Supplementary Materials

Pulmonary Function Test Measurement Changes Over Time

Of the 47 studies included in the meta-analysis of imaging abnormalities, 26 also assessed PFTs and reported values as a percentage of predicted norms (**Table S1**). **Table S3** presents a summary of the results obtained from the REML, including overall means, and standard deviations of PFTs.

FEV₁/FVC (%), was reported in 17 studies, eight of which occurred at early-follow-up. The raw means (95% CI) were 85.4 (79.2-91.6) for all timepoints, 85.4 (78.8-92.0) for early follow-up, and 86.5 (80.8-92.2) for late follow-up. Interstudy heterogeneity was highest between early follow-up studies ($I^2 = 99.34\%$), followed by all timepoints ($I^2 = 99.20\%$), and then late follow-up ($I^2 = 99.03\%$). No heterogeneity was associated with follow-up time, and the relationship between FEV₁/FVC, and follow-up time was not significant (p = 0.80).

23 studies evaluated FEV₁ percent predicted (%pred), and the raw mean for all of these was 91.4 (88.2-94.6). The raw mean FEV₁ %pred for the 12 studies with an early follow-up time was 91.4 (87.5-95.3), and 96.2 (94.2-98.3) for the 11 studies with a late follow-up time. The I² values were 90.75%, 93.82%, and 75.55%, respectively. The R² was 18.40%, and follow-up time was significantly associated with increased FEV₁ (p = 0.03).

24 studies reported FVC %pred. 11 of these had an early follow-up. The raw mean FVC %pred for all timepoints, early follow-up, and late follow-up were 92.5 (88.0-97.0), 92.5 (87.5-97.5), and 96.1 (92.5-100.0), respectively. Interstudy heterogeneity for all timepoints was 94.73%, 95.17% in early follow-up and 93.89% in late follow-up. Heterogeneity due to follow-up was 0.53% and the relationship between follow-up time was not significant (p = 0.24).

24 studies reported DLCO %pred, 12 at early follow-up. The raw mean of all timepoints for DLCO %pred was 76.1 (71.1-81.2). At the early timepoint, the mean was 76.1 (70.8-81.5), and

it was 84.7 (80.0-89.5) at late timepoint. Interstudy heterogeneity for each timepoint was 95.30%, 96.02%, and 94.28%, respectively. 17.57% of heterogeneity was accounted for by follow-up time. Follow-up time significantly impacted DLCO (p = 0.02).

A meta-regression was performed between dyspnea and FEV1 (% predicted), and dyspnea and DLCO (% predicted). Neither were significantly correlated (p = 0.39, 0.16, respectively). The regression included the nine studies reporting both FEV1 and dyspnea had an R² of 0.00%, and an I² of 76.35%. The regression including DLCO also included nine studies and had slightly more interstudy heterogeneity (I² = 88.35%) and 7.39% of heterogeneity in DLCO was attributable to dyspnea proportions within the cohort. Furthermore, DLCO was not significantly associated with any given imaging abnormality. However, while the meta-analysis of all PFTs did not exhibit significant publication bias, the meta-regression between DLCO and CT abnormalities did have an Egger's test p value < 0.05.

After stepwise removal of studies which contributed to heterogeneity, our findings remain mostly the same. DLCO and FEV1 significantly changed over time between early and late follow-up time points, but remained in the normal range, while FEV1/FVC and FVC did not. Furthermore, the relationship between FEV1 and dyspnea, and DLCO and dyspnea also remained non-significant. However, the relationship between DLCO and imaging abnormalities became significant after the removal of these studies. Notably, GGOs and DLCO, and reticulations and DLCO were negatively correlated (i.e., higher average DLCO (% pred) was associated with a lower proportion of these abnormalities). The R² for these meta regressions were 92.09%, and 97.49%, respectively (p < 0.0001, p < 0.0001).

Stepwise Removal of Studies in the proportion of Imaging Abnormalities and associated meta-regressions

Results from the stepwise removal of heterogeneity are available in Table S4. Briefly, most of our findings are consistent with what was obtained prior to the removal of these studies.

2

However, many of the effects became much more pronounced. Notably, all specific abnormalities (GGOs, reticulations, bronchiectasis, consolidations, and fibrosis) significantly changed over time (p < 0.001 for all). Interestingly, while most of these abnormalities decreased, fibrosis and bronchiectasis increased over time.

Likewise, the meta-regression relationships also became stronger. Dyspnea was significantly correlated with all abnormalities, CT-only, and GGOs (p < 0.0001 for all). Age was significantly correlated with all abnormalities, CT-only, GGOs, reticulations, consolidations, bronchiectasis, and fibrosis (p < 0.0001 for all). Female sex was negatively correlated with all abnormalities, CT-only, GGOs, reticulations, consolidations, bronchiectasis, and fibrosis (p < 0.0001 for all). Female sex was negatively correlated with all abnormalities, CT-only, GGOs, reticulations, consolidations, bronchiectasis, and fibrosis (p < 0.0001 for all). R² values for these relationships exceeded 90%. Results are described in further detail in Table S5.

