

Potential Long-Term Impact of COVID-19 Medical Problems

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Agenda

- What are the major long-term health problems due to COVID-19?
- What is their impact on function and the ability to work?
- Who is affected?
- What is the effect on long term survival?

Defining Chronic Post-Covid-19 Syndromes

From the onset of first symptoms:

- **Post-acute COVID** > 3 weeks
- **Chronic COVID-19**
“Long Covid”
“Long-haul Syndrome” } > 12 wks

- A positive COVID-19 PCR test is *not* a pre-requisite for diagnosis (many not tested, or in a timely way, false negative tests common)
- Can occur after mild disease
- Occurs at any age, most late 50’s

Greenhalgh T, et al. *BMJ* 2020;370:m3026 <http://dx.doi.org/10.1136/bmj.m3026>

COVID Symptom Study. How long does COVID-19 last? Kings College London, 2020. https://covid19.joinzoe.com/post/covid-long-term?fbclid=IwAR1RxlcmmdL-EFjh_al-

Chronic Symptoms after COVID-19 Infection

- Shortness of breath
- Fatigue
- Chest pain
- Cough
- Fevers
- Arthralgia
- Myalgia
- Insomnia
- Dizziness
- Tachycardia
- Headaches
- Anxiety
- Depression
- “Brain fog”/ cognitive dysfunction
- Stroke
- Blood clots – body, lung

Long Term Medical Consequences of COVID-19

Non-Specific

- Post-ICU Syndrome (PICS)
 - Cognitive dysfunction
 - Functional dysfunction
 - Pain
 - Depression
- Exacerbation of pre-morbid chronic conditions

COVID-19 Associated

- Renal
- Pulmonary
- Cardiovascular
- Neurological, Cognitive
- Psychological
- Autoimmune, muscular and joint
- Post-viral fatigue

Post-ICU Syndrome (PICS)

