Weill Cornell Medicine

Opportunities of Digitally Enabled Pathways

Using data science to understand the long term impacts of COVID-19

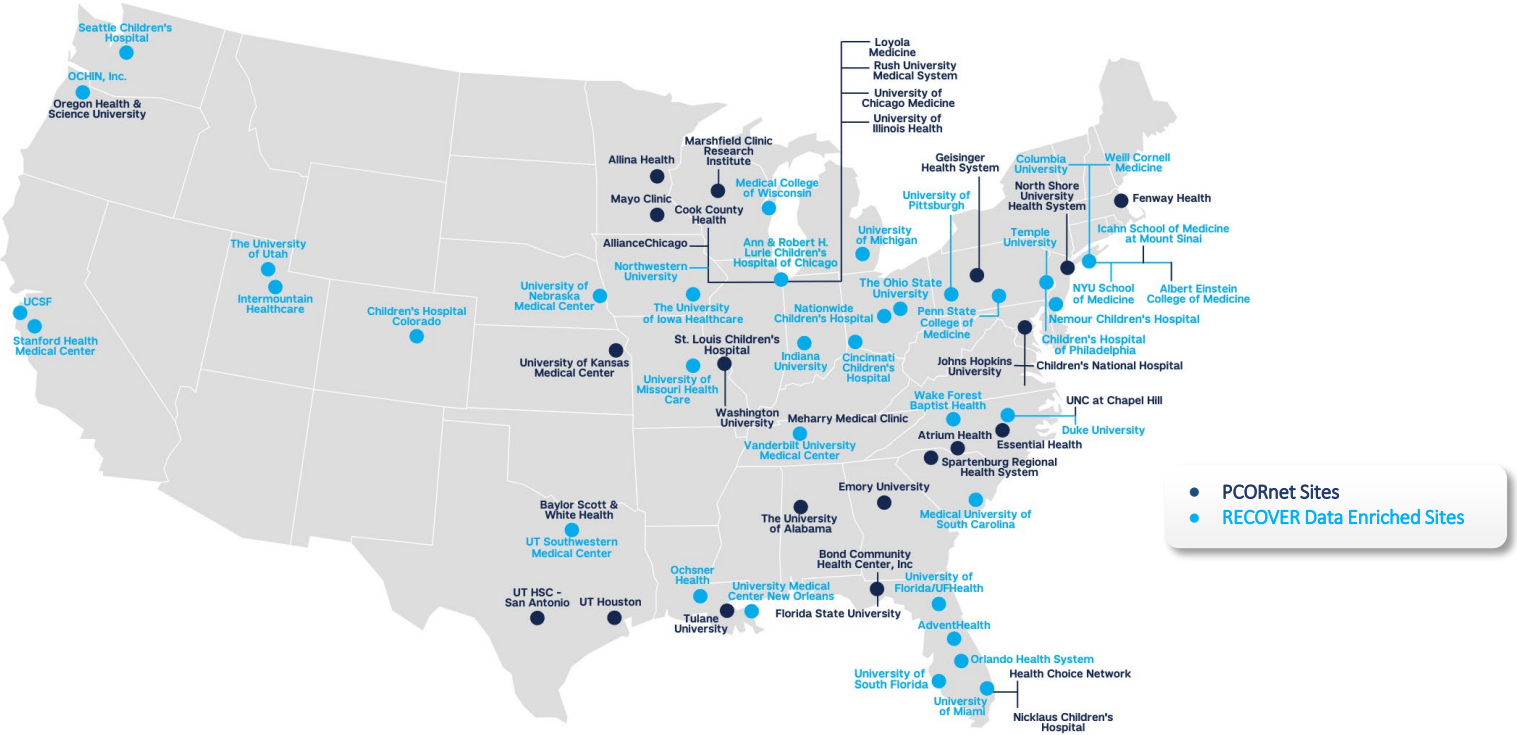
Rainu Kaushal, M.D., M.P.H
Senior Associate Dean, Clinical Research
Nanette L. Laitman Distinguished Professor, Chairwoman,
Department of Population Health Sciences
Weill Cornell Medicine and NewYork Presbyterian

Diagnosing PASC

- Challenges
  - Rapidly evolving conditions
  - New COVID-19 variants
  - Clusters of symptoms and conditions
  - Limited research ready data
  - Silos between patients, physicians, informaticists, scientists, and data sources

- Yet, on October 1, 2021, new ICD 10 code for PASC was established
  - For sequela of COVID-19, or associated symptoms or conditions that develop following a previous COVID-19 infection, assign a code(s) for the specific symptom(s) or condition(s) related to the previous COVID-19 infection, if known, and code U09.9, Post COVID-19 condition, unspecified.

