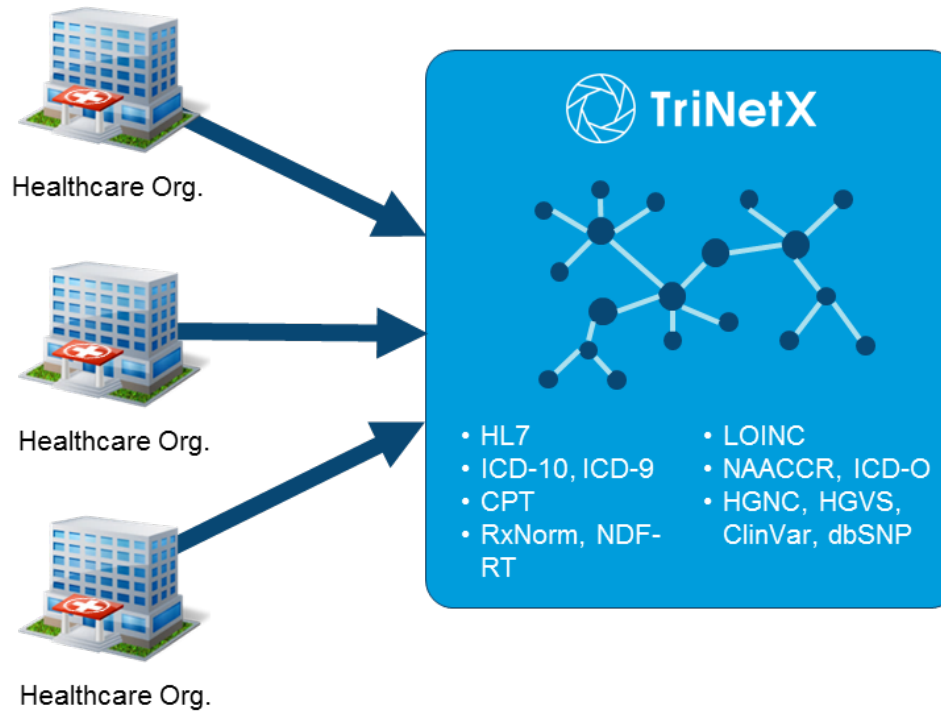
Demographics      Lab Results

Diagnoses      Oncology

Procedures      Genomics

Medications      NLP

## MAPPED TO CONTROLLED TERMINOLOGIES



## MASTER TERMINOLOGY BUILT FOR USABILITY

**MUST Have**      **CANNOT Have**

HbA1c      Search Term...

Code	Term Description	Patients
TXN:LAB:9037	L Hemoglobin a1c/hemoglobin.total in blood	3,294,500

**ADD TO QUERY**

D Demographics      Dx Diagnoses      L Labs

M Medications      P Procedures      G Genomics

# Cohort

- Assessment Period: February 20, 2020 – June 19, 2020
- COVID-19 Cohort Definition
  - Any COVID-19 ICD-10 diagnosis- B97.29, U07.1, B34.2, B97.2, or J12.81
  - COVID-19 Antigen/RNA Lab Testing
- Sensitivity analyses conducted using cohort definition above OR
  - Codes for COVID-19 Antibodies Lab Testing
- Inclusion Criteria - Hospitalization term within 1 week of COVID-19 Diagnosis

# Cohort Characteristics

- Thromboembolic conditions
  - ICD-10 codes from previous Sentinel analyses were used to define pulmonary embolism, deep venous thrombosis, ischemic stroke, hemorrhagic stroke, transient ischemic attack, and acute myocardial infarction
  - For ischemic limb and disseminated intravascular coagulation, TriNetX definitions were used
- COVID-Severity Related conditions
  - Identified using ICD-10 codes, CPT codes and HCPCS codes recorded in TriNetX EHR
- Thrombolytic Medications and COVID-19 potential treatments
  - Identified using RxNorm and HCPCS codes recorded in TriNetX EHR
- Laboratory tests performed and test results available
  - Identified using LOINC codes recorded in TriNetX EHR
  - Most recent lab test result available was used

