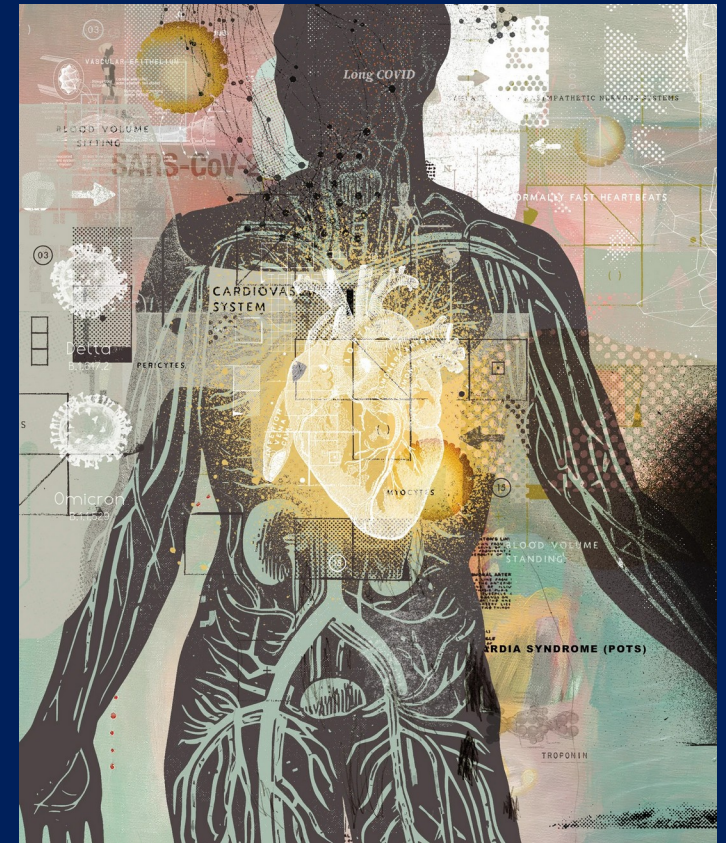


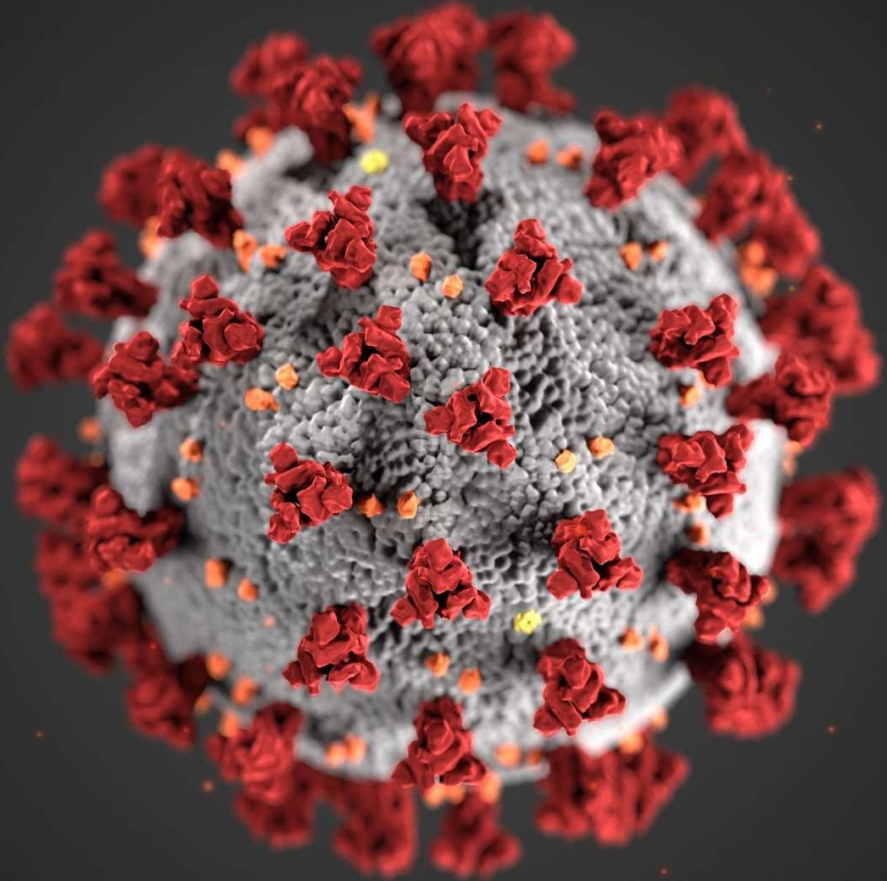
The Lingering Impact of COVID-19: Arrhythmias and Autonomic Dysfunction

