Prevalence and clinical implications of abnormal body composition phenotypes in patients with COVID-19: a systematic review

Montes-Ibarra M, Orsso CE et al. Online supplementary material

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Supplementary Table 1. Search strategy

1. MEDLINE (via OVID)
Search date: October 10, 2021
Search results: 2111

1 [Concept 1 BODY COMPOSITION]	**0**
2 exp Body Composition/	59099
3 body composition.mp.	63271
4 exp Muscle, Skeletal/	283145
5 exp Muscles/	706582
6 (musc* or fat-free mass or phase angle).mp.	1167411
7 (lean adj3 (tissue* or mass*)).mp.	16977
8 (musc* adj3 (radiodensit* or attenuation* or densit* or intensit* or echointensit* or echogenicit* or quality)).mp.	7948
9 exp Adipose Tissue/	103709
10 exp Adiposity/	13871
11 (adipos* or body fat*).mp.	187794
12 (fat adj3 (mass or percent* or visceral or subcutaneous)).mp.	63147
13 exp Sarcopenia/	6192
14 (sarcopen* or musc* weakness or musc* atrophy).mp.	58740
15 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14	1543159
16 ("coronavirus disease 2019" or 2019-ncov or ncov19 or ncov-19 or 2019-novel CoV or severe acute respiratory syndrome coronavirus 2 or sars-cov2 or sars-cov-2 or sarscov2 or sarscov-2 or Sars-coronavirus2 or Sars-coronavirus-2 or SARS-like coronavirus* or coronavirus-19 or covid19 or covid-19 or "covid 2019" or "B.1.1.7" or "B.1.351" or "B.1.617.1" or "B.1.617.2" or (variant* adj2 (India* or "South Africa*" or UK or English or Brazil* or alpha or beta or delta or gamma or kappa or lambda or "P.1" or "C.37")) or ((novel or new or nouveau) adj2 (CoV or nCoV or coronavirus* or corona virus))).mp.	187861
17 coronavirus disease 2019/ or (((pneumonia or covid* or coronavirus* or corona virus* or ncov* or 2019-ncov or sars*).mp. or exp pneumonia/) and Wuhan.mp.)	111586
18 (exp Coronavirus/ or exp Coronavirus Infections/ or (coronavirus* or corona virus* or OC43 or NL63 or 229E or HKU1 or HCoV* or ncov* or covid* or sars-cov* or sarscov* or Sars-coronavirus* or Severe Acute Respiratory Syndrome Coronavirus* or D614G).mp.) not (SARS or SARS-CoV or MERS or MERS-CoV or Middle East respiratory syndrome or camel* or dromedar* or equine or coronary or coronal or covidence* or covidien or influenza virus or HIV or bovine or calves or TGEV or feline or porcine or BCoV or PED or PEDV or PDCoV or FIPV or FCoV or SADS-CoV or canine or CCov or zoonotic or avian influenza or H1N1 or H5N1 or H5N6 or IBV or murine corona*).mp.	73061
19 or/16-18	195385
20 limit 19 to yr="2019 -Current"	185715

21	15 and 20	2165
22	animals/	6930616
23	humans/	19739191
24	22 not (22 and 23)	4859794
25	(veterinary or rabbit or rabbits or animal or animals or mouse or mice or rodent or rodents or rat or rats or hamster* or pig or pigs or porcine or horse* or equine or cow or cows or bovine or goat or goats or sheep or ovine or canine or dog or dogs or feline or cat or cats or zebrafish).ti.	2293373
26	24 or 25	5301898
27	21 not 26	2133
28	limit 27 to english language	2111

2. EMBASE
Search date: October 10, 2021
Search results: 1121

1 [Concept 1 BODY COMPOSITION]	**0**
2 exp Body Composition/	110873
3 body composition.ti,ab.	54169
4 exp Muscle, Skeletal/	367681
5 exp Muscles/	782201
6 (musc* or fat-free mass or phase angle).mp.	1931672
7 (lean adj3 (tissue* or mass*)).mp.	24633
8 (musc* adj3 (radiodensit* or attenuation* or densit* or intensit* or echointensit* or echogenicit* or quality)).mp.	10554
9 exp Adipose Tissue/	176537
10 exp Adiposity/	568100
11 (adipos* or body fat*).mp.	240395
12 (fat adj3 (mass or percent* or visceral or subcutaneous)).mp.	99203
13 exp Sarcopenia/	14098
14 (sarcopen* or musc* weakness or musc* atrophy).mp.	122229
15 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14	2717821
16 ((exp Coronavirus/ or exp Coronavirus Infections/ or (coronavirus* or corona virus* or OC43 or NL63 or 229E or HKU1 or HCoV* or ncov* or covid* or sars-cov* or sarscov* or Sars-coronavirus* or Severe Acute Respiratory Syndrome Coronavirus* or D614G).mp.) not (SARS or SARS-CoV or MERS or MERS-CoV or Middle East respiratory syndrome or camel* or dromedar* or equine or coronary or coronal or covidence* or covidien or influenza virus or HIV or bovine or calves or TGEV or feline or porcine or BCoV or PED or PEDV or PDCoV or FIPV or FCoV or SADS-CoV or canine or CCov or zoonotic or avian influenza or H1N1 or H5N1 or H5N6 or IBV or murine corona*).mp.) or coronavirus disease 2019/ or (((pneumonia or covid* or coronavirus* or corona virus* or ncov* or 2019-ncov or sars*).mp. or exp pneumonia/) and Wuhan.mp.) or ("coronavirus disease 2019" or 2019-ncov or ncov19 or ncov-19 or 2019-novel CoV or severe acute respiratory syndrome coronavirus 2 or sars-cov2 or sars-cov-2 or sarscov2 or sarscov-2 or Sars-coronavirus2 or Sars-coronavirus-2 or SARS-like coronavirus* or coronavirus-19 or covid19 or covid-19 or "covid 2019" or "B.1.1.7" or "B.1.351" or "B.1.617.1" or "B.1.617.2" or (variant* adj2 (India* or "South Africa*" or UK or English or Brazil* or alpha or beta or delta or gamma or kappa or lambda or "P.1"	207649

or "C.37")) or ((novel or new or nouveau) adj2 (CoV or nCoV or coronavirus* or corona virus))).mp.	
17 15 and 16	9890
18 limit 17 to (human and english language and exclude medline journals and yr="2019 -Current" and article)	1121

3. CINAHL
Search date: October 10, 2021
Search results: 279

#	Query	Results
S18	(S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13) AND (S14 OR S15 OR S16 OR S17)	279
S17	(covid or 2019-ncov or ncov19 or ncov-19 or 2019-novel CoV or sars-cov2 or sars-cov-2 or sarscov2 or sarscov-2 or Sars-coronavirus2 or Sars-coronavirus-2 or SARS-like coronavirus* or coronavirus-19	68,748
S16	(MH "COVID-19") OR (MH "COVID-19 Pandemic") OR (MH "SARS-CoV-2")	35,445
S15	(((MH "Coronavirus+") OR (MH "Coronavirus Infections+") or (coronavirus* or corona virus* or OC43 or NL63 or 229E or HKU1 or HCoV* or ncov* or covid* or sars-cov* or sarscov* or Sars-coronavirus* or Severe Acute Respiratory Syndrome Coronavirus*)) NOT ((SARS or SARS-CoV or MERS or MERS-CoV or Middle East respiratory syndrome or camel* or dromedar* or equine or coronary or coronal or covidence* or covidien or influenza virus or HIV or bovine or calves or TGEV or feline or porcine or BCoV or PED or PEDV or PDCoV or FIPV or FCoV or SADS-CoV or canine or CCov or zoonotic or avian influenza or H1N1 or H5N1 or H5N6 or IBV or murine corona*))	68,094
S14	"[Concept 2 COVID-19]"	17
S13	(sarcopen* OR "musc* weakness" OR "musc* atrophy")	16,934
S12	(MH Sarcopenia+)	2,836
S11	(fat N3 (mass OR percent* OR visceral OR subcutaneous))	18,343
S10	(adipos* OR "body fat*")	39,158
S9	(MH "Adiposity+")	17
S8	(MH "Adipose Tissue+")	28,628
S7	(musc* N3(radiodensit* OR attenuation* OR densit* OR intensit* OR echointensit* OR echogenicit* OR quality))	3,060
S6	(lean N3 (tissue* OR mass*))	5,188
S5	(MH Muscles+)	87,895
S4	(MH "Muscle+")	616
S3	"body composition"	23,968
S2	(MH "Body Composition+")	1,073
S1	"[Concept 1 BODY COMPOSITION]"	27,176

4. SCOPUS

Search date: October 10, 2021

Search results: 1923

((TITLE-ABS-KEY (((coronavirus* OR "corona virus*" OR ncov* OR 2019-ncov OR sars*)))) OR (TITLE-ABS-KEY (("covid 2019" OR pandemic*)))) AND ((TITLE-ABS-KEY ((musc* OR "fat free mass*" OR "phase angle*" OR "lean tissue*" OR "lean mass*"))) OR (TITLE-ABS-KEY ((sarcopen* OR "muscle strength*" OR ("muscle weakness*" OR "muscle mass*" OR "muscle quality*" OR "muscle echo intensity*" OR "body composition*")))) OR (TITLE-ABS-KEY (((adipos* OR "body fat*" OR "adipose tissue*" OR "visceral adiposity*" OR "subcutaneous adiposity*"))))) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (PUBYEAR , 2021) OR LIMIT-TO (PUBYEAR , 2020) OR LIMIT-TO (PUBYEAR , 2019)) AND (LIMIT-TO (LANGUAGE , "English")) AND (LIMIT-TO (EXACTKEYWORD , "adipose tissue") OR LIMIT-TO (EXACTKEYWORD , "Coronavirus Disease 2019") OR LIMIT-TO (EXACTKEYWORD , "COVID-19") OR LIMIT-TO (EXACTKEYWORD , "muscle loss") OR LIMIT-TO (EXACTKEYWORD , "visceral fat"))	**1923**

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1. MEDLINE (via OVID)

Search date: March 3, 2022

New search results: 550

1 [Concept 1 BODY COMPOSITION]	**0**
2 exp Body Composition/	60809
3 body composition.mp.	64832
4 exp Muscle, Skeletal/	289262
5 exp Muscles/	717286
6 (musc* or fat-free mass or phase angle).mp.	1186582
7 (lean adj3 (tissue* or mass*)).mp.	17397
8 (musc* adj3 (radiodensit* or attenuation* or densit* or intensit* or echointensit* or echogenicit* or quality)).mp.	8300
9 exp Adipose Tissue/	106251
10 exp Adiposity/	14493
11 (adipos* or body fat*).mp.	192239
12 (fat adj3 (mass or percent* or visceral or subcutaneous)).mp.	64808
13 exp Sarcopenia/	7044
14 (sarcopen* or musc* weakness or musc* atrophy).mp.	60933
15 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14	1570330
16 ("coronavirus disease 2019" or 2019-ncov or ncov19 or ncov-19 or 2019-novel CoV or severe acute respiratory syndrome coronavirus 2 or sars-cov2 or sars-cov-2 or sarscov2 or sarscov-2 or Sars-coronavirus2 or Sars-coronavirus-2 or SARS-like coronavirus* or coronavirus-19 or covid19 or covid-19 or "covid 2019" or "B.1.1.7" or "B.1.351" or "B.1.617.1" or "B.1.617.2" or (variant* adj2 (India* or "South Africa*" or UK or English or Brazil* or alpha or beta or delta or gamma or kappa or lambda or "P.1" or "C.37")) or ((novel or new or nouveau) adj2 (CoV or nCoV or coronavirus* or corona virus))).mp.	235772
17 coronavirus disease 2019/ or (((pneumonia or covid* or coronavirus* or corona virus* or ncov* or 2019-ncov or sars*).mp. or exp pneumonia/) and Wuhan.mp.)	145628
18 (exp Coronavirus/ or exp Coronavirus Infections/ or (coronavirus* or corona virus* or OC43 or NL63 or 229E or HKU1 or HCoV* or ncov* or covid* or sars-cov* or sarscov* or Sars-coronavirus* or Severe Acute Respiratory Syndrome Coronavirus* or D614G).mp.) not (SARS or SARS-CoV or MERS or MERS-CoV or Middle East respiratory syndrome or camel* or dromedar* or equine or coronary or coronal or covidence* or covidien or influenza virus or HIV or bovine or calves or TGEV or feline or porcine or BCoV or PED or PEDV or PDCoV or	85942

