LONG TERM PULMONARY EFFECTS OF COVID-19

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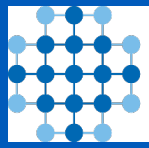

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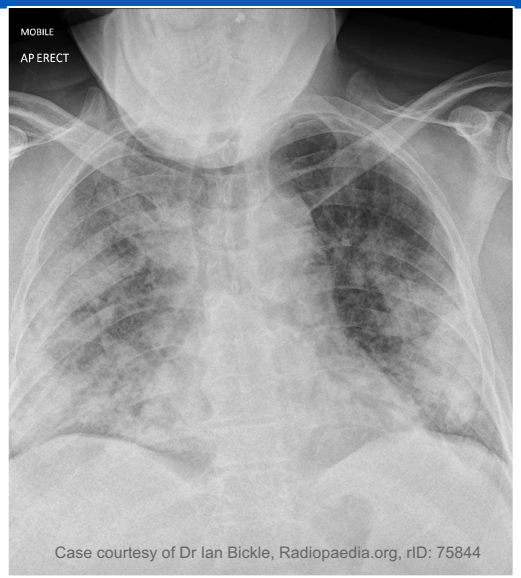
DISCLOSURES

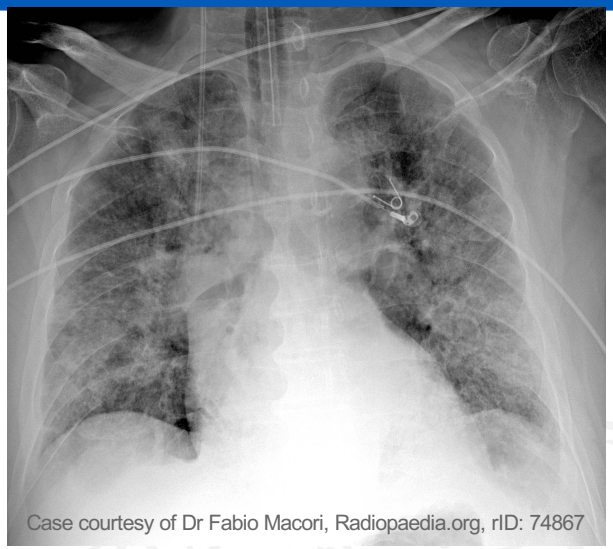
- I have no conflicts of interest related to the material to be presented

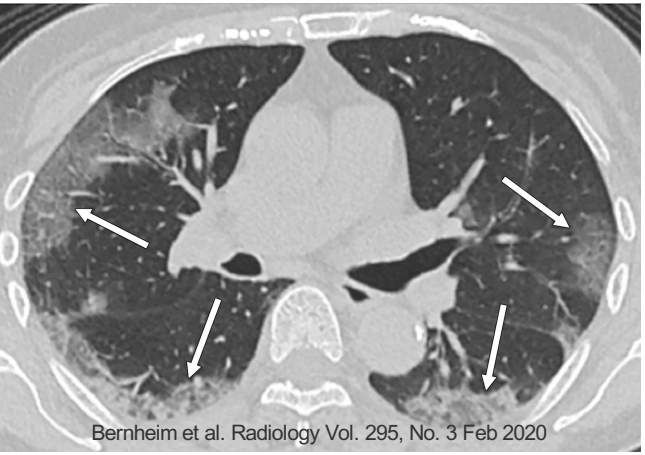
ACUTE COVID-19

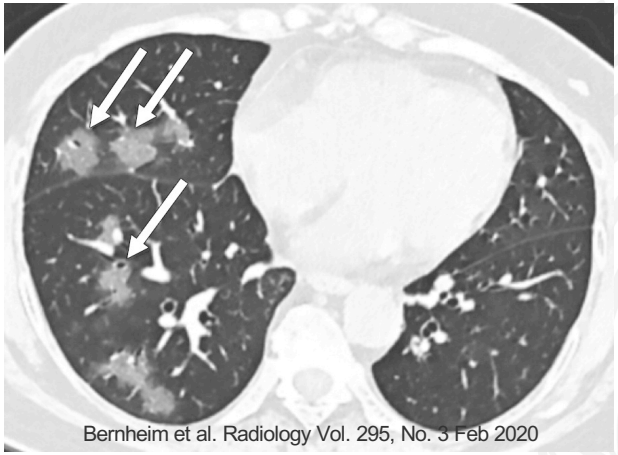
- Imaging abnormalities may suggest mechanism for long term impairment
- Alveolar air space involvement



Case courtesy of Dr Ian Bickle, Radiopaedia.org, rID: 75844


Case courtesy of Dr Fabio Macori, Radiopaedia.org, rID: 74867


Bernheim et al. Radiology Vol. 295, No. 3 Feb 2020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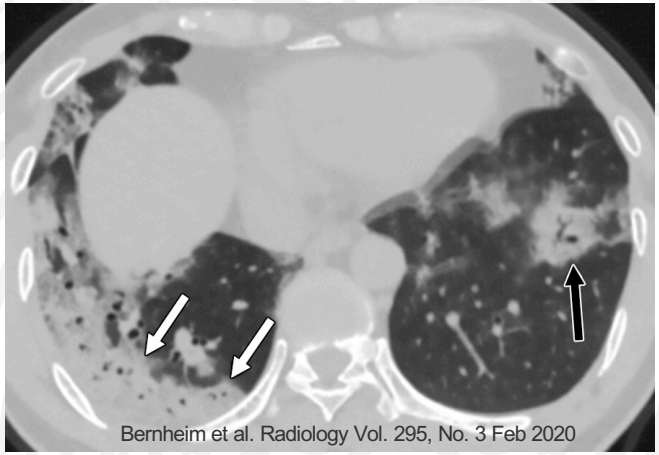
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ACUTE COVID-19

- 60% of patients had bilateral disease
- 50% of patients had multilobar disease
- 75% of patients had GGO with or without consolidation representing alveolar damage

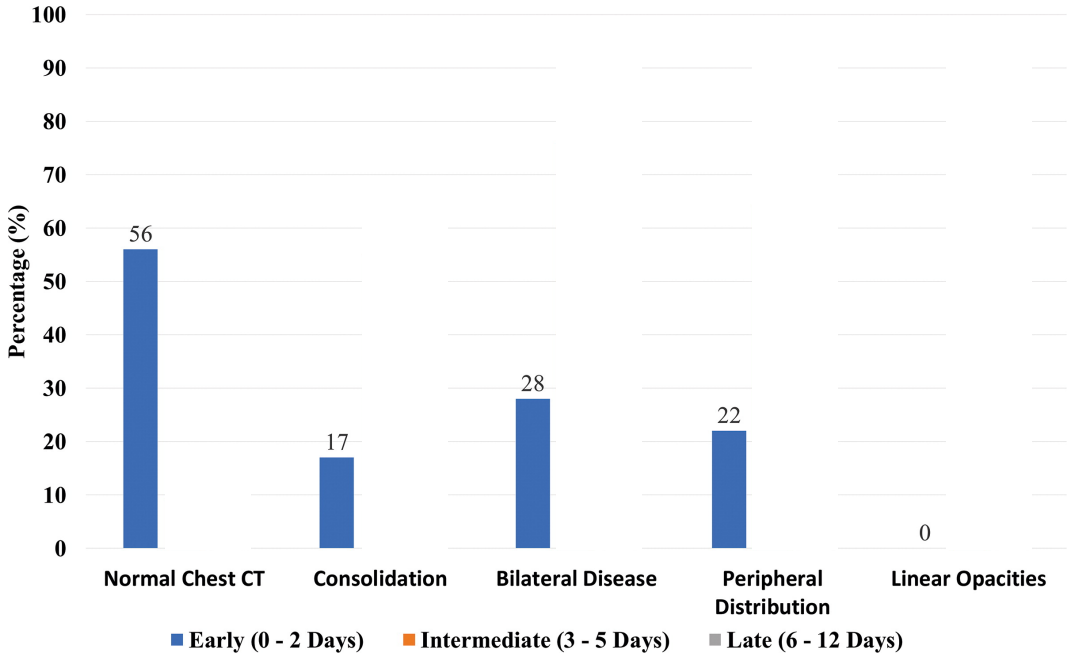

Table 2: Findings on Chest CT Scans

Finding	No. of Patients (n = 121)
GGOs and consolidation	
Absence of both GGOs and consolidation	27 (22)
Presence of either GGOs or consolidation	94 (78)
Presence of GGOs without consolidation	41 (34)
Presence of GGOs with consolidation	50 (41)
Presence of consolidation without GGOs	2 (2)
No. of lobes affected	
0	27 (22)
1	18 (15)
2	14 (12)
3	11 (9)
4	18 (15)
5	33 (27)
>2	62 (50)
Bilateral lung disease	73 (60)
Frequency of lobe involvement	
Right upper lobe	53 (44)
Right middle lobe	50 (41)
Right lower lobe	79 (65)
Left upper lobe	58 (48)
Left lower lobe	76 (63)
Total lung severity score	
Mean	3
Range	0–18
Standard deviation	3

Note.—Except where indicated, data are numbers of patients. Numbers in parentheses are percentages. GGO = ground-glass opacity.