PCORnet & RECOVER Sites



PCORnet Resources and Tools

Established by PCORI in 2014

Electronic health care records on over 100 million patients

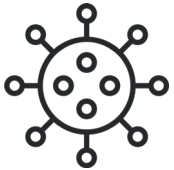
15B+ rows of data

Data Types

Electronic Health Records
Claims Data
Social Determinants of Health
Patient Reported Outcomes
Genomics
Geo codes
Natural Language Processing
Derived Concepts
Death Registry
Vaccine Registry

Over 3,000 Studies

Clinical trials
Health services research
Observational cohorts



COVID-19 positive data on over 1 million patients

PCORnet COVID-19 & PASC Studies
55 Ongoing Studies

Ongoing Studies	Sponsor
Telehealth Outcomes: Social Vulnerability and Chronic Conditions	AHRQ
COVID-19 Electronic Health Data Initiative	CDC
COVID-19: PCORnet/CDC COVID-19 Surveillance	CDC
CBER Biologics Effectiveness and Safety (BEST) IDIQ #2	FDA
Real world data on Remdesivir for SARS-CoV-2 in flyover nation	Gilead
COVID-19 Morbidity, Mortality, and Air Pollution	Health Effects Institute
A Multicenter, Adaptive, Randomized Controlled Platform Trial of the Safety and Efficacy of Antithrombotic Strategies in Hospitalized Adults with COVID-19	NIH
A Prospective Cohort Study to Assess Longitudinal Immune Responses in Hospitalized Patients with COVID-19	NH
Accelerating COVID-19 Therapeutic Interventions and Vaccines 4 ACUTE (ACTIV-4)	NIH
Accelerating COVID-19 Therapeutic Interventions and Vaccines (ACTIV) 6 - Evaluate Efficacy of Repurposed Medications	NIH
COVID-19 Outpatient Thrombosis Prevention Trial: A multicenter adaptive randomized placebo-controlled platform trial evaluating the efficacy and safety of antithrombotic strategies in COVID-19 adults not requiring hospitalization at time of diagnosis	NIH
The Impacts of County-Level COVID-19-Related Public Health and Social Policies on Racial/Ethnic and Socioeconomic Disparities in Mental Health and Healthcare Utilization	NIH
Risk prediction model for severe COVID outcomes among older patients (50+) with and without diabetes	NIH

Ongoing Studies	Sponsor
Building Capacity to Support the Pandemic's Unsung Heroes: Frontline Essential Food Service Workers	PCORI
Comparing Patient-Reported Impact of COVID-19 Shelter-in-Place Policies and Access to Containment and Mitigation Strategies, Overall and in Vulnerable Populations (Citizen Science Study)	PCORI
COVID-19: Enhancement Coagulopathy	PCORI
Evaluating the Comparative Effectiveness of Telemedicine in Primary Care: Learning from the COVID-19 Pandemic	PCORI
Grounding Health Research in Design Thinking for Equitable Engagement to Address COVID-19 (GRID Engagement)	PCORI
Healthcare Worker Exposure Response and Outcomes Registry	PCORI
Impact of COVID-19 on treatment of hypertension - Blood Pressure Control Laboratory (BPCL) COVID Supplement	PCORI
Louisiana Experiment Assessing Diabetes outcomes (LEAD Study)	PCORI
Methods to Identify and Predict Which Patients Will Have High Healthcare Needs and Use: COVID-19 Enhancement	PCORI
Predictive Modeling of COVID data: High Utilizers Data Enhancement	PCORI
COVID-19 in Pediatric Populations	RTW Charitable Foundation

PCORnet Science

Annals of Internal Medicine

Letters | 17 November 2020

Obesity and COVID-19 in New York City: A Retrospective Cohort Study FREE

PLOS ONE

Socioeconomic variation in characteristics, outcomes, and healthcare utilization of COVID-19 patients in New York City

Yongkang Zhang, Dhruv Khullar, Fei Wang, Peter Steel, Yiyuan Wu, Duncan Orlander, Mark Weiner, Rainu Kaushal

JGIM Journal of General Internal Medicine

Impact of the Early Phase of the COVID-19 Pandemic on US Healthcare Workers: Results from the HERO Registry