20-40% COVID-19 Patients had ARDS; High Mortality

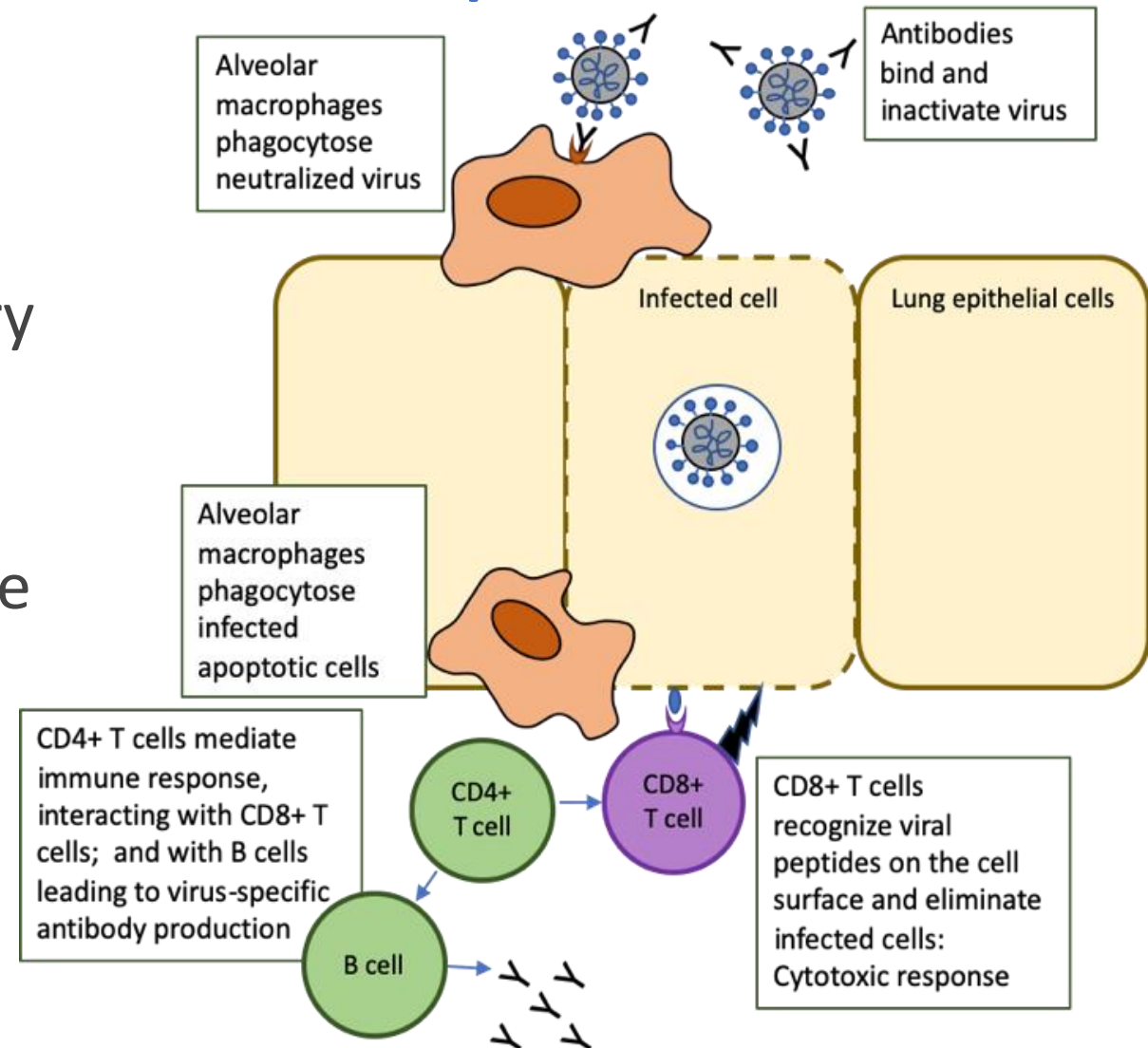
- ↓ physical function 20-80%
 - ? Inflammatory cytokines
- ↓ cognitive function \leq 80%
 - Improves, can last 5 yrs
- Psychiatric
 - PTSD 50%
 - Anxiety
 - Depression
- More rapid resolution with
 - Higher educational attainment
 - Lower frailty

***Other causes excluded.
Persists 3-6 mo. to years.
One third never return to work.***



One Theory: An Autoimmune Response

- Most infected with COVID-19 develop a strong T cell response (CD4 & CD8), some have a “memory phenotype” leading to potential longer-term immunity
- Some may have an altered response where “innate” molecules initiate the immune response causing an autoimmune or inflammatory syndrome



Organ-based Chronic COVID-19 Syndromes

Pulmonary

- Chronic short of breath
- →, ↓ Exercise tolerance
- Restrictive (fibrotic) dz
- Interstitial disease

Cardiovascular

- Myocarditis
- Arrhythmia - autonomic dysfunction: “POTS”-like
- Thrombotic syndromes

Autoimmune

- Fevers
- Arthritis
- Fatigue
- Muscular pain
- Multisystem Inflammatory Syndrome (peds, adults)

Renal

- 37% CKD persists
- 31% on RRT at discharge
- New ESRD

Neurologic

- Headache
- Cognitive impairment “fog”
- Stroke
- “Myalgic encephalitis-Chronic Fatigue – Like” Syndrome
- Vertigo
- Anosmia, aguesia
- **Psychiatric** – anxiety, depression, PTSD

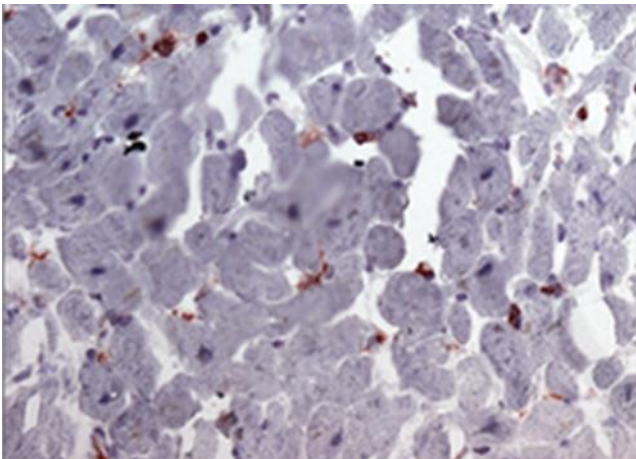
Any of these syndromes can cause disability.

