Update on PASC

Kelly Gebo, MD, MPH
Professor of Medicine
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Disclosures

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Department of Defense
Bloomberg Philanthropies

Consulting:

Teach for America,
Aspen Institute,
Uptodate,
Medicolegal work
Objectives

• Understand different definitions of Post Acute Sequelae of COVID-19 (PASC)
• Appreciate risk factors for PASC
• Work up of PASC
• Treatment options
• JHU PACT Clinic
• Important Future Research Questions
What is PASC?

Depends on who you ask!

Post COVID-19 condition occurs in individuals with a history of probable or confirmed SARS-CoV-2 infection, usually 3 months from the onset of COVID-19 with symptoms that last for at least 2 months and cannot be explained by an alternative diagnosis. Common symptoms include fatigue, shortness of breath, cognitive dysfunction but also others (see Table 3 and Annex 2) which generally have an impact on everyday functioning. Symptoms may be new onset, following initial recovery from an acute COVID-19 episode, or persist from the initial illness. Symptoms may also fluctuate or relapse over time. A separate definition may be applicable for children.

Post-COVID Conditions

We use post-COVID conditions as an umbrella term for the wide range of health consequences that are present four or more weeks after infection with SARS-CoV-2. The time frame of four or more weeks provides a rough approximation of effects that occur beyond the acute period, but the timeframe might change as we learn more.
Post-Acute Sequelae SARS-CoV-2 (PASC)

Post-Acute Sequelae of SARS-CoV-2

10-30% with symptoms

- Incidence of neuromuscular, cardiovascular disorders...
- Mental health burden
- Healthcare utilization
- Risk of death (8 extra deaths/1000 pts)

**Neurologic**
- Headaches
- Dizziness
- Encephalopathy
- Guillain-Barré
- Ageusia
- Myalgia
- Anosmia
- Stroke

**Renal**
- Acute kidney injury
- Proteinuria
- Hematuria

**Hepatic**
- Elevated aminotransferases
- Elevated bilirubin

**Gastrointestinal**
- Diarrhea
- Nausea/vomiting
- Abdominal pain
- Anorexia

**Thromboembolism**
- Deep vein thrombosis
- Pulmonary embolism
- Catheter-related thrombosis

**Cardiac**
- Takotsubo cardiomyopathy
- Myocardial injury/myocarditis
- Cardiac arrhythmias
- Cardiogenic shock
- Myocardial ischemia
- Acute cor pulmonale

**Endocrine**
- Hyperglycemia
- Diabetic ketoacidosis

**Dermatological**
- Petechiae
- Livedo reticularis
- Erythematous rash
- Urticaria
- Vesicles
- Pernio-like lesions
Risk Factors for PASC

- Severity of COVID-19
- Baseline health status
- Age
- Female sex
- Increased BMI
- Unvaccinated
Severity

342 Dutch people followed from diagnosis through 1 year with monthly surveys. Assessed time from illness onset to complete recovery. Female sex and obesity associated with slow recovery.
Female sex, obesity

Multivariable Cox proportional hazard model

<table>
<thead>
<tr>
<th>Determinants at illness onset</th>
<th>aHR (95%CI)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, years</td>
<td>0.200</td>
<td></td>
</tr>
<tr>
<td>Age (per 10 year increase)</td>
<td>0.92 (0.82-1.04)</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td>0.013</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>Ref.</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>0.65 (0.47-0.92)</td>
<td></td>
</tr>
<tr>
<td>BMI, kg/m2</td>
<td>0.057</td>
<td></td>
</tr>
<tr>
<td>Normal weight</td>
<td>Ref.</td>
<td></td>
</tr>
<tr>
<td>Overweight</td>
<td>0.71 (0.49-1.03)</td>
<td></td>
</tr>
<tr>
<td>Obese</td>
<td>0.62 (0.39-0.97)</td>
<td></td>
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<tr>
<td>Number of comorbidities</td>
<td>0.454</td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>Ref.</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.78 (0.50-1.21)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0.67 (0.37-1.23)</td>
<td></td>
</tr>
<tr>
<td>3 or more</td>
<td>0.72 (0.36-1.42)</td>
<td></td>
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</tbody>
</table>
Predictors of PASC: OP vs. IP

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Qualifying non-hospitalised patients</th>
<th>Qualifying hospitalised patients</th>
<th>All qualifying patients</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Importance</td>
<td>Odds ratio (95% CI)</td>
<td>Importance</td>
</tr>
<tr>
<td>Post-COVID outpatient utilisation</td>
<td>77.58</td>
<td>4.58 (3.75-5.57)</td>
<td>744.99</td>
</tr>
<tr>
<td>Difficulty breathing (dx)</td>
<td>25.95</td>
<td>10.65 (7.23-15.7)</td>
<td>41.49</td>
</tr>
<tr>
<td>Age</td>
<td>18.26</td>
<td>*</td>
<td>159.54</td>
</tr>
<tr>
<td>Dyspnoea (dx)</td>
<td>14.01</td>
<td>10.65 (7.23-15.7)</td>
<td>51.04</td>
</tr>
<tr>
<td>Male sex</td>
<td>11.26</td>
<td>0.59 (0.38-0.91)</td>
<td>18.78</td>
</tr>
<tr>
<td>COVID vaccine (med)</td>
<td>9.72</td>
<td>0.49 (0.27-0.89)</td>
<td>54.84</td>
</tr>
<tr>
<td>Post-COVID inpatient utilisation</td>
<td>2.27</td>
<td>3.18 (1.14-6.11)</td>
<td>161.05</td>
</tr>
</tbody>
</table>