Christopher B. Forrest MD, PhD, Haolin Xu MS, Laine E. Thomas PhD, Laura E. Webb BS, Lauren W. Cohen MA, Timothy S. Carey MD, MPH, Cynthia H. Chuang MD, MSc, Nancy M. Dariaseh PhD, Rainu

npj | digital medicine

Clinical subphenotypes in COVID-19: derivation, validation, prediction, temporal patterns, and interaction with social determinants of health

Chang Su, Yongkang Zhang, James H. Flory, Mark G. Weiner, Rainu Kaushal, Edward J. Schenck & Fei Wang

JAMA

Effect of Antithrombotic Therapy on Clinical Outcomes in Outpatients With Clinically Stable Symptomatic COVID-19

The ACTIV-4B Randomized Clinical Trial

Jean M. Connors, MD[1]; Maria M. Brooks, PhD[2]; Frank C. Sciurba, MD[2]; Jerry A. Krishnan, MD[3]; Joseph R. Bledsoe, MD[4]; Andrei Kindzelski, MD[5]; Amanda L. Baucom, MS[2]; Bridget-Anne Kirwan, PhD[6]; Heather Eng, BA[2]; Deborah Martin, BA[2]; Elaine Zaharris, BA[1]; Brendan Everett, MD[1]; Lauren Castro, MS[3]; Nancy L. Shapiro, PharmD[3]; Janet Y. Lin, MD[3]; Peter C. Hou, MD[1]; Carl J. Pepine, MD[7]; Eileen Handberg, PhD[7]; Daniel O. Haight, MD[8]; Jason W. Wilson, MD[9]; Sarah Majercik, MD[4]; Zhuxuan Fu, MS[2]; Yongqi Zhong, PhD[2]; Vidya Venugopal, PhD[2]; Scott Beach, PhD[2]; Steve Wisnlewski, PhD[2]; Paul M Ridker, MD[1]; for the ACTIV-4B Investigators

JAMA Network Open

Disparities and Temporal Trends in COVID-19 Exposures and Mitigating Behaviors Among Black and Hispanic Adults in an Urban Setting

Sheila Badri, MD[1,2]; Vanessa Sardá, MD, MPH[1,2]; Jorge Soria Moncada, MD[1]; Monica Merçon, MD[1,2]; Katayoun Rezai, MD[1,2]; Robert A. Weinstein, MD[1,2]; William E. Trick, MD[2,3]

NIH National Institutes of Health *Turning Discovery Into Health* — Preprint: Made publicly accessible prior to peer review

COVID-19 reopening strategies at the county level in the face of uncertainty: Multiple Models for Outbreak Decision Support

Katriona Shea et al.

Journal of Biomedical Informatics

A predictive model of clinical deterioration among hospitalized COVID-19 patients by harnessing hospital course trajectories

Elizabeth Mauer[a], Jihui Lee[a], Justin Choi[b], Hongzhe Zhang[a], Katherine L. Hoffman[a], Imaani J. Easthausen[a], Mangala Rajan[b], Mark G. Weiner[a], Rainu Kaushal[a], Monika M. Safford[b], Peter A.D. Steel[c], Samprit Banerjee[a]

JAMA Internal Medicine

Hospitalizations for Chronic Disease and Acute Conditions in the Time of COVID-19

Saul Blecker, MD, MHS[1]; Simon A. Jones, PhD[1]; Christopher M. Petrilli, MD[2]; Andrew J. Admon, MD, MPH, MSc[3]; Himali Weerahandi, MD, MPH[1,2]; Fritz Francois, MD, MSc[4]; Leora I. Horwitz, MD, MHS[1]

PLOS ONE

Epidemiology of COVID-19 vs. influenza: Differential failure of COVID-19 mitigation among Hispanics, Cook County Health, Illinois

William E. Trick, Sheila Badri, Kruti Doshi, Huiyuan Zhang, Katayoun Rezai, Michael J. Hoffman, Robert A. Weinstein

Journal of Clinical Oncology

An American Society of Clinical Oncology Journal

COVID-19 Severity and Outcomes in Patients With Cancer: A Matched Cohort Study

The NEW ENGLAND JOURNAL of MEDICINE

June 11, 2020

N Engl J Med 2020; 382:2372-2374

DOI: 10.1056/NEJMc2010419

CORRESPONDENCE

Clinical Characteristics of Covid-19 in New York City

Open Forum Infectious Diseases

399. Epidemiology of Laboratory-identified Late-onset SARS-CoV-2 Positivity in Two Large, Urban, Acute-Care Hospitals: Implications for Surveillance of Hospital-Acquired COVID-19