# Study Design

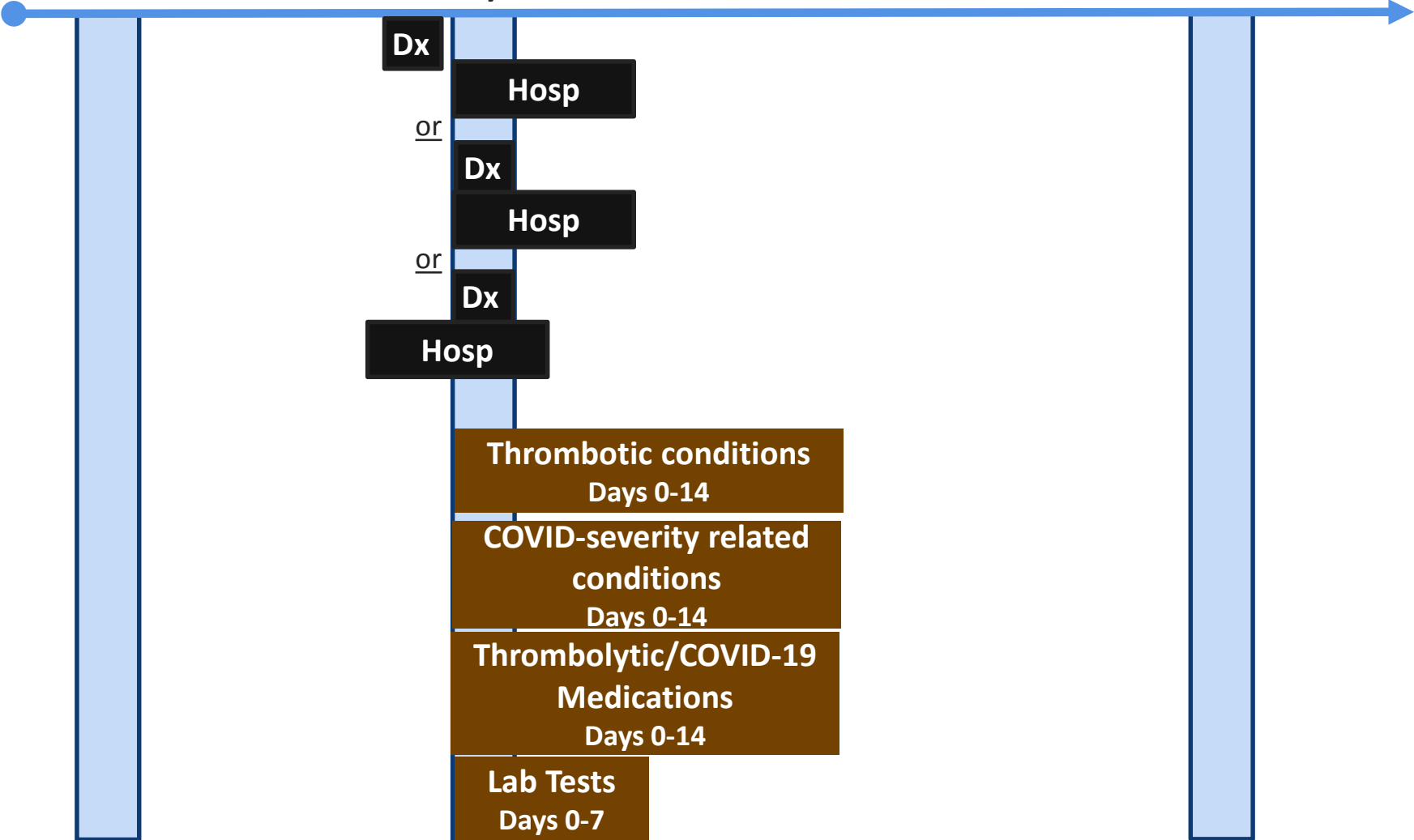
20Feb2020

**Index Date**  
(First day COVID-19 Dx and  
Hospitalization are both met)  
Day 0

19Jun2020

**Cohort Identification Criteria**  
Dx: COVID-19 Diagnosis by  
ICD-10 Dx code or COVID-19  
antigen/RNA test  
**AND**  
Hosp: Hospitalization within  
1-week of COVID-19 diagnosis