Authors	Country	Study Period (mm/yy)	Sample Size	Age, mean ± SD or median [IQR] years	Acute COVID-19 Severity	Time from acute illness (months)	Imaging Technology	Outcomes used for meta-analysis
Balbi et. al.(23)	Italy	02/20 - 05/20	91	66 [59-71]	Hospitalized	3	СТ	Total Patients with Any Imaging Abnormality, GGO, Reticulations, Consolidations, Dyspnea, PFTs
Bardakci et. al.(24)	Turkey	03/20 - 07/20	60	N/A	Hospitalized	6	СТ	Total Patients with Any Imaging Abnormality
Cao et. al.(26)	China	01/20 - 03/20	51	43·5 ± 15·9	Hospitalized , mixed severity	3	СТ	Total Patients with Any Imaging Abnormality, GGO, Dyspnea
Caruso et. al.(27)	Italy	03/20 - 05/20	118	65 ± 12	Hospitalized with moderate to severe COVID-19 pneumonia	6	СТ	Total Patients with Any Imaging Abnormality, GGO, Reticulations, Consolidations, Fibrosis, Bronchiectasis, Dyspnea
Chen et. al.(28)	China	02/20 - 03/20	41	51 [38-59]	Hospitalized , mixed severity	3, 6, 12	СТ	Total Patients with Any Imaging Abnormality, PFTs
Dai et. al.(29)	China	01/20 - 10/20	45	48 ± 14	Hospitalized , mixed severity	6	СТ	Total Patients with Any Imaging Abnormality, GGO, Reticulations, Consolidations

Table S1. Summary of Studies Included in the Meta-Analysis

Fortini et. al.(30)	Italy	03/20 - 05/20	59	68·2 ± 12·8	Hospitalized , not severe	3	Ultrasound	Total Patients with Any Imaging Abnormality, Dyspnea, PFTs
Frija- Masson et. al.(31)	France	02/20 - 08/20	137	59 [50-68]	Hospitalized	3	СТ	GGO, Reticulations, Fibrosis', PFTs
Froidure et. al.(32)	Belgium	03/20 - 06/20	107	60 [53–68]	Hospitalized , mixed severity	3	СТ	GGO, Reticulations, Consolidations, Fibrosis, Dyspnea, PFTs
Gamberini et. al.(33)	Italy	02/20 - 05/20	37	64 [55-70]	ICU	9 to 12	СТ	Consolidations, Fibrosis.
Gianella et. al.(34)	Switzerla nd	03/20 - 04/20	39	62.5 [51-71]	Hospitalized , mixed severity	3	СТ	Total Patients with Any Imaging Abnormality, GGO, PFTs
Gonzalez et. al.(35)	Spain	03/20 - 06/20	57	60 [48-65]	ICU, experienced ARDS	3	СТ	Total Patients with Any Imaging Abnormality, GGO, Reticulations, Consolidations, Fibrosis, Bronchiectasis, Dyspnea, PFTs
Grist et. al.(36)	The United Kingdom	08/20 - 12/20	9	57 ± 7	Hospital, excluding invasive ventilation	5	Xenon Magnetic Resonance Imaging, CT	Total Patients with Any Imaging Abnormality, Dyspnea, PFTs
Guler et. al.(37)	Switzerla nd	05/20 - 09/20	52	Mild-52·9 ± 10·9 Severe-	Mixed	4	СТ	Reticulations, Consolidations, Bronchiectasis

				12.0				
Gurbani et. al. (71)	Spain	03/20- 08/20	77	57±13.14	Hospitalized	4	Ultrasound	Total Patients with Any Imaging Abnormality, PFTs, Dyspnea Total Patients with Any
Hellemons et. al.(38)	The Netherla nds	02/20 - 07/20	87	58·2 ± 12·3	Hospitalized , ICU	3, 6	СТ	Imaging Abnormality, GGO, Reticulations, Consolidations, Fibrosis, Bronchiectasis, PFTs
Holdsworth et. al. (70)	UK	08/20- 04/21	171	39 [30-46.7] range 17-61	Severe acute COVID illness (hospital admission)	3	СТ	Total Patients with Any Imaging Abnormality, GGO, Fibrosis, PFTs, Dyspnea
Hu et. al.(39)	China	01/20 - 24/20	18	Moderate: 43·76 ± 12·89 Severe: 52·44 ± 11·88	Hospitalized , no mechanical ventilation	5	СТ	Total Patients with Any Imaging Abnormality, GGO
Huang et. al.(40)	China	01/20 - 05/20	353	57 [47-65]	Hospitalized	6	СТ	Total Patients with Any Imaging Abnormality, GGO, Reticulations, Consolidations
Johnsen et. al.(41)	Denmark	03/20 - 08/20	57	51 ± 13	Mixed, hospitalized , and non- hospitalized	3	СТ	Total Patients with Any Imaging Abnormality, PFTs
Jutant et. al. (68)	France	06/20- 10/20	171	57.3±13.2	ICU and non-ICU hospitalized	4	СТ	Total Patients with Any Imaging Abnormality, GGOs, Reticulations,

Critical: 60.3 ±

12.0

Labarca et. al.(42)	Chile	04/20 - 07/20	60	Mild: 39·2 ± 14·3 Moderate: 47·4 ± 11 Severe: 50·0 ± 10·3	Hospitalized from mild to severe	4	СТ	Consolidations, PFTs, Dyspnea Total Patients with Any Imaging Abnormality, GGO, Reticulations, Consolidations, Fibrosis, Bronchiectasis
Lerum et. al.(43)	Norway	Mar-20	15	ICU: 52 [50- 59]	Hospitalized , ICU (note: only ICU cohort met inclusion criteria)	3	СТ	GGO, PFTs
Li et. al.(44)	China	01/20 - 04/20	86	Pulmonary Fibrosis: 33·06 ± 17·50 No pulmonary Fibrosis: 50·68 ± 13·25	Hospitalized , mixed	3, 4	СТ	GGO, Bronchiectasis
Liao et. al.(45)	China	03/21 - 04/21	256	39·0 [33·0– 48·0]	Hospitalized	12	СТ	Total Patients with Any Imaging Abnormality, GGO, Reticulations, Consolidations, Fibrosis, Bronchiectasis, PFTs
Liu et. al.(46)	China	02/20 - 03/20	41	50 ± 14	Hospitalized	3, 7	СТ	GGO, Reticulations, Consolidations, Bronchiectasis