William Trick, MD, Michael Y Lin, MD, MPH, Sharon F Welbel, MD, Onfofre T Donceras, MS, RN, CIC, Huiyuan Zhang, MS, Marion Tseng, PhD, MPVM, Carlos Santos, MD, MPHS

JAMA Network Open

Aggregating Electronic Health Record Data for COVID-19 Research—Caveat Emptor

Jeffrey S. Brown, PhD[1]; Lisa Bastarache, MS[2]; Mark G. Weiner, MD[3]

ANNALS OF SURGERY

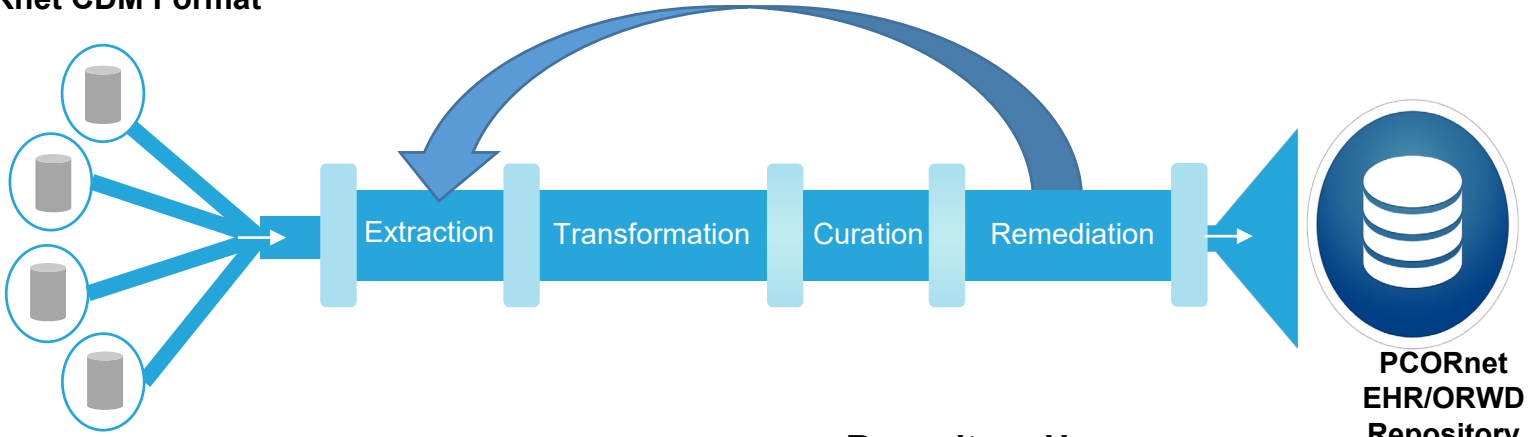
Percutaneous and Open Tracheostomy in Patients with COVID-19

Comparison and Outcomes of an Institutional Series in New York City

Weill Cornell Medicine

Computable Phenotypes

Data from 41 Health Systems in the PCORnet CDM Format



PCORnet EHR/ORWD Repository

Repository Uses

Visualization

Query

Cohort Identification (Codesets and CP)

Science

Example Visualization

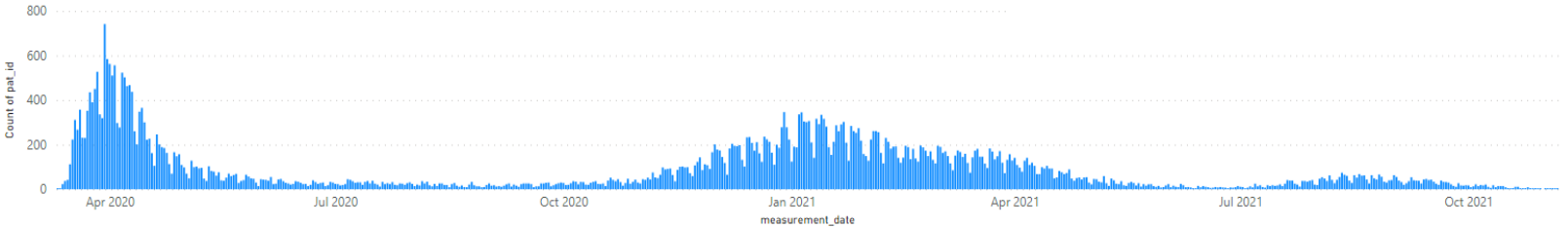
Timing of diagnosis with respect to COVID