FIPV or FCoV or SADS-CoV or canine or CCov or zoonotic or avian influenza or H1N1 or H5N1 or H5N6 or IBV or murine corona*).mp.		
19	or/16-18	243671
20	limit 19 to yr="2019 -Current"	233993
21	15 and 20	2859
22	animals/	7050694
23	humans/	20217359
24	22 not (22 and 23)	4932425
25	(veterinary or rabbit or rabbits or animal or animals or mouse or mice or rodent or rodents or rat or rats or hamster* or pig or pigs or porcine or horse* or equine or cow or cows or bovine or goat or goats or sheep or ovine or canine or dog or dogs or feline or cat or cats or zebrafish).ti.	2318185
26	24 or 25	5375703
27	21 not 26	810
28	limit 27 to english language	550

2. EMBASE

Search date: March 3, 2022

Search results: 703

1 [Concept 1 BODY COMPOSITION]	**0**
2 exp Body Composition/	113861
3 body composition.ti,ab.	55786
4 exp Muscle, Skeletal/	376427
5 exp Muscles/	798005
6 (musc* or fat-free mass or phase angle).mp.	1970304
7 (lean adj3 (tissue* or mass*)).mp.	25210
8 (musc* adj3 (radiodensit* or attenuation* or densit* or intensit* or echointensit* or echogenicit* or quality)).mp.	10974
9 exp Adipose Tissue/	180927
10 exp Adiposity/	584785
11 (adipos* or body fat*).mp.	246512
12 (fat adj3 (mass or percent* or visceral or subcutaneous)).mp.	102086
13 exp Sarcopenia/	15404
14 (sarcopen* or musc* weakness or musc* atrophy).mp.	126582
15 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14	2777949
16 ((exp Coronavirus/ or exp Coronavirus Infections/ or (coronavirus* or corona virus* or OC43 or NL63 or 229E or HKU1 or HCoV* or ncov* or covid* or sars-cov* or sarscov* or Sars-coronavirus* or Severe Acute Respiratory Syndrome Coronavirus* or D614G).mp.) not (SARS or SARS-CoV or MERS or MERS-CoV or Middle East respiratory syndrome or camel* or dromedar* or equine or coronary or coronal or covidence* or covidien or influenza virus or HIV or bovine or calves or TGEV or feline or porcine or BCoV or PED or PEDV or PDCoV or FIPV or FCoV or SADS-CoV or canine or CCov or zoonotic or avian influenza or H1N1 or H5N1 or H5N6 or IBV or murine corona*).mp.) or coronavirus disease 2019/ or (((pneumonia or covid* or coronavirus* or corona virus* or ncov* or 2019-ncov or sars*).mp. or exp pneumonia/) and Wuhan.mp.) or ("coronavirus disease 2019" or 2019-ncov or ncov19 or ncov-19 or 2019-novel CoV or severe acute respiratory syndrome coronavirus 2 or sars-cov2 or sars-cov-2 or sarscov2 or sarscov-2 or Sars-coronavirus2 or Sars-coronavirus-2 or SARS-like coronavirus* or coronavirus-19 or covid19 or covid-19 or "covid 2019" or "B.1.1.7" or "B.1.351" or "B.1.617.1" or "B.1.617.2" or (variant* adj2 (India* or "South Africa*" or UK or English or Brazil* or alpha or beta or delta or gamma or kappa or lambda or "P.1"	269361

or "C.37")) or ((novel or new or nouveau) adj2 (CoV or nCoV or coronavirus* or corona virus))).mp.	
17 15 and 16	13821
18 limit 17 to (human and english language and exclude medline journals and yr="2019 -Current" and article)	703

3. CINAHL

Search date: March 3, 2022

Search results: 178

#	Query	Results
S18	(S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13) AND (S14 OR S15 OR S16 OR S17)	178
S17	(covid or 2019-ncov or ncov19 or ncov-19 or 2019-novel CoV or sars-cov2 or sars-cov-2 or sarscov2 or sarscov-2 or Sars-coronavirus2 or Sars-coronavirus-2 or SARS-like coronavirus* or coronavirus-19	87,439
S16	(MH "COVID-19") OR (MH "COVID-19 Pandemic") OR (MH "SARS-CoV-2")	51,746
S15	(((MH "Coronavirus+") OR (MH "Coronavirus Infections+") or (coronavirus* or corona virus* or OC43 or NL63 or 229E or HKU1 or HCoV* or ncov* or covid* or sars-cov* or sarscov* or Sars-coronavirus* or Severe Acute Respiratory Syndrome Coronavirus*)) NOT ((SARS or SARS-CoV or MERS or MERS-CoV or Middle East respiratory syndrome or camel* or dromedar* or equine or coronary or coronal or covidence* or covidien or influenza virus or HIV or bovine or calves or TGEV or feline or porcine or BCoV or PED or PEDV or PDCoV or FIPV or FCoV or SADS-CoV or canine or CCov or zoonotic or avian influenza or H1N1 or H5N1 or H5N6 or IBV or murine corona*))	85,783
S14	"[Concept 2 COVID-19]"	571
S13	(sarcopen* OR "musc* weakness" OR "musc* atrophy")	17,719
S12	(MH Sarcopenia+)	3,168
S11	(fat N3 (mass OR percent* OR visceral OR subcutaneous))	19,124
S10	(adipos* OR "body fat*")	40,435
S9	(MH "Adiposity+")	19
S8	(MH "Adipose Tissue+")	29,530
S7	(musc* N3(radiodensit* OR attenuation* OR densit* OR intensit* OR echointensit* OR echogenicit* OR quality)	3,226
S6	(lean N3 (tissue* OR mass*))	5,419
S5	(MH Muscles+)	90,573
S4	(MH "Muscle+")	633
S3	"body composition"	24,651
S2	(MH "Body Composition+")	1,107
S1	"[Concept 1 BODY COMPOSITION]"	28,030

4. SCOPUS

Search date: March 3, 2022

Search results: 115

((TITLE-ABS-KEY (((coronavirus* OR "corona virus*" OR ncov* OR 2019-ncov OR sars*)))) OR (TITLE-ABS-KEY (("covid 2019" OR pandemic*)))) AND ((TITLE-ABS-KEY ((musc* OR "fat free mass*" OR "phase angle*" OR "lean tissue*" OR "lean mass*"))) OR (TITLE-ABS-KEY ((sarcopen* OR "muscle strength*" OR ("muscle weakness*" OR "muscle mass*" OR "muscle quality*" OR "muscle echo intensity*" OR "body composition*")))) OR (TITLE-ABS-KEY (((adipos* OR "body fat*" OR "adipose tissue*" OR "visceral adiposity*" OR "subcutaneous adiposity*"))))) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (PUBYEAR , 2022) OR (LIMIT-TO (PUBYEAR , 2021) OR LIMIT-TO (PUBYEAR , 2020) OR LIMIT-TO (PUBYEAR , 2019)) AND (LIMIT-TO (LANGUAGE , "English")) AND (LIMIT-TO (EXACTKEYWORD , "adipose tissue") OR LIMIT-TO (EXACTKEYWORD , "Coronavirus Disease 2019") OR LIMIT-TO (EXACTKEYWORD , "COVID-19") OR LIMIT-TO (EXACTKEYWORD , "muscle loss") OR LIMIT-TO (EXACTKEYWORD , "visceral fat"))	**115**

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1. MEDLINE (via OVID)

Search date: September 26, 2022

New search results: 3732

1 [Concept 1 BODY COMPOSITION]	**0**
2 exp Body Composition/	62311
3 body composition.mp.	67138
4 exp Muscle, Skeletal/	296172
5 exp Muscles/	728760
6 (musc* or fat-free mass or phase angle).mp.	1214794
7 (lean adj3 (tissue* or mass*)).mp.	18071
8 (musc* adj3 (radiodensit* or attenuation* or densit* or intensit* or echointensit* or echogenicit* or quality)).mp.	8817
9 exp Adipose Tissue/	108751
10 exp Adiposity/	14969
11 (adipos* or body fat*).mp.	14969
12 (fat adj3 (mass or percent* or visceral or subcutaneous)).mp.	67365
13 exp Sarcopenia/	8059
14 (sarcopen* or musc* weakness or musc* atrophy).mp.	64183
15 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14	1608850
16 ("coronavirus disease 2019" or 2019-ncov or ncov19 or ncov-19 or 2019-novel CoV or severe acute respiratory syndrome coronavirus 2 or sars-cov2 or sars-cov-2 or sarscov2 or sarscov-2 or Sars-coronavirus2 or Sars-coronavirus-2 or SARS-like coronavirus* or coronavirus-19 or covid19 or covid-19 or "covid 2019" or "B.1.1.7" or "B.1.351" or "B.1.617.1" or "B.1.617.2" or (variant* adj2 (India* or "South Africa*" or UK or English or Brazil* or alpha or beta or delta or gamma or kappa or lambda or "P.1" or "C.37")) or ((novel or new or nouveau) adj2 (CoV or nCoV or coronavirus* or corona virus))).mp.	304223
17 coronavirus disease 2019/ or (((pneumonia or covid* or coronavirus* or corona virus* or ncov* or 2019-ncov or sars*).mp. or exp pneumonia/) and Wuhan.mp.)	193052
18 (exp Coronavirus/ or exp Coronavirus Infections/ or (coronavirus* or corona virus* or OC43 or NL63 or 229E or HKU1 or HCoV* or ncov* or covid* or sars-cov* or sarscov* or Sars-coronavirus* or Severe Acute Respiratory Syndrome Coronavirus* or D614G).mp.) not (SARS or SARS-CoV or MERS or MERS-CoV or Middle East respiratory syndrome or camel* or dromedar* or equine or coronary or coronal or covidence* or covidien or influenza virus or HIV or bovine or calves or TGEV or feline or porcine or BCoV or PED or PEDV or PDCoV or	122487

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FIPV or FCoV or SADS-CoV or canine or CCov or zoonotic or avian influenza or H1N1 or H5N1 or H5N6 or IBV or murine corona*).mp.		
19	or/16-18	312707
20	limit 19 to yr="2019 -Current"	303017
21	15 and 20	3933
22	animals/	7178121
23	humans/	20792633
24	22 not (22 and 23)	5019234
25	(veterinary or rabbit or rabbits or animal or animals or mouse or mice or rodent or rodents or rat or rats or hamster* or pig or pigs or porcine or horse* or equine or cow or cows or bovine or goat or goats or sheep or ovine or canine or dog or dogs or feline or cat or cats or zebrafish).ti.	2356111
26	24 or 25	5474948
27	21 not 26	3868
28	limit 27 to english language	3732

2. EMBASE

Search date: September 26, 2022

Search results: 2572

1 [Concept 1 BODY COMPOSITION]	**0**
2 exp Body Composition/	118449
3 body composition.ti,ab.	58208
4 exp Muscle, Skeletal/	391119
5 exp Muscles/	824707
6 (musc* or fat-free mass or phase angle).mp.	2031444
7 (lean adj3 (tissue* or mass*)).mp.	26066
8 (musc* adj3 (radiodensit* or attenuation* or densit* or intensit* or echointensit* or echogenicit* or quality)).mp.	11654
9 exp Adipose Tissue/	188516
10 exp Adiposity/	611049
11 (adipos* or body fat*).mp.	256362
12 (fat adj3 (mass or percent* or visceral or subcutaneous)).mp.	106355
13 exp Sarcopenia/	17280
14 (sarcopen* or musc* weakness or musc* atrophy).mp.	133355
15 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14	2873144
16 ((exp Coronavirus/ or exp Coronavirus Infections/ or (coronavirus* or corona virus* or OC43 or NL63 or 229E or HKU1 or HCoV* or ncov* or covid* or sars-cov* or sarscov* or Sars-coronavirus* or Severe Acute Respiratory Syndrome Coronavirus* or D614G).mp.) not (SARS or SARS-CoV or MERS or MERS-CoV or Middle East respiratory syndrome or camel* or dromedar* or equine or coronary or coronal or covidence* or covidien or influenza virus or HIV or bovine or calves or TGEV or feline or porcine or BCoV or PED or PEDV or PDCoV or FIPV or FCoV or SADS-CoV or canine or CCov or zoonotic or avian influenza or H1N1 or H5N1 or H5N6 or IBV or murine corona*).mp.) or coronavirus disease 2019/ or (((pneumonia or covid* or coronavirus* or corona virus* or ncov* or 2019-ncov or sars*).mp. or exp pneumonia/) and Wuhan.mp.) or ("coronavirus disease 2019" or 2019-ncov or ncov19 or ncov-19 or 2019-novel CoV or severe acute respiratory syndrome coronavirus 2 or sars-cov2 or sars-cov-2 or sarscov2 or sarscov-2 or Sars-coronavirus2 or Sars-coronavirus-2 or SARS-like coronavirus* or coronavirus-19 or covid19 or covid-19 or "covid 2019" or "B.1.1.7" or "B.1.351" or "B.1.617.1" or "B.1.617.2" or (variant* adj2 (India* or "South Africa*" or UK or English or Brazil* or alpha or beta or delta or gamma or kappa or lambda or "P.1"	355506

or "C.37")) or ((novel or new or nouveau) adj2 (CoV or nCoV or coronavirus* or corona virus))).mp.	
17 15 and 16	19172
18 limit 17 to (human and english language and exclude medline journals and yr="2019 -Current" and article)	2572