The Indian Perspective

Raja Selvaraj
19 May 2024



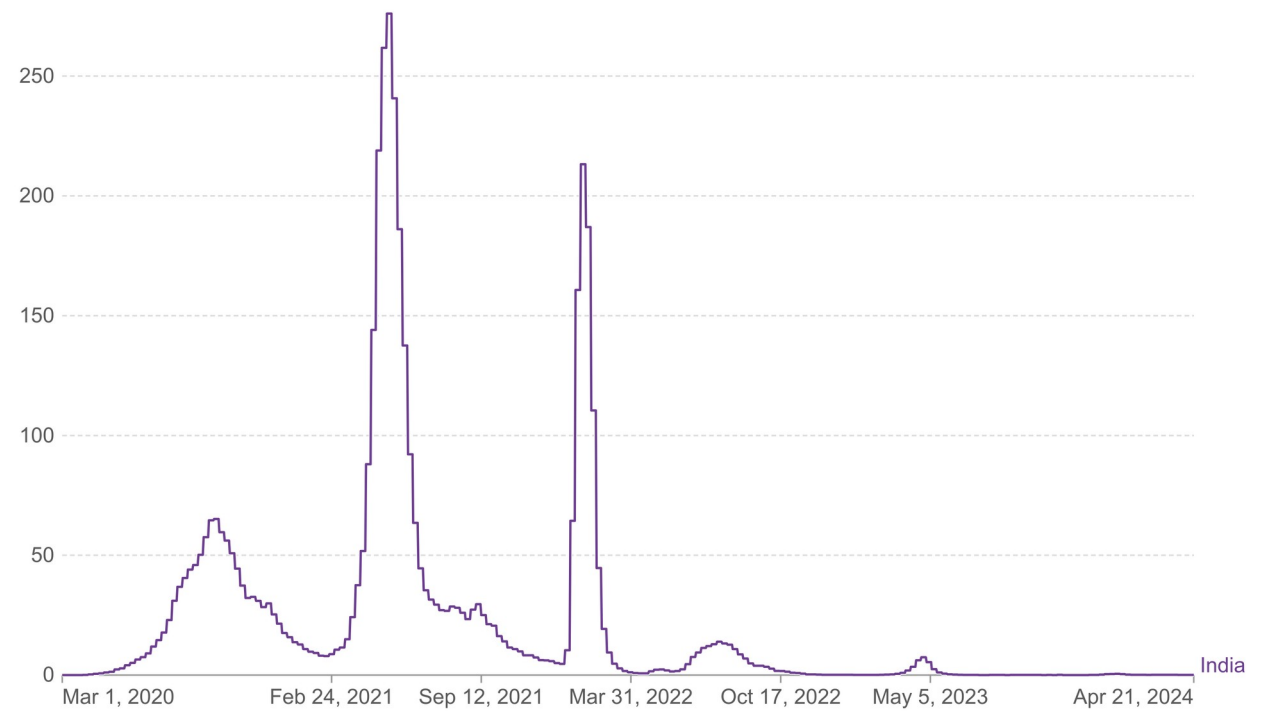
COVID 19



Daily new confirmed COVID-19 cases per million people

Our World
in Data

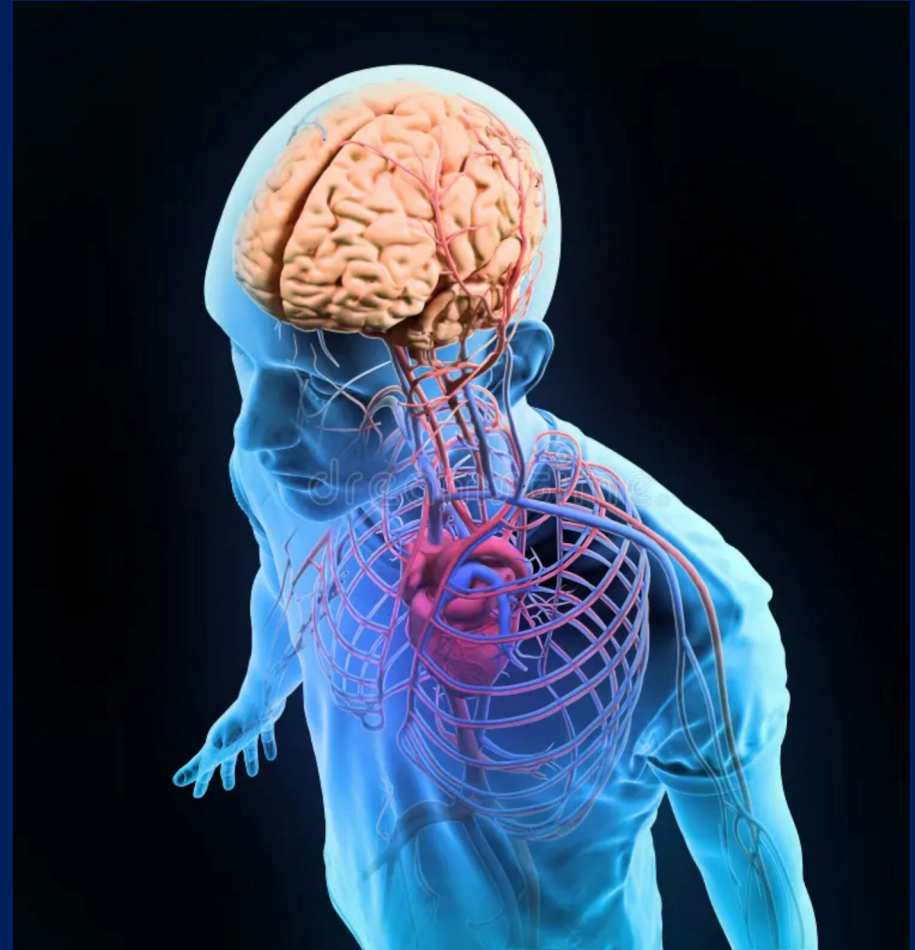
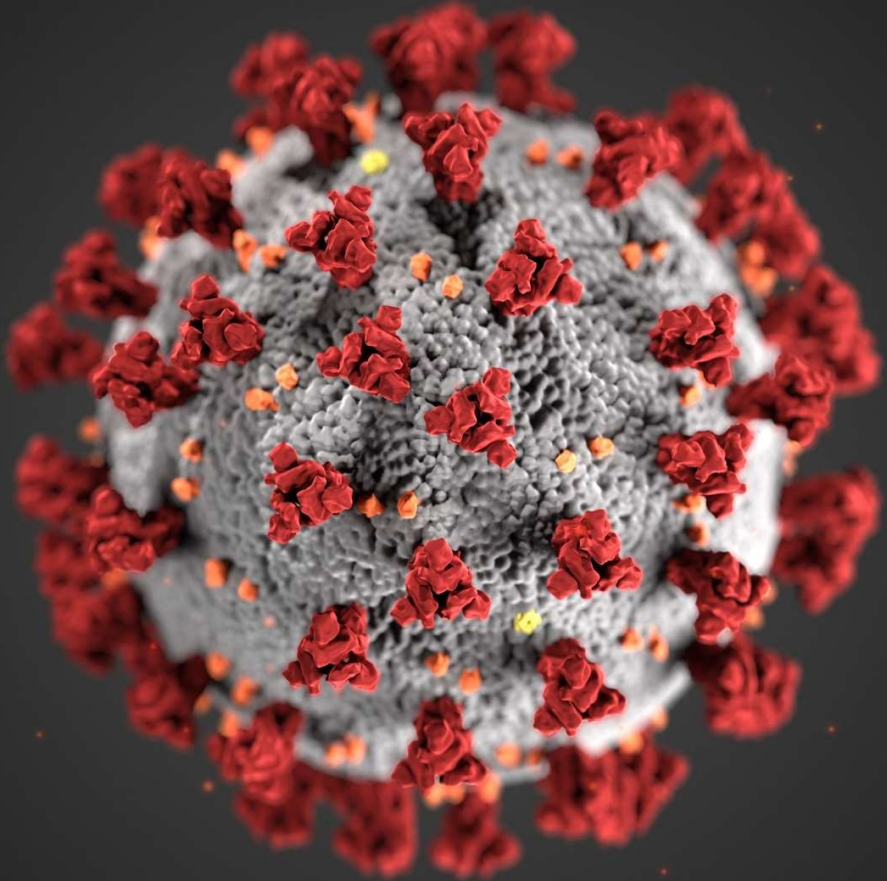
7-day rolling average. Due to limited testing, the number of confirmed cases is lower than the true number of infections.



Data source: WHO COVID-19 Dashboard

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COVID 19



Paul Garner: For 7 weeks I have been through a roller coaster of ill health, extreme emotions, and utter exhaustion

May 5, 2020

Paul Garner, professor of infectious diseases at Liverpool School of Tropical Medicine, discusses his experience of having covid-19



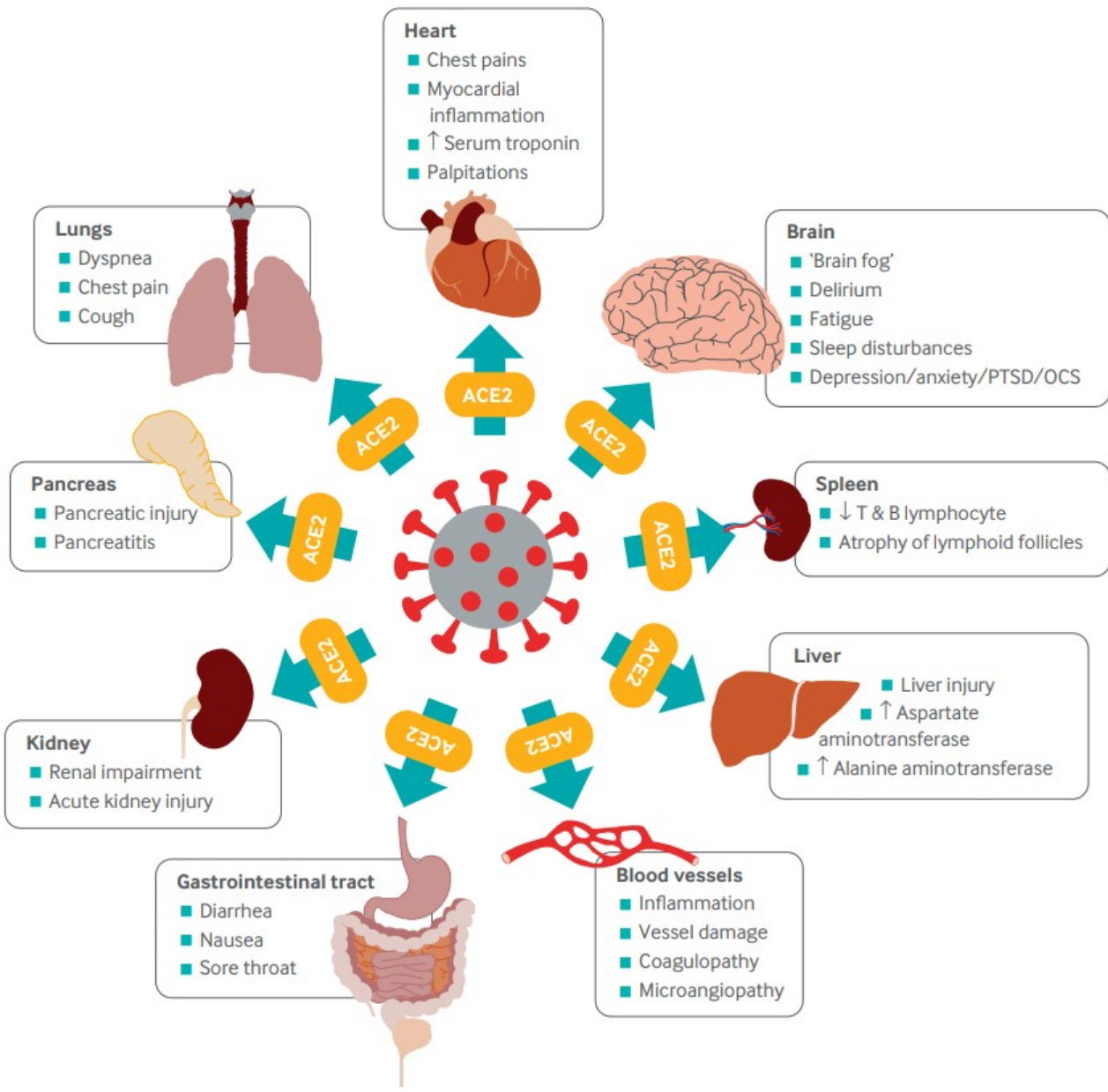
In mid March I developed covid-19. For almost seven weeks I have been through a roller coaster of ill health, extreme emotions, and utter exhaustion. Although not hospitalised, it has been frightening and long. The illness ebbs and flows, but never goes away. Health professionals, employers, partners, and people with the disease need to know that this illness can last for weeks, and **the long tail is not some "post-viral fatigue syndrome"**—it is the disease. People who have a more protracted illness need help to understand and cope with the constantly shifting, bizarre symptoms, and their unpredictable course.