pre | post | acute

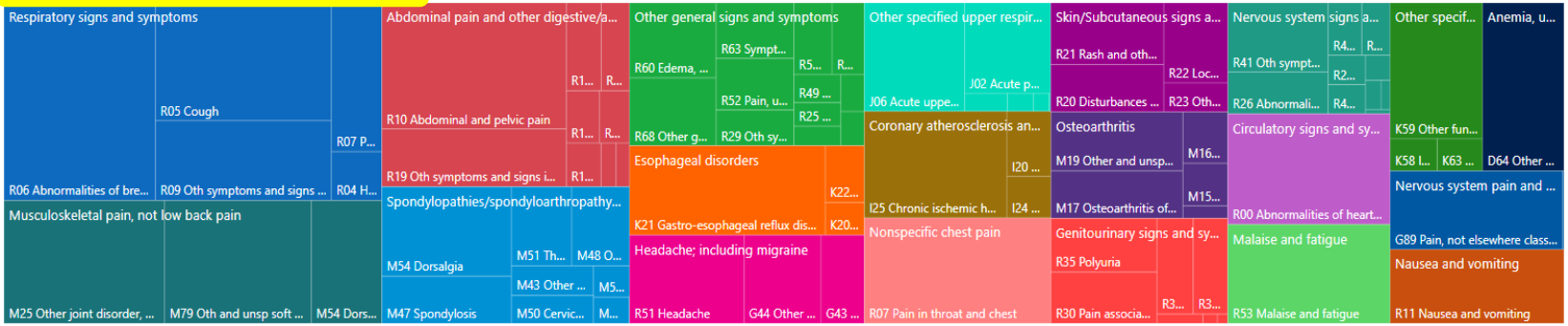
Limit to PASC Screening Diagnoses

True

Count of COVID Ag/PCR positive patients per day



Count of COVID postitive patients with PASC components



Query Examples

Characterizing PASC:

- Demographics
- Time trends
- Comorbidities (Utilizing a tailored Elixhauser comorbidity set of conditions which includes 31 co-morbidities as well as two medications)
- COVID-19 care settings
- COVID-19 medications (24 medications, including the therapeutic convalescent plasma and newer therapeutics directed towards the omicron variant)
- Vaccination status

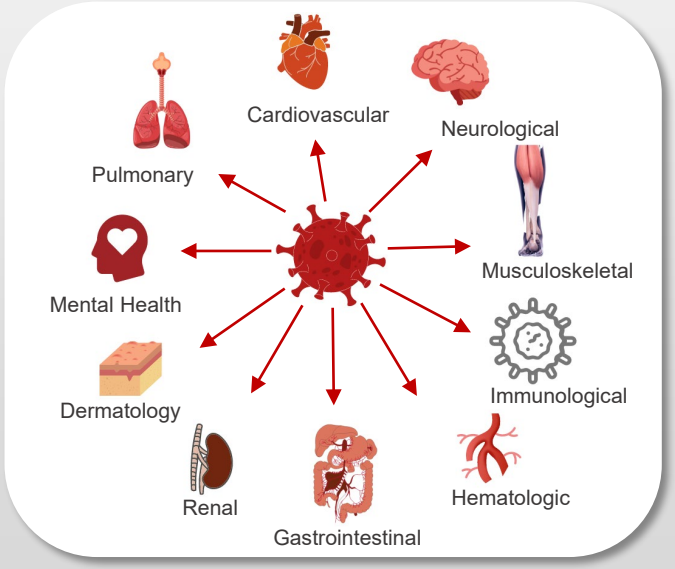
Computable Phenotypes

Literature Review
(200+ Studies)

Data Driven Insights

Expert Clinician Input

- Screening Computable Phenotype for PASC
  6,000 diagnostic clusters
- Resulted in 10 key areas to focus on:



Characteristics of PASC

Study Population

- 168,701 COVID-19 positive from between March – December 2020 with medical encounters from 40 healthcare systems pre and post COVID-19
- 1,622,185 adults without COVID-19 and with encounters