Fibrosis,

Luger et. al.(47)	Austria	04/20 - 08/20	86	57 [51-70]	Hospitalized , mixed severity	3, 6, 12	СТ	Total Patients with Any Imaging Abnormality, GGO, Reticulations, Consolidations GGOs,
Martino et. al. (67)	Italy	03/20- 05/20	52 (6 mo) 47 (12 mo)	68 [56 5-75]	Hospitalized	6, 12	СТ	Consolidations, Bronchiectasis, Reticulations, PFTs, Dyspnea
McGroder et. al.(48)	The Unites States of America	03/20 - 05/20	76	54 ± 13.7	Hospitalized	4	СТ	Total Patients with Any Imaging Abnormality, GGO, Reticulations, Bronchiectasis, PFTs
Miwa et. al.(49)	Japan	04/20 - 12/20	17	63 [59-67]	Hospitalized , invasive mechanical ventilation	3	СТ	Total Patients with Any Imaging Abnormality, GGO, Consolidations, PFTs
Mohr et. al.(50)	Germany	04/20 - 09/20	10	50 ± 13·1	Hospitalized , some with mechanical ventilation	4	СТ	Total Patients with Any Imaging Abnormality, GGO
Muhammad et. al. (69)	Pakistan	03/21- 03/22	173	53.62	Hospitalized	3, 6	СТ	Fibrosis
Mumoli et. al.(51)	Italy	05/20 - 08/20	77	62·7 ± 9·5	Hospitalized , mixed severity	3	CT and x-ray	Total Patients with Any Imaging Abnormality, GGO, Fibrosis, Dyspnea
Nabahati et. al.(52)	Iran	Mar-20	173	53·62 ± 13·67	Hospitalized . Moderate or severe pneumonia	3, 6	СТ	Fibrosis, Bronchiectasis

Noel-Savina et. al.(53)	France	04/20 - 09/20	72	60·5 ± 12·8	Hospitalized , ICU and non-ICU, COVID-19 pneumonia	4	Scintigraphy and CT	Total Patients with Any Imaging Abnormality, GGO, Reticulations, Bronchiectasis, Dyspnea, PFTs
Núñez- Fernández et. al.(54)	Spain	03/20 - 05/20	200	62 [50-71]	Hospitalized , mixed severity	3	X-ray	Total Patients with Any Imaging Abnormality, PFTs
Remy- Jardin et. al.(55)	France	03/20 - 04/20	55	59·7 ± 13·7	Hospitalized	3	Dual Energy CT Angiography	Total Patients with Any Imaging Abnormality, GGO, PFTs
Robey et. al.(56)	The United Kingdom	03/20 - 06/20	72	58	Hospitalized , ICU and non-ICU	4	СТ	Total Patients with Any Imaging Abnormality, GGO, Fibrosis
Skala et. al.(57)	Czech Republic	06/2020 - 10/2020	102	46.7	Hospitalized and non- hospitalized	3	СТ	Total Patients with Any Imaging Abnormality, GGO, Consolidations, Fibrosis, Bronchiectasis,
Truffaut et. al.(59)	Belgium	03/20 - 06/20	22	54.6 ± 10.9	Hospitalized , ARDS	3	СТ	Dyspnea Total Patients with Any Imaging Abnormality, GGO, Consolidations, Fibrosis, PFTs
van Gassel et. al.(60)	The Netherla nds	03/20 - 05/20	46	63·00 [55·00- 68·00]	Hospitalized , ICU	3	СТ	Total Patients with Any Imaging Abnormality, GGO, Reticulations, Fibrosis, PFTs
Vijayakumar et. al.(61)	The United Kingdom	03/20 - 06/20	73	59 ± 13	Hospitalized	3, 12	СТ	Total Patients with Any Imaging Abnormality, GGO, Reticulations, Consolidations,

Wu Q et. al.(62)	China	01/20 - 09/20	48	47 [36·8-57·3]	Hospitalized	6	СТ	Bronchiectasis, Dyspnea Total Patients with Any Imaging Abnormality, GGO, Reticulations, Bronchiectasis, Dyspnea
Wu X et. al.(63)	China	N/A	83	60 [52–66]	Hospitalized with mixed severity not requiring mech ventilation	3, 6, 9, 12	СТ	Total Patients with Any Imaging Abnormality, GGO, Reticulations, Bronchiectasis, Dyspnea, PFTs
Zhang et. al.(65)	China	01/20 - 03/20	40	57 [40-68]	Hospitalized	8	СТ	Total Patients with Any Imaging Abnormality, GGO, Reticulations, Consolidations Total Patients with Any
Zhao et. al.(8)	China	01/21 - 02/21	94	48 ± 11·90	Hospitalized	12	СТ	Imaging Abnormality, GGO, Reticulations, Consolidations, Fibrosis, PFTs
Zhou et. al.(66)	China	03/20 - 03/20	164	Severe/Critical : 63.00 [56.00- 69.00] Mild/Moderate: 56.00 [47.50- 63.00] Asymptomatic:	Hospitalized and non- Hospitalized	4	СТ	Total Patients with Any Imaging Abnormality, GGO, Reticulations, Fibrosis, Bronchiectasis

Fibrosis,

46.00 [39.50-57.00] Abbreviations: CT, computed tomography; GGOs, ground glass opacities; ICU, intensive care unit; PFTs, pulmonary function testing

Table S2. Summary of Meta-Regression between Imaging Abnormalities and Dyspnea Proportions, Sex, and Age

Abbreviations: CT, computed tomography; GGOs, ground glass opacities; NA, not available due to lack of studies. ^a Correlations for female are negative.