<https://blogs.bmj.com/bmj/2020/05/05/paul-garner-people-who-have-a-more-protracted-illness-need-help-to-understand-and-cope-with-the-constantly-shifting-bizarre-symptoms/>

Long COVID - Signs, symptoms, and conditions that continue or develop after acute COVID-19 infection.

PASC (Post acute sequelae of COVID) - Constellation of new, returning, or persistent health problems experienced by individuals 4 or more weeks after SARS-CoV-2 infection. (4 weeks used by CDC, others use 12 weeks)

Long COVID



PASC-CVD - Broad group of cardiovascular conditions that manifest ≥ 4 weeks after SARS-CoV-2 infection. Includes, but is not limited to, myocarditis and other forms of myocardial involvement, pericarditis, new or worsening myocardial ischemia due to obstructive coronary artery disease, microvascular dysfunction, nonischemic cardiomyopathy with involvement of the left and/or right ventricles, thromboembolism, cardiovascular sequelae of pulmonary disease, and arrhythmia

PASC-CVS - Heterogeneous disorder that includes widely - ranging cardiovascular symptoms, without objective evidence of cardiovascular disease using standard diagnostic tests.

PASC-CVS is due to autonomic dysfunction



[Mayo Clin Proc.](#) 2012 Dec; 87(12): 1196–1201.
doi: [10.1016/j.mayocp.2012.10.013](#)

PMCID: PMC3541923
NIHMSID: [NIHMS422427](#)
PMID: [23218087](#)

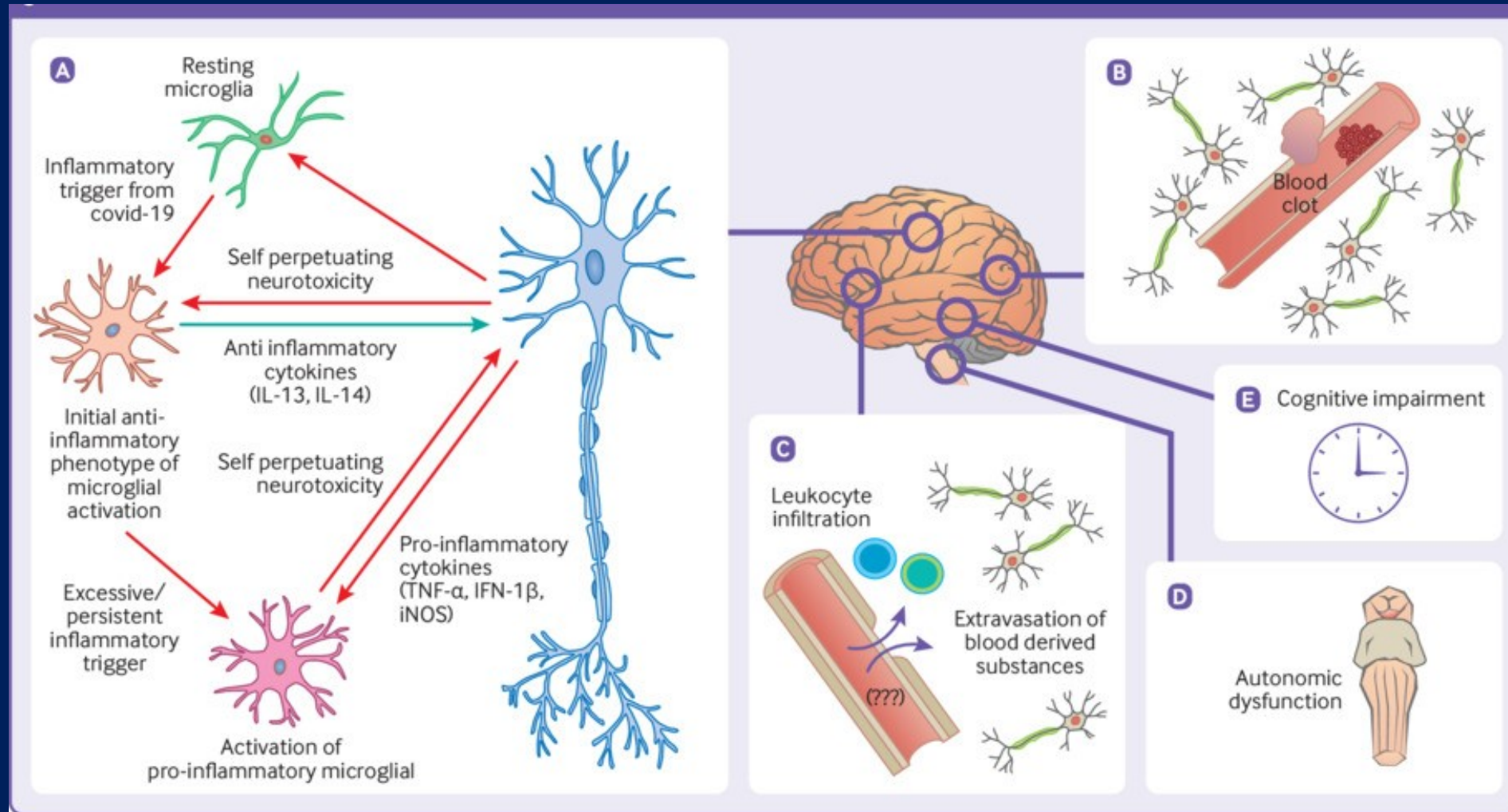
COMPASS 31: A Refined and Abbreviated Composite Autonomic Symptom Score

[David M. Sletten](#),^a [Guillermo A. Suarez](#),^{†,a} [Phillip A. Low](#),^a [Jay Mandrekar](#),^b and [Wolfgang Singer](#)^{a,*}