Prevalence, persistence, treatments and severity remain unknown.

Myocarditis and Chronic Post-Acute COVID-19

MRI study:

100 pts. 71 (64-92) days after COVID-19, no symptoms, 53% male, age 49 (45-53), 67% home ill, 33% hosp. → 60% showed ongoing myocardial inflammation



COVID-19 Autopsy Study

277 autopsies, med. Age 75, 97.6% co-morbidities

Initial review: 7.2% myocarditis, most not functionally significant

Second review: Prevalence <2%

Unclear if myocarditis persists

One Year Disability from Chronic COVID-19-Associated Heart Disease

Heart Disease & Disability (Blue Book)

- Chronic heart failure ✓
- Ischemic heart disease
- Recurrent arrhythmias ✓
- Symptomatic congenital heart dis.
- Heart transplant
- Aneurism of aorta or branches
- Chronic venous insufficiency ✓
- Peripheral arterial disease ✓

Post-Acute COVID-19 Heart Disease ?

- Myocarditis ? → *fibrosis* → *cardiomyopathy, chronic heart failure*
- Other cardiomyopathy ? → *CHF*
- Arrhythmias, “POTS-like disease”
- Venous thrombotic disease → *Chronic venous insufficiency*
- Arterial thrombotic disease (PAD)

Chronic COVID-19-associated Cardiac causes and ages of disabled likely similar to other causes of the same syndromes

Return to Work Predictors with Heart Disease

(angina, MI, valvular, congenital, arrhythmias, pericarditis, endocarditis)

Predictors of RTW

- **Self-rated health**
- **Symptom-free after surgery**
- Attend cardiac rehabilitation
- Treatment (PTCA vs. CABG and SV)
- Health locus of control
- Physical health
- Treatment (PTCA vs. CABG and SV)

- **Working class (white collar)**
- Socioeconomic status (high)