**Cohort Characteristics  
Assessment Window**



# Attrition Table

## Analyze Criteria

Exclude HCOs with 0 patients Criteria Impact

Most to least

Least to most



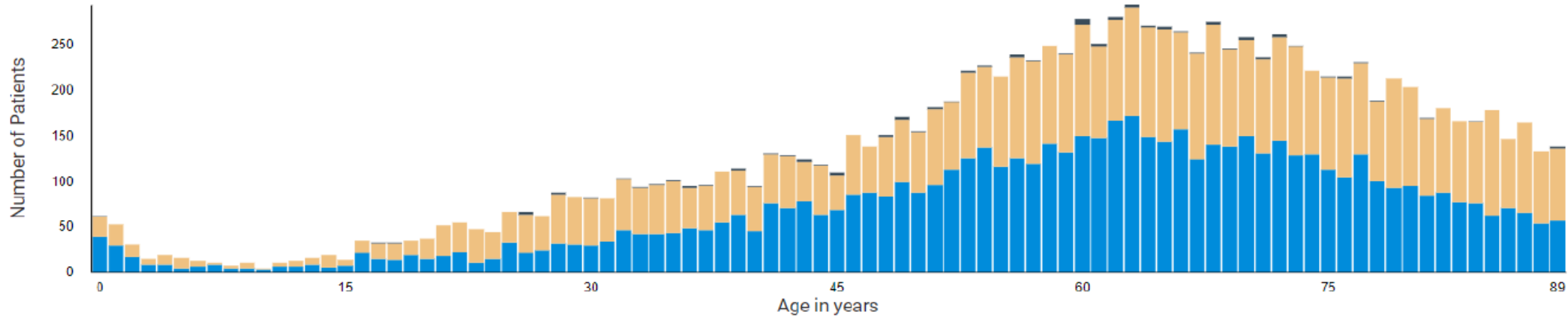
	Patients		HCOs
Network	89,060,130		62
Base Population <a href="#">See All</a>	66,600	(-100%)	50
Population Any age / Any sex	66,600	(0%)	50
<input checked="" type="checkbox"/> <i>Event 2A The terms in this event occurred on or after Feb 20, 2020 Must</i> Have: B34.2 Coronavirus infection, unspecified <input type="checkbox"/> OR B97.2 Coronavirus as the cause of ...	12,560	(-81%)	45
	<b>12,560</b> Patients		<b>45</b> HCOs



**COVID-19 Diagnosis by ICD-10 Dx code or antigen test  
AND  
Hospitalization within 1-week of COVID-19 Diagnosis**



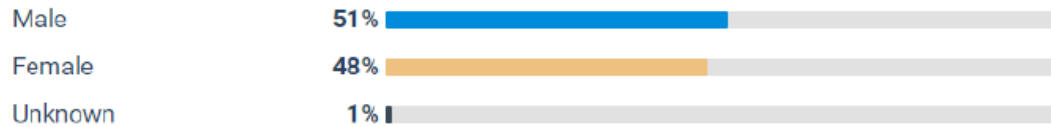
# COVID-19 Cohort Demographics



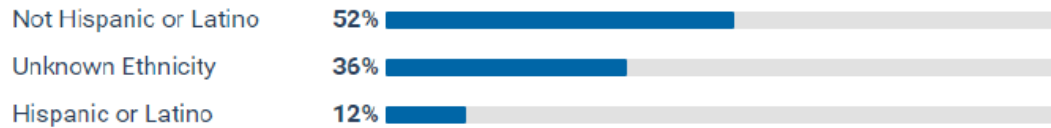
Patients 90 and Older: 551

Total Patients	Minimum Age	Maximum Age	Mean Age	Standard Deviation
<b>12,560</b>	<b>0</b>	<b>90</b>	<b>60</b>	<b>20</b>

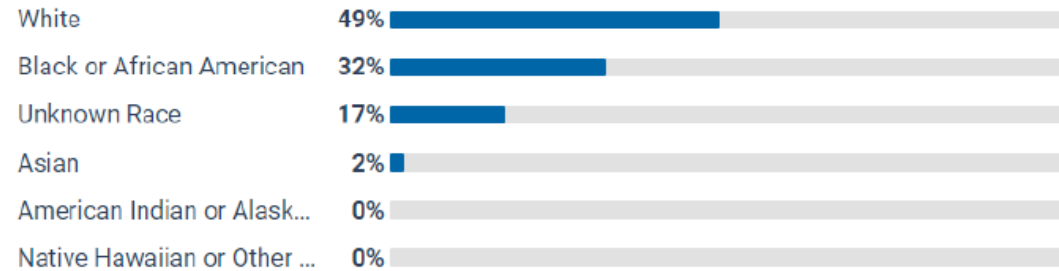
## Sex



## Ethnicity



## Race



# Prevalence of Thrombotic-Related Outcomes

	N	%
<b>Total COVID-19 Patients</b>	12,560	100%
Pulmonary Embolism	310	2.5%
Deep Venous Thrombosis	270	2.1%
Disseminated Intravascular Coagulation	30	0.2%
Myocardial Infarction	490	3.9%
Angina	1,250	10.0%
Peripheral Vascular Disease/Limb Ischemia	10	0.1%
Ischemic Stroke	300	2.4%
Hemorrhagic Stroke	150	1.2%
Transient Ischemic Attack	60	0.5%