Main Outcome

- A new symptom or condition post COVID-19 that was absent pre COVID-19

Results

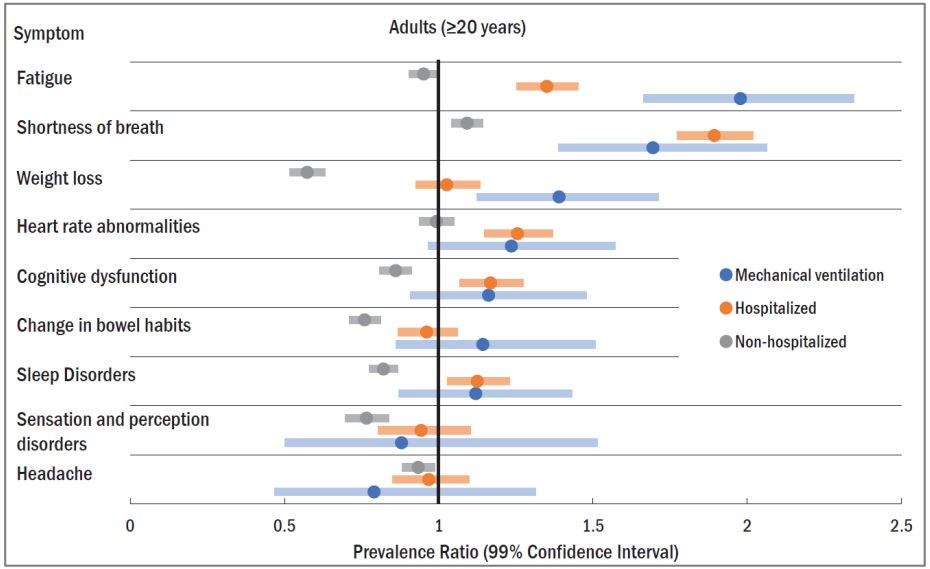
- 96,606 (57%) of adults had a new symptom or condition
- Severity of COVID index illness correlated with a new symptom or condition
    - 17,565 (73%) for hospitalized patients

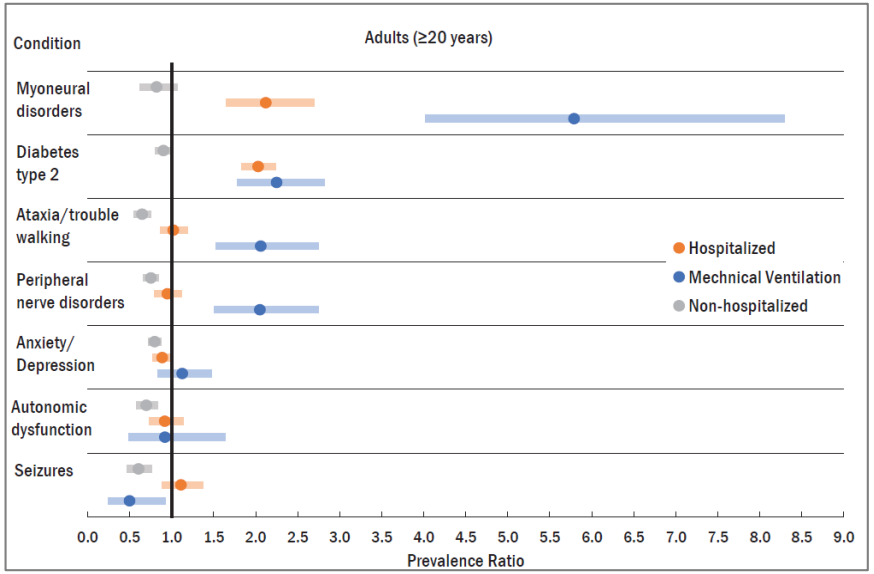
Prevalence of select new symptoms and conditions among persons aged <20 years and ≥20 years 31–150 days after testing positive or negative for SARS-CoV-2

Alfonso C. Hernandez-Romieu MD, MPH, Thomas Carton PhD, MS, Sharon Saydah MD, Eduardo Azziz- Baumgartner MD, Tegan K. Boehmer, PhD, Nedra Garret MS, Charles Bailey MD, Lindsay G. Cowell MS PhD, Christine Draper MD, Ken Mayer MD, Kshema Nagavedu, Jon Puro, Sonja A. Rasmussen MD, William E. Trick MD, Valentine Wanga PhD, Jennifer Chevinsky MD, Brendan Jackson MD, Alyson Goodman MD, Jennifer R. Cope MD, MPH, Adi Gundlapalli MD PhD, Jason P. Block, MD, MPH

(in press JAMA OPEN NETWORK)

PCORnet PASC Results





PASC prevalence will be more accurate with:

- Longer follow up period
- More nuanced PASC definition

Thank you

Rainu Kaushal, M.D., M.P.H
rak2007@med.cornell.edu