Barriers to RTW

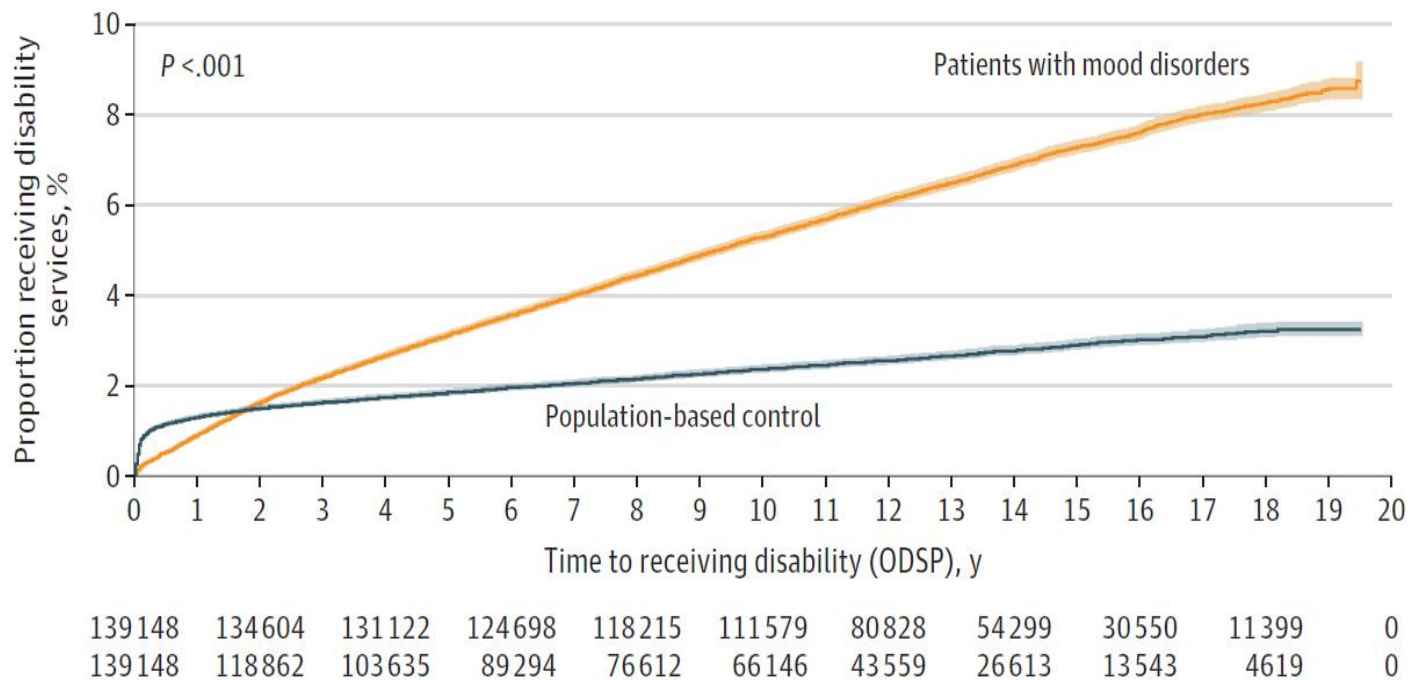
- **Comorbidity**
- **Duration of Disease**
- **Depression**
- Anxiety
- Disease severity
- Length of stay in hospital

- **Age (older)**
- **Education (low)**
- **Gender (female)**
- Residence (rural)

Do these apply to myocarditis/heart failure and arrhythmias from COVID-19?

Mood Disorders and Disability

Time to Disability Following Diagnosis of Mood Disorder



Canadian population-based data
Disability outcomes:

- long-term inability to work
adj. hazard ratio, 2.03 (95%CI, 1.95-2.11)
- long-term care admission
aHR, 2.20 (95%CI, 1.80-2.69)

Incidence and persistence of mood disorders after COVID-19 is unknown, but appears common – need further data.

Myalgic encephalomyelitis/chronic fatigue syndrome (ME/CFS)

Symptoms

- Chronic fatigue
- Post-exertional malaise
- Insomnia, pain, thinking and concentrating problems, dizziness
- Functional impairment; some house- or bed-bound

Epidemiology

- All ages, majority 40-60 yrs
- Women > men
- White > nonwhite
- 836,000 - 2.5 M US affected
- Most undiagnosed
- Cause unclear

Is the Post-COVID-19 fatigue similar to this syndrome? Will it resolve? Uncertainty regarding percentage will go on to disability.

Who has Chronic COVID-19 Syndromes?

Current Sources of Epidemiology and Prevalence:

- Social media reports
- Medical Literature up to 6 mo. followup

Current data have inherent biases due to:

- access to healthcare
- regional demography
- socioeconomic circumstances
- Reporting



ncoa.org

Many broader studies are underway.

Who has Chronic COVID-19 Syndromes?

Acute Covid-9 has disproportionately affected those who are or have:

- learning disabilities, mental health problems
- older and frail, nursing home residents (8-13x hosp. risk)
- chronic disease (3-5X hosp. risk)
- black, asian & other minority ethnicities (1.3-5.3X hosp. risk)

We do not know if these populations have an increased risk of ongoing symptoms or chronic COVID-19.