Evaluated Factors	<i>م</i> Abno	Any ormality	A Abnoi (CT	ny rmality only)	GG	iOs	Reticu	lations	Bronch	iectasis	Consoli	idations	Fibr	osis
	R ²	p-value	R ²	p- value	R ²	p- value	R ²	p- value	R ²	p- value	R ²	p- value	R ²	p-value
Cohort Proportion of Dyspnea	28 %	0.012	14 %	0.10	0.0 %	0.47	N	IA	Ν	IA	N	A	Ν	IA
Cohort Proportion of Females ^a	3.8 %	0.11	6∙3 %	0.069	0.0 %	0.36	32 %	0.001	37 %	0.001	18 %	0.025	0.0 %	0.70
Cohort Mean Age	24 %	0.002	30 %	0.001	21 %	0.004	38 %	0.001	14 %	0.081	0.0%	0.55	15 %	0.051

Table S3. Summary of Meta-Regression of Pulmonary Function Testing

Pulmonary Function	Patients Evaluated at Each Time Point, N	Raw Mean, All Timepoints (95% Cl)	Raw Mean Early Follow-up (95% Cl)	Raw Mean F/U**, (95% CI)	Change from early to late follow-up, p- value [†]	Heterogeneity attributable to follow-up time [‡]
FEV1/FVC (percent)	1532 (total), 700 (early F/U), 832 (late F/U)	85·4 (79·2-91·6)	85.4 (78.8-92.0)	86.5 (80.8-92.2)	0.80	0.00 %
FEV1 (percent predicted)	2019 (total), 1049 (early F/U), 970 (late F/U)	91.4 (88.2-94.6)	91.4 (87.5-95.3)	96·2 (94·2-98·3)	0.024	14 %
FVC (percent predicted)	2035 (total), 919 (early F/U), 1116 (late F/U)	92·5 (88·0-97·0)	92·5 (87·5-97·5)	96·1 (92·5-100·0)	0.24	0.53 %
DLCO (percent predicted)	2099 (total), 1025 (early F/U), 1075 (late F/U)	76-1 (71-1-81-2)	76.1 (70.8-81.5)	84.7 (80.0-89.5)	0.034	18 %

Abbreviations: FEV1, Forced Expiratory Volume in the first second; FVC, Forced Vital Capacity; DLCO, Diffusing Capacity for Carbon Monoxide;

F/U, follow-up; CI, confidence interval. *3 months since acute infection. **>3 months since acute infection. †p-value from random effects model.

‡R² from random effects model.

Abnormality	Studies Included/Total studies	Overall prevalence of imaging abnormalities (95% Cl)	At early F/U*, prevalence (95% Cl)	At late F/U**, prevalence (95% CI)	Change from early to late follow-up, p- value [†]	Heterogeneity attributable to follow-up time [‡]
Any abnormality	20/38 (total), 7/18 (early F/U), 13/20 (late F/U)	65.8 [62.9-68.7]	62.5 [57.3- 67.7]	57·4% (64·3- 70·6%)	0.098	53 %
Any abnormality (CT imaging subgroup)	19/34 (total), 7/16 (early F/U), 12/18 (late F/U)	65·8% (62·6-69·0%)	62·5% (57·3- 67·7%)	67·6% (63·9- 71·3%)	0.12	28 %
GGOs	23/37 (total), 10/18 (early F/U, 13/19 (late F/U)	51.6% (46.6-56.7%)	62·6% (57·9- 67·4%)	43·2% (40·4- 46·1%)	>0.0001	93 %
Reticulations	11/22 (total), 3/7 (early F/U), 8/15 (late F/U)	14·2% (7·48-20·9%)	29·3% (23·9- 34·7%)	7·83% (3·75- 11·9%)	>0.0001	100 %
Bronchiectasi s	9/19 (total), 4/7 (early F/U), 5/12 (late F/U)	19·6% (12·6-26·5%)	9·68% (4·99- 14·4%)	27·3% (22·2- 32·5%)	>0.0001	89 %
Consolidation s	15/22 (total), 7/10 (early F/U), 8/12 (late F/U)	5.75% (3.03-8.47%)	9·34% (4·84- 13·8%)	3·67% (0·02- 7·09%)	0.049	0.0 %
Fibrosis	8/21 (total), 4/11 (early F/U), 4/10 (late F/U)	13•1% (7•41-18•7%)	6·60% (1·77- 11·44%)	19·8% (14·5- 25·0%)	0.0003	100 %

Table S4. Total and specific chest imaging abnormalities during follow-up after stepwise removal of heterogeneity

Abbreviations: CT, computed tomography; GGOs, ground glass opacities; F/U, follow-up; CI, confidence interval. *3 months since acute infection. **>3 months since acute infection. †p-value from random effects model. ‡R2 from random effects model.

Evaluated Factors	Abı	Any normality	A Abno (CT	ny rmality only)	GO	GOs	Reticu	lations	Bronch	niectasis	Consol	idations	Fib	rosis
	R ²	p-value	R ²	p- value	R ²	p- value	R ²	p- value	R ²	p- value	R ²	p- value	R ²	p-value
Cohort Proportion of Dyspnea	97 %	<0.0001	95 %	<0.00 01	100 %	<0.000 1	Ν	IA	٢	NA	٢	IA	٦	NA
Cohort Proportion of Females	95 %	<0.0001	92 %	<0.00 01	92 %	<0.000 1	89 %	<0·00 01	78 %	0.0001	96 %	<0·000 1	97 %	<0·000 1
Cohort Mean Age	98 %	<0.0001	100 %	<0∙000 1	93 %	<0.000 1	97 %	<0.000 1	87 %	<0·00 01	87 %	<0·000 1	78 %	<0·000 1

Table S5. Summary of Meta-Regression between Imaging Abnormalities and Dyspnea Proportions, Sex, and Age after stepwise removal of heterogeneity

Abbreviations: CT, computed tomography; GGOs, ground glass opacities; NA, not available due to lack of studies. ^a Correlations for female are negative.