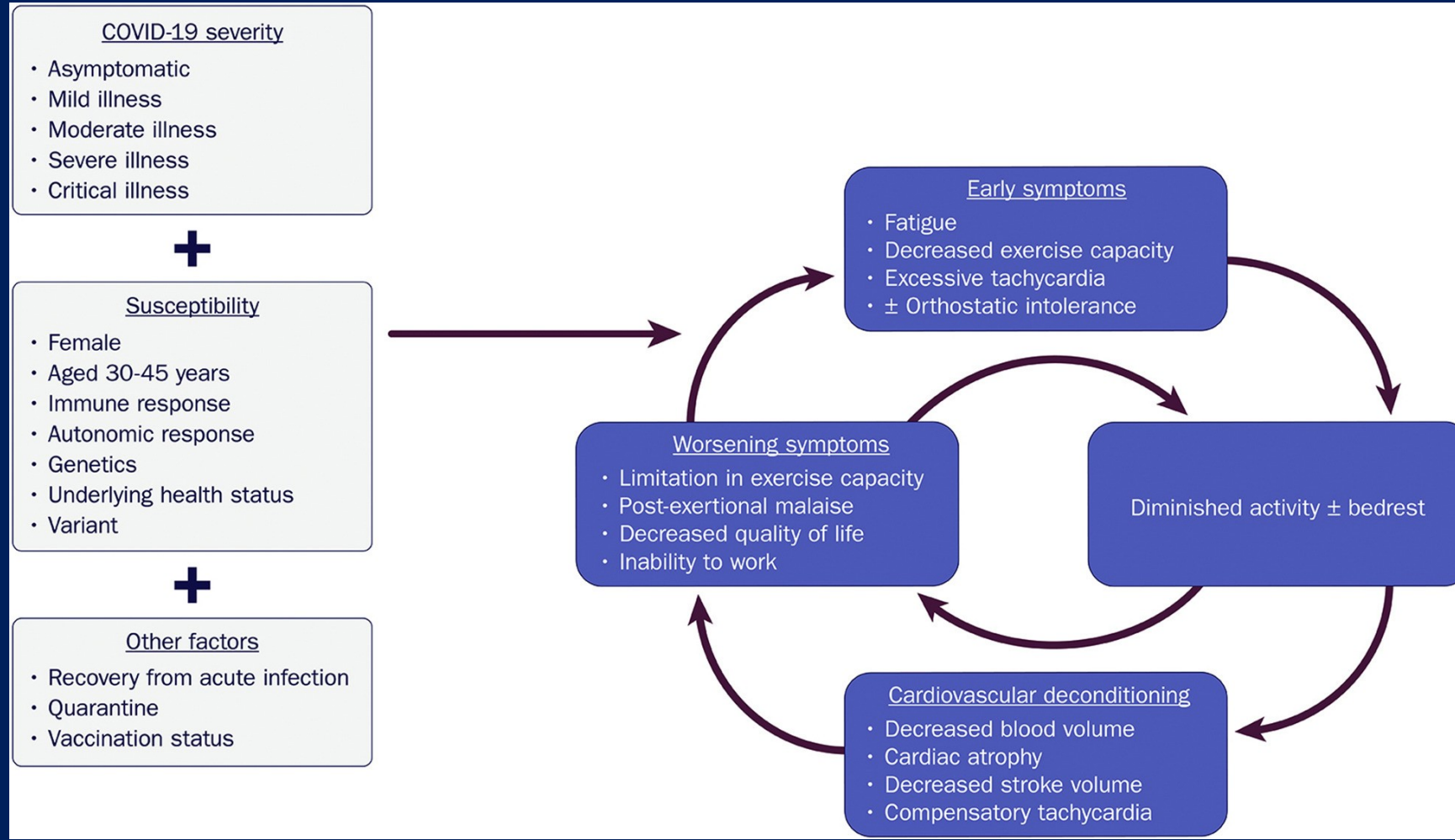
66 % of 2314 patients with PASC-CVS had Compass-31 score > 20

Larsen NW et al. Characterization of autonomic symptom burden in long COVID: A global survey of 2,314 adults. *Front Neurol.* 2022 Oct 19;13:1012668. doi: [10.3389/fneur.2022.1012668](#)