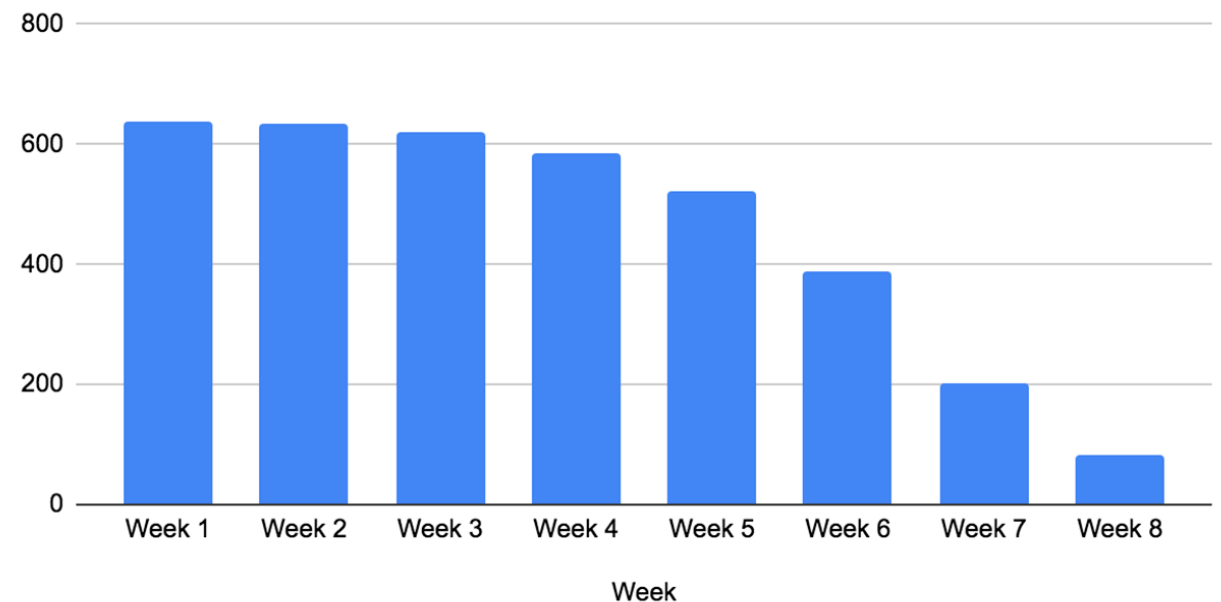
Social Media Patient-led Research: “Long Haul” COVID-19