Bernheim et al. Radiology Vol. 295, No. 3 Feb 2020

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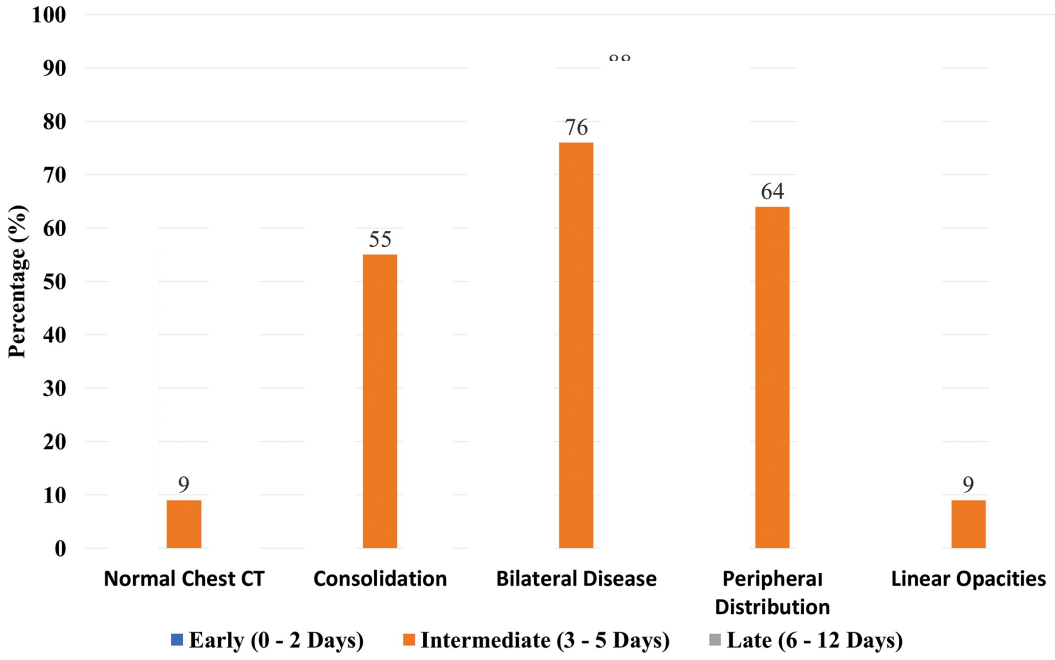

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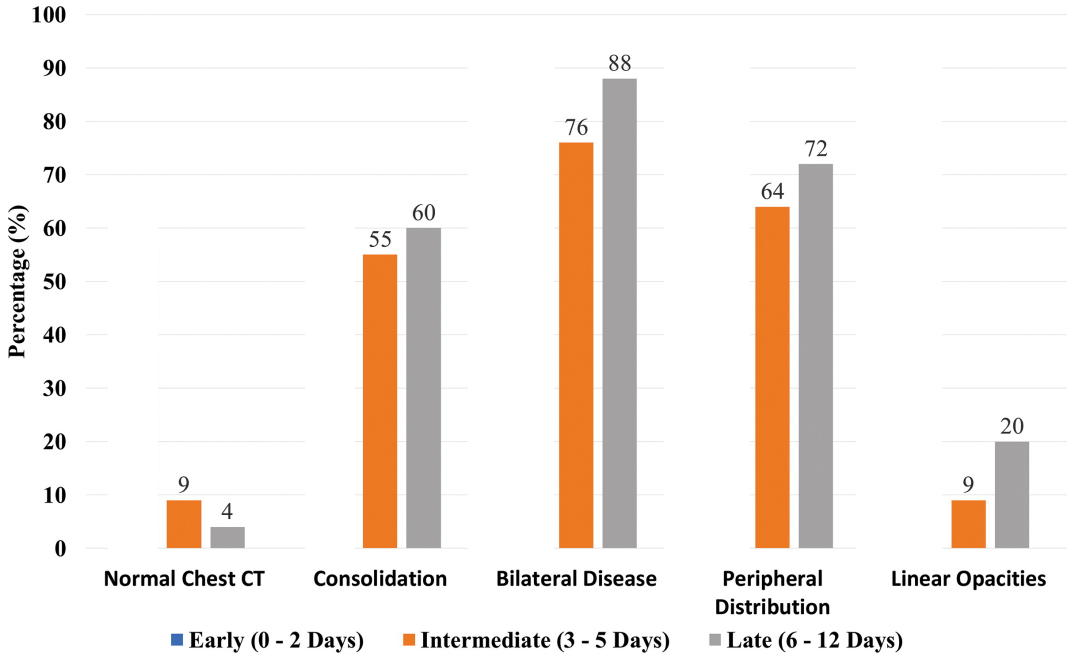

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Bernheim et al. Radiology Vol. 295, No. 3 Feb 2020

COVID-19 ARDS- Phenotypes and possible

- PHENOTYPES-?
  - Gattinoni et al, April 14, 2020
    - L type = early, good compliance, low recruitability, low lung weight
    - H type = late, poor compliance (stiff lung), high recruitability, high lung weight, hypoxia due to significant R->L shunt
    - Transition from L-type to H-type
    - No data yet on differences in mortality or pulmonary morbidity
  - Haudebourg et al, August 15, 2020
    - Heterogenous respiratory mechanics
    - Not significantly different from non-COVID ARDS
- If we assume the similarities between COVID-ARDS and non-COVID ARDS suggested by Haudebourg, should there be an expectation of similar long term pulmonary consequences?
- Do our early SARS-CoV-2 observations suggest a similar impact on longer term pulmonary function to SARS-CoV-1 outcomes (2002)?

Gattinoni et al. Intensive Care Med [online ahead of print] 14 Apr 2020
Haudebourg et al. American Journal of Respiratory and Critical Care Medicine Volume 202 Number 2 | August 15 2020
Zhang P, Li J, Liu H, et al. Long-term bone and lung consequences associated with hospital-acquired severe acute respiratory syndrome: a 15-year follow-up from a prospective cohort study. Bone Res. 2020;8:8

LONG TERM SEQUELAE OF ARDS

ORIGINAL ARTICLE

Functional Disability 5 Years after Acute Respiratory Distress Syndrome

Margaret S. Herridge, M.D., M.P.H., Catherine M. Tansey, M.Sc., Andrea Matté, B.Sc., George Tomlinson, Ph.D., Natalia Diaz-Granados, M.Sc., Andrew Cooper, M.D., Cameron B. Guest, M.D., C. David Mazer, M.D., Sangeeta Mehta, M.D., Thomas E. Stewart, M.D., Paul Kudlow, B.Sc., Deborah Cook, M.D., et al., for the Canadian Critical Care Trials Group

Herridge et al. April 7, 2011. N Engl J Med 2011; 364:1293-1304

Table 2. Clinical Outcomes from 1 Year to 5 Years in Survivors of ARDS.