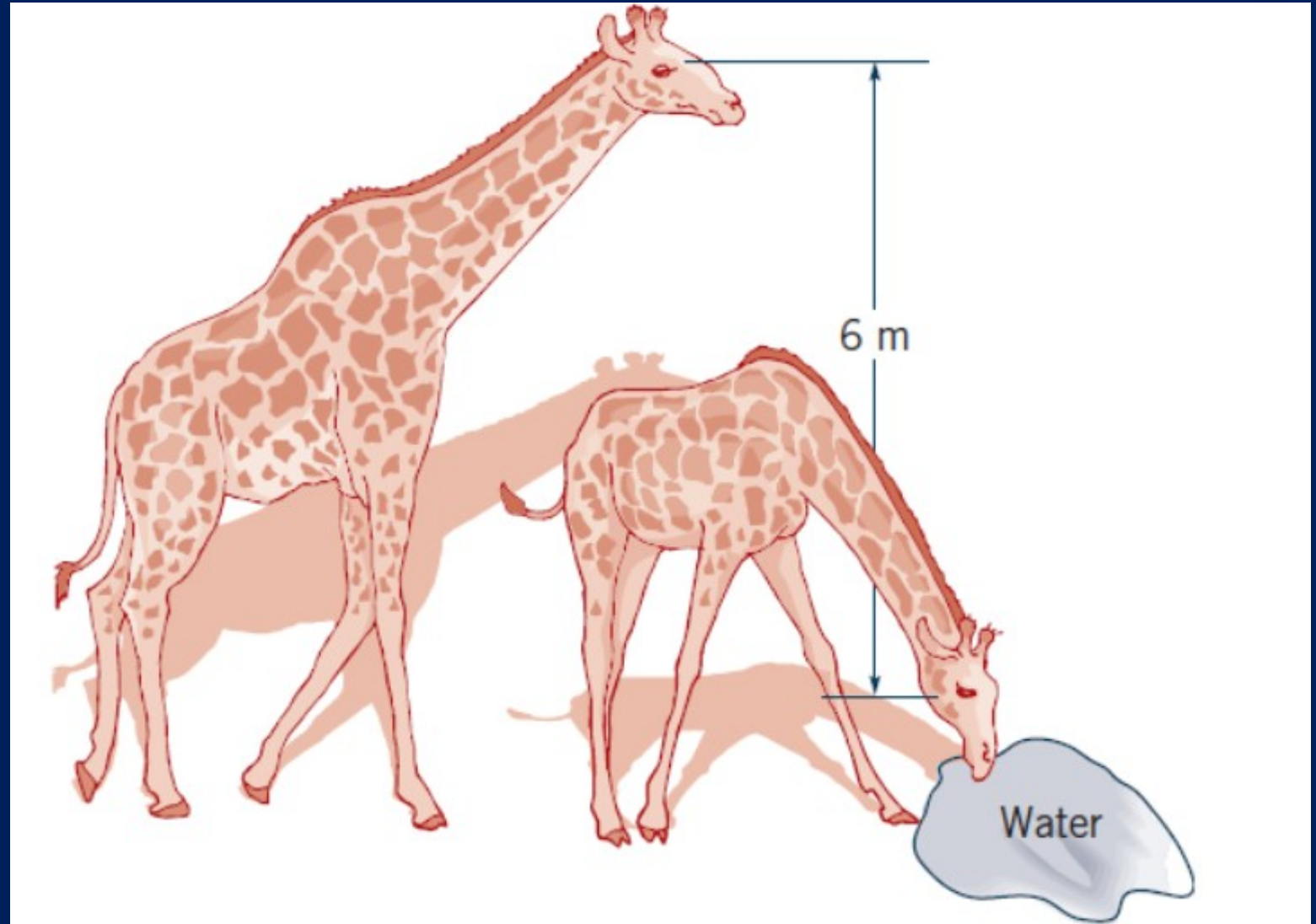
Mechanisms



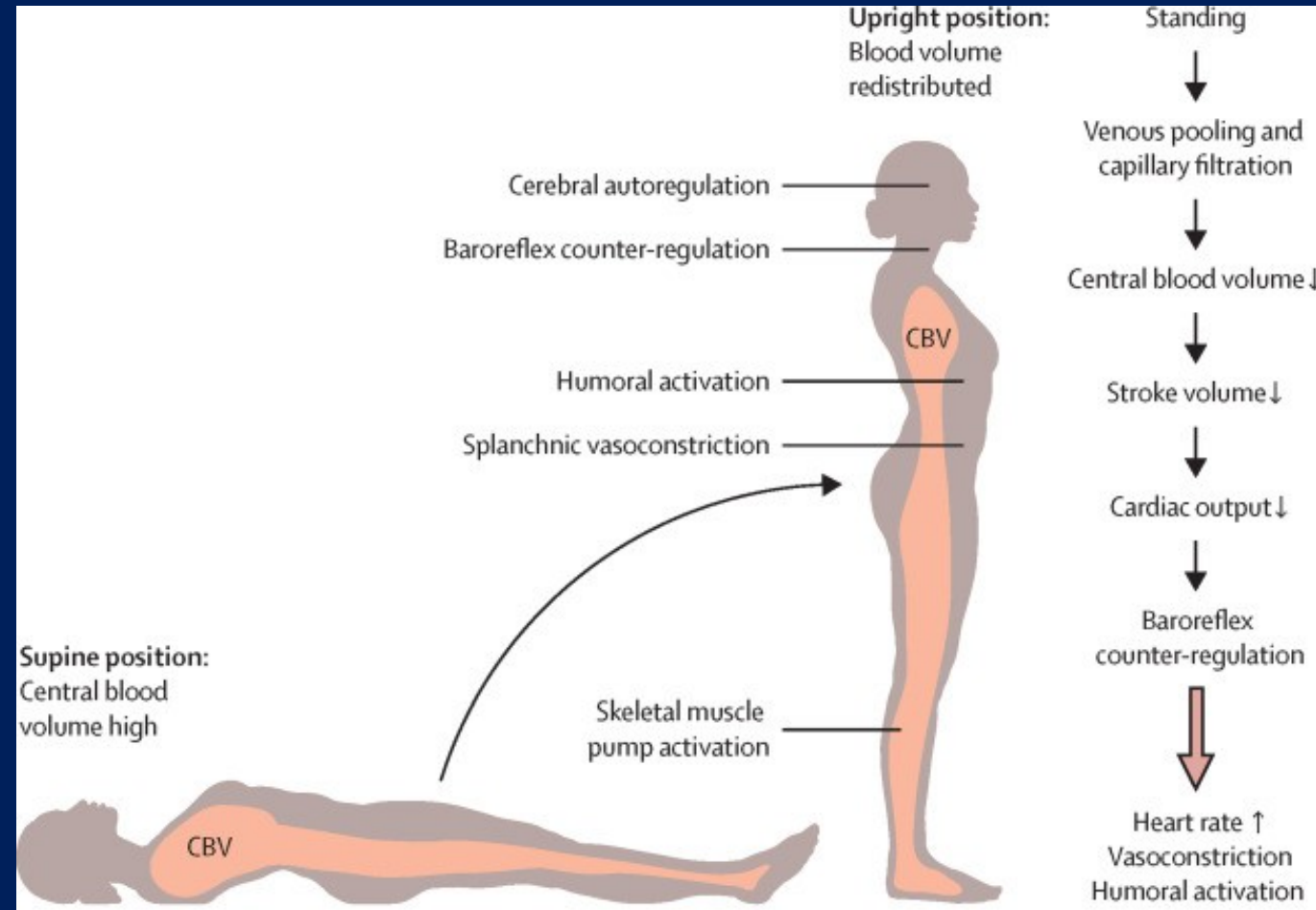
Deconditioning spiral



Orthostasis can be a challenge



Autonomic nervous system and orthostasis



Orthostatic intolerance syndromes

- Orthostatic hypotension
- Postural orthostatic tachycardia syndrome
- Vasovagal syncope

Impact

- How many patients have dysautonomia causing PASC in India ?

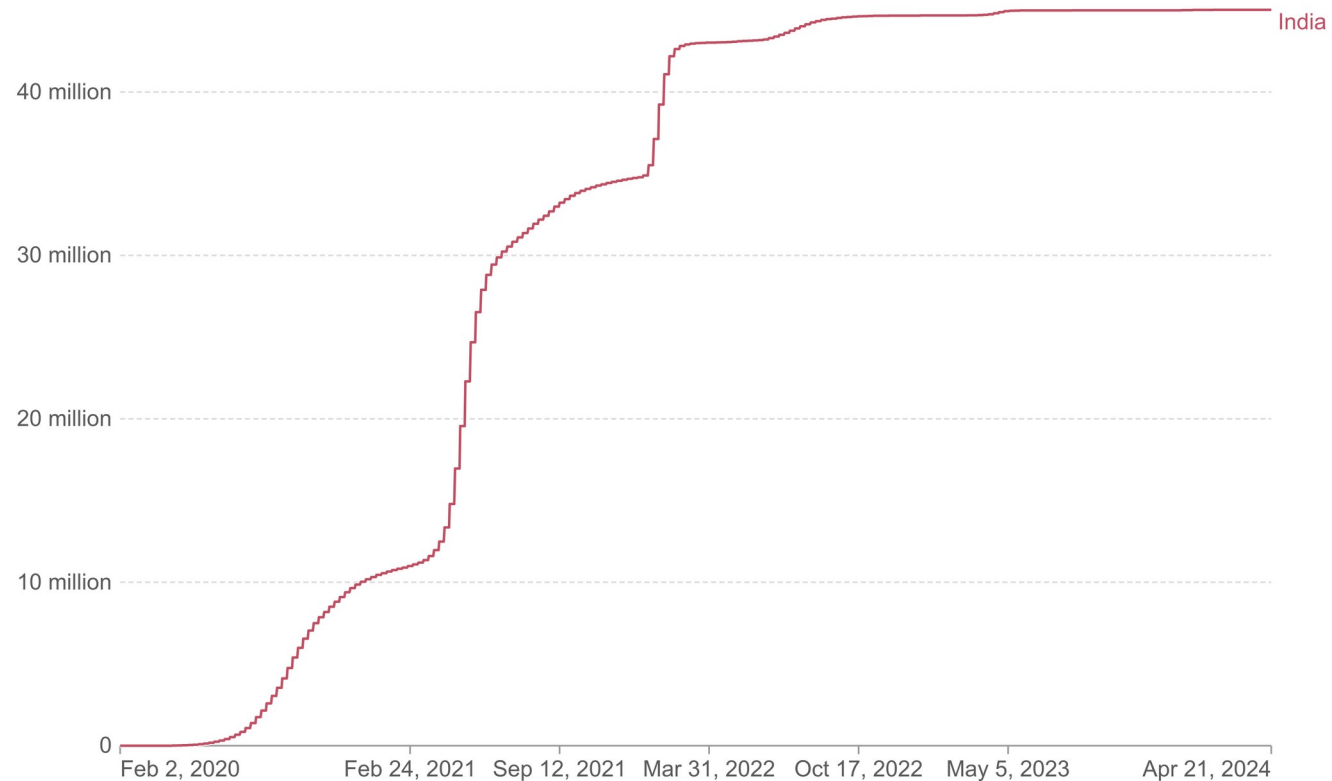
Confirmed COVID-19

45 Million

Cumulative confirmed COVID-19 cases

Our World in Data

Due to limited testing, the number of confirmed cases is lower than the true number of infections.