# Prevalence of COVID-Severity Related Outcomes

	N	%
<b>Total COVID-19 Patients</b>	12,560	100%
Supplemental Oxygen (Diagnostic Terms)	450	3.6%
Supplemental Oxygen (Procedural Terms)	1,230	9.8%
BiPAP	0	0.0%
Mechanical Ventilation	1,960	15.6%
ECMO	60	0.5%
Hypoxemia	2,490	19.8%
Sepsis	2,800	22.3%
Pneumonia	6,530	52.0%
Acute Respiratory Failure	5,270	42.0%
ARDS	1,530	12.2%

# Thrombolytic Medication Utilization

	N	%
<b>Total COVID-19 Patients</b>	12,560	100%
Tissue Plasminogen Activator	420	3.3%
Heparin	2,520	20.1%
Low Molecular Weight Heparin	4,530	36.1%
Other Thrombolytic Medications	410	3.3%
Vitamin K Antagonists	320	2.5%
Factor Xa Inhibitors	1,100	8.8%
Thrombin Inhibitors	60	0.5%
Anti-Platelet Therapy	2,350	18.7%

# COVID-19 Potential Medications Utilization

	N	%
<b>Total COVID-19 Patients</b>	12,560	100%
Lopinavir/Ritonavir	40	0.3%
Remdesivir	100	0.8%
Tocilizumab	350	2.9%
Sarilumab	10	0.1%
Methylprednisolone	1,090	8.7%
Azithromycin	2,850	22.7%
Hydroxychloroquine or Chloroquine	2,330	18.6%
Norepinephrine	580	4.6%
Dexamethasone	420	3.3%

# Laboratory Measures Evaluation (1 of 2)

	N	%	Mean	SD
<b>Total COVID-19 Patients</b>	12,560	100%	-	-
Hemoglobin, g/dL	11,410	90.8%	11.2	2.3
Hematocrit, %	11,370	90.5%	34.8	6.7
Platelet Count, 10 <sup>3</sup> cells/ $\mu$ L	10,850	86.4%	252.8	124.4
White Blood Cell Count, 10 <sup>3</sup> cells/ $\mu$ L	9,840	78.3%	8.5	5.5
Lymphocytes, %	9,950	79.2%	17.4	12.6
D-Dimer (FEU), ng/mL FEU	3,200	25.5%	296.8	1,160.0
D-Dimer (DDU), $\mu$ g/dL DDU	2,250	17.9%	855.9	1,858.8
Fibrinogen, mg/dL	1,580	12.6%	536.1	197.1
Prothrombin Time (PT), s	4,940	39.3%	14.3	6
Partial Thromboplastin Time (PTT), s	4,680	37.3	34.7	16
INR	6,020	47.9%	1.3	0.6

# Laboratory Measures Evaluation (2 of 2)

	N	%	Mean	SD
<b>Total COVID-19 Patients</b>	12,560	100%	-	-
Fibrin Degradation Products, µg/mL	0	0.0%	-	-
Factor VIII activity, %	20	0.2%	197.8	139.1
VWF antigen	0	0.0%	-	-
Troponin, ng/mL	3,240	25.8%	5.4	39.3
C-Reactive Protein, mg/L	8,160	65.0%	72.8	88.9
Brain-Type Natriuretic Peptide (BNP), pg/mL	1,960	15.6%	283.2	632.6
LDH, U/L	7,090	56.4%	401.1	684.7
Creatinine, mg/dL	11,450	91.2%	1.4	1.9
BUN, mg/dL	9,540	76.0%	22.7	21
Glomerular Filtration Rate (GFR, CKD-EPI), mL/min per 1.73m <sup>2</sup>	10,040	79.9%	72.2	36.9
Lactate, mmol/L	5,880	46.8%	1.5	2.3