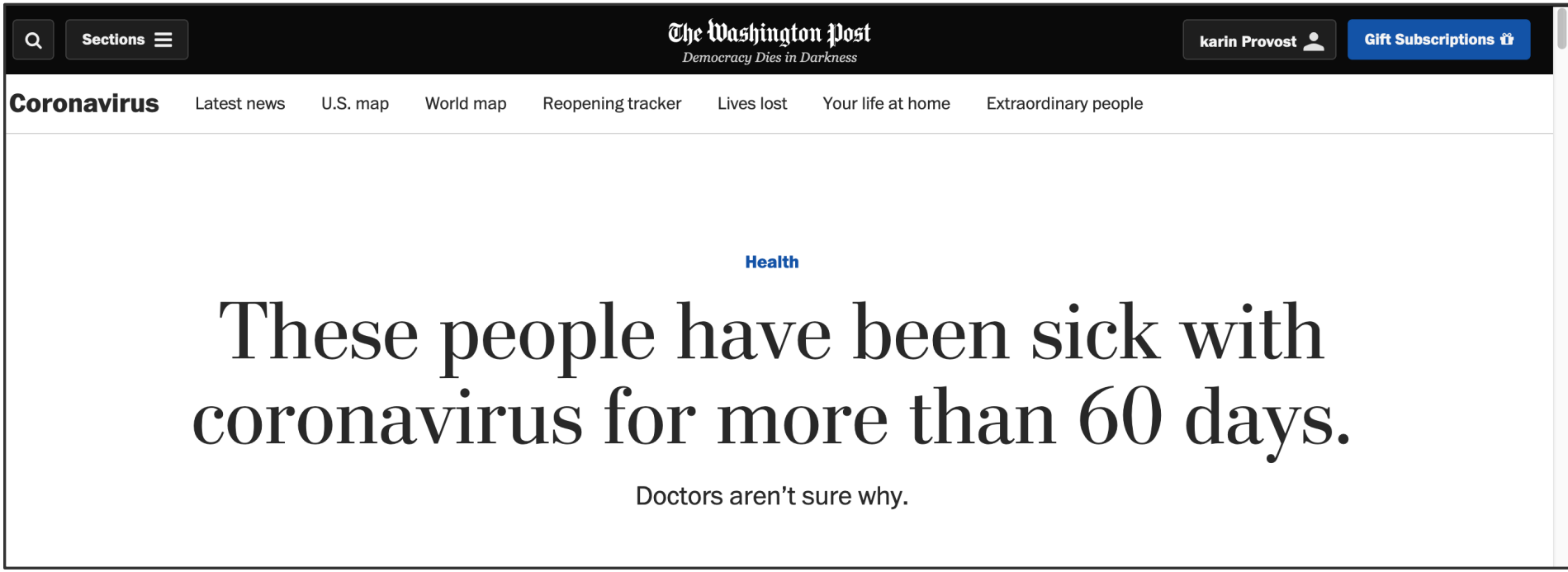
Clinical Outcomes	At 1 Year (N=83)	At 2 Years (N=69)	At 3 Years (N=71)	At 4 Years (N=63)	At 5 Years (N=64)
Site of visit — no. of patients (%)					
Clinic	60 (72)	44 (64)	42 (59)	36 (57)	35 (55)
Home	23 (28)	25 (36)	29 (41)	27 (43)	29 (45)
Returned to work — no. of patients (%)*	40 (48)	45 (65)	50 (70)	46 (73)	49 (77)
Returned to original work — no. of patients/total no. (%)	31/40 (78)	36/45 (80)	46/50 (92)	41/46 (89)	46/49 (94)
Pulmonary function — % of predicted†					
Forced vital capacity					
Median	85	86	76	84	84
Interquartile range	71–98	71–100	67–98	70–100	72–101
Forced expiratory volume in 1 sec					
Median	86	87	79	85	83
Interquartile range	74–100	75–99	66–97	68–98	69–98
Total lung capacity‡					
Median	95	94	93	92	94
Interquartile range	81–103	84–108	78–107	79–104	78–105
Residual volume‡					
Median	105	96	101	96	96
Interquartile range	90–116	78–118	80–116	80–110	73–108
Carbon monoxide diffusion capacity‡					
Median	72	78	77	82	80
Interquartile range	61–86	63–89	63–93	68–94	70–86
Distance walked in 6 min§					
Median — m	422	416	418	406	436
Interquartile range	277–510	285–496	311–474	314–488	324–512
Percent of predicted¶	66	68	67	71	76
Oxygen saturation <88% — no. of patients/total no. (%)	5/81 (6)	7/64 (11)	6/64 (9)	5/57 (8)	8/54 (15)
Change in weight from pre–ICU stay — %	−2	1	2	2	3
Median SF-36 score‖					
Physical functioning	60	70	70	75	75
Role, physical	25	50	100	75	88
Bodily pain	62	62	72	74	74
General health	52	62	55	59	62
Vitality	55	55	50	50	55
Social functioning	63	75	75	69	75
Role, emotional	100	100	100	100	100
Mental health	72	76	72	76	76
Mean costs after initial hospitalization					

’Long term’ for COVID is only 6 months, but there is a signal of long term morbidity

8 cases interviewed

40 year old female PT
Male Cardiologist


sciencealert
Trending
(Bundit Binsuk/EyeEm/Getty Images)
HEALTH
Even People With Mild COVID-19 Symptoms Are Experiencing Long-Term Fatigue
FRANCES WILLIAMS, THE CONVERSATION 19 JULY 2020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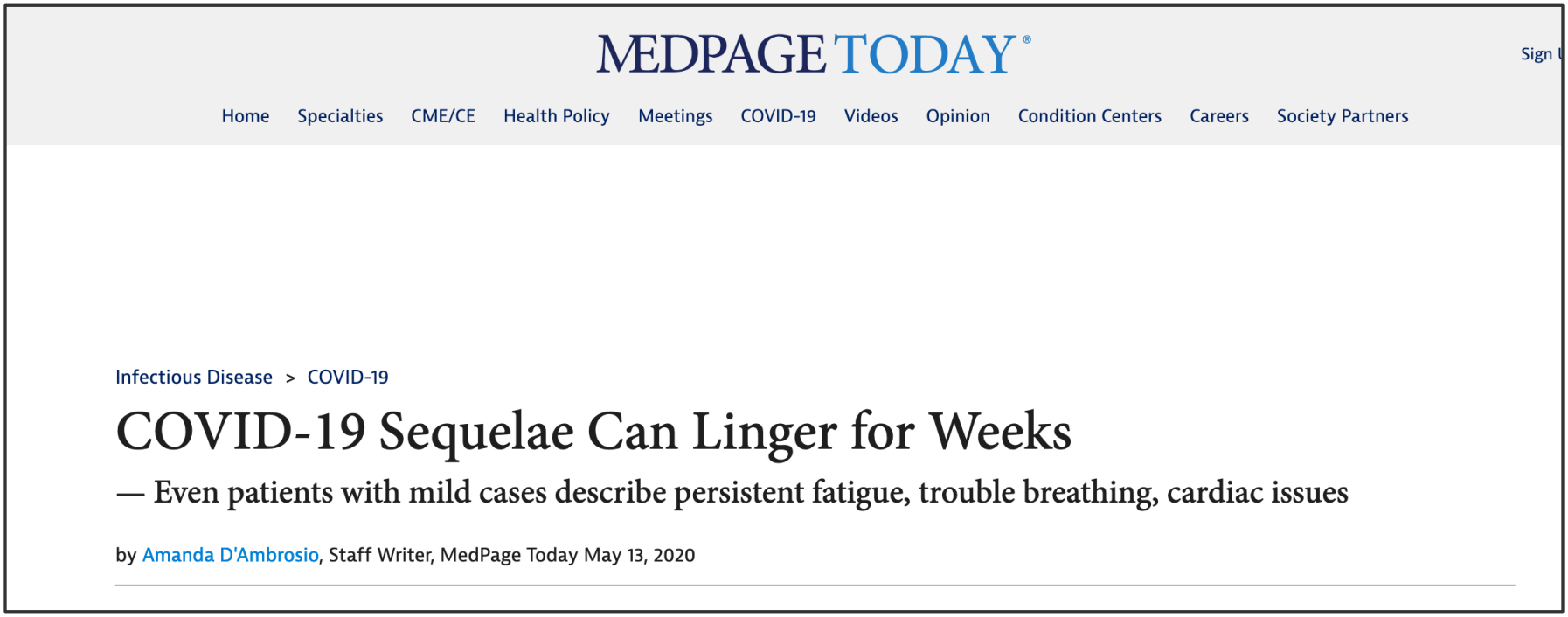
These people have been sick with coronavirus for more than 60 days.
Doctors aren't sure why.