3. CINAHL

Search date: September 26, 2022

Search results: 504

#	Query	Results
S18	(S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13) AND (S14 OR S15 OR S16 OR S17)	504
S17	(covid or 2019-ncov or ncov19 or ncov-19 or 2019-novel CoV or sars-cov2 or sars-cov-2 or sarscov2 or sarscov-2 or Sars-coronavirus2 or Sars-coronavirus-2 or SARS-like coronavirus* or coronavirus-19	111,617
S16	(MH "COVID-19") OR (MH "COVID-19 Pandemic") OR (MH "SARS-CoV-2")	64,762
S15	(((MH "Coronavirus+") OR (MH "Coronavirus Infections+") or (coronavirus* or corona virus* or OC43 or NL63 or 229E or HKU1 or HCoV* or ncov* or covid* or sars-cov* or sarscov* or Sars-coronavirus* or Severe Acute Respiratory Syndrome Coronavirus*)) NOT ((SARS or SARS-CoV or MERS or MERS-CoV or Middle East respiratory syndrome or camel* or dromedar* or equine or coronary or coronal or covidence* or covidien or influenza virus or HIV or bovine or calves or TGEV or feline or porcine or BCoV or PED or PEDV or PDCoV or FIPV or FCoV or SADS-CoV or canine or CCov or zoonotic or avian influenza or H1N1 or H5N1 or H5N6 or IBV or murine corona*))	108,979
S14	"[Concept 2 COVID-19]"	678
S13	(sarcopen* OR "musc* weakness" OR "musc* atrophy")	18,752
S12	(MH Sarcopenia+)	3,597
S11	(fat N3 (mass OR percent* OR visceral OR subcutaneous))	19,662
S10	(adipos* OR "body fat*")	41,660
S9	(MH "Adiposity+")	19
S8	(MH "Adipose Tissue+")	30,411
S7	(musc* N3(radiodensit* OR attenuation* OR densit* OR intensit* OR echointensit* OR echogenicit* OR quality)	3,414
S6	(lean N3 (tissue* OR mass*))	5,510
S5	(MH Muscles+)	93,046
S4	(MH "Muscle+")	636
S3	"body composition"	25312
S2	(MH "Body Composition+")	1,112
S1	"[Concept 1 BODY COMPOSITION]"	28,030

4. SCOPUS

Search date: September 26, 2022

Search results: 814

((TITLE-ABS-KEY (((coronavirus* OR "corona virus*" OR ncov* OR 2019-ncov OR sars*)))) OR (TITLE-ABS-KEY (("covid 2019" OR pandemic*)))) AND ((TITLE-ABS-KEY ((musc* OR "fat free mass*" OR "phase angle*" OR "lean tissue*" OR "lean mass*"))) OR (TITLE-ABS-KEY ((sarcopen* OR "muscle strength*" OR ("muscle weakness*" OR "muscle mass*" OR "muscle quality*" OR "muscle echo intensity*" OR "body composition*")))) OR (TITLE-ABS-KEY (((adipos* OR "body fat*" OR "adipose tissue*" OR "visceral adiposity*" OR "subcutaneous adiposity*"))))) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (PUBYEAR , 2022) OR (LIMIT-TO (PUBYEAR , 2021) OR LIMIT-TO (PUBYEAR , 2020) OR LIMIT-TO (PUBYEAR , 2019)) AND (LIMIT-TO (LANGUAGE , "English")) AND (LIMIT-TO (EXACTKEYWORD , "adipose tissue") OR LIMIT-TO (EXACTKEYWORD , "Coronavirus Disease 2019") OR LIMIT-TO (EXACTKEYWORD , "COVID-19") OR LIMIT-TO (EXACTKEYWORD , "muscle loss") OR LIMIT-TO (EXACTKEYWORD , "visceral fat"))	**814**

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Supplementary Table 2. Pre-print summary search

Reviewer	File	Original search date	Title	Preprint platform	Meet eligibility criteria?	Published online?
CEO	OVID MEDLINE 2082	Oct-21	SARS-CoV-2 Spike Protein Regulation of Angiotensin Converting Enzyme 2 and Tissue Renin-Angiotensin Systems:	bioRxiv	No, exclude	
CEO	OVID MEDLINE 2082	Oct-21	An Autoantigen Atlas from Human Lung HFL1 Cells Offers Clues to Neurological and Diverse Autoimmune	bioRxiv	No, exclude	
CEO	OVID MEDLINE 2082	Oct-21	Hyperglycemia in Acute COVID-19 is Characterized by Adipose Tissue Dysfunction and Insulin Resistance.	medRxiv	No, exclude	
CEO	OVID MEDLINE 2082	Oct-21	Non-alcoholic fatty liver disease (NAFLD) and risk of hospitalization for Covid-19.	medRxiv	No, exclude	
CEO	OVID MEDLINE 2082	Oct-21	ACE2 expression in adipose tissue is associated with COVID-19 cardio-metabolic risk factors and cell type	medRxiv	No, exclude	
CEO	OVID MEDLINE 2082	Oct-21	Single-cell Transcriptome Analysis Indicates New Potential Regulation Mechanism of ACE2 and NPs signaling	medRxiv	No, exclude	
MM	OVID MEDLINE 3 MARCH	Mar-22	SARS-CoV-2 infection of human iPSC-derived cardiac	bioRxiv	No, exclude	

Reviewer	File	Original search date	Title	Preprint platform	Meet eligibility criteria?	Published online?
			cells reflects cytopathic features in hearts of patients with COVID-19.			
MM	OVID MEDLINE 3 MARCH	Mar-22	SARS-CoV-2 spike protein-mediated cell signaling in lung vascular cells.	bioRxiv	No, exclude	
MM	EMABSE 3 march	Mar-22	Causal associations between body fat accumulation and COVID-19 severity: A Mendelian randomization study	medRxiv	Yes, include	Yes. Included in our extraction table
MM	EMABSE 3 march	Mar-22	Epicardial adipose tissue thickness is associated with increased COVID-19 severity and mortality	medRxiv	No, exclude	

Inclusion criteria: Records with keywords related to preprint publications must not be linked to a published manuscript. Records must not contain keywords related to preprint publications in the abstract field, meaning that the record was a systematic review that included manuscripts in preprint.

Keywords: AAS Open Research, arXiv, bioRxiv, FocUS Archive, JMIR Preprints, medRxiv, MetaArXiv, NutriXiv, OSF Preprints, PeerJ Preprints, Preprint, Preprints with The Lancet, Preprints.org, Research Square, ResearchGate, SciELO Preprints, SportRxiv, SSRN, Surgery Open Science

Source: https://bmjopen.bmj.com/content/10/12/e041849#DC2

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	Search files (March 2022) Reviewer 1			
Preprint platforms	**Scopus 3 march**	**OVID MEDLINE 3 march**	**EMBASE 3 march**	**CINHAL 3 march**
AAS Open Research	No results	No results	No results	No results
arXiv	No results	No results	No results	No results
bioRxiv	No results	2 result	No results	No results
FocUS Archive	No results	No results	No results	No results
JMIR Preprints	No results	No results	No results	No results
medRxiv	No results	No results	2 results	No results
MetaArXiv	No results	No results	No results	No results
NutriXiv	No results	No results	No results	No results
OSF Preprints	No results	No results	No results	No results
PeerJ Preprints	No results	No results	No results	No results
Preprint	No results	No additional results to medRxiv	No results	No results
Preprints with The Lancet	No results	No results	No results	No results
Preprints.org	No results	No results	No results	No results
Research Square	No results	No results	No results	No results
ResearchGate	No results	No results	No results	No results
SciELO Preprints	No results	No results	No results	No results
SportRxiv	No results	No results	No results	No results
SSRN	No results	No results	No results	No results
Surgery Open Science	No results	No results	No results	No results

	Search files (October 2021) Reviewer 2			
Preprint platforms	**Scopus 1887**	**OVID MEDLINE 2082**	**EMBASE 1110**	**CINHAL 279**
AAS Open Research	No results	No results	No results	No results
arXiv	No results	No results	No results	No results
bioRxiv	No results	2 results	No results	No results
FocUS Archive	No results	No results	No results	No results
JMIR Preprints	No results	No results	No results	No results
medRxiv	No results	4 results	No results	No results
MetaArXiv	No results	No results	No results	No results
NutriXiv	No results	No results	No results	No results
OSF Preprints	No results	No results	No results	No results
PeerJ Preprints	No results	No results	No results	No results
Preprint	No results	No additional results to medRxiv	No results	No results
Preprints with The Lancet	No results	No results	No results	No results
Preprints.org	No results	No results	No results	No results
Research Square	No results	No results	No results	No results
ResearchGate	No results	No results	No results	No results
SciELO Preprints	No results	No results	No results	No results
SportRxiv	No results	No results	No results	No results
SSRN	No results	No results	No results	No results
Surgery Open Science	No results	No results	No results	No results

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Supplementary Table 3. Quality assessment Newcastle-Ottawa Scale
Cross- sectional studies. Adapted from case-control studies scale

Selection	
1 Definition adequate	a) Yes, with independent validation. *e.g., >1 person/record to extract information, or reference to primary record source such as CT images or medical records) (*1*)* b) Yes, e.g., electronic records or based on self-reports with no reference to primary record (0*) c) No description (0*)
2 Representativeness of the cases	a) Consecutive or obviously representative series of cases. *e.g., Include all eligible COVID patients with body composition outcome (*1*)* b) Potential for selection biases or not stated *e.g., not stated inclusion* (0*)
3 Selection of Controls	a) Community controls same community as cases *(*1*)* b) Hospital controls *within same community as cases but derived from a hospitalized population* (0*) c) No description (0*)
4 Definition of Controls	a) No history of disease (endpoint) It must explicitly state that controls (healthy) have no history of this outcome. If in the study are not healthy controls, we can compare with different severity groups such as hospital ward, MV or outpatients *(*1*)* b) No description of source No mention of history of outcome (0*)
Comparability	
1 On the basis of the design or analysis	a) Study controls for: *for age or sex (principal factor) (1*)* b) Study controls for additional factor: *e.g., SOFA scores, disease degree (1*)*
Exposure	
1 Ascertainment of exposure	a) Secure record *E.g., CT images retrieved from electronic records. C*hoose this one if it is a body composition related outcome e.g., sarcopenia (1*) b) Structured interview where blind to case/control status (1*) c) Interview not blinded to case/control status (0*) d) Written self-report or medical record only Choose this one if it is an *outcome related to disease severity or clinical outcome* (0*) e) No description (0*)
2 Same method of ascertainment for cases and controls	a) Yes, *e.g., both CT images were extracted from medical records* (1*) b) No (0*)
3 Non-Response rate	a) Same rate for both groups *e.g., All participants had a CT image at the beginning of the study (1*)* b) Non respondents described (0*) c) Rate different and no designation (0*)

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Cohort studies

Selection	
1 Representativeness of the exposed cohort	a) Truly representative: *Clear diagnosis with a PCR test* (1*) b) Somewhat representative: *Clinical symptoms but not PCR* test (1*) c) Selected group: *not including all the COVID patients, but just the ones with special characteristics* (0*) d) No description (0*)
2 Selection of the non-exposed cohort	a) Drawn from the same community as the exposed cohort e.g., *Compare people from ICU vs ICU or standard ward vs standard ward.* (1*) b) Drawn from different community. *e.g., ICU vs ward* (0*) c) No description (0*)
3 Ascertainment of exposure	a) Secure record. *E.g., CT images retrieved from electronic records* (1*) b) Structured interview (1*) c) Written self-reported (0*) d) No description (0*)
4 Demonstration that outcome of interest was not present at start of study	a) Yes: *Need to have a previous assessment before the baseline assessment of body composition to know how they were before. (*1*) b) No: Did not mention how (0*) *If they want to assess mortality studies need a statement of no history of disease to obtain an asterisk*
Comparability	
1 On the basis of the design or analysis	a) Study controls for: *for age or sex (principal factor) (1*)* b) Study controls for additional factor: *e.g., SOFA scores, disease degree (1*)*
Outcome	
1 Assessment of outcome	a) Independent blind assessment *(1*) e.g., Radiologist interpreting CT images that does not know the identity of patients.* b) Record linkage *(1*) Outcome identified thorough databases.* c) Self-report (0*) d) No description (0*)
2 Was follow-up long enough for outcomes to occur	a) Yes: An adequate follow up period for outcomes to develop. *e.g., > 10 days change in body composition*

	*(*1*)* b) No: (0*) < 10 days of follow up* If the follow-up period is reported with a mean and a range, and the mean is longer than the required minimum, rate it as 'yes.'
3 Adequacy of follow up of cohorts	a) Complete follow up *(1*)* b) Follow up loss <=20 % or description provided of those lost (*1*)* c) Follow up rate <=80% and no description of those lost (0*) d) No statement (0*)

Abbreviations: CT: Computed tomography; ICU: intensive care unit; PCR: polymerase chain reaction; SOFA: Sequential organ failure assessment

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Supplementary Table 4. Findings of studies assessing body composition abnormalities and clinical outcomes in patients with COVID19 (N = 62).