# Summary and Next Steps

- Around 12,560 COVID-19 hospitalized patients were identified in TriNetX database on June 19, 2020
  - Of these, 2% had evidence of pulmonary embolism and 2% had deep vein thrombosis within 2 weeks of COVID-19 diagnosis and hospitalization
  - Approximately 36% of COVID-19 patients had low molecular weight Heparin and 20% had Heparin administered within 2 weeks of COVID-19 diagnosis and hospitalization
  - Majority of COVID-19 patients had Hemoglobin, Platelet count, and White blood counts laboratory tests performed within 1 week of COVID-19 diagnosis and hospitalization
- Next steps
  - Further characterize the cohort describing vital sign measures, other conditions, and health care utilization indicative of COVID-19 symptoms/severity



# Acknowledgements

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- Jennifer Stacey

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- Michael Nguyen
- Silvia Perez-Vilar
- Danijela Stojanovic



Thank You

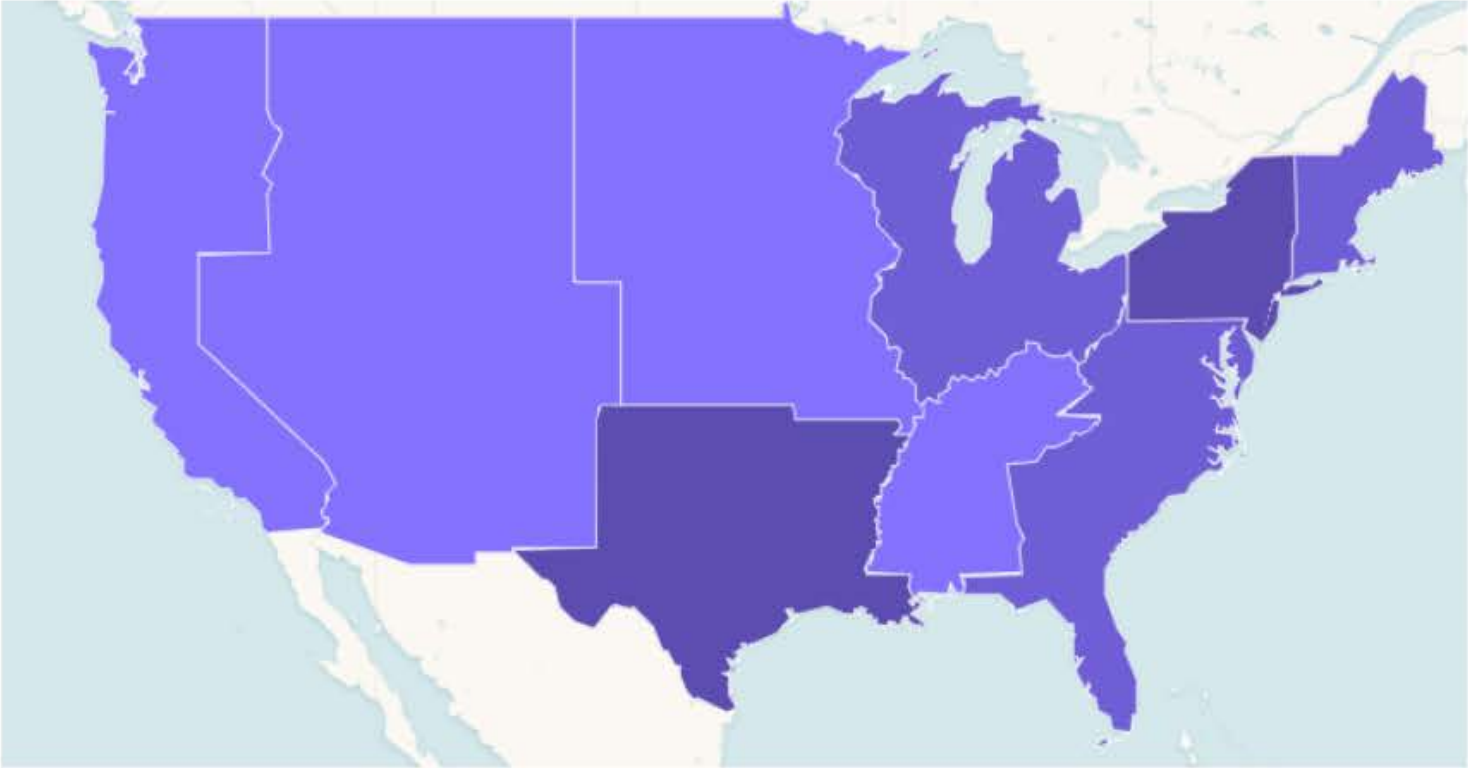
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# Supplemental Slides