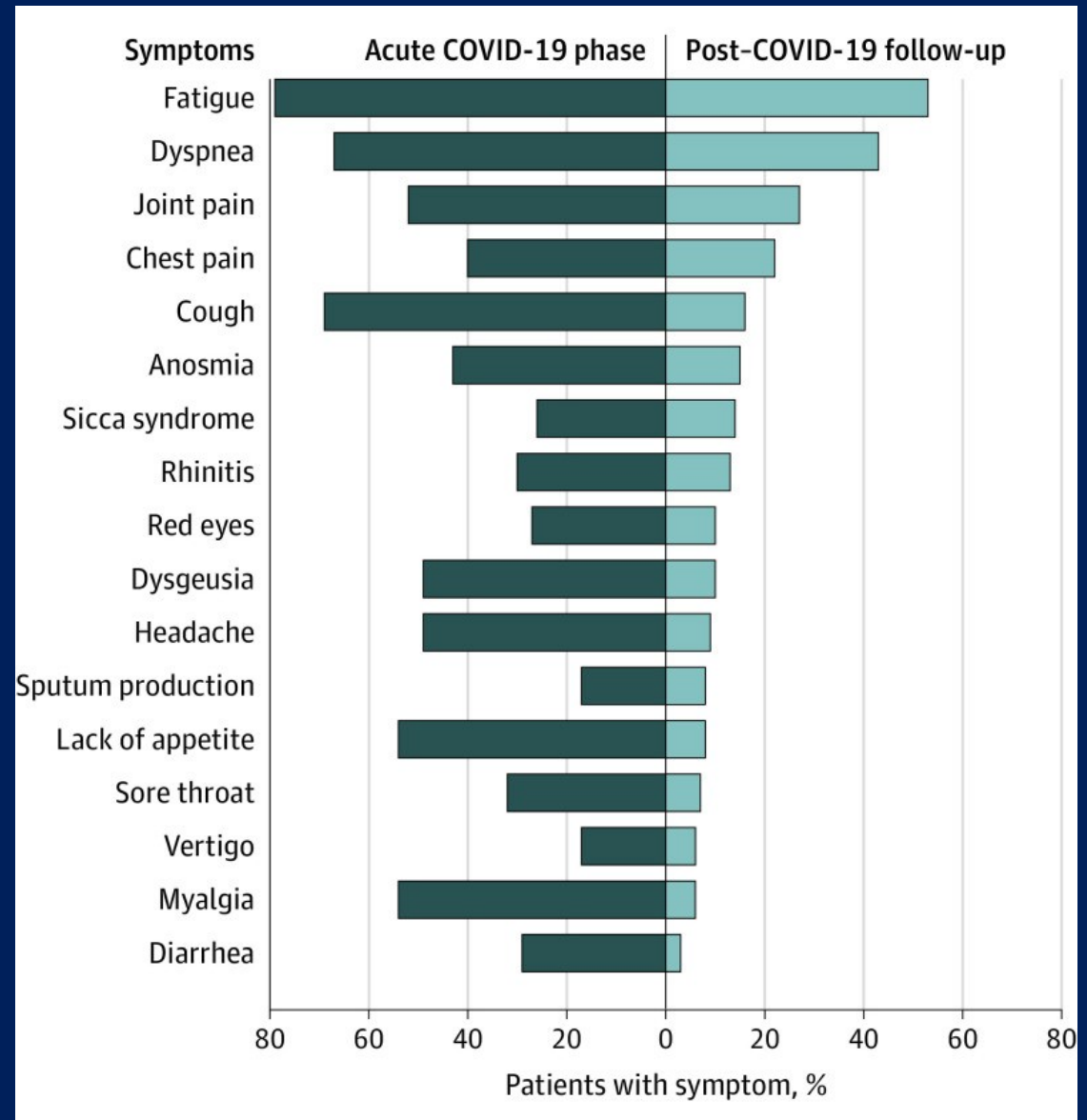
Data source: WHO COVID-19 Dashboard

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<https://ourworldindata.org/coronavirus/country/india#what-is-the-cumulative-number-of-confirmed-cases>

Disabling symptoms at 2 months in 44%

19 Million



Carfi A et al. Gemelli Against COVID-19 Post-Acute Care Study Group. Persistent Symptoms in Patients After Acute COVID-19. JAMA. 2020 Aug 11;324(6):603-605. doi: 10.1001/jama.2020.12603.

**PASC-CVS
in about
50%**

9.5 Million

**Dysautonomia
in 66%**

6.3 Million

Larsen NW et al. Characterization of autonomic symptom burden in long COVID: A global survey of 2,314 adults. *Front Neurol.* 2022 Oct 19;13:1012668. doi: 10.3389/fneur.2022.1012668

**Improve in 1-3
years - 50%**

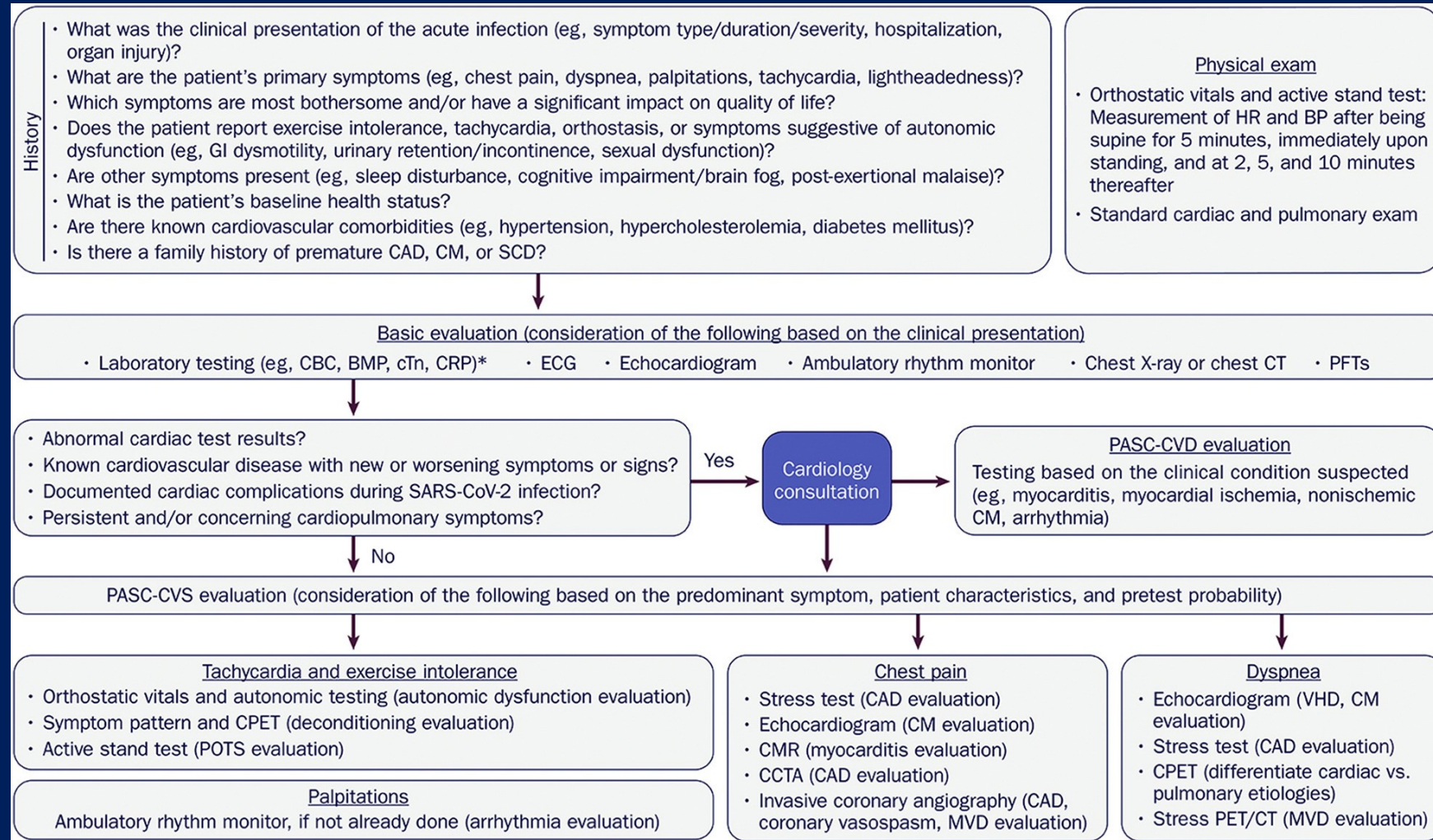
3.2 Million

1. Dani M, Dirksen A, Taraborrelli P, et al. Autonomic dysfunction in 'long COVID': rationale, physiology and management strategies. Clin Med (Lond)2021;21:e63-7. doi:10.7861/clinmed.2020-0896 pmid:33243837

Where are these patients ?