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COVID-19 Sequelae Can Linger for Weeks

— Even patients with mild cases describe persistent fatigue, trouble breathing, cardiac issues

by Amanda D'Ambrosio, Staff Writer, MedPage Today May 13, 2020


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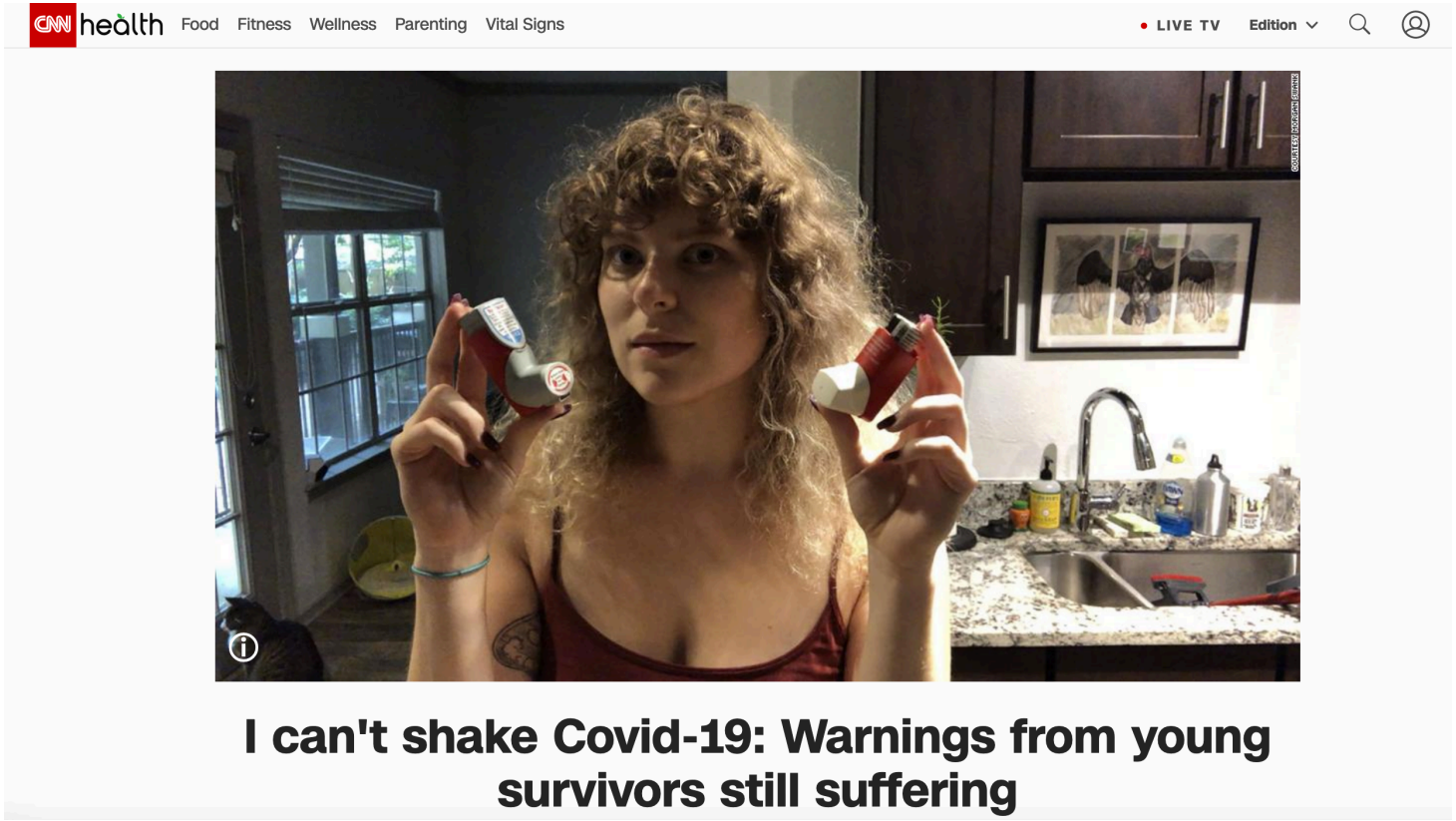
Maps and Cases
Who's Wearing a Mask?
Possible Treatments
Economy
Here's What Recovery From Covid-19 Looks Like for Many Survivors
Continuing shortness of breath, muscle weakness, flashbacks, mental fogginess and other symptoms may plague patients for a long time.



28 year old male environmental engineer
28 year old female writer
30 year old male lawyer
24 year old college student

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EClinicalMedicine 000 (2020) 100463

Contents lists available at ScienceDirect
EClinicalMedicine
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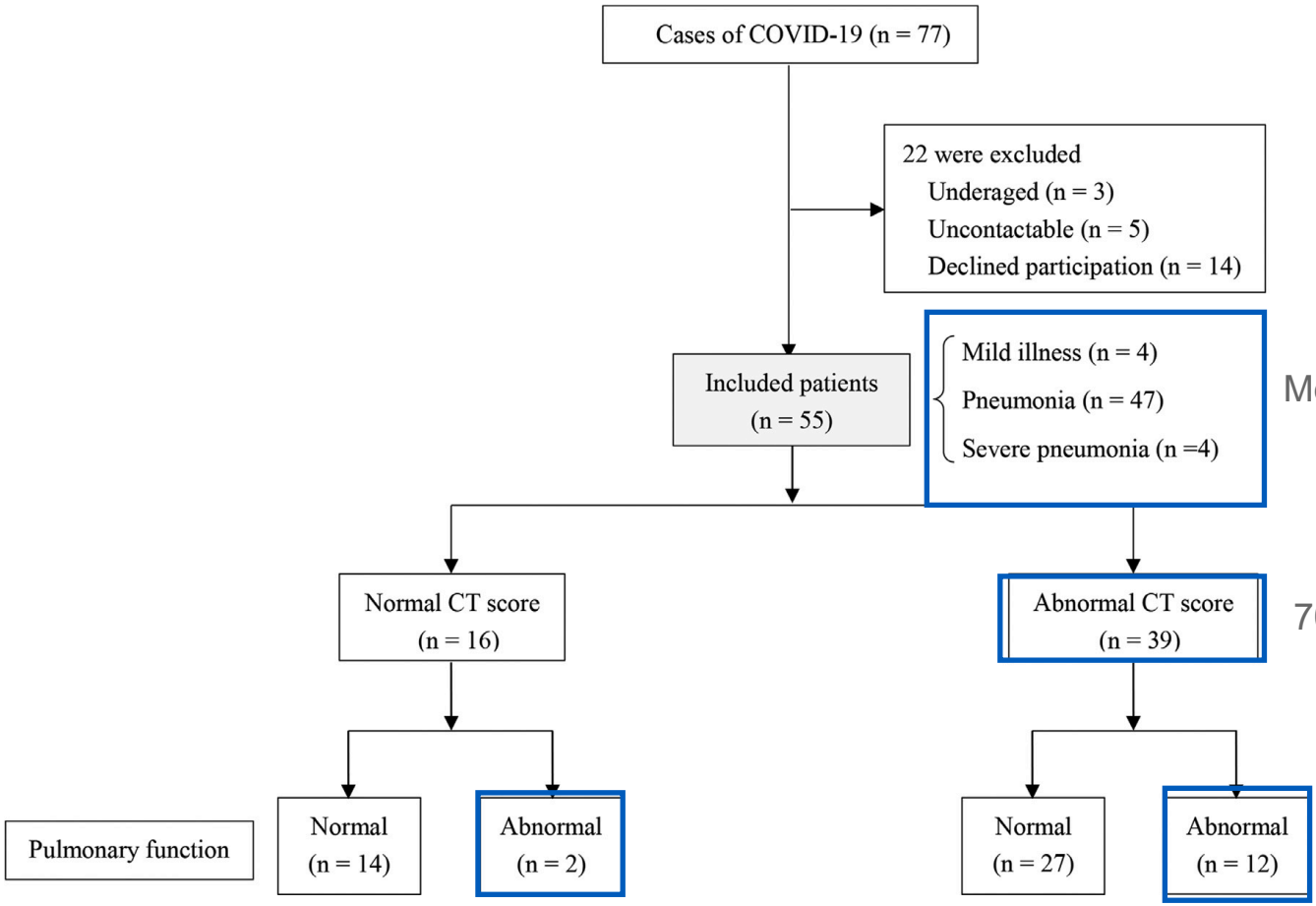
Follow-up study of the pulmonary function and related physiological characteristics of COVID-19 survivors three months after recovery