							. ,	7	7	/ / / / / / / /
							he	/	.*	late la
						wint	ome		esent ss	our state of the s
					1	rors draw	. Caufe?	estwash	anabes the	server and so and
				/	exposed	april de	SP of the	all colo	al period the	action double size and south
				ab and re	amente a	eserie ou	et saturdit	Ne rec	FOR STREET	AND TO THE ADDRESS OF
			de	appel at	Sert mul	sthe stre	ancomela	sint	bent mu	und Co weiter
		/	sterio	webeco	e be con	ush no the	e ^{be} co	webeco	stretolo	ALCONCE STORE
Author	Title	1.111	/ 20	3.01	A.OL	4.0	¢,0	»/ ۲.*	· *	•/
Balbi et. al.	Post-discharge chest CL1 findings and pulmonary function tests in severe COVID-19 patients									
Bardakci et. al.	Evaluation of long-term radiological findings, pulmonary functions, and health-related quality of life in survivors of severe COVID-19									
Cao et. al.	Three-month outcomes of recovered COVID-19 patients: prospective observational study.									Legend
Caruso et al	Post-Acute Sequelae of COVID-19 Pneumonia: Six-month Chest CT									Definitely yes
	Follow-up One-year follow-up of chest CT findings in patients after S&RS-CoV-									
Chen et. al.	2 infection Follow-Up Study of the Cardiopulmonary and Psychological									Probably yes
Dai et. al.	Outcomes of COVID-19 Survivors Six Months After Discharge in Sichuan, China									Probably no
Fortini et. al.	COVID-19: persistence of symptoms and lung alterations after 3–6 months from hospital discharge									Definitely no
Frija-Masson et. al.	Residual ground glass opacities three months after Covid-19 pneumonia correlate to alteration of respiratory function: The post									Not applicable
Froidure et al	Covid M3 study Integrative respiratory follow-up of severe COVID-19 reveals									
	common functional and lung imaging sequelae Health-related quality of life profiles, trajectories, persistent									
Gamberini et. al.	symptoms and pulmonary function one year after ICU discharge in invasively ventilated COVID-19 patients, a prospective follow-up Conserve follow-up of chert (CI finding in prospective follow-up									
Gianella et. al.	2 infection.									
Gonzalez et. al.	COVID-19 A 3-Month Prospective Cohort									
Grist et. al.	Hyperpolarized 129Xe MRI Abnormalities in Dyspneic Patients 3 Months after COVID-19 Pneumonia: Preliminary Results									
Guler et. al.	Pulmonary function and radiological features 4 months after COVID-19: first results from the national prospective									
Gurbani et. al.	observational Swiss COVID-19 lung study Clinical outcomes and lung ultrasound finding in COVID-19 follow									
	up: Calm comes after the storm? Persistent Health Problems beyond Pulmonary Recovery up to 6									
Hellemons et. al.	Months after Hospitalization for SARS-CoV-2; A Longitudinal Study of Respiratory, Physical and Psychological Outcomes									
Holdsworth et. al.	Comprehensive clinical assessment identifies specific neurocognitive deficits in working-age patients with long-COVID									
Hu et. al.	Clinical Features and Temporal Lung Radiographic Changes in 25 Patients Recovering from COVID-19 Pneumonia: A Retrospective									
Huang et. al.	6-month consequences of COVID-19 in patients discharged from									
labarra at al	Descriptive analysis of long COVID sequelae identified in a									-
Johnsen et. al.	multidisciplinary clinic serving nospitalised and non-nospitalised patients									
Jutant et. al.	Respiratory symptoms and radiological findings in post-acute COVID-19 syndrome									
Labarca et. al.	Analysis of clinical symptoms, radiological changes and pulmonary function data 4 months after COVID-19									
Lerum et. al.	Dyspnoea, lung function and CT findings 3 months after hospital admission for COVID-19									
Li et. al.	Pulmonary fibrosis and its related factors in discharged patients									
tion at al	Long-Term Effects of COVID-19 on Health Care Workers 1-Year									
ciao ec. al.	Post-Discharge in Wuhan									
Liu et. al.	Survivors Seven Months After Recovery									
Luger et. Al.	Chest CT of Lung Injury 1 Year after COVID-19 Pneumonia: The CovILD Study									
Martino et. al.	6 and 12 month outcomes in patients following COVID-19-related hospitalization: a prospective monocentric study									
McGroder et, al.	Pulmonary fibrosis 4 months after COVID-19 is associated with									
Miwa et al	Abnormal pulmonary function and imaging studies in critical	-								
di.	COVID-19 survivors at 100 days after the onset of symptoms	<u> </u>								
Mohr et. al.	dyspnoea after recovery from COVID-19									
Muhammad et. al,	Analysis of predictive factors of post-covid-19 associated pulmonary fibrosis: a longitudinal study									
Mumoli et. al.	Lung Function and Symptoms in Post-COVID-19 Patients									
Nabahati et. al.	Post-COVID-19 pulmonary fibrosis and its predictive factors: a prospective study									
Noel-Savina et al	Severe SARS-CoV-2 pneumonia: Clinical, functional and imaging	-								
Núñez-Fernández et.	outcomes at 4 months Alterations in Respiratory Function Test Three Months after									
ai	Hospitalisation for COVID-19 Pneumonia: Value of Determining Nitric Oxide Diffusion Assessment of pulmonary arterial circulation 3 months after									
Remy-Jardin et. al.	hospitalization for SARS-CoV-2 pneumonia: Dual-energy CT (DECT) angiographic study in SS patients									
Robey et. al.	Pulmonary Sequelae at 4 Months After COVID-19 Infection: A Single-Centre Experience of a COVID Follow-Up Service									
Skala et. al.	Heterogeneity of post-COVID impairment: interim analysis of a prospective study from Czechia									
Truffaut et. al.	Post-discharge critical COVID-19 lung function related to severity									
	or radiologic lung involvement at admission High Prevalence of Pulmonary Sequelae at 3 Months after Hospital									
van Gassel et. al.	Discharge in Mechanically Ventilated Survivors of COVID-19									
Vijayakumar et. al.	Li Lung Abnormalities after COVID-19 at 3 Months and 1 Year after Hospital Discharge									
Wu Q. et. al.	A Follow-Up Study of Lung Function and Chest Computed Tomography at 6 Months after Discharge in Patients with Coronavirus Disease 2019									
Wu X. et. al.	3-month, 6-month, 9-month, and 12-month respiratory outcomes in patients following COVID-19-related hospitalisation: a									
Zhang et. al	prospective study Eight months follow-up study on pulmonary function, lung radiographic, and related physiological characteristics in COVID-19.									
	survivors Follow-up study on COVID-19 survivors one year after discharge									
Zhao et. al.	from hospital Comparison of Residual Pulmonary Abnormalities 3 Monthe Afree									
Zhou et. al.	Discharge in Patients Who Recovered From COVID-19 of Different Severity									

Figure S1 Clarity Bias Assessment



Figure S2: Forest Plot Proportion of Any Imaging Abnormality at Any, Early, and Late Follow-up.