Author	**Population** **a) Settings** **b) Total sample size (n)** **c) Study design**	**Body composition assessment** **a) Technique** **b) Measurement site** **c) Component analyzed (AT, MM, MC, PhA) + specification**	**Main clinical outcomes** **i. ICU admission** **ii. Survival and mortality** **iii. Disease severity (e.g., MV, severity scores or classifications, complications)**	**Additional clinical outcomes** **i. Hospitalization stay** **ii. Comorbidities/conditions** **iii. Muscle function and discharge** **iv. Inflammatory biomarkers**
Antonarelli (81)	**a)** ICU **b)** 112 **c)** Retrospective	**a)** CT **b)** T4 (single axial image) **c)** MM (PM CSA); MC (PM SMD)	**ii.** PM CSA and PM SMD were unrelated to mortality. **iii.** Patients with successful extubation had higher PM CSA (42.1 ± 7.9 cm^2) than those with extubation failure (37.8 ± 6.4 cm^2; p = 0.0056). Lower PM CSA predicted successful extubation (adj OR: 1.22, 95% CI 1.11−1.35, p < 0.0109). No differences in PM SMD between patients with successful and failed extubation. No differences in PM CSA and PM SMD between those with high and low CT severity pneumonia.	**i.** Lower PM CSA predicted prolonged ICU stay (OR: 1.69, 95% CI 1.23−2.19; p < 0.0292). Patients with shorter ICU stay had higher PM SMD (30.2 ± 6.2 HU) than those who stayed longer in ICU (26.1 ± 4.9 HU; p = 0.0002).
Attaway (43)	**a)** HW **b)** COVID-19 CT n=95; Non COVID: 19 **c)** Retrospective	**a)** CT **b)** T12 (single axial image) **c)** MM (PM CSA, ESM CSA)	**i.** Admission to the ICU was associated with lower initial ESM CSA (27.9 cm^2 [IQR 24.5, 37.3] vs. 37.0 cm^2 [IQR 30.8, 46.8], p = 0.025). Percent PM CSA loss was associated with ICU admission (adj HR: 2.01 [95% CI 1.14–3.55]). Percent	**i.** ICU length of stay was not associated with percent PM CSA loss or percent ESM CSA loss in adjusted models.

			ESM CSA loss was related to ICU admission (adj HR: 8.22 [1.11–61.04]). **ii.** The percent loss of PM CSA standardized to 30 days was greater (p = 0.037) in those who died (−2.69 cm² [IQR −8.81, −1.54]) versus those who survived (−1.14 cm² [IQR −5.17, −0.24]). Percent PM CSA loss was associated with mortality (adj HR 5.30 [95% CI: 1.19–23.6]). Percent ESM CSA loss was not associated with mortality. **iii.** Invasive and non-invasive MV were not associated with percent PM CSA loss or percent ESM CSA loss in adjusted models.	
Aykin Yigman (97)	**a)** OC, HW **b)** 161 **c)** Prospective	**a)** CT **b)** T4, T12 (single axial image at each site) **c)** MM (T4 SM CSA: PM, intercostals, paraspinals, serratus, latissimus dorsi; T12: ESM CSA)	**iii.** SM CSA at T4 was negatively associated with pneumonia (adj β: −16.232, p = 0.006), need of oxygen (adj β: −10.718, p = 0.021), need of intubation (adj β: −16.714, p = 0.013). ESM CSA at T12 was negatively correlated with need of oxygen (adj β: −7.509, p = 0.014) and intubation (adj β: −4.040, p = 0.003) but not pneumonia.	**i.** Inpatients had lower SM CSA at T4 (p = 0.003) and ESM CSA at T12 (p = 0.004) than outpatients. **ii.** SM CSA at T4 and ESM at T12 were not associated with BMI.
Battisti (90)	**a)** ED **b)** 144 **c)** Retrospective	**a)** CT **b)** L2 (single sagittal image) **c)** AT (SAT and VAT thickness)	**i.** Patients in ICU had higher VAT (17.9 ± 6.5 mm) and lower SAT (15.6 ±7.4 mm) than those not admitted to ICU (VAT: 13.1 ± 6.0 mm, p < 0.001; SAT: 19.2 ± 9.7 mm, p = 0.011). Higher VAT predicted risk of	**ii.** BMI was positively correlated with VAT (r = 0.407; p < 0.003) and SAT (r = 0.289; p < 0.003).

			ICU admission (adj OR: 1.16, 95% CI 1.07-1.26; p < 0.0001)**.**	
Beltrao (47)	**a)** HW, ICU **b)** 200 **c)** Prospective	**a)** CT **b)** Thoracoabdominal level (axial image between T12 and L2) **c)** AT (VAT, SAT, VAT/SAT, VAT/SM), MM (total muscle CSA)	**ii.** Mortality rate was higher in the sarcopenic group (SM area < 92 cm^2) without obesity than in the sarcopenic obesity group (28.2% vs 12.5%, p = 0.0004). Independent predictors of mortality included: VAT >150 cm^2 (adj OR: 6.15, p <0.002), muscle CSA < 92 cm^2 (adj OR: 7.94, p <0.005), VAT/SM CSA >2 (adj OR: 13.9, p <0.0001). **iii.** muscle CSA was lower in critical patients than in noncritical patients (p <0.001), and VAT/SAT (p <0.05) and VAT/SM CSA (p <0.001) ratios were higher in critically ill patients.	**i.** Shorter length of stay segregated with high muscle CSA and low VAT (both p <0.05). **iv.** Leptin positively correlated with SAT, VAT/muscle CSA, and VAT; leptin inversely correlated with VAT/SAT; these body composition measures were not correlated with CRP; IL-6 was inversely correlated with muscle CSA (p<0.001).
Besutti (74)	**a)** ED **b)** 318 **c)** Retrospective	**a)** CT **b)** MM: single axial image above the aortic arch; AT: single axial image at T7-T8 **c)** AT (TAT, SAT, VAT, IMAT); MM (PM mass); MC (PM SMD)	**ii.** Higher PM SMD had a protective effect on death (adj OR: 0.962, 95% CI 0.922–1.004). TAT, VAT, and IMAT were not associated with mortality. **iii.** Higher PM SMD had a protective effect on MV and/or death, as a composite outcome (adj OR: 0.964, 95% CI 0.934–0.996). Higher TAT (adj OR: 1.005, 95% CI 1.002−1.009), VAT (adj OR: 1.026, 95% CI 1.008–1.043), and IMAT (adj OR: 1.024, 95% CI 1.005–1.043) were associated with MV and/or death.	**i.** Higher PM SMD had a protective effect on hospitalization (adj OR: 0.967, 95% CI 0.935−1.000). Higher TAT (adj OR: 1.005, 1.002−1.008), VAT (adj OR: 1.028, 95%CI 1.008–1.049) and IMAT (adj OR: 1.028, 95%CI 1.006–1.050) were associated with an increase in hospitalization. **ii.** BMI correlated with TAT (r = 0.706; p <0.001), VAT (r = 0.505; p <0.001), SAT (r = 0.630; p <0.001), IMAT (r = 0.612; p <0.001).

				iv. Higher TAT (β: 0.008, 95% CI 0.00−0.016) and VAT (β: 0.064, 95% CI 0.017−0.111) were associated with higher CRP. IMAT was not associated with CRP. The second (β: −3.648, 95% CI −5.760, −1.535) and fourth quartile (β: −4.820, 95% CI −7.238, −2.403) of PM SMD were inversely associated with CRP.
Beypinar (77)	**a)** ICU **b)** 36 **c)** Retrospective	**a)** CT **b)** L3 (single axial image) **c)** AT (SAT, VAT, TAT); MM (SMI, psoas SM index)	**ii**. Lower psoas index was associated with higher mortality (p = 0.010). No effect found for SMI or VAT on mortality.	None
Bunnell (95)	**a)** N/R **b)** 124 **c)** Retrospective	**a)** CT **b)** L4 (single axial image) **c)** AT (TAT, SAT, VAT, IMAT); MM (total muscle CSA)	**i.** Higher VAT/SAT ratio (adj HR: 1.30, 95% CI 1.04–1.62, p = 0.022) and higher IMAT (adj HR: 1.44, 95% CI 1.10–1.89, p = 0.008) were associated with ICU admission or death (as a composite outcome). TAT, VAT, and total muscle CSA were not associated with ICU admission or death (as a composite outcome).	None
Chandarana (96)	**a)** OC, HW **b)** 51 **c)** Retrospective	**a)** CT **b)** L3 (single axial image) **c)** AT (TAT, SAT, VAT, VAT/TAT)	**iii.** No differences in VAT, SAT, TAT, and VAT/TAT between hospitalized patients requiring and not requiring MV.	**i.** Compared to outpatients, VAT (p = 0.01) and VAT/TAT (p = 0.01) were higher in hospitalized patients. These group of

				patients had similar SAT and TAT. **ii.** SAT (0.84; p<0.001) and TAT (0.72; p<0.001) were positively correlated with BMI but VAT was not.
Chandarana (99)	**a)** OC, HW, ICU **b)** 99 **c)** Retrospective	**a)** CT **b)** L3 (single axial image) **c)** AT (TAT, VAT, IMAT), MM (total muscle CSA, SMI)	None	**i**. Compared to outpatients, inpatients had higher IMAT (17.8 ± 9.4 cm^2 vs. 12.1 ± 7.0 cm^2), higher VAT (234.8 ± 112.1 cm^2 vs. 157.9 ± 92.4 cm^2), higher TAT (0.48 ± 0.14 cm^2 vs. 0.38 ± 0.16 cm^2), all p < 0.001. No difference between groups for total muscle CSA was found; however, inpatients had lower SMI than outpatients (p = 0.012). Model predicting hospitalization that included sex, BMI, race (Black), SMI, VAT/TAT, VAT/TAT*sex, and IMAT/total muscle mass demonstrated the highest AUC of 0.83.
Cornejo-Pareja (48)	**a)** HW **b)** 127 **c)** Prospective	**a)** BIA (BIA 101 Bioimpedance Vector Analyzer [AKERN, Italy],	**i.** Higher ICU admission ratio for those in the lowest standardized PhA quartile (p = 0.009).	**i.** Lower standardized PhA was related to a longer hospital stay (Q1 vs Q4: median [IQR], 23 [11–35] vs.