Yu-miao Zhao[a,b,1], Yao-min Shang[c,1], Wen-bin Song[d,1], Qing-quan Li[e], Hua Xie[e], Qin-fu Xu[f], Jun-li Jia[f], Li-ming Li[f], Hong-li Mao[g], Xiu-man Zhou[b], Hong Luo[d,2,***], Yan-feng Gao[b,2,**], Ai-guo Xu[a,2,*]

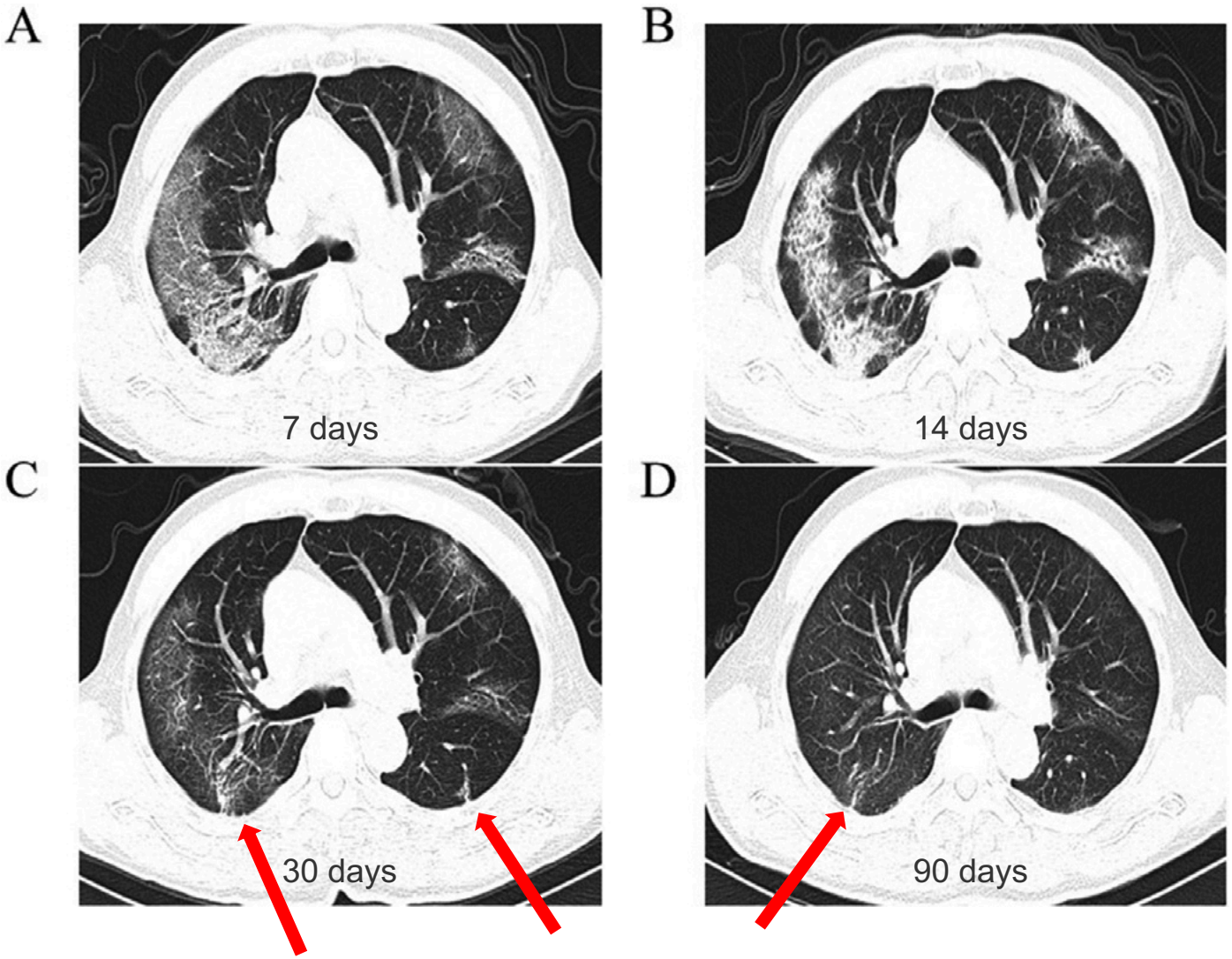
[a] Department of Respiratory and Critical Care Medicine. The First Affiliated Hospital of Zhengzhou University, Zhengzhou 450051, China
[b] School of Life Sciences, Zhengzhou University, Zhengzhou 450001, China
[c] Department of Respiration, Henan Provincial Chest Hospital, Zhengzhou 450003, China
[d] Department of Respiratory and Critical Care Medicine, Guangshan People's Hospital, Xinyang 465400, China
[e] Department of Respiratory and Critical Care Medicine, Xixian People's Hospital, Xinyang 464200, China
[f] Department of Radiology, The First Affiliated Hospital of Zhengzhou University 450051, China
[g] Clinical Laboratory, The First Affiliated Hospital of Zhengzhou University 450051, China

Y.-m. Zhao et al. EClinicalMedicine (2020), https://doi.org/10.1016/j.eclinm.2020.100463



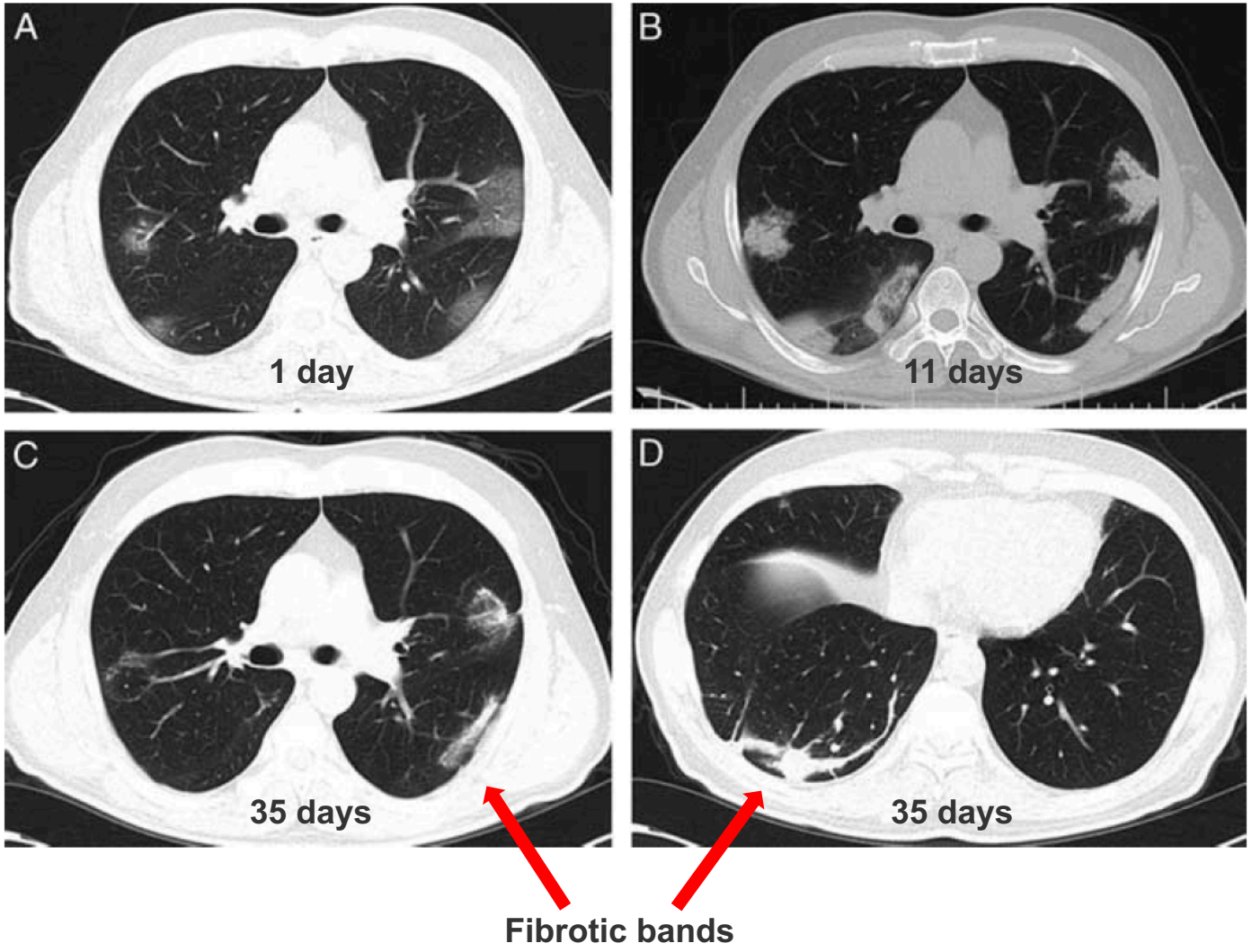
25.4% with mild-moderate disease had persistent PFT abnormalities at 90 days