Slack
BODY POLITIC

- 640 responses
- 72% US, 76% White, 4% hosp.
- 58% pre-existing conditions

Persistence of Symptoms

Number of Participants who had Reached Week x (1-8) In the Survey



Who Has Persistent Symptoms after COVID-19

UK: after hospitalization

- 163 pts; 141 @ 28 days followup
- median age 60, 56% male

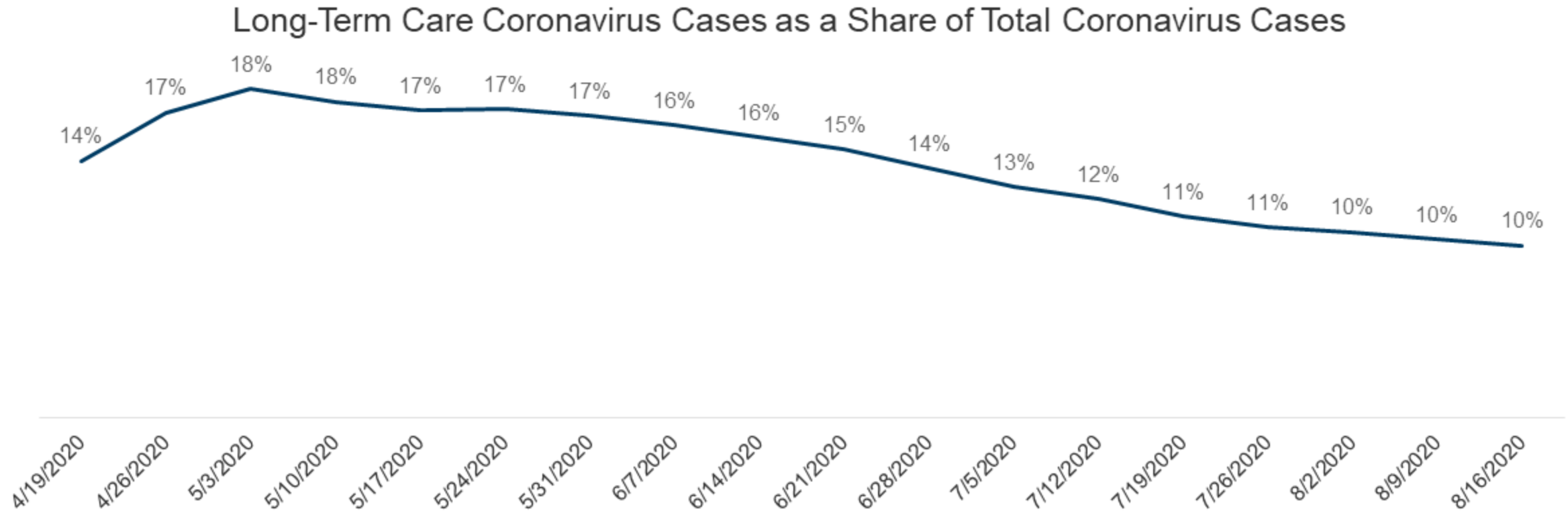
Persistent symptoms @ 8-12 wks
by WHO criteria

- 16 (59%) mild (no O₂ req.)
- 49 (75%) mod. (O₂ req.)
- 16 (89%) severe (ICU, HF, or intubation)

Paris

- women (sex ratio 4:1)
- ~ 40 yrs old
- no relevant medical history
- few biological abnormalities
- Few +PRP; 50% Abs +

Long-Term Care Cases Make Up A Smaller Share of Cases Now Than Earlier In The Pandemic



NOTES: Denominator is based on number of states reporting each week. The number of states included in each week's calculation of share of cases varies from 24-35 states. Data is available for <10 states prior to April 19th, so a national share of cases was not calculated for those weeks.