		single frequency [50 kHz]) **b)** Whole body (hand-to-foot BIA) **c)** PhA (measured and standardized)	**ii.** Cox regression: Lower PhA was associated with higher mortality hazards ratio (adj HR: 3.912, 95% CI 1.322−11.572; p = 0.014). Higher mortality rate for those in the lowest standardized PhA (Q1 vs Q4: 32.4% vs. 0%, p < 0.001).	13 [7–17] days, p = 0.018). In COVID-19 survivors, PhA (r = −0.313, p = 0.001) and standardized PhA (r = −0.311, p = 0.001) were correlated with length of stay. **iv.** Lower standardized PhA was related to higher CRP (Q1 vs Q4: 32.6 [14.4−158.3] vs. 10.3 [4−46] mg/L, p = 0.017) and lower albumin (Q1 vs Q4: 2.3 [2.2−2.7] vs. 3.1 [2.8−3.2], p <0.001).
Damanti (4)	**a)** ICU **b)** 81 **c)** Retrospective	**a)** CT **b)** L1, L2, L3 (single axial image) **c)** AT (IMAT, SAT, TAT, VAT); MM (total muscle CSA, SMI); MC (total SMD)	**ii.** Lower total muscle CSA (HR: 0.98, 95% CI 0.96−0.99; p = 0.02), lower SMI (HR: 0.96, 95% CI 0.94−0.99; p = 0.002), and lower total SMD (HR: 0.88, 95% CI 0.78−0.99; p = 0.046) were associated with higher hospital mortality in unadjusted analyses. SMI was the only variable that remained associated with hospital and ICU mortality in adjusted analyses for age, sex, and frailty index. **iii.** Total muscle CSA (OR: 1.02, 95% CI 1.00−1.03; p = 0.017) and SMI (OR: 1.06, 95% CI 1.01−1.1; p = 0.008) predicted successful extubation; all associations were lost in adjusted analyses. Lower total muscle CSA was associated with higher risk (OR: 0.97, 95% CI 0.95−0.99; p = 0.03) of complication during ICU stay.	**i.** Lower total SMD was associated with longer of hospital stay in adjusted analyses (adj β range: −1.03 to −1.48; p < 0.01) but unrelated to ICU stay. In analyses adjusted for age, sex, and frailty index, total muscle CSA was associated with both hospital and ICU length of stay but SMI was not. In analysis adjusted for age, sex, and BMI, SMI was associated with ICU length of stay and unrelated with hospital length of stay; total muscle CSA was unrelated

			Lower total muscle CSA (β: −0.02, 95% CI −0.41 to −0.006; p = 0.01) and lower total SMD were associated with higher risk of complications during ICU stay (β: −0.07, 95% CI −0.13 to −0.002; p = 0.03). In adjusted analyses, number of complications in ICU were related with total muscle CSA and SMI only.	with these hospitalization outcomes. **ii.** Muscle mass was correlated with BMI (r = 0.3; p = 0.007).
Da Porto (82)	**a)** ED **b)** 150 **c)** Prospective	**a)** Bioelectrical Impedance **b)** Tetrapolar hand-to-foot **c)** FM (VAT), MM (FFM, SM), PhA	**ii.** PhA was not associated with 60-day mortality. **iii.** PhA was not associated with MV at 60-days.	**ii.** COVID-19 patients with malnutrition had lower FFM (49.9 ± 9.3, p < 0.001), SM (20.9 ± 5.7, p < 0.001), PhA (p < 0.001) than without malnutrition.
De Andrade-Junior (44)	**a)** ICU **b)** 32 **c)** Prospective	**a)** US B-mode ultrasound (Logiq e ultrasound, GE Healthcare, USA) **b)** Quadriceps muscle **c)** MM (RF CSA, anterior quadriceps thickness [RF plus vastus intermedius]); MC (quadriceps muscle echo intensity)	**iii.** On day 1, patients that required MV showed lower RF CSA than those without MV (p < 0.05). On day 10, no differences were found in RF CSA, anterior quadriceps thickness and echo intensity between patients with and without MV.	
De Lorenzo (72)	**a)** ICU **b)** 22 **c)** Prospective	**a)** CT **b)** Last rib **c)** AT (estimated using SAT thickness obtained	None	**iv.** At baseline, ALT and AST were higher in “obese” than in “lean” patients, but there were no differences for CRP or albumin between

		in CT images into the Siri equation)		groups. At day 10, CRP, direct bilirubin, fibrinogen concentrations were lower in "lean" patients (respectively p = 0.005; p = 0.033; p = 0.028)
Del Giorno (49)	**a)** HW **b)** 90 **c)** Retrospective	**a)** BIA (BIA 101, Akern Bioresearch, Florence, Italy; manufacturer equation) **b)** Hand-to-foot **c)** FM, MM (FFM), PhA	**i.** Lower PhA predicted the composite outcome (i.e., death, admission to ICU, a prolonged hospitalization and a loss of appetite) (AUC: 0.597, 95% CI 0.486–0.708; sensitivity 82%, specificity 45%) but no associations were found in unadjusted and adjusted regression analyses. FM and FFM did not predict having the composite outcome. FM was associated with composite outcome in adjusted multivariable regression analysis (adj OR: 0.65, 95% CI 0.44-0.97).	**i.** PhA predicted prolonged hospitalization (AUC: 0.589, CI 95% 0.483–0.696; sensitivity 82%, specificity 45%). No associations were found between BIA-derived parameters (PhA, FM, FFM) and length of hospitalization in unadjusted and adjusted regression analyses (p >0.05).
Do Amaral e Castro (98)	**a)** HW **b)** 123 **c)** Retrospective	**a)** CT **b)** N/R **c)** MM (PM and paravertebral muscle CSA), MC (PM SMD, paravertebral SMD), AT (SAT)	**iii.** PM SMD was associated with worse outcome of severity (MV, ICU, death) (32.6 ± 12.4 vs 37.5 ± 12.3; p = 0.042). No differences between patients with worse and better outcome of severity were found for PM CSA and index; SAT CSA and index; and paravertebral CSA, index, and SMD.	None
Erdöl (50)	**a)** HW **b)** 232 **c)** Retrospective	**a)** CT **b**) Single axial image just above the aortic arch (PM) and at T12 (ESM)	**i.** ICU admission was the greatest in the lowest tertile of total SM (p < 0.001). **ii.** In-hospital mortality was more common in the lowest total SM tertile than in other groups (p < 0.001).	**i.** No difference was observed in duration of ICU stay (p = 0.185) and regular hospitalization (p = 0.183) between SM tertiles. Length

		c) MM (total SM [sum of PM and ESM], SMI), MC (ESM SMD, PM SMD)	Total SMI predicted mortality in multivariate analysis (adj HR 0.90, 95% CI 0.85−0.95, p < 0.001) **iii.** MV need was more common in the lowest total SM tertile than in other groups (p <0.001).	of hospitalization was weakly correlated with PM SMD (r = −0.14, p = 0.028) and ESM SMD (r = −0.17, p = 0.010) but unrelated to PM CSA and ESM CSA. **ii**. Diabetes mellitus, hypertension, and SMI were predictors of in-hospital mortality in adjusted models. **iv.** CRP levels were the highest in lowest total SM tertile (all p values < 0.05); albumin levels were the lowest in the lowest total SM tertile (p < 0.001). PM and ESM SMD were positively correlated with albumin (r range= 0.42−0.56, p < 0.001) and inversely correlated with CRP (r range = −0.31 to −0.44, p < 0.001).
Favre (20)	**a)** NR **b)** 112 **c)** Retrospective	**a)** CT **b)** L3-L4 (single axial image) **c)** AT (VAT, SAT)	**iii.** The best predictive value for severe COVID-19 was found for a VAT CSA ≥128.5 cm^2 (ROC curve), which was associated with COVID-19 severity (p < 0.001); excess of VAT was associated with severe COVID-19 (p = 0.022). Excess of SAT was not associated with severe COVID-19 (p = 0.640); SAT was not different in patients with mild or severe COVID-19.	None

Feng (51)	**a)** ICU **b)** 116 **c)** Retrospective	**a)** CT **b)** T12 paraspinal muscles **c)** MM (paraspinal muscle CSA, paraspinal index), MC (paraspinal SMD)	**iii.** Patients with critical illness (i.e., respiratory failure requiring MV, shock, ICU admission, or death) had higher paraspinal SMD ($p < 0.001$); no differences were found for paraspinal muscle CSA and index. Patients with lower paraspinal SMD were more likely to develop critical illness (adj OR: 0.87, 95% CI 0.80-0.95; $p = 0.002$). Higher paraspinal SMD was associated with a 29% lower in risk of critical illness in female patients ($p = 0.006$) but not in male.	**i**. Longer hospital stay in patients with lower paraspinal index ($p = 0.034$) or lower paraspinal SMD ($p < 0.001$) **ii.** In multivariate analysis, no associations between paraspinal muscle CSA and development of pulmonary fibrosis were found. **iv.** No differences in CRP between patients with lower paraspinal index or lower paraspinal SMD. Patients with lower paraspinal SMD had lower albumin levels ($p = 0.005$) but no differences for lower paraspinal index.
Formenti (75)	**a)** ICU **b)** 32 **c)** Prospective	**a)** US **b)** RF: 15 cm above the superior border of patella. **c)** MM (RF thickness and CSA); MC (RF echo intensity)	**ii.** RF thickness was higher in survivors than non-survivors ($p = 0.0283$); RF CSA did not differ between survivors and non-survivors. Non-survivors had higher echo intensity in RF muscles than survivors ($p < 0.001$).	None
Gao (37)	**a)** HW **b)** 435,504 UK Biobank participants. Data from COVID-19	**a)** BIA (Tanita BC418 MA) **b)** Hand-to-foot, segmental BIA **c)** FM (FFM, FMI); MM (SMI)	**i.** FMI and ALST index were not associated with ICU admission in the UK Biobank. **ii.** Higher FMI was associated with COVID-19 mortality (HR: 1.21, 95% CI 1.02−1.45) but ALST index was not in the	**i**. Higher FMI was associated with hospital admission (HR: 1.21, 95% CI 1.05−1.40) but ALST index was not in the UK Biobank.

	Host Genetics Initiative were also used in the study but not included in this review because control groups were individuals without a COVID-19 diagnosis. **c)** Prospective		UK Biobank. Associations were retained in adjusted models.	
Giraudo (52)	**a)** ICU or HW **b)** 150 **c)** Retrospective	**a)** CT **b)** T12 paraspinal muscles (Single axial image) **c)** MC (paraverterbral SMD)	**i.** Paravertebral SMD <30 HU was related to ICU admission (p = 0.004); Patients in ICU had lower paravertebral SMD (29 ± 24 vs 39.4 ± 12 HU; p = 0.001).	**iii.** Patients with low paravertebral SMD had lower Barthel Index scores (54.4 ± 33 vs 85.1 ± 26; p < 0.001). **iv.** Patients with low paravertebral SMD had higher WBC count (9.4 ± 7 vs 7.2 ± 4 $10^{\wedge 9}$/L, p = 0.019), and CRP (71.5 ± 71 vs 44 ± 48 mg/L, p = 0.009), and lactate dehydrogenase values (335 ± 163 vs 265.8 ± 116 U/L, p = 0.008)
Goehler (70)	**a)** HW **b)** 378 **c)** Retrospective	**a)** CT **b)** L1 (single axial image) **c)** AT (VAT)	**ii.** Patients with higher VAT (≥ 100 cm^2) had higher risk of death or intubation over 28 days compared with those with lower VAT (P < .001). In adjusted models, HR for VAT was 1.97 (95% CI 1.32−3.09).	**ii.** VAT differed between those with a normal or overweight BMI compared with those with obesity (p < 0.0001). Participants with VAT ≥100 cm^2 had higher

				rates of diabetes (p = 0.02) but no differences in other comorbidities including coronary artery disease, myocardial infarction, COPD, asthma, and congestive heart failure. **iv.** Participants with VAT ≥ 100 cm^2 had higher CRP on admission compared with those with a VAT < 100 cm^2 (p <0.01)
Hocaoglu (76)	**a)** HW or OC **b)** 217 **c)** Retrospective	**a)** CT **b)** PM: above the aortic arch at baseline (Single axial image) **c)** MC (PM SMD), AT: pectoral muscle fat infiltration (calculated)	**ii**. PM SMD was lower in patients who died (p < 0.05). The risk of mortality was higher in female with PM SMD levels ≤15.9 (OR: 4.466, 95% CI 1.909–10.448). The risk of mortality was higher in males with PM SMD levels ≤34.1 (OR: 4.3, 95% CI 1.795–10.468). Fatty volume of female cases who died was higher than in the female cases who survived (p < 0.05), which was similar in males.	**i.** PM SMD was similar in female outpatient and inpatients (p = 0.091), but it was different in outpatient or inpatient treatment of surviving female cases <65 years of age (p = 0.014). PM SMD was lower in male inpatients compared to outpatients (p = 0.032).
Kang (53)	**a)** HW **b)** 127 **c)** Retrospective	**a)** CT **b)** L2 (single axial image) **c)** MM (SMI), MC (total SMD), VAT index, SAT index, VAT:SAT ratio, IMAT)	**ii.** Non-survivors had higher VAT:SAT ratio (p = 0.002), lower SAT index (p = 0.035) and lower total SMD (p < 0.001) compared to survivors; SMI and VAT index did not differ between groups. Survival length was shorter in patients with high VAT:SAT ratio (p = 0.038) but did not differ between sarcopenia status (p = 0.850). Sarcopenia and high VAT:SAT	None