TLC	7.27%
FEV1	10.91%
FVC	10.91%
DLCO	12.73%



Fibrotic bands

Y.-m. Zhao et al. EClinicalMedicine (2020), https://doi.org/10.1016/j.eclinm.2020.100463



Salehi et al. Thorac Imaging Volume 35, Number 4, July 2020

- Older age and higher peak CXR imaging abnormalities associated with persistently abnormal CT
- Greater inflammatory response associated with persistently abnormal CT
  - CRP
  - D-dimer
  - **BUN**
- Co-morbidities associated with increased mortality in COVID did not correlate with persistently abnormal CT

Table 1
Univariate analysis of predictors of abnormal CT scores.

Parameters	Normal range	Normal CT (n = 16)	Abnormal CT (n = 39)	P value
Age, years	**≥ 18**	**37.13 ± 11.73**	**52.05 ± 15.05**	**0.001**
Sex, (% female)		37.50%	43.59%	0.643
Incubation period, d		**4.50 (2.50–6.00)**	**6.00 (4.00–9.00)**	**0.046**
Temperature, °C		37.83 (36.90–38.50)	37.74 (37.20–38.30)	0.926
CXR peak score		**5.00 ± 3.44**	**8.32 ± 5.00**	**0.019**
Comorbidities				
Hypertension		0	6	0.236
Coronary heart disease		0	2	0.897
Diabetes mellitus		0	2	0.897
Signs and symptoms at admission				
Fever		12 (75%)	25 (64.10%)	0.641
Cough		7 (43.75%)	23 (58.97%)	0.303
Feeble		4 (25%)	14 (7.27%)	0.641
Laboratory data				
Blood routine				
Leucocyte count ($\times 10^9$/L)	4–10	5.26 ± 1.92	5.81 ± 1.84	0.331
Neutrophil count($\times 10^9$/L)	2–7	3.51 ± 1.52	3.92 ± 1.76	0.417
Lymphocyte count ($\times 10^9$/L)	0.8–4.0	1.37 (0.98–1.69)	1.41 (1.08–1.77)	0.767
NLR		2.56 (2.10–3.11)	2.84 (1.71–3.97)	0.711
Hemoglobin concentration (g/L)	110–160	145.63 ± 19.46	139.62 ± 20.43	0.320
Platelet count ($\times 10^9$/L)	100–300	184.00 (128.00–217.25)	167.00 (143.00–210.00)	0.926
Blood Biochemistry				
ALT, U/L	0–40	22.75 ± 7.33	27.35 ± 8.85	0.071
AST, U/L	0–40	16.00 (8.68–28.13)	22.60 (14.40–30.40)	0.159
Albumin, g/L	**40–53**	**44.64 ± 3.83**	**41.76 ± 3.31**	**0.007**
TP, g/L	64–83	66.38 ± 4.41	64.32 ± 5.37	0.180
GGT, U/L	7–50	16.45 (13.18–24.30)	24.80 (16.40–44.00)	0.062
Total bilirubin, μmol/L	3.42–20.50	9.10 (7.28–13.98)	9.20 (7.60–12.80)	0.487
Urea nitrogen, mmol/L	**1.43–7.14**	**3.86 (3.03–4.23)**	**4.73 (3.96–5.32)**	**0.000**
UA, μmol/L	170–390	304.24 ± 82.90	265.64 ± 99.64	0.178
Glucose, mmol/L	**3.89–6.11**	**4.84 (4.82–5.44)**	**5.73 (4.93–6.62)**	**0.006**
TG, mmol/L	0.00–1.71	0.98 (0.88–1.30)	1.18 (1.03–1.73)	0.059
Infection associated				
hsCRP, mg/L		**1.04 (0.36–9.65)**	**6.43 (0.93–15.00)**	**0.041**
Myocardial injury markers				
CK, U/L	25–200	83.45 (51.45–120.20)	66.70 (42.90–103.10)	0.420
LDH, U/L	0.00–3.10	198.21 ± 49.61	205.00 ± 77.29	0.747
Blood coagulation				
Prothrombin time, s	10–13.5	11.10 (10.65–14.98)	12.70 (10.80–14.90)	0.383
Thrombin time, s	10–18	15.90 (13.88–17.48)	16.60 (14.80–18.10)	0.321
Fibrinogen, g/L	2.00–4.00	3.19 (2.97–3.55)	3.56 (3.00–4.67)	0.097
D-dimer, mg/L	**0–0.55**	**0.16 ± 0.01**	**0.30 ± 0.04**	**0.006**
Treatment				
Low-dose corticosteroids		2 (12.50%)	5 (12.82%)	0.974
Hospital period, d		14.06 ± 4.80	15.87 ± 6.84	0.340

Data are expressed as mean± SD, median (IQR) and No. (%). Comparisons were determined by Student's test, Mann-Whitney U test or χ^2 test as appropriate.
Abbreviations: NLR, Neutrophil-lymphocyte ratio. ALT, Alanine aminotransferase. AST, Aspartate aminotransferase. TP, Total protein. GGT, Gamma-Glutamyl Transferase. UA, Uric acid. TG, Triglyceride. hsCRP, High-sensitivity c-reactive protein. CK, Creatine kinase. LDH, Lactate dehydrogenase.

Y.-m. Zhao et al. EClinicalMedicine (2020), https://doi.org/10.1016/j.eclinm.2020.100463

- Older age and higher peak CXR imaging abnormalities associated with persistently abnormal CT
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Table 2
Multivariate analysis of predictors of abnormal CT score.

	β	*P* value	OR (95% CI)	*P* value	OR (95% CI) [a]	*P* value [a]
Age	0.009	0.817	1.009 (0.933 to 1.093)	0.817	1.033 (0.978–1.099)	0.315
Incubation period	0.115	0.488	1.122 (0.811 to 1.553)	0.488	1.254 (0.951–1.654)	0.108
CXR peak score	0.026	0.832	1.027 (0.806 to 1.307)	0.832	1.051 (0.888–1.243)	0.565
Albumin	−0.421	0.051	0.657 (0.430 to 1.002)	0.051	0.730 (0.564–0.944)	0.016
Urea nitrogen	**1.967**	**0.046**	**7.149 (1.038 to 49.216)**	**0.046**	**2.364 (1.038–5.385)**	**0.041**
Glucose	0.151	0.711	1.164 (0.523 to 2.590)	0.711	1.392 (0.551–3.516)	0.485
hsCRP	0.025	0.417	1.025 (0.966 to 1.088)	0.417	1.015 (0.972–1.059)	0.482
D-dimer	0.005	0.268	1.005 (0.996 to 1.013)	0.268	1.006 (0.999–1.012)	0.115

Abbreviations: CI, confidence interval. [a] Logistic regression analysis adjusted for sex, the level of CREA, UA *P* values.

Y.-m. Zhao et al. EClinicalMedicine (2020), https://doi.org/10.1016/j.eclinm.2020.100463

- Older age and higher peak imaging abnormalities did not associate with persistently abnormal DLCO
- Greater inflammatory response was associated with persistently abnormal DLCO
  - ESR
  - **D-dimer**
- Persistent imaging abnormalities did not correlate with DLCO abnormalities
  - 39/55 with abnormal CT
  - 9/55 with abnormal DLCO
- Persistent DLCO abnormalities at 3 months following similar course, though early, to prior ARDS long term data
- Did not discuss impact of abnormal DLCO or imaging on symptom scores or functional status

Table 3
Univariate analysis of predictors of abnormal DLCO% predicted.