Abbreviations: SWA, subjects with abnormality; TS, total subjects; RE, random effects

Author(s) and Year

,

Early follow-up (3 mo)	SWA	TS			
Vijayakumar et. al. (2021)	35	73	⊢⊷		0.48 [0.37, 0.59]
van den Borst et. al. (2020)	73	84		⊦ ≡ 1	0.87 [0.79, 0.93]
Truffaut et. al. (2021)	0	22	н		0.00 [0.00, 0.08]
Skala et. al. (2021)	11	102	I I		0.11 [0.05, 0.18]
Remy-Jardin et. al. (2021)	39	55	; H	-=-1	0.71 [0.58, 0.82]
Mumoli et. al. (2021)	23	77	⊢∎┥┊		0.30 [0.20, 0.41]
Miwa et. al. (2021)	16	17	j	·	0.94 [0.76, 1.00]
Luger et. al. (2022)	50	86	<u>⊧</u> ∎	4	0.58 [0.48, 0.68]
Li et. al. (2021)	65	86		} ≡1	0.76 [0.66, 0.84]
Lerum et. al. (2021)	6	15		4	0.40 [0.16, 0.66]
Holdsworth et. al. (2022)	11	97			0.11 [0.06, 0.19]
Hellemons et. al. (2021)	50	8/		4	0.57 [0.47, 0.68]
Gonzalez et. al. (2021)	34	57	H	=	0.60 [0.47, 0.72]
Gianella et. al. (2021)	23	39	· · ·	=	0.59 [0.43, 0.74]
Froidure et. al. (2021)	100	107	: F		0.68 [0.59, 0.77]
Frija-Masson et. al. (2021)	103	137			
Cao et al. (2021)	29	01			
Baldi et. al. (2021)	50	91	-	F1	0.62 [0.51, 0.71]
RE Model for Early Follow-Up (Q = 377.01, df = 17, p	< .01; l	$\tau^2 = 96.0\%, \ \tau^2 = 0.0\%$.08) 🔶	•	0.53 [0.39, 0.66]
Late follow-up (>3 mo)					
Zhou et. al. (2021)	105	164			0.64 [0.57, 0.71]
Zhao et. al. (2020)	28	94	H∎4 :		0.30 [0.21, 0.39]
Zhang et. al. (2021)	21	40	⊢÷–	4	0.52 [0.37, 0.68]
Wu et. al. (2021)	19	83	⊢∎⊣ :		0.23 [0.14, 0.33]
Wu et. al. (2021)	10	48	H		0.21 [0.10, 0.34]
Robey et. al. (2021)	32	72	H		0.44 [0.33, 0.56]
Noel-Savina et. al. (2021)	33	72	H		0.46 [0.34, 0.57]
Mohr et. al. (2021)	5	10			0.50 [0.19, 0.81]
McGroder et. al. (2021)	33	76	H∎+I		0.43 [0.32, 0.55]
Martino et al. (2022)	7	59	1=1		0 12 [0 05, 0 22]
Liu et. al. (2021)	5	41			0.12 [0.04, 0.24]
Liao et. al. (2021)	63	256	- 💻 🗄		0.25 [0.20, 0.30]
Labarca et. al. (2021)	27	60			0.45 [0.33, 0.58]
Jutant et. al. (2022)	/2	1/1			0.42 [0.35, 0.50]
Huang et. al. (2021)	158	353			0.45 [0.40, 0.50]
Hu el. al. (2021)	0	18		1	
Campenni et. al. (2021)	21	31		-	
Daruss et al. (2021)	19	40 110			0.42 [0.26, 0.57]
Caruso et. al. (2021)	49	110			0.42 [0.33, 0.51]
RE Model for Late Follow-Up (Q = 143.87, df = 18, p ·	< .01; l ²	$= 88.1\%, \tau^2 = 0.0$	02)		0.37 [0.31, 0.45]
Test for Subaroup Differences: $Q_M = 3.86$, df = 1, p =	0.05				
······································					
			Гi		
			0	1	
			U	I	
			Proport	tion	

Figure S3: Forest Plot Proportion of GGOs at Any, Early, and Late Follow-up. Abbreviations: SWA,

subjects with abnormality; TS, total subjects; RE, random effects



Figure S4: Forest Plot Proportion of Reticulations at Any, Early, and Late Follow-up. Abbreviations:

SWA, subjects with abnormality; TS, total subjects; RE, random effects

Author(s) and Year	SWA TS	Proportion of	CT Abnormalities [95% CI]
Early follow-up (3 mo)			
Vijavakumar et. al. (2021)	41 73	i. ⊨=-1	0.56 [0.45, 0.67]
van den Borst et. al. (2020)	76 84		0.90 [0.83, 0.96]
Truffaut et al (2021)	19 22		0.86 [0.68, 0.98]
Skala et al. (2021)	48 102		0 47 [0 37 0 57]
Remy-lardin et al. (2021)	40 55	·	0 73 [0 60 0 84]
Mumoli et al. (2021)	51 77		
Minuter at (2021)	16 17		
1 upper et. al. (2021)	54 86		0.63 [0.52, 0.73]
$\begin{array}{c} \text{Luger et. al. (2022)} \\ \text{lobrson et. al. (2021)} \end{array}$	20 57		0.53 [0.02, 0.75]
Holdoworth at al. (2021)	30 57		
Holusworth et. al. (2022)	31 97		0.32 [0.23, 0.42]
	15 87		0.86 [0.78, 0.93]
Gonzalez et. al. (2021)	40 57		0.70 [0.58, 0.81]
	32 39		0.82 [0.68, 0.93]
Chen et. al. (2021)	17 41	F	0.41 [0.27, 0.57]
Cao et. al. (2021)	29 51	H ;- -1	0.57 [0.43, 0.70]
Balbi et. al. (2021)	74 91	■	0.81 [0.73, 0.89]
RE Model for Early Follow-Up (Q = 160.8	0, df = 15, p < .01; l ² = 90.2%, τ ² =	0.04)	0.68 [0.58, 0.77]
Late follow-up (>3 mo)			
Zhou et. al. (2021)	114 164	: .	0.70 [0.62, 0.76]
Zhao et. al. (2020)	67 94		0.71 [0.62, 0.80]
Zhang et. al. (2021)	12 40	⊢ 1	0.30 [0.17, 0.45]
Wu et. al. (2021)	22 83	}	0.27 [0.18, 0.37]
Wu et. al. (2021)	11 48	⊢	0.23 [0.12, 0.36]
Robey et. al. (2021)	47 72	 -=-	0.65 [0.54, 0.76]
Noel-Savina et al (2021)	50 72	i i i i i i i i i i i i i i i i i i i	0.69 [0.58, 0.80]
Mohr et al (2021)	6 10		0.60 [0.28, 0.89]
McGroder et al (2021)	45 76	· · · ·	0.59 [0.48, 0.70]
Liu et al (2021)	16 41	, . Herit	0.39 [0.25, 0.55]
Liao et al (2021)	96 256		0 38 [0 32 0 44]
Laberca et al. (2021)	37 60		
$\left[utant et al. (2022) \right]$	108 171		
Huang et al. (2021)	266 353		0.75 [0.30, 0.70]
Hu at al. (2021)	200 333		0.70 [0.71, 0.00]
Dri et al. (2021)	9 18		
Daret, al. (2021)	41 43		
Caruso et. al. (2021)	85 118		0.72 [0.64, 0.80]
Bardakci et. al. (2021)	39 60	<u> </u> -=-	0.65 [0.52, 0.77]
RE Model for Late Follow-Up (Q = 228.89	P , df = 17, p < .01; l ² = 93.0%, τ^2 =	0.04)	0.58 [0.49, 0.67]
RE Model for All Studies (Q = 398.07, df	= 33, p < .01; l ² = 92.3%, τ ² = 0.04) 🔶	0.63 [0.56, 0.69]
Test for Subgroup Differences: $Q_M = 2.28$	8, df = 1, p = 0.13		
		0 1	
		Proportion	

Figure S5 Forest Plot Proportion of CT-only Abnormalities at Any, Early, and Late Follow-up

Abbreviations: SWA, subjects with abnormality; TS, total subjects; RE, random effects

Author(s) and Year	SWA	TS		Proportion of Fibrosis [95% CI]
Early follow-up (3 mo)				
Vijayakumar et. al. (2021)	9	73	H=-1	0.12 [0.06, 0.21]
van den Borst et. al. (2020)	22	84	+∎-i	0.26 [0.17, 0.36]
Truffaut et. al. (2021)	19	22	⊢	0.86 [0.68, 0.98]
Skala et. al. (2021)	6	102		0.06 [0.02, 0.11]
Nabahati et. al. (2021)	90	173	H H H	0.52 [0.45, 0.59]
Mumoli et. al. (2021)	13	77	⊦∎⊣	0.17 [0.09, 0.26]
Holdsworth et. al. (2022)	4	97		0.04 [0.01, 0.09]
Hellemons et. al. (2021)	29	87	+=-1	0.33 [0.24, 0.44]
Gonzalez et. al. (2021)	12	57	+	0.21 [0.11, 0.33]
Froidure et. al. (2021)	22	107	HEH	0.21 [0.13, 0.29]
Frija-Masson et. al. (2021)	8	137		0.06 [0.02, 0.10]
RE Model for Early Follow-Up (Q = 206.0	07, df = 10, p < .01; l ²	= 96.1%	$(6, \tau^2 = 0.07) \bigstar$	0.23 [0.11, 0.38]
Late follow-up (>3 mo)				
Zhou et. al. (2021)	76	164	H	0.46 [0.39, 0.54]
Zhao et. al. (2020)	8	94	HE-1	0.09 [0.04, 0.15]
Robey et. al. (2021)	15	72	+=-1	0.21 [0.12, 0.31]
Muhammad et. al. (2022)	41	62	⊢1	0.66 [0.54, 0.77]
Liu et. al. (2021)	12	41	⊢ ⊷ ⊣	0.29 [0.16, 0.44]
Liao et. al. (2021)	26	256		0.10 [0.07, 0.14]
Labarca et. al. (2021)	8	60	⊢ ∎-1	0.13 [0.06, 0.23]
Jutant et. al. (2022)	33	171		0.19 [0.14, 0.26]
Gamberini et. al. (2021)	26	37	⊢ 1	0.70 [0.54, 0.84]
Caruso et. al. (2021)	85	118	H∎H	0.72 [0.64, 0.80]
RE Model for Late Follow-Up (Q = 282.3	6, df = 9, p < .01; l ² =	96.9%,	$\tau^2 = 0.07)$	0.34 [0.18, 0.51]
RE Model for All Studies (Q = 505.73, df Test for Subgroup Differences: $Q_M = 0.9$	= 20, p < .01; l ² = 96. 5, df = 1, p = 0.33	6%, τ ²	= 0.07)	0.28 [0.18, 0.39]
			г т	
			0 1	
			Proportion	

Figure S6 Forest Plot Proportion of Fibrosis at Any, Early, and Late Follow-up

Abbreviations: SWA, subjects with abnormality; TS, total subjects; RE, random effects