			ratio did not predict mortality in univariate analysis. **Note:** Data on myosteatosis was not abstracted here due to inconsistencies on how Kang et al classified this measure.	
Kardas (83)	**a)** ICU **b)** 46 **c)** Retrospective	**a)** CT **b)** T4 (single axial image) **c)** MM (PM index, PM CSA), MC (PM SMD)	**ii.** PM index, PM CSA, and PM SMD were not associated with 30-day mortality. **iii.** Duration of MV was not associated with PM CSA, PM index, PM SMD	**i.** No association was found between PM CSA, PM index, PM SMD and length of hospital or ICU stay.
Kellnar (45)	**a)** HW **b)** 12 **c)** Prospective	**a)** BIA (Nutribox body impedance analyzer [Data Input, Germany]) **b)** Whole body (hand-to-foot) **c)** PhA	None	**i.** PhA decrease on day 3 of hospitalization by 0.6° ($p<0.01$), but values were reversed to baseline values at hospital discharge
Kim (54)	**a)** HW **b)** 121 **c)** Retrospective	**a)** CT **b)** T12 (single axial image) **c)** MM (total muscle CSA, SMI)	**ii.** Patients with low SMI had a higher death rate than those normal SMI (17.2% vs 2.2%; $p = 0.004$). However, SMI was not associated with mortality in adjusted regression analysis. **iii.** Compared to normal SMI, patients with low SMI had greater frequency of acute respiratory distress syndrome ($p = 0.006$) and oxygen support ($p = 0.004$), and a greater National Early Warning Score 2 ($p < 0.001$). However, rate of MV and shock did not differ between SMI status.	**i.** Patients who stayed in hospital longer had more frequently lower SMI than those who stayed shorter (28.8% vs. 12.7%; $p = 0.035$). Length of hospital stay was longer for those with low SMI (median 55 d) than normal SMI (median 28 d; $p < 0.001$). **ii.** Patients with low SMI had lower prevalence of hypertension ($p = 0.034$) and cardiovascular disease ($p =$

				0.011) at baseline, but no differences in the prevalence of diabetes and chronic lung or kidney disease was found. **iii.** Low SMI was an independent predictor of delayed hospital discharge (adj HR: 0.47, 95% CI 0.23–0.96). **iv.** Patients with low SMI had higher WBC count (p = 0.010), lower lymphocyte count (p = 0.001), and higher CRP levels (p = 0.005).
Koehler (55)	**a)** HW **b)** 162 **c)** Retrospective	**a)** CT **b)** L3 and T4 **c)** FM (VAT); MM (total muscle CSA, SMI); MC (total SMD)	**i.** Compared to HW patients, patients in the ICU had: - lower total muscle CSA at L3 in univariate (p = 0.007) and adj multivariate analyses (p < 0.001). - greater prevalence of low SMI at L3 in univariate (p < 0.001) and adj multivariate analyses (p = 0.001). - lower prevalence of low SMD at L3 in univariate analysis (p = 0.006), but this association did not remain significant in adj multivariate analysis. - greater VAT in univariate (p < 0.001) and adj multivariate analyses (p = 0.015). - lower SMD at T4 in univariate (p = 0.026) but not multivariate analyses. - lower muscle CSA at T4 in adj multivariate analysis (p = 0.004)	None

			However, no differences between groups were found for SAT at L3 (univariate and adj multivariate analysis).	
Kottlors (91)	**a)** HW **b)** 58 **c)** Prospective	**a)** CT **b)** T12 (Single axial image) **c)** AT (FMR: ratio of waist circumference per paravertebral muscle circumference); MM (muscle circumference)	**i.** In multivariate logistic regression analysis, FMR ($p < 0.001$), age ($p < 0.01$), and sex ($p < 0.05$) were found to be predictors for ICU admission.	None
Kremer (42)	**a)** HW **b)** 113 (combined cohort of patients from COVID-19 waves 1 and 2 in Germany) **c)** Prospective	**a)** US (Aplico i800 ultrasound system) **b)** At the level of the caudal kidney pole **c)** MM (total muscle mass, muscle area index; (MC (muscle thickness)	**ii.** Association of psoas muscle area index with 30-day mortality was found in the combined cohort of hospitalized COVID-19 patients ($p = 0.018$).Psoas muscle thickness index (but not tight muscles thickness index) was also associated with 30-day mortality in Kaplan-Meier survival curves in both COVID-19 waves **iii.** The prevalence of complicated or critical COVID-19 severity did not differ between groups with low or normal psoas muscle area index. Frequency of MV and MV duration were similar between groups.	**i.** Prolonged hospital stay ($p = 0.02$) but not ICU stay ($p = 0.290$) in patients with a lower psoas muscle mass index **ii.** Patients with low psoas muscle area index had higher prevalence of hypertension ($p = 0.002$) but the prevalence of diabetes, obesity (BMI >30 kg/m^2), cardiovascular, chronic respiratory, and cerebrovascular diseases did not differ between groups.
McGovern (56)	**a)** ED **b)** 63 **c)** Retrospective	**a)** CT **b)** L3 **c)** AT (VAT, SAT); MM (total muscle	**i.** ICU admission was associated with higher VAT ($p < 0.05$) but unrelated to SAT, SMI, and total SMD.	**ii.** VAT and SAT was associated with BMI ($p < 0.01$) and active cancer ($p < 0.01$ for VAT and $p < 0.05$

		CSA, SMI); MC (total SMD)	**ii.** 30-day mortality was associated with higher VAT ($p < 0.01$) and low SMI ($p < 0.05$) but unrelated to SAT and total SMD.	for SAT). Low SMI was associated with BMI ($p < 0.001$). SAT related to chronic renal failure and asthma. Body composition abnormalities were not related to the prevalence of clinical frailty, liver disease, hypertension, heart failure and diabetes. **iv.** CRP, albumin, and neutrophil:lymphocyte ratio were not associated with VAT, SAT, SMI, and total SMD.
Menozzi (41)	**a)** HW **b)** 272 (Pandemic waves 1 and 2 in Italy) **c)** Retrospective	**a)** CT **b)** T12 **c)** MM (total muscle CSA)	**iii.** Association was found between low muscle mass and poor clinical outcome during first wave (adj HR: 2.29, 95% CI 1.17−4.49; $p = 0.0162$) but not in the second wave.	**iv.** In patients with low muscle mass, mean CRP was 12.2 ± 9.9 mg/dL during the first wave and 6.9 ± 7.4 mg/dL during the second wave ($p < 0.0071$); mean albumin was 3.1 ± 0.5 g/dL in the first wave and 3.4 ± 0.4 g/dL ($p <0.001$)
Moctezuma-Velázquez (57)	**a)** HW **b)** 519 **c)** Retrospective	**a)** CT **b)** T12 **c)** MM (SMI)	**i.** SMI was associated with ICU admission (OR: 1.01, 95% CI 1.00–1.03; $p = 0.048$). The association did not remain statistically significant in multivariable analysis. **ii.** Low SMI and SMI were not associated with death in univariable or multivariable analyses.	**ii.** Compared to normal SMI, patients with low SMI had lower prevalence of overweight/obesity ($p < 0.001$) and diabetes ($p = 0.03$) but higher Charlson Index ($p < 0.001$); prevalence of hypertension, coronary

			iii. Days on MV were not different between patients with and without low SMI (12 [6–19] vs. 10 [5–15]; p = 0.5). SMI (as continuous variable) and low SMI were not associated with MV in multivariable analysis.	artery disease, or chronic kidney disease did not differ between groups. **iv.** Albumin and CRP was similar between patients with low or normal SMI. Patients with low SMI had lower lymphocytes count (p < 0.001).
Molwitz (58)	**a)** HW **b)** 46 **c)** Retrospective	**a)** CT **b)** T12 and L3 (single axial image at each level) **c)** MM (total muscle CSA and SMI at L3, paraspinal muscle CSA at T12); MC (SMD); AT (SAT, VAT, FMR [fat to muscle ratio, estimated total body fat mass in kg])	**ii.** Time to death was not associated with total muscle CSA at L3, SMI at L3, paraspinal muscle CSA at T12, SMD at L3, SMD at L3 and T12, SAT at L3, SAT at T12, VAT at L3, estimated total body fat mass, or FMR (adjusted analysis). **iii.** MV was not associated with muscle CSA at L3, SMI at L3, paraspinal muscle CSA at T12, SMD at L3 and T12, SAT at L3, SAT at T12, VAT, or estimated total body fat mass, FMR (adjusted analysis).	**i.** Length of stay was not correlated to muscle CSA at L3, paraspinal muscle CSA at T12, SMI at L3, SMD at L3 and T12, SAT at L3, SAT at T12, VAT, or estimated total body fat mass, FMR, and length of stay (Spearman's correlation, coefficients not reported)
Moonen (89)	**a)** HW **b)** 54 **c)** Prospective	**a)** BIA InBody S10® (InBody Co., Ltd., Seoul,South Korea) **b)** Segmental electrodes (left and right thumb and	**i.** In univariate analysis, ICU patients had significantly higher FFM (p = 0.028) and SMI (p = 0.006) than HW patients; PhA was lower in the ICU group (p = 0.017) than in HW patients; FM and body fat (in %) were similar between groups. In adjusted regression analysis, all associations lost significance.	None

		index finger and both ankles) **c)** FM (FM, %FM); MM (FFM, SMM, soft lean mass), PhA	**ii.** Lower PhA was associated with mortality (adj OR: 0.208; p = 0.025). **iii.** Lower PhA was associated with COVID-19 severity in the composite score (adj OR 0.299, p = 0.046). Composite outcomes (BIA values entered in a multiple logistic regression model: FFM, PhA, %FM, LST and water compartments). PhA was not associated with complications.	
Moonen (93)	**a)** HW **b)** 150 **c)** Prospective	**a)** BIA InBody S10® (InBody Co., Ltd., Seoul, Korea) **b)** Segmental electrodes (left and right thumb and index finger and both ankles) **c)** FM (FM, % FM); MM (FFM, soft lean mass ,SMI), PhA	**i.** In analyses adjusted for age, sex, and SOFA score, FFM (adj OR: 1.047, p = 0.033), LST (adj OR: 1.050, p = 0.032), and SMI (adj OR: 1.447, p = 0.041) were positively associated with the ICU-admission. PhA was inversely associated with ICU-admission in analysis adjusted for age, sex, and respiratory rate (adj OR: 0.531, p = 0.021) **iii.** In analysis adjusted for age, sex, and respiratory rate, lower PhA was inversely associated with composite score (adj OR: 0.502, p = 0.012) and complications (adj OR: 0.531, p = 0.021); FM was inversely associated with complications (adj OR: 0.971, p = 0.046).	**i**. PhA, SMI, and body fat (in %) were not associated with length of hospital or ICU stay in analyses adjusted for age, sex, and SOFA score. PhA was inversely associated with length of hospital stay in analysis adjusted for age, sex, and respiratory rate (adj OR: 0.875, p = 0.037).
Nobel (86)	**a)** HW **b)** 190 **c)** Retrospective	**a)** CT **b)** L3 (single axial image) **c)** MM (SMI) AT (SAT index, VAT index, IMAT	**ii.** Those who died within 30 days had a significantly higher IMAT index compared to those who did not die, independent of gastrointestinal symptoms (GI) status (with GI: p = 0.025; no GI: p = 0.049). SMI was associated with 30-day mortality	None

		index, VAT/SAT ratio)	among those without GI (p = 0.010). VAT index, SAT index and VAT/SAT ratio were not related to mortality.	
Ogata (6)	**a)** HW **b)** 53 **c)** Retrospective	**a)** CT **b)** At the level of the upper pole of the right kidney **c)** AT (VAT, SAT, TAT)	**iii.** VAT/TAT was associated with severe disease (adj HR per 1% increase: 1.055, 95% CI 1.000–1.112, p = 0.049) and critical disease (adj HR per 1% increase: 1.094 (95% CI 1.007–1.187), p = 0.03). VAT, SAT, and TAT alone were not associated with disease severity in crude and adjusted analyses.	None
Osuna-Padilla (59)	**a)** ICU **b)** 67 **c)** Prospective	**a)** BIA (InBody S10®, InBody Co, Ltd., Seoul, South Korea). **b)** Eight electrodes: each wrist, distal 3rd metacarpal bone of each hand, central part of each ankle, distal part of the 2nd metatarsal bone in each foot **c)** PhA	**ii.** Low PhA was associated with higher risk of death (60-day mortality; adj HR: 3.08, 95% CI 1.12–8.41; p = 0.02). A PhA <3.85° showed the highest specificity (90%) and sensitivity (66.7%) for mortality prediction in females, and PhA <5.25° showed specificity of 72% and sensitivity of 72% in males. **iii.** PhA was correlated with severity scores such as APACHE II score (r = −0.39, p = 0.001) and NUTRIC score (r = −0.47, p = 0.0001) but not with SOFA score. PhA was correlated with MV duration (r = −0.42, p = 0.005) but not associated with MV in univariate linear regression.	**i.** PhA was correlated with length of stay (r = −0.33, p = 0.03) but not associated with length of stay in univariate linear regression.
Osuna-Padilla (40)	a) ICU b) 86 c) Prospective	a) CT and BIA (InBody S10®, InBody Co., Ltd.,	**ii.** No difference in mortality rate was observed between patients with low and normal SMI (22 vs 27%, p = 0.61). **iii.** MV duration was not associated with	**i**. Associations between low SMI and hospitalization were found (adj HR 0.50, 95% CI 0.29-0.86, p = 0.014). Low