Parameters	Normal range	DLCO normal group (n = 46)	DLCO impaired group (n = 9)	P value
Age, years	≥ 18	44.99 ± 14.70	52.57 ± 18.91	0.095
Sex, (% female)		19 (41.30%)	4 (44.44%)	0.861
Incubation period, d		6.00 (4.00–7.25)	6.00 (4.50–7.50)	0.503
Temperature, °C		37.80 (36.70–38.43)	38.00 (37.60–38.35)	0.600
CXR peak score		7.22 ± 4.66	8.06 ± 5.82	0.638
Comorbidities				
Hypertension		5 (10.87%)	1 (11.11%)	0.983
Coronary heart disease		2 (4.35%)	0 (0%)	1.000
Diabetes mellitus		1 (2.17%)	1 (11.11%)	0.737
Signs and symptoms at admission				
Fever		28 (60.87%)	9 (100%)	0.057
Cough		22 (47.83%)	8 (88.89%)	0.058
Feeble		18 (39.13%)	0 (0%)	0.057
Laboratory data				
Blood Routine				
Leucocyte count ($\times 10^9$/L)	4–10	5.62 ± 1.75	5.81 ± 2.50	0.774
Neutrophil count($\times 10^9$/L)	2–7	3.74 ± 1.48	4.11 ± 2.63	0.556
Lymphocyte count ($\times 10^9$/L)	0.8–4.0	1.42 (1.08–1.73)	1.22 (0.98–1.87)	0.601
NLR		2.79 (1.89–3.66)	2.11 (1.73–4.46)	0.716
Hemoglobin concentration (g/L)	110–160	143.59 ± 18.73	130.00 ± 24.44	0.064
Platelet count ($\times 10^{12}$/L)	100–300	175.67 ± 55.40	179.89 ± 75.67	0.845
Blood Biochemistry				
ALT, U/L	0–40	24.90 ± 7.42	31.63 ± 12.30	0.146
AST, U/L	0–40	20.45 (13.98–30.10)	21.30 (11.50–38.90)	0.991
Albumin, g/L	**40–53**	**43.03 ± 3.66**	**40.38 ± 3.12**	**0.047**
TP, g/L	64–83	65.12 ± 4.92	63.39 ± 6.49	0.518
GGT, U/L	7–50	20.60 (15.05–38.13)	25.90 (16.00–52.35)	0.460
Total bilirubin, μmol/L	**3.42–20.50**	**8.90 (7.28–13.38)**	**13.20 (9.65–16.35)**	**0.048**
Urea nitrogen, mmol/L	**1.43–7.14**	**4.25 (3.73–4.97)**	**5.14 (4.68–6.91)**	**0.012**
Creatinine, mmol/L	44–97	65.61 ± 15.63	77.63 ± 23.97	0.060
UA, μmol/L	170–390	276.96 ± 84.70	276.37 ± 147.67	0.987
Glucose, mmol/L	3.89–6.11	5.40 (4.82–5.95)	5.79 (5.14–8.33)	0.187
Inflammatory markers				
ESR, mm/h	0–20	26.50 (7.00–45.50)	52.00 (20.00–86.50)	0.050
Myocardial injury markers				
CK, U/L	25–200	76.20 (49.13–104.83)	54.00 (36.50–117.90)	0.290
LDH, U/L	100–240	191.90 (164.25–230.43)	219.00 (139.00–322.60)	0.345
Blood coagulation				
Prothrombin time, s	**10.0–13.5**	**12.25 (10.75–14.55)**	**15.20 (11.40–16.35)**	**0.043**
D-dimer, mg/L	**0–0.55**	**0.23 ± 0.17**	**0.42 ± 0.21**	**0.006**
Treatment				
low-dose corticosteroids		6 (13.04%)	1 (11.11%)	1.000
Hospital period (d)		15.50 (10.00–18.00)	17.00 (11.50–19.50)	0.600

Data are expressed as mean± SD, median (IQR) and No. (%). Comparisons were determined by Student's test, Mann-Whitney U test or χ^2 test as appropriate.
Abbreviations: NLR, Neutrophil-lymphocyte ratio. ALT, Alanine aminotransferase. AST, Aspartate aminotransferase. TP, Total protein. GGT, Gamma-Glutamyl Transferase. UA, Uric acid. TG, Triglyceride. HDL, High-density lipoprotein. ESR, Erythrocyte sedimentation rate. CK, Creatine kinase. LDH, Lactate dehydrogenase.

- Older age and higher peak imaging abnormalities did not associate with persistently abnormal DLCO
- Greater inflammatory response was associated with persistently abnormal DLCO
  - ESR
  - **D-dimer**
- Persistent imaging abnormalities did not correlate with DLCO abnormalities
  - 39/55 with abnormal CT
  - 9/55 with abnormal DLCO
- Persistent DLCO abnormalities at 3 months following similar course, though early, to prior ARDS long term data
- Did not discuss impact of abnormal DLCO or imaging on symptom scores or functional status

Table 4
Multivariate analysis of predictors of abnormal DLCO.

	β	*P* value	OR (95% CI)	*P* value [a]	OR (95% CI) [a]
Albumin	−0.181	0.251	0.834 (0.612 to 1.136)	0.054	0.711 (0.503–1.006)
Total bilirubin	0.092	0.246	1.096 (0.938 to 1.281)	0.515	1.048 (0.910–1.207)
Urea nitrogen	0.494	0.166	1.640 (0.815 to 3.298)	0.332	1.434 (0.692–2.973)
Prothrombin time	0.335	0.097	1.398 (0.941 to 2.077)	0.163	1.449 (0.861–2.438)
D-dimer	**0.064**	**0.031**	**1.066 (1.006 to 1.129)**	**0.047**	**1.011 (1.001–1.023)**

Abbreviations: CI, confidence interval. [a] Logistic regression analysis adjusted for sex, age, history of smoking, the level of CREA *P* values.

How do the observed radiographic and PFT abnormalities correlate with functional status? Looking to SARS-CoV-1

RESPIRATORY INFECTION

Impact of severe acute respiratory syndrome (SARS) on pulmonary function, functional capacity and quality of life in a cohort of survivors

D S Hui, G M Joynt, K T Wong, C D Gomersall, T S Li, G Antonio, F W Ko, M C Chan, D P Chan, M W Tong, T H Rainer, A T Ahuja, C S Cockram, J J Y Sung

Thorax 2005;**60**:401–409. doi: 10.1136/thx.2004.030205

SARS-CoV-1

Table 2 Frequency of lung function parameters below normal range in SARS patients

	N <60% predicted value		N <70% predicted value		N <80% predicted value	
	3 months	6 months	3 months	6 months	3 months	6 months
FEV_1	0	0	2 (1.8%)	1 (0.9%)	3 (2.7%)	4 (3.6%)
FVC	1 (0.9%)	1 (0.9%)	1 (0.9%)	1 (0.9%)	6 (5.5%)	4 (3.6%)
VC	1 (0.9%)	2 (1.8%)	2 (1.8%)	3 (2.7%)	6 (5.5%)	5 (4.5%)
TLC	0	0	3 (2.7%)	2 (1.8%)	7 (6.4%)	8 (7.3%)
TLCO	2 (1.8%)	7 (6.4%)	7 (6.4%)	9 (8.2%)	14 (12.7%)	17 (15.5%)
KCO	0	0	0	0	2 (1.8%)	1 (0.9%)

TLC, total lung capacity; VC, vital capacity; FVC, forced vital capacity; FEV_1, forced expiratory volume in 1 second; TLCO, carbon monoxide transfer factor adjusted for haemoglobin; KCO, transfer coefficient (transfer factor per alveolar volume).