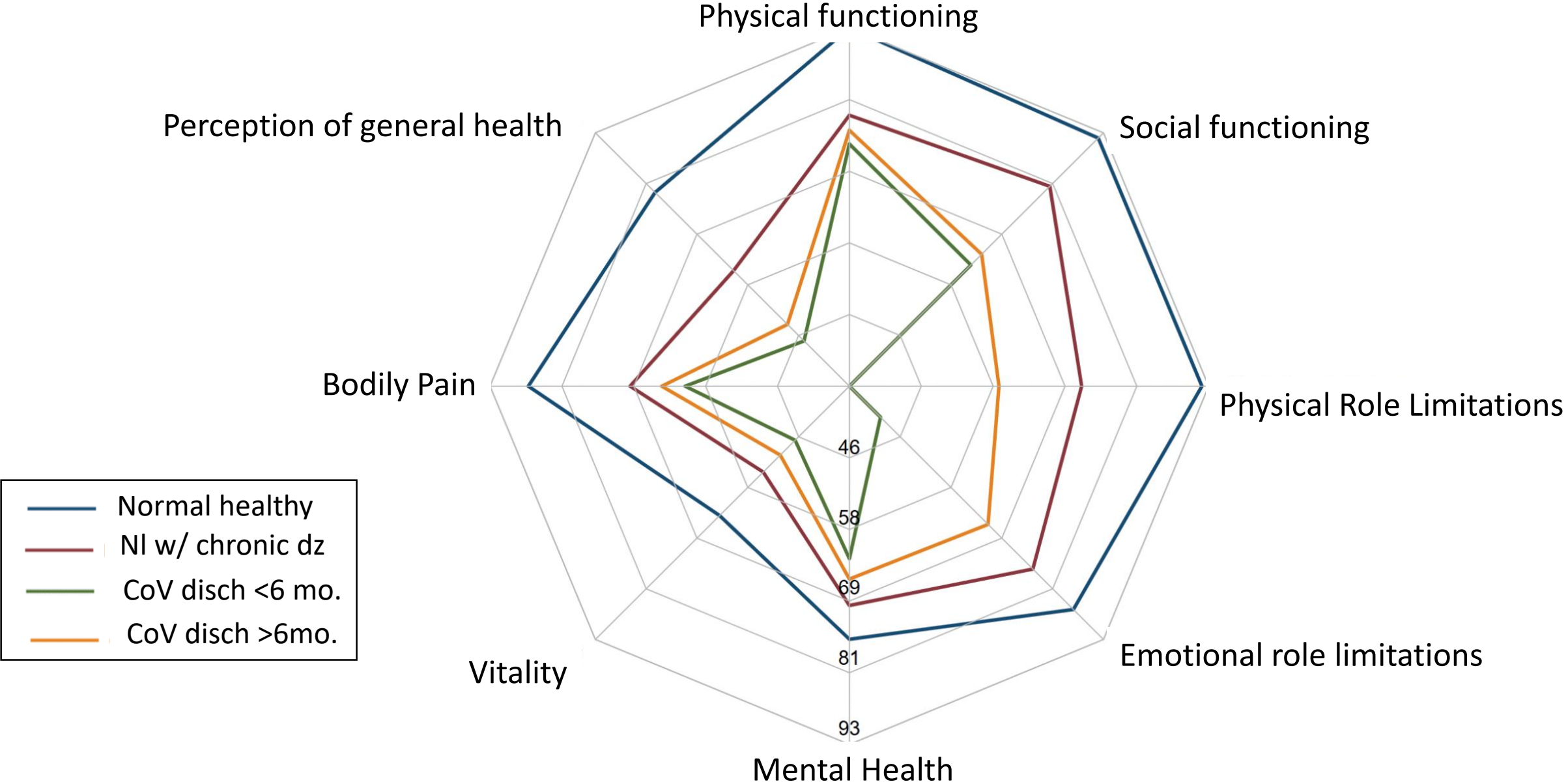
SOURCE: KFF analysis of available state reports, press releases, official state data from news reports, & The COVID Tracking Project.

My Guess - Who will have Chronic COVID-19?

- Middle-aged – later 50s
- Female predominance
- Across all severity groups, but greater prevalence in those with moderate or severe disease
- Includes those with PICS rather with COVID-19
- Includes those never tested but had symptoms

The risk factors for developing Chronic COVID-19 Syndromes are not the same as that for acquiring COVID-19.

Lessons from SARS (2002) and MERS (2012)



Ahmed H, et al. J Rehabil Med 2020;52(5):jrm00063. 2 Ngai JC, et al. *Respirology* 2010; 15: 543-50.

SARS 2003: Return to Work One Year Later

Study Population

- 117 SARS pts Canada
- med. age 42
- 67% women
- 65% health care workers
- 115 hosp. (mean LOS 14 d)
- 16% ICU (mean LOS 10d); 9% mech. Ventilation

Status	N = 107
Full time work	71 (66%)
Pre-SARS work	79 (74%)
Not returned to work	18 (17%)

- 23 returned FT with no modifications
- Those requiring modifications took 93 days (ave.) to return to FT

SARS at One Year: Emotional Status, Rehabilitation Use, Pulmonary/Physical Function

Health Care Utilization

- Intense specialized rehabilitation
9/117 patients
- Hospital program 20 pts, ~ 11.5 visits
- Private OT/ PT 20 pts, 28.6 visits
- Home Rehab 2pts, 6.0 visits