		Seoul, South Korea). b) L3 for CT (single axial image); Eight electrodes for BIA: each wrist, distal 3rd metacarpal bone of each hand, central part of each ankle, distal part of the 2nd metatarsal bone in each foot c) PhA; MM (FFM, total muscle CSA, SMI)	SMI (adj HR: 0.60, 95% CI 0.35−1.05, p = 0.07). No differences in NUTRI-Score, SOFA and APACHE II scores between patients with low and normal SMI. Note: Results present on both columns are derived from CT analysis	SMI was also associated with ICU length of stay (adj HR: 0.53, 95% CI 0.30−0.92, p = 0.024). **ii.** Patients with low SMI had higher prevalence of diabetes (p = 0.005) than those with normal SMI, but no differences in hypertension and acute kidney injury were found. SMI was not associated with BMI.
Padilha (60)	**a)** HW, ICU **b)** 200 **c)** Retrospective	**a)** CT **b)** L1 (single axial image) **c)** SM (total muscle CSA, SMI), MC (total SMD)	**ii.** Low SMD was associated with 90-day mortality (adj OR: 3.33, 95% CI 1.28-8.65, p = 0.014); low muscle CSA was associated with mortality only among males (adj OR: 8.33, 95% CI 2.21-31.32, p = 0.002); low SMI was not associated with mortality. **iii.** Patients with low SMD had higher prevalence of acute kidney injury (p = 0.005), shock (p = 0.001), ≥2 complications (p = 0.026) and higher rate of MV. However, no differences between groups were found for acute distress syndrome, acute cardiac injury, and pulmonary embolism.	Compared to patients with high SMD, patients with low SMD had: **i.** Longer length of hospital stay (p<0.001). **ii.** Greater prevalence of hypertension (p = 0.002), diabetes (p = 0.039), and ≥2 comorbidities (p = 0.026). However, no differences between groups were found for the prevalence of dyslipidemia, emphysema, chronic kidney disease, congestive heart failure, coronaropathy, stroke, chronic liver disease,

				autoimmune rheumatic diseases, and cancer. **iv.** High creatinine (p = 0.001) but no difference in the frequency of high CRP (p = 0.243)
Pediconi (71)	**a)** HW **b)** 62 **c)** Retrospective	**a)** CT **b)** L3 (single axial image) **c)** AT (SAT, VAT)	**i.** VAT score was the best predictor of ICU admission in all models incorporating this parameter (adj OR: 12.842, 95% CI 2.045–80.652). Patients in ICU had higher SAT areas (p = 0.047), VAT areas (p = 0.011), and VAT scores (p = 0.003).	None
Petersen (94)	**a)** HW, ICU **b)** 30 **c)** Retrospective	**a)** CT **b)** L1 (single axial image) **c)** AT (VAT, TAT, SAT)	**i**. ICU patients had higher TAT and higher VAT compared to those in a regular ward (96.9 ± 33.5 cm^2 vs. 70.0 ± 28.2 cm^2, p = 0.031). A 10 cm^2 increase in VAT (adj OR: 1.37, 95% CI 1.07–1.89) and in TAT (adj OR: 1.13, 95% CI 1.03–1.29) were associated with ICU admission. **iii.** ICU patients with MV had higher VAT than free breathers ([+MV] ICU 124.2 cm^2 vs. [−MV] ICU 96.6 cm^2 vs. HW 70.0 cm^2, p = 0.006). A 10 cm^2 increase in VAT (adj OR: 1.32, 95% CI 1.04–1.91) and in TAT (adj OR: 1.28, 95% CI 1.06–1.80) were associated with the need for MV. SAT differed between patients in HW, (+MV) ICU, and (−MV) ICU in ANOVA analysis (p = 0.039), but post hoc analysis was not conducted to evaluate which groups differed.	**ii.** VAT and BMI showed a moderate correlation (r = 0.53, p < 0.001).

Polat (84)	**a)** HW, ICU **b)** 130 **c)** Prospective	**a)** CT **b)** L2 (single axial image) **c)** MM (psoas muscle CSA, psoas muscle index) Note: psoas density was calculated using the "Hounsfield unit average" formula and associations were not abstracted here as this value may differ from other studies that evaluated SMD using mean HU values.	**i.** Psoas muscle CSA and psoas muscle index were not significantly different between ICU and HW patients. These measures were not associated with ICU admission. **ii.** The psoas muscle CSA and psoas muscle index were lower in those who died (all $p < 0.001$); psoas muscle index, age, and comorbidity were all associated with mortality ($p = 0.001$, $p = 0.017$ and $p = 0.019$, respectively). Psoas CSA was not associated with mortality in adjusted analysis.	None
Poros (78)	**a)** ICU **b)** 74 **c)** Retrospective	**a)** CT **b)** VAT at T12 and L1; SM at T5 **c)** AT (VAT); MM (total muscle CSA, PM CSA)	**i.** In males, muscle CSA was positively correlated with and ICU-free days (Spearman's $\rho = 0.32$; $p = 0.017$). **ii.** VAT/muscle CSA and VAT/PM CSA values were associated with higher mortality ($p < 0.001$). Deceased patients had higher VAT values compared to survivors ($p < 0.001$ for both males and female). Deceased patients had lower muscle CSA and PM CSA than survivors in both sexes (all $p < 0.001$). **iii**. In males, muscle mass was positively correlated with MV-free days (Spearman's $\rho = 0.27$; $p = 0.047$).	**i.** VAT, VAT/muscle CSA and VAT/PM CSA values were negatively correlated to the length of ICU stay in female (Spearman's ρ of -0.72, -0.65, and -0.71 respectively; all $p < 0.016$) but not in males.
Reyes-Torres (100)	**a)** ICU **b)** 112 **c)** Prospective	**a)** BIA (SECA 954; SECA Co, Hamburg, Germany)	None	**iii.** A lower PhA (< 4.8°) was associated with a lower rate of swallowing recovery at hospital discharge compared

		b) Segmental impedance in hands and feet **c)** PhA		with those patients with higher PhA (log-rank test = 0.007). PhA in patients with dysphagia was lower than that in those without dysphagia (4.0 ± 1.0° vs. 5.2 ± 0.9°, $p < 0.001$).
Rossi (79)	**a)** ICU **b)** 153 **c)** Retrospective	**a)** CT **b)** L3 and L4 (single axial image) **c)** AT (IMAT) MC (psoas SMD, IMAT/muscle)	**ii.** Patients in the higher tertile of IMAT/muscle had higher mortality at 28 days from ICU admission compared to those in the first tertile (adj HR 3.94, 95% CI 1.03–15.09). Participants in the lowest tertile of psoas SMD had higher mortality at 28 days (HR 3.27, 95% CI: 1.18–4.61), but the relationship was no longer significant in adjusted analysis.	**iv.** Participants in the higher tertile of IMAT/muscle and psoas SMD had higher creatine kinase adjusted for body weight at baseline and at day 1-7 compared to those in the first tertile ($p < 0.05$).
Sahin (87)	**a)** HW, ICU **b)** 68 **c)** Retrospective	**a)** CT **b)** T12 (single axial image) **c)** MM (total muscle CSA, SMI), MC (SMD)	**i.** Patients admitted to ICU had lower SMD ($p = 0.029$) than those in the HW. Muscle CSA and SMI did not differ between groups. SMD was an independent predictor of ICU admission (adj β: –0.274; $p = 0.044$). **ii.** Non-survivors had lower SMD ($p = 0.025$) but similar muscle CSA and SMI than survivors. SMD was an independent predictor of mortality (adj β: –0.254; $p = 0.036$). **iii.** Patients requiring non-invasive MV had lower SMD ($p = 0.048$) than those not in need of MV. Muscle CSA and SMI did not differ between groups. SMD was an	None

			independent predictor of MV (adj β: –0.322; p = 0.047).	
Scheffler (85)	**a)** HW **b)** 64 **c)** Retrospective	**a)** CT **b)** NR (Axial images) **c)** AT (SAT, VAT, TAT)	**ii.** Survivors had higher SAT area than non-survivors (142.7 ± 85.0 cm^2 vs. 92.6 ± 81.1 cm^2; p = 0.028). Higher SAT protected against mortality with 1 dm^2 increase in SAT being associated with 59% lower risk of death after adjustments for age, sex, and BMI (adj OR: 0.231, 95% CI 0.071–0.751; p = 0.015). TAT was also inversely associated with in-hospital mortality (adj OR: 0.578, 95% CI 0.336–0.993; p = 0.047). VAT was not associated with in-hospital mortality. **iii**. A more severe pulmonary involvement was associated with increased VAT (adj OR: 2.862, 95% CI 1.523–5.379; p = 0.001), TAT (adj OR: 1.851, 95% CI 1.27–2.695; p = 0.001), and SAT (adj OR: 1.917, 95% CI 1.124–3.271; p = 0.017).	None
Schiaffino (80)	**a)** HW **b)** 552 **c)** Retrospective	**a)** CT **b)** T5 and T12 (single axial image) **c)** MM (paravertebral muscles CSA), MC (paravertebral muscles SMD)	**i.** Paravertebral CSA at T5 showed the strongest association with ICU admission (adj OR: 4.3, 95% CI 2.5−7.7; p < 0.001). Paravertebral CSA (at T12) and SMD (at T5 and T12) were not associated with ICU admission. **ii.** Paravertebral CSA at T5 was the strongest predictor of death (adj OR: 2.3, 95% CI 1.0−2.9; p = 0.03). Other predictors of mortality included paravertebral CSA at T12 (adj OR: 1.7, 95% CI 0.9−2.2; p = 0.048), and	None

			paravertebral SMD at T12 (undj OR: 0.5, 95% CI 0.3−0.8; p = 0.002). Paravertebral SMD at T5 was not associated with mortality.	
Stevanovic (73)	**a)** HW, ICU **b)** 216 **c)** Prospective	**a)** BIA (Tanita BC-543) **b)** Foot-to-foot **c)** FM (% FM)	**i.** ICU was predicted by high % FM (adj OR 7.141, 95% CI 3.538−14.413, p = 0.001). **ii.** Mortality was predicted by high % FM (adj OR 3.353, 95% CI 1.471-6.642; p = 0.004)	**iv.** Patients with high % FM had higher lactate-dehydrogenase (p = 0.024) but similar values for other markers (i.e., CRP, IL-6, fibrinogen, ferritin, procalcitonin) than patients with normal % FM.
Surov (88)	**a)** OC, HW, ICU **b)** 1138 **c)** Retrospective	**a)** CT **b)** T4 (PM; single axial image) **c)** MM (PM CSA and PMI), MC (pectoralis SMD)	**i.** Lower values in all PM measures were associated with ICU admission (p <0.001). In multivariate analysis, predictors of ICU admission included PMI and PM SMD (adj OR range 0.94-0.96, all p<0.001). **ii.** Lower values in all PM measures were associated with 30-day mortality (p <0.001). In multivariate analysis, all PM measures predicted 30-d mortality (adj OR range 0.86-0.96, all p <0.001) **iii.** All investigated PM measures were lower in the patients with unfavorable courses of COVID-19, including MV (p <0.001). They all also predicted MV (OR 0.87-0.98, all p<0.05)	None
Ufuk (61)	**a)** N/R **b)** 130 **c)** Retrospective	**a)** CT **b)** Above the aortic arch (single axial image)	**ii.** Patients who died had lower PMI (7.9 ± 2.1cm^2/m^2 vs 12.5 ± 3.5 cm^2/m^2, p < 0.001). Presence of low PMI predicted death (adj OR: 11.6, 95% CI 1.5−89.9; p = 0.019). Lower PMI in a continuous scale	**i.** Prolonged hospital stay (> 10 days) was associated with lower PMI (in a continuous scale; adj OR: 0.83, 95% CI 0.72−0.96; p = 0.038) and