Author(s) and Year	SWA	N TS		Proportion of Bronchiectasis [95% CI]
Early follow-up (3 mo)				
Vijayakumar et. al. (2021)	5	73	Hel	0.07 [0.02, 0.14]
van den Borst et. al. (2020)	51	84	⊨= i	0.61 [0.50, 0.71]
Skala et. al. (2021)	12	102	HEH	0.12 [0.06, 0.19]
Nabahati et. al. (2021)	11	173		0.06 [0.03, 0.11]
Li et. al. (2021)	14	86	H=-1	0.16 [0.09, 0.25]
Hellemons et. al. (2021)	31	87	⊦≖⊣	0.36 [0.26, 0.46]
Gonzalez et. al. (2021)	41	57	⊢ ∎-1	0.72 [0.59, 0.83]
RE Model for Early Follow-Up (Q = 183.	70, df = 6, p < .01; l ² :	= 97.0%,	$\tau^2 = 0.09$)	0.27 [0.10, 0.49]
Late follow-up (>3 mo)				
Zhou et. al. (2021)	4	164		0.02 [0.01, 0.05]
Wu et. al. (2021)	1	83	•	0.01 [0.00, 0.05]
Wu et. al. (2021)	1	48	н	0.02 [0.00, 0.09]
Noel-Savina et. al. (2021)	17	72	┝━┥	0.24 [0.14, 0.34]
McGroder et. al. (2021)	21	76	+∎-1	0.28 [0.18, 0.38]
Martino et al. (2022)	4	59	H	0.07 [0.01, 0.15]
Liao et. al. (2021)	4	256		0.02 [0.00, 0.04]
Labarca et. al. (2021)	6	60	H=1	0.10 [0.03, 0.19]
Guler et. al. (2021)	20	52	⊢ ∎-1	0.38 [0.26, 0.52]
Gamberini et. al. (2021)	10	37	⊢ -	0.27 [0.14, 0.43]
Dai et. al. (2021)	3	45	H	0.07 [0.01, 0.16]
Caruso et. al. (2021)	29	118	HEH	0.25 [0.17, 0.33]
RE Model for Late Follow-Up (Q = 148.4	6, df = 11, p < .01; I ²	= 92.2%	$\tau^{2} = 0.03)$	0.12 [0.05, 0.20]
RE Model for All Studies (Q = 390.38 , df Test for Subgroup Differences: $Q_M = 2.8$	= 18, p < .01; l ² = 95 6, df = 1, p = 0.09	.5%, τ ²	= 0.06) 🔶	0.17 [0.09, 0.26]
			г <u>і</u>	1
			0	1
			Proportion	

Figure S7 Forest Plot Proportion of Bronchiectasis at Any, Early, and Late Follow-up Abbreviations:

SWA, subjects with abnormality; TS, total subjects; RE, random effects

Author(s) and Year	SWA	тs	Proportion of Consolidations [95% CI]
Early follow-up (3 mo)			
Vijayakumar et. al. (2021)	5	73 I II	0.07 [0.02, 0.14]
Truffaut et. al. (2021)	2	22 ⊢→	0.09 [0.00, 0.25]
Skala et. al. (2021)	2 1	02	0.02 [0.00, 0.06]
Miwa et. al. (2021)	6	17	0.35 [0.14, 0.60]
Luger et. al. (2022)	6	86 🛏	0.07 [0.02, 0.13]
Hellemons et. al. (2021)	13	87 म■+	0.15 [0.08, 0.23]
Gonzalez et. al. (2021)	9	57 H - -I	0.16 [0.07, 0.27]
Gianella et. al. (2021)	1	39 H	0.03 [0.00, 0.11]
Froidure et. al. (2021)	8 1	07	0.07 [0.03, 0.13]
Balbi et. al. (2021)	1	91 🔳	0.01 [0.00, 0.05]
RE Model for Early Follow-Up (Q = 35.2	2, df = 9, p < .01; l ² = 76	.6%, $\tau^2 = 0.01$) \blacklozenge	0.08 [0.04, 0.13]
Late follow-up (>3 mo)			
Zhao et. al. (2020)	2	94 🔳	0.02 [0.00, 0.06]
Zhang et. al. (2021)	0	40 H	0.00 [0.00, 0.04]
Martino et al. (2022)	7	59 H - -I	0.12 [0.05, 0.22]
Liu et. al. (2021)	4	41 ⊢	0.10 [0.02, 0.21]
Liao et. al. (2021)	8 2	256	0.03 [0.01, 0.06]
Labarca et. al. (2021)	1	60 H	0.02 [0.00, 0.07]
Jutant et. al. (2022)	10 1	71	0.06 [0.03, 0.10]
Huang et. al. (2021)	4 3	353	0.01 [0.00, 0.03]
Guler et. al. (2021)	15	52 —	н 0.29 [0.17, 0.42]
Gamberini et. al. (2021)	3	37 ⊢	0.08 [0.01, 0.20]
Dai et. al. (2021)	9	45 ⊢⊷⊣	0.20 [0.09, 0.33]
Caruso et. al. (2021)	2 1	18	0.02 [0.00, 0.05]
RE Model for Late Follow-Up (Q = 70.72	2, df = 11, p < .01; l ² = 88	$3.2\%, \tau^2 = 0.02)$ \blacklozenge	0.06 [0.02, 0.10]
RE Model for All Studies (Q = 114.54, df	f = 21, p < .01; l ² = 84.3%	%, τ ² = 0.02) ♦	0.06 [0.04, 0.10]
Test for Subgroup Differences: $Q_M = 0.5$	60, df = 1, p = 0.48		
		Γ	I
		0	1
		Pro	portion

Figure S8 Forest Plot Proportion of Consolidations at Any, Early, and Late Follow-up Abbreviations:

SWA, subjects with abnormality; TS, total subjects; RE, random effects



Figure S9. Funnel plots assessing publication bias of A) All Abnormalities across all modalities, B) CTonly abnormalities, and C) GGOs