Emotional

- SF36 domains 0.3 - 1.0 SD below normal

Pulmonary/ Physical Function

- Most normal lung function
- ICU patients:
 - restrictive disease @ 6mo.; resolved by 1 yr
 - Very similar to other ARDS pts
- Exercise capacity:
 - 18% w/ clin reduction in 6-min walk
- Many report shortness of breath and fatigue contributing to exercise limitation

Predicting Rates of Disability

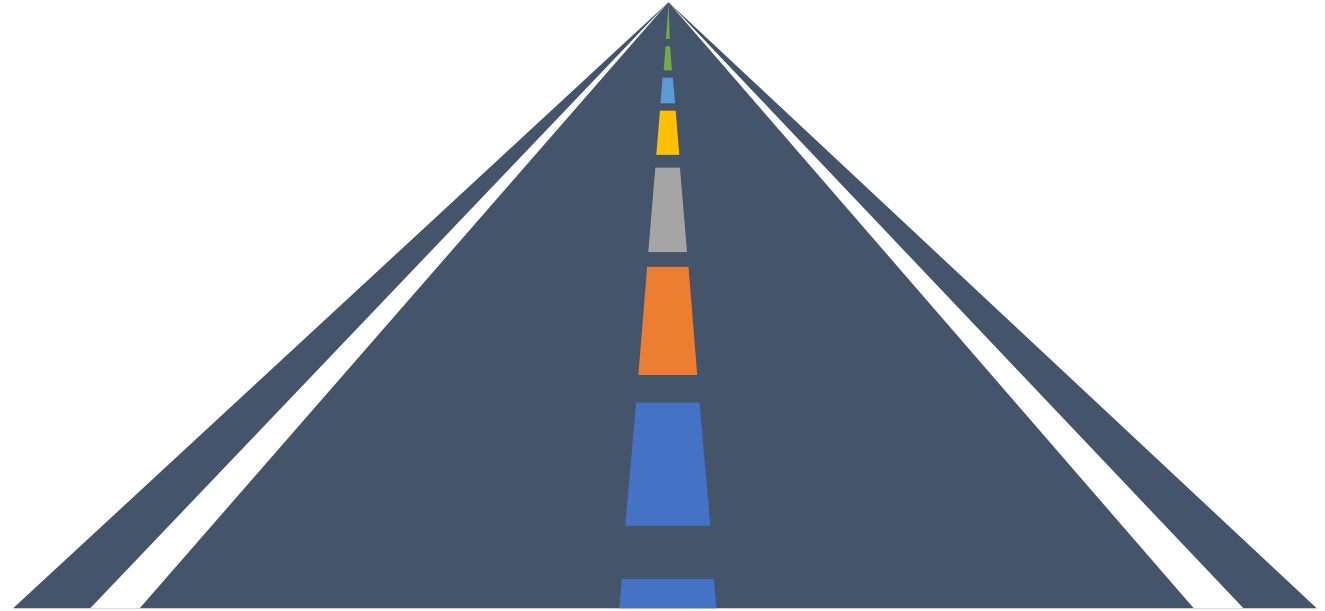
- Syndrome-driven disability (PICS, organ-system diseases [e.g. ESRD]) likely similar to chronic COVID-19 syndromes; disability rates known;
- Autoimmune syndromes uncertain, likely to increase disability
- Middle-aged population affected by chronic COVID-19 syndromes likely increase those on disability/SSI prior to age 62
- Mortality in aged 75+ or in congregate living will decrease the numbers receiving social security.

What are Implications of Post-acute COVID-19 Syndromes for Disability?

	<u>US Current %</u>	<u>Chronic COVID-19 Impact in</u> <u>adults < 62</u>
Mobility	13.7%	↑
Cognition	10.8%	↑
Independent living	6.8%	↑
Hearing	5.9%	?
Vision	4.6%	?
Self-care	3.7%	↑



The Road Ahead



- Define the pathophysiology and clinical course of post-COVID-19 syndromes
- Identify who is at risk
- Prevent and treat chronic COVID-19 syndromes
- Assess and address increases in related disability