Pfaff 2022. *Lancet Digital Health*
PASC Evaluation Guidelines

- Cardiopulmonary
- Neurologic
- Hypercoagulable
- Olfactory/gustatory
- Fatigue/poor energy

- Vitals (pulse ox)
  - orthostatics
- Assess for fibrosis/pleural effusion
- 6M Walk test

PM R. 2021 Sep;13(9):1027-1043.
PASC Treatment Guidelines

• Fatigue:
  – titrated return to activity,
  – energy conservation strategies,
  – healthy diet and hydration,
  – treat any underlying comorbid conditions including pain/insomnia

PM R. 2021 Sep;13(9):1027-1043.
PASC Treatment

- Cough:
  - OTC cough suppressant as needed

- Dyspnea:
  - Optimize pharmacotherapy for underlying dz
  - Mild symptoms: breathing exercise and breathless management
  - Moderate/Severe: refer to pulmonary, consider pulmonary rehab
PASC Treatment

• Neuro:
  – Consider EMG for weakness
  – Brain Fog: follow with Montreal Cognitive Assessment (MOCA) consider neuropsych eval

• Orthostasis:
  – Mild: hydration, compression stockings, PT
  – POTS: consider medications
1 year outcomes among survivors in China

- N=1276 with 1 year FU (54 admitted to ICU)
- 49% with ≥1 symptom (Fatigue 20%)
- Dyspnea 30%
- Anxiety or Depression 26%

- Compared to matched controls a greater proportion of COVID-19 survivors had decreased mobility, pain, anxiety/Depression or SOB

1-year outcomes in hospital survivors with COVID-19: a longitudinal cohort study

June 14, 2022
JH PACT

- Established April 7, 2020
- Post-Intensive Care Syndrome (PICS) framework
- Multi-D: PCCM, PM&R, JH Homecare
- Telemed/In-person Hybrid
- JH PACT-ICU: Severe initial COVID-19 (ICU LOS > 48hrs)
- JH PACT-Base: Mild to moderate initial COVID-19

Ann M. Parker, MD, PhD  Alba Azola, MD
PCCM                          PM&R

JOHNS HOPKINS MEDICINE
Rapid Design and Implementation of Post-COVID-19 Clinics

Lekshmi Santhosh, MD, MAEd; Brian Block, MD; Soo Yeon Kim, MD; Sarath Raju, MD, MPH; Rupal J. Shah, MD; Neeta Thakur, MD, MPH; Emily Pfeil Brigham, MD, MHS; and Ann Marie Parker, MD, PhD

Core Team:
1. Pulmonary-Critical Care
2. Physical Medicine & Rehabilitation
3. Homecare PT/OT/SLP

Partnerships:
• Primary Care
• Psychiatry
• Psychology
• Neurology
• Cardiology
• Hematology
• Infectious Disease
• Nephrology
• Dermatology
• Hepatology
• Otolaryngology
JH PACT:

Pulmonary & Rehabilitation Medicine including:
• Interstitial lung disease
• Postural orthostatic tachycardia syndrome (POTS)

Homecare
• Rehabilitation services
• Nursing

On-Campus Rehabilitation
• Physical Therapy
• Occupational Therapy
• Speech-Language Pathology
• Rehab Psychology

JH PACT → 30% reduction in readmissions (16% to 11%)

https://www.hopkinsmedicine.org/coronavirus/pact/
Research Opportunities

https://recovercovid.org/
Future?

• What are the phenotypes?
• Does early treatment impact PASC?
• What are the best treatments for PASC?
  What are the best mechanisms to prevent PASC?
• What will be the long term outcomes of those with PASC?
  – Will it vary by phenotype?
Thank you!

• Patients and research participants who graciously shared their stories and samples
Questions?

Email: kgebo@jhmi.edu
Twitter: @kgebo
Post COVID-19 condition occurs in individuals with a history of probable or confirmed SARS-CoV-2 infection, usually 3 months from the onset of COVID-19 with symptoms that last for at least 2 months and cannot be explained by an alternative diagnosis. Common symptoms include fatigue, shortness of breath, cognitive dysfunction but also others* and generally have an impact on everyday functioning. Symptoms may be new onset following initial recovery from an acute COVID-19 episode or persist from the initial illness. Symptoms may also fluctuate or relapse over time.