Comparison of PFT abnormalities at 3 months

	SARS-CoV-2 (n=55)	SARS-CoV-1 (n=110)
FVC	10.9%	5.5%
FEV1	10.9%	2.7%
TLC	7.27%	6.24%
DLCO	12.73%	12.7%

Y.-m. Zhao et al. EClinicalMedicine (2020), https://doi.org/10.1016/j.eclinm.2020.100463
Hui et al. Thorax 2005;60:401–409. doi: 10.1136/thx.2004.030205

SARS-CoV-1: Correlation between Pulmonary Function and HRQoL

Physical Functioning
Role limitation due to physical problems
Bodily Pain
General Health
Vitality
Social Functioning
Role Limitation due to emotional problems
Mental Health

Table 6 Correlations between pulmonary function and HRQoL at 6 months (n = 110)

SF-36	FVC	FEV_1	VC	TLC	TLCO*
PF	0.31*	0.40*	0.42*	0.19	0.30*
RP	0.31*	0.39*	0.35*	0.18	0.34*
BP	0.16	0.29*	0.27*	0.03	0.17
GH	0.29*	0.32*	0.29*	0.11	0.32*
VT	0.16	0.23†	0.12	0.01	0.13
SF	0.24‡	0.39*	0.24‡	0.13	0.27‡
RE	0.15	0.22†	0.22†	−0.01	0.22†
MH	0.13	0.22†	0.09	0.02	0.26‡

PF, physical functioning; SF, social functioning; RP, role limitation due to physical problems; RE, role limitation due to emotional problems; MH, mental health; BP, bodily pain; VT, vitality; GH, general health.
Values shown are Pearson's correlation coefficients (*r*).
*p<0.01; †p<0.05; ‡p=0.05.

Hui et al. Thorax 2005;60:401–409. doi: 10.1136/thx.2004.030205

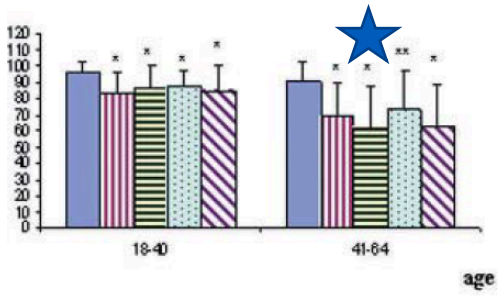
Table 2. Clinical Outcomes from 1 Year to 5 Years in Survivors of ARDS.

Clinical Outcomes	At 1 Year (N=83)	At 2 Years (N=69)	At 3 Years (N=71)	At 4 Years (N=63)	At 5 Years (N=64)
Median SF-36 score					
Physical functioning	60	70	70	75	75
Role, physical	25	50	100	75	88
Bodily pain	62	62	72	74	74
General health	52	62	55	59	62
Vitality	55	55	50	50	55

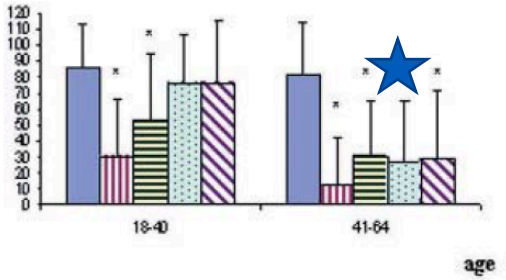
Herridge et al. April 7, 2011. N Engl J Med 2011; 364:1293-1304

SARS-CoV-1: Impact of Illness Severity and Age on Functional Status

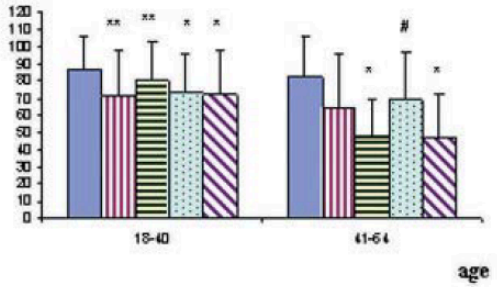
Physical Functioning



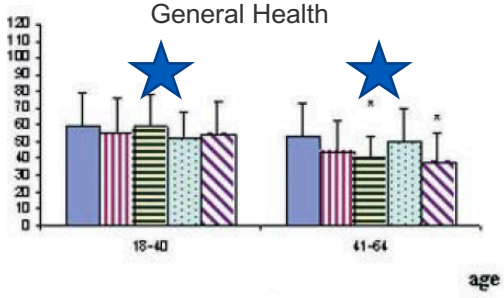
Role limitation due to physical problems



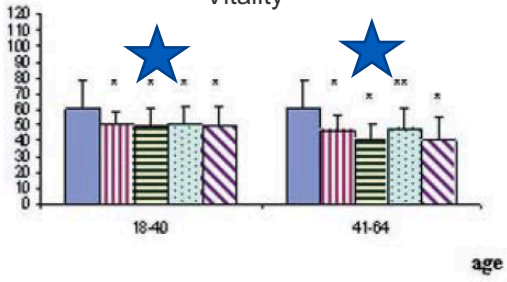
Bodily Pain



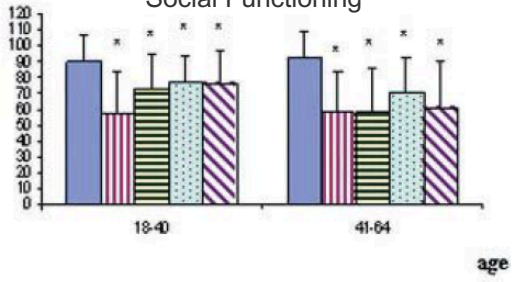
General Health



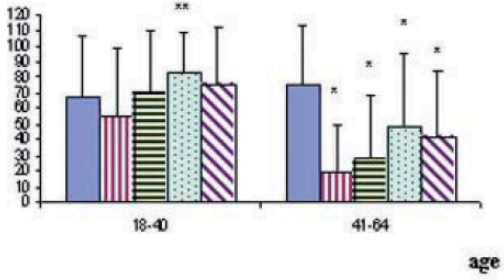
Vitality



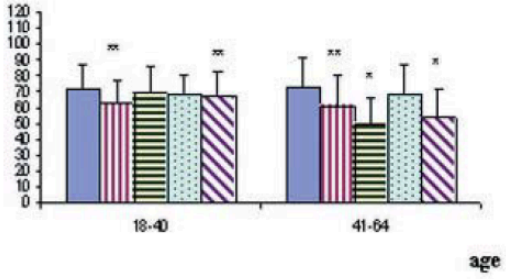
Social Functioning



Role Limitation due to emotional problems



Mental Health



Where does that leave us?

- We don't have true long term data yet in SARS-CoV-2 to assess the long term impact on pulmonary function and the impact on overall functional status
- We have have a lot to learn about the pathophysiology of SARS-CoV-2, transmission, generation of immunity and failure to maintain immunity, as well as the long term impact of the C-ARDS with MSOF
- 3 month data in SARS-CoV-2 is similar to SARS-CoV-1
  - Multiple studies demonstrate persistently abnormal CT imaging suggesting evolution to fibrotic band-like changes
    - Significant heterogeneity- Multiple case reports of rapid pulmonary fibrosis
  - Sustained reduction in DLCO in SARS-CoV-2 is similar toSARS CoV-1, other viral pneumonias (H1N1, H7N9) and non-COVID ARDS
    - SARS-CoV-2 may additionally have more impact on airway obstruction with greater % of patients with persistent reductions in FEV1
- Impact of SARS-CoV-2 on HRQOL is unknown
  - Impact on HRQoL for SARS-CoV-1 is similar to non-COVID ARDS
  - Patients >40 years were more functionally impacted by SARS-CoV-1 (SF-36) than those less than 40 years of age, though severity of disease (ICU v. non-ICU) did not segregate as clearly
  - From the lay press, it appears that younger patients (25-40) are also significantly impacted

St Li et al. Crit Care Resusc. 2006 Dec;8(4):302-8.
Y.-m. Zhao et al. EClinicalMedicine (2020), https://doi.org/10.1016/j.eclinm.2020.100463
Hui et al. Thorax 2005;60:401–409. doi: 10.1136/thx.2004.030205

One thinks about the worst nightmare of an infectious disease person who's interested in global health and outbreaks: It's the combination of a new microbe that has a spectacular degree of capability of transmitting, and has a considerable degree of morbidity and mortality. And here it is, it's happened — your worst nightmare, the perfect storm. It's one of those things where you're really just functioning on adrenaline. We're learning on the fly, learning on the job, building the plane as they're flying it.

Anthony Fauci, MD
July 14, 2020