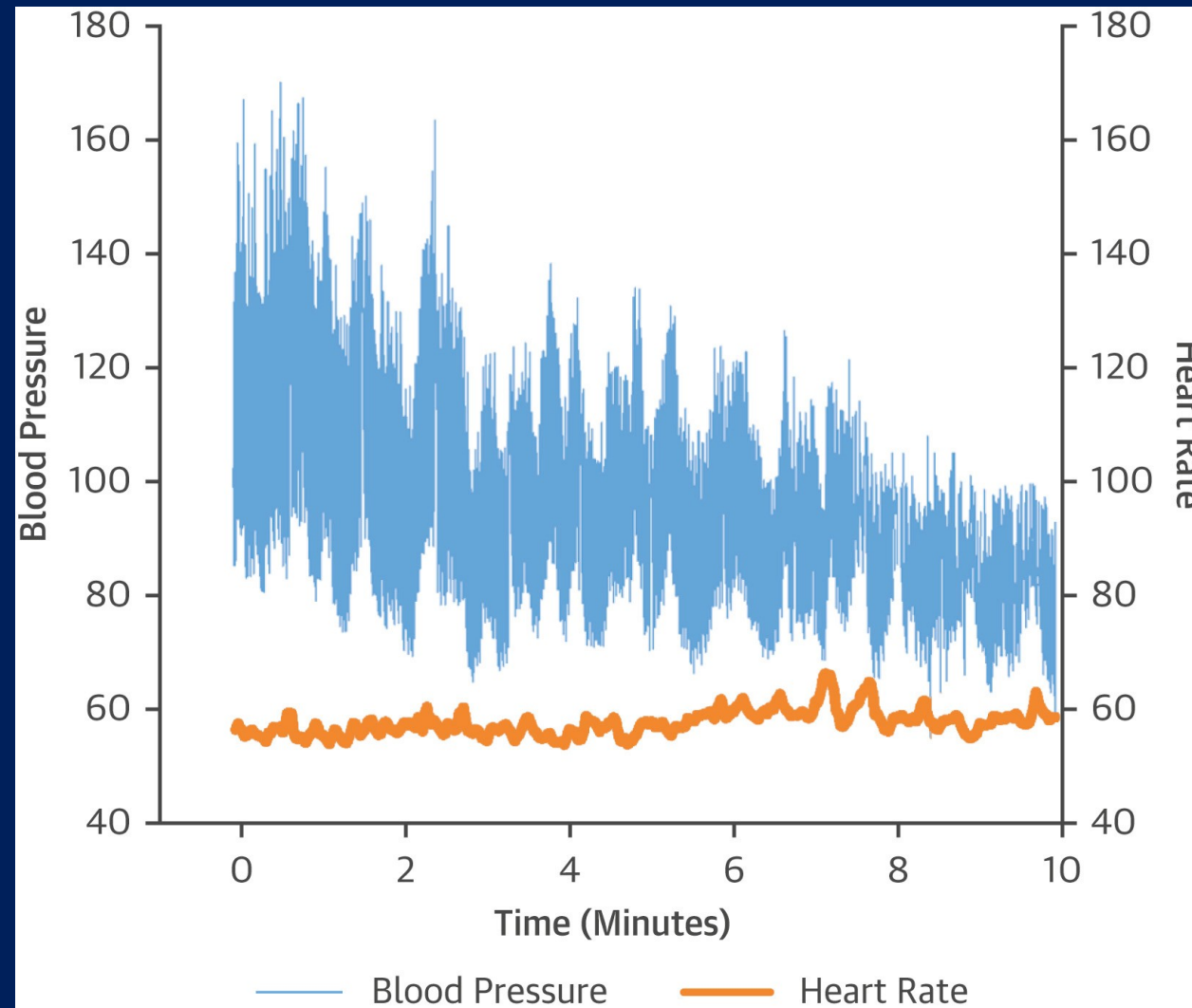
- Improved / adapted with time
- Did not seek medical attention
- Did not come to the right person
- But who is the right person ?
- PASC-CVS and dysautonomia not considered

Evaluation in PASC

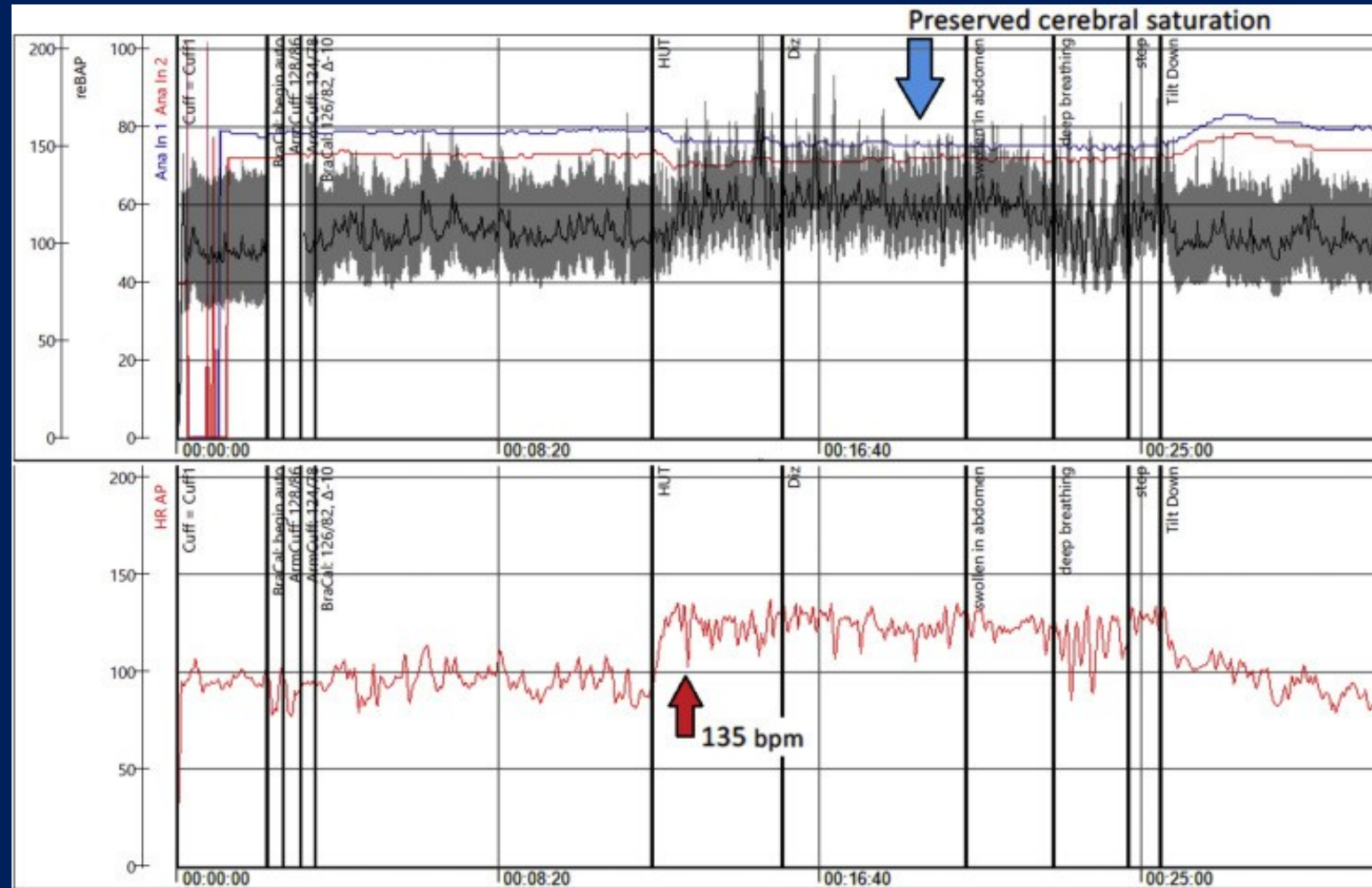


2022 ACC Expert Consensus Decision Pathway on Cardiovascular Sequelae of COVID-19 in Adults: Myocarditis and Other Myocardial Involvement, Post-Acute Sequelae of SARS-CoV-2 Infection, and Return to Play: JACC Volume 79, Issue 17, 3 May 2022, Pages 1717-1756