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# COVID-19 Geographic Distribution

US Regions	Patients	Percent
New England	1,700	13%
Middle Atlantic	3,280	26%
East North Central	1,400	11%
West North Central	620	5%
South Atlantic	1,690	13%
East South Central	320	3%
West South Central	2,850	23%
Mountain	610	5%
Pacific	130	1%



Patient location is determined by location of HCO headquarters

# COVID-19 Codes

## ICD-10 Diagnosis Codes

Code	Description
B97.29	Other CoV as the cause of diseases classified elsewhere
U07.1	COVID-19, virus identified
B34.2	CoV infection, Unspec site
J12.81	Pneumonia due to SARS-associated CoV
B97.2	CoV as the cause of diseases classified elsewhere
B97.21	SARS-associated CoV causing diseases clasd elswhr

## Antibody Lab Testing LOINC Codes

Code	Description
94505-5	SARS-CoV-2 (COVID19) IgG Ab [Units/volume] in Serum or Plasma by Immunoassay
94506-3	SARS-CoV-2 (COVID19) IgM Ab [Units/volume] in Serum or Plasma by Immunoassay

## Antigen Lab Testing LOINC Codes

Code	Description
94307-6	SARS CoV 2 N gene [Presence] in Unspec specimen by NAA using primer-probe set N1
94308-4	SARS CoV 2 N gene [Presence] in Unspec specimen by NAA using primer-probe set N2
94309-2	SARS CoV 2 RNA [Presence] in Unspec specimen by NAA with probe detect
94310-0	SARS-like CoV N gene [Presence] in Unspec specimen by NAA with probe detect
94311-8	SARS CoV 2 N gene [Cycle Threshold #] in Unspec specimen by NAA using primer-probe set N1
94312-6	SARS CoV 2 N gene [Cycle Threshold #] in Unspec specimen by NAA using primer-probe set N2
94313-4	SARS-like CoV N gene [Cycle Threshold #] in Unspec specimen by NAA with probe detect
94314-2	SARS CoV 2 RdRp gene [Presence] in Unspec specimen by NAA with probe detect
94315-9	SARS CoV 2 E gene [Presence] in Unspec specimen by NAA with probe detect
94316-7	SARS CoV 2 N gene [Presence] in Unspec specimen by NAA with probe detect
94500-6	SARS CoV 2 RNA [Presence] in Resp specimen by NAA with probe detect
94502-2	SARS-related CoV RNA [Presence] in Resp specimen by NAA with probe detect
94509-7	SARS CoV 2 E gene [Cycle Threshold #] in Unspec specimen by NAA with probe detect
94510-5	SARS CoV 2 N gene [Cycle Threshold #] in Unspec specimen by NAA with probe detect
94511-3	SARS CoV 2 ORF1ab region [Cycle Threshold #] in Unspec specimen by NAA with probe detect
94533-7	SARS CoV 2 N gene [Presence] in Resp specimen by NAA with probe detect
94534-5	SARS CoV 2 RdRp gene [Presence] in Resp specimen by NAA with probe detect
94559-2	SARS CoV 2 ORF1ab region [Presence] in Resp specimen by NAA with probe detect
94565-9	SARS CoV 2 RNA [Presence] in Nasopharynx by NAA with non-probe detect
94639-2	SARS CoV 2 ORF1ab region [Presence] in Unspec specimen by NAA with probe detect
94640-0	SARS CoV 2 S gene [Presence] in Resp specimen by NAA with probe detect
94641-8	SARS CoV 2 S gene [Presence] in Unspec specimen by NAA with probe detect
94642-6	SARS CoV 2 S gene [Cycle Threshold #] in Resp specimen by NAA with probe detect
94643-4	SARS CoV 2 S gene [Cycle Threshold #] in Unspec specimen by NAA with probe detect
94644-2	SARS CoV 2 ORF1ab region [Cycle Threshold #] in Resp specimen by NAA with probe detect
94645-9	SARS CoV 2 RdRp gene [Cycle Threshold #] in Unspec specimen by NAA with probe detect
94646-7	SARS CoV 2 RdRp gene [Cycle Threshold #] in Resp specimen by NAA with probe detect
94647-5	SARS-related CoV RNA [Presence] in Unspec specimen by NAA with probe detect
94660-8	SARS CoV 2 RNA [Presence] in Serum or Plasma by NAA with probe detect