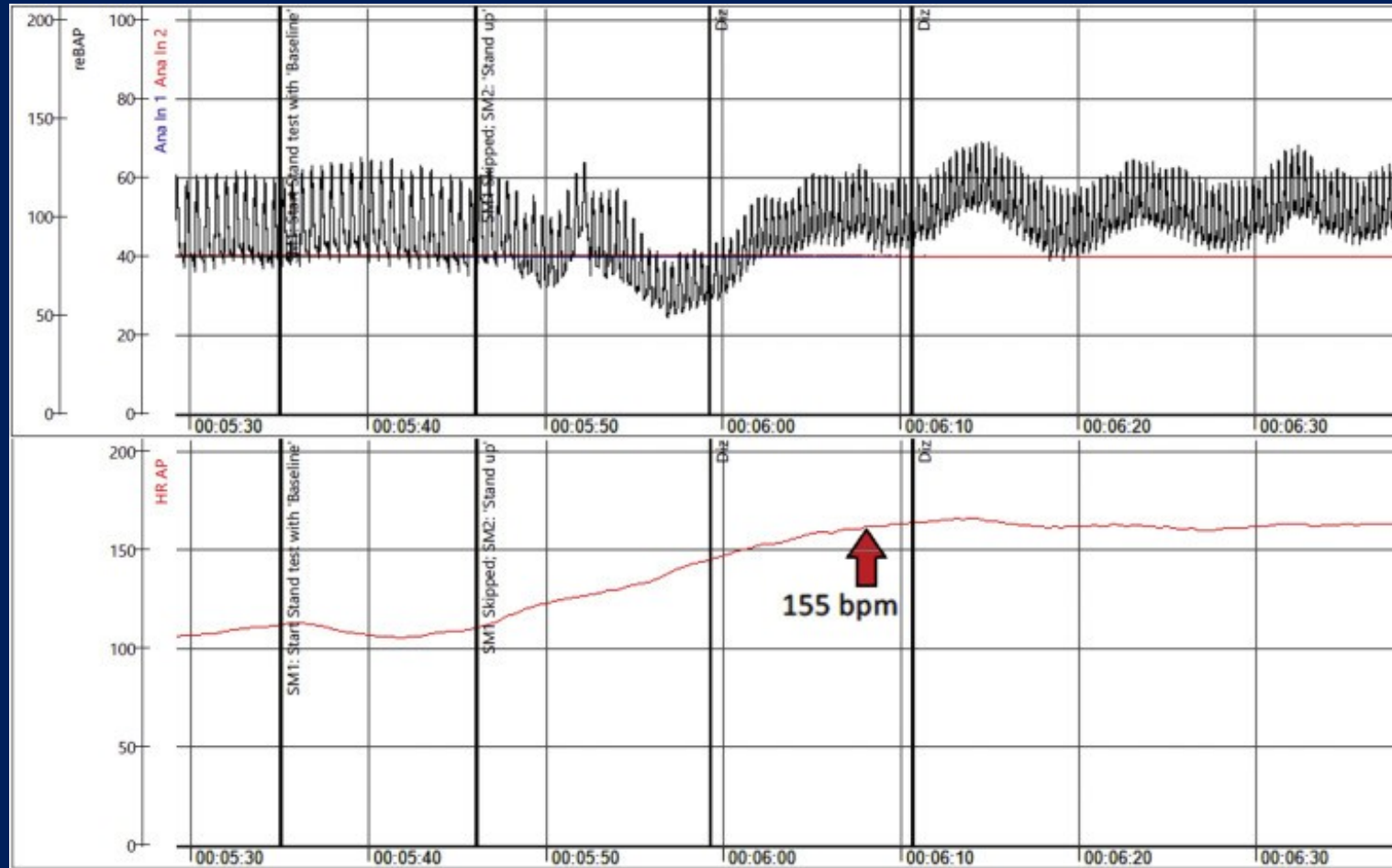
HUTT – Orthostatic hypotension



HUTT – POTS

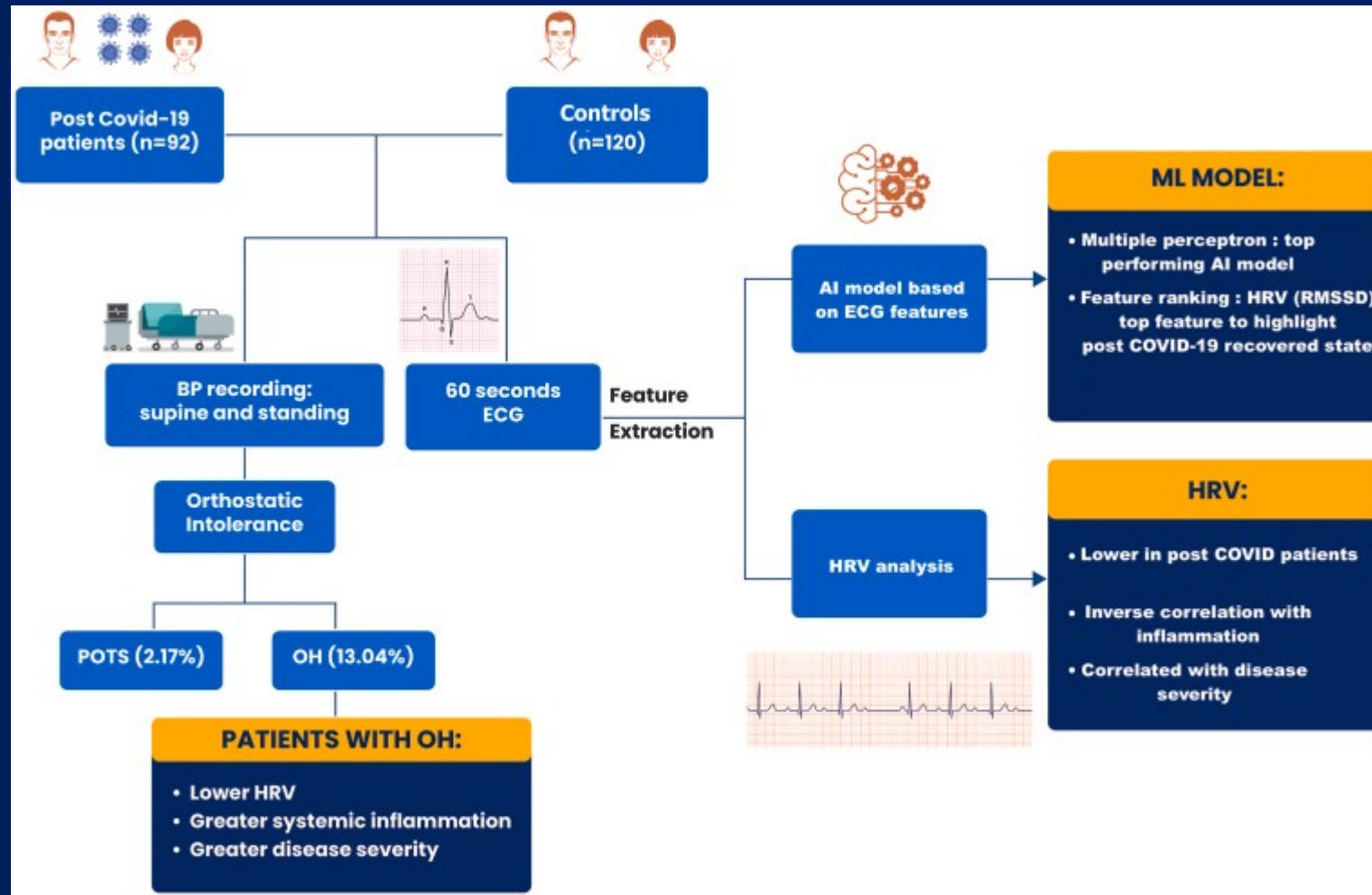


Active stand test



Sheldon RS, Grubb BP, 2nd, Olshansky B, et al. 2015 Heart Rhythm Society expert consensus statement on the diagnosis and treatment of postural tachycardia syndrome, inappropriate sinus tachycardia, and vasovagal syncope. Heart Rhythm 2015; 12:e41–63.

Heart rate variability



Shah B, Kunal S, Bansal A, Jain J, Poundrik S, Shetty MK, et al. Heart rate variability as a marker of cardiovascular dysautonomia in post-COVID-19 syndrome using artificial intelligence. Indian Pacing Electrophysiol J. (2022) 22:70–6. doi: 10.1016/j.ipej.2022.01.004

Management

- Education
- Exercise
- Fluid and salt repletion
- Avoid exacerbating / triggering factors
- Isometric exercise to abort episodes
- Compression garments
- Cardiac rehabilitation program

Pharmacologic treatment

- Propranolol – Beta blocker
- Ivabradine
- Midodrine – alpha agonist, peripheral vasoconstrictor
- Fludrocortisone – volume depletion
- Clonidine – central adrenergic inhibitor

Uncommon / experimental

- HRV biofeedback training
- IVIG
- Auricular stimulation
- Stellate ganglion block

- 1) Corrado, J. et al. HEART rate variability biofeedback for long COVID symptoms (HEARTLOC): protocol for a feasibility study. *BMJ Open*. 12, e066044 (2022).
- 2) Novak, P. Post COVID-19 syndrome associated with orthostatic cerebral hypoperfusion syndrome, small fiber neuropathy and benefit of immunotherapy: a case report. *eNeurologicalSci* 21, 100276 (2020)
- 3) Uehara, L. et al. Transcutaneous auricular vagus nerve stimulation effects on inflammatory markers and clinical evolution of patients with COVID-19: a pilot randomized clinical trial. *Exp. Rev. Med. Devices* 19, 915–920 (2022)
- 4) Liu, L. D. & Duricka, D. L. Stellate ganglion block reduces symptoms of Long COVID: a case series. *J. Neuroimmunol.* 362, 577784 (2022)

Challenges for India

- Scope of the problem
 - Population level studies
 - Cohort studies
- Clinics with multidisciplinary team based approach
- Explore novel therapies