		c) MM (PM CSA, PMI)	also predicted death (adj OR: 0.53, 95% CI 0.29−0.96, p = 0.036) but not PM CSA. **iii.** Presence of low PMI predicted intubation (adj OR 3.9, 95 % CI 0.8−18.8, p = 0.025). PM CSA was also associated with intubation (adj OR: 0.98, 95% CI 0.96−1.00, p = 0.04) but not PMI in a continuous scale.	lower PM CSA (in a continuous scale; adj OR: 0.93, 95% CI 0.89−0.98; p = 0.01). **ii.** Prevalence of comorbidities (hypertension, diabetes, asthma/COPD, immunosuppression, malignancy, heart failure, cardiovascular disease, chronic renal failure) did not differ between patients with low and normal PMI.
Umbrello (46)	**a)** ICU **b)** 28 **c)** Prospective	**a)** US (Esaote MyLab X8 device (Esaote SpA, Genova, Italy) **b)** Right RF **c)** MM (RF CSA) MC (muscle echo intensity)	**i.** RF echo intensity increased during the first 7 days of ICU stay **(**p<0.001). RF CSA decreased in the first 7 days of ICU stay **(**p<0.001). **ii.** Compared to survivors, non-survivors had greater reductions in RF CSA (p = 0.0021) and greater increases in RF echo intensity (p = 0.0387) over 7 days.	None
Watanabe (92)	**a)** ED **b)** 150 **c)** Retrospective	**a)** CT **b)** Thoracoabdominal level (single axial image) **c)** AT (VAT, TAT, SAT)	**i**. Upon categorization by VAT quartiles, higher ICU admission was observed with higher VAT accumulation (p = 0.009). Higher ICU admission was associated with higher VAT (adj OR: 2.474, 95% CI 1.017−6.019; p = 0.046) and higher TAT (adj OR: 1.59, 95% CI 1.057−2.392; p = 0.026) but not SAT. **iii.** Patients requiring intubation had a higher VAT (p < 0.05) but did not show a higher TAT or SAT compared to those not	**iv.** VAT and TAT were positively correlated with CRP and lactate dehydrogenase (all p < 0.05) but not with lymphocytes. SAT was positively correlated with lactate dehydrogenase (p < 0.05) but not with CRP or lymphocytes.

			in need of intubation. Note that all patients admitted to ICU were intubated and required MV.	
Wilkinson (38)	**a)** HW **b)** 490,301 UK Biobank **c)** Prospective	**a)** BIA **b)** Hand-to-foot, segmental; 8 polar electrodes, **c)** FM (% FM); MM (estimated ALM from FFM values)	**iii.** Individuals with high fat mass (% FM >25% in men and >35% in women) were 1.8 times more likely to have severe COVID-19 (adj OR: 1.761, 95% CI 1.602–1.935; p < 0.001). Individuals with sarcopenic obesity (high %FM + low ALST index) were 2.6 times more likely to have severe COVID-19 (adj OR: 2.880, 95% CI 2.248–3.691; p < 0.001). Low ALST index alone was not associated with severe COVID-19.	None
Yang 2020 (62)	**a)** HW **b)** 143 **c)** Retrospective	**a)** CT **b)** L3 **c)** AT (SAT, VAT, VAT/SAT); MM (muscle CSA, SMD)	**ii**. High IMAT increased the risk of death (p = 0.012); VAT was not found to increase risk of death (p = 0.056) **iii.** High VAT/SAT or low muscle SMD increased the risk of MV (p = 0.013 and p < 0.001, respectively). Patients with low muscle SMD had higher rate of critical illness compared to those without (52.1% vs. 11.1%, p<0.001). Higher VAT/SAT (adj OR 2.47, 95% CI: 1.05–5.98; p = 0.040) and low muscle SMD (adj OR 11.90, 95% CI 4.50–36.14; p < 0.001) were independent risk factors for critical illness. Muscle CSA, VAT, and SAT did not differ between critical illness status.	**ii.** Frequency of comorbidities did not differ between patients with high vs. low VAT/SAT and low vs. high muscle SMD. Comorbidities evaluated included hypertension, diabetes, cardiovascular disease, cerebrovascular disease, COPD, chronic liver and kidney disease, and cancer.
Yi 2021 (63)	**a)** HW **b)** 234 **c)** Retrospective	**a)** CT **b)** T12 (single axial image)	**iii.** Patients with severe illness had higher incidence of myosteatosis (p< 0.05). Myosteatosis (presence of muscle SMD;	None

		c) AT (IMAT, SMFI); MM (SMI) Note: other body composition measures were calculated but not abstracted in this review due to the lack of clarity on definitions.	OR: 7.557, 95% CI 2.382−23.975; p < 0.001) and presence of reduced SMI (OR: 0.122, 95% CI 0.016−0.963; p = 0.042) were associated with higher risk of transition to severe illness.	
Ying-Hao (64)	**a)** HW **b)** 116 **c)** Retrospective	**a)** CT **b)** Above the aortic arch (single axial image; only baseline CT was used in body composition analysis) **c)** MM (PM CSA; PMI [i.e., PM CSA/body surface area])	**iii.** Low PMI group showed a higher clinical syndrome score (p <0.001), prolonged peak of lung injury (p = 0.025), and more antibiotic prescriptions (p <0.001) than the normal group. Low PMI was a predictor of severe lung injury in multivariate analysis at admission (adj OR: 8.53, 95% CI 1.10-31.37; p<0.001), peak lung injury (adj OR: 8.64, 95% CI 2.79−25.69; p < 0.001), and day 14±2 (adj OR: 4.03, 95% CI 1.25−12.95); p = 0.019).	**i.** Length of hospital stay did not differ between low and normal PMI. **ii.** No differences in BMI between low and normal PMI groups were found (p =0.124). Presence of comorbidities (hypertension, diabetes, coronary heart disease, COPD/asthma, chronic kidney disease, and cancer history) did not differ between PMI groups.
Yoshiji (39)	**a)** HW **b**) Body composition data: UK Biobank (n = 461,460); Clinical outcome date: COVID-19	**a)** BIA (Tanita BC418MA) **b)** Hand-to-foot, segmental BIA **c)** AT (FM, %FM), MM (FFM)	**iii.** In multivariate mendelian randomization, FM was independently associated with severe COVID-19 (adj OR: 2.91, 95% CI 1.71–4.96; p < 0.0001). However, FFM was not associated with severe COVID-19.	**i.** In multivariable MR, only FM was independently associated with COVID-19 hospitalization (adj OR = 2.38, 95% CI 1.56–3.61; p < 0.0001). FFM (OR: 1.27, 95% CI 1.13–1.42; p < 0.0001) and % FM

	Host Genetics Initiative: 19,444 **c)** Prospective (Mendelian randomization using two distinct data cohorts)			(OR: 1.44, 95% CI 1.26–1.66; $p < 0.0001$) were associated with an increased risk of COVID-19 hospitalization in univariable mendelian randomization, but this was not confirmed in multivariable analysis.

Abbreviations: ***Settings***: ED: emergency department; HW: hospital ward; ICU: Intensive care unit; OC: outpatient clinic; **Technique**: BIA: bioelectrical impedance analysis; CT: computed tomography; US: ultrasound; **Component analyzed**: AT: adipose tissue; ALM: appendicular lean mass; ESM: erector spinae muscle; FM: fat mass; FFM:fat free mass; IMAT: intermuscular adipose tissue; MM: muscle mass; PM: pectoralis muscle; PhA: phase angle; PMI: pectoralis muscle index; RF: rectus femoris; SAT: subcutaneous adipose tissue; SMD: skeletal muscle radiodensity; SMI: skeletal muscle mass index; TAT: total adipose tissue; VAT: visceral adipose tissue **Others:** ALT: alanine aminotransferase; APACHEII: Acute Physiology and Chronic Health Evaluation II; AST: aspartate transaminase; BMI: body mass index; CRP: C-reactive protein; CSA: cross-sectional area; HR: Hazard ratio; HU: Hounsfield Units; IL-6: interleukin-6; OR: odds ratio; SOFA: Sequential Organ Failure Assessment; WBC: white blood cells.

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Prevalence and clinical implications of abnormal body composition phenotypes in patients with COVID-19: a systematic review

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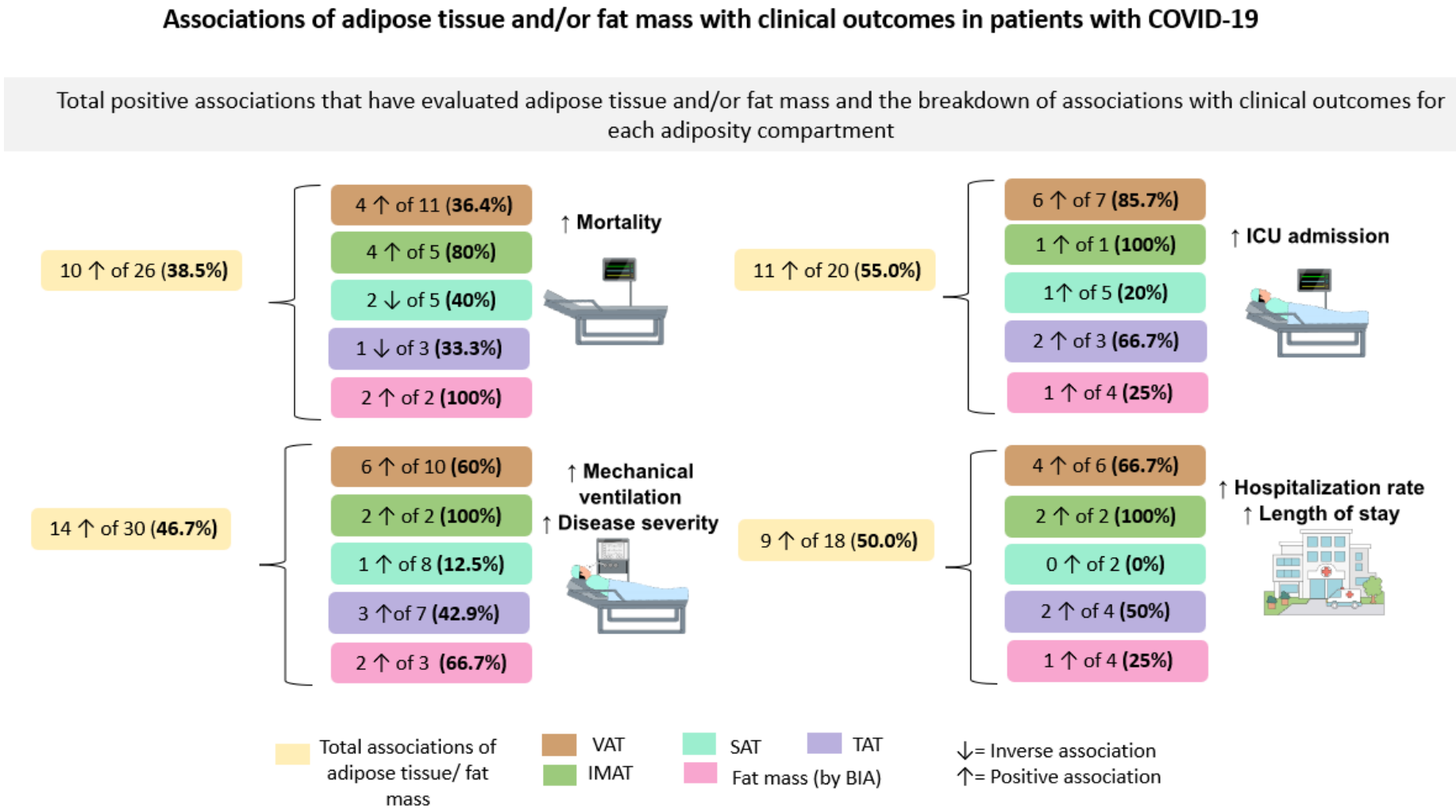

Supplementary Figure 1. Findings by each adiposity compartment. Total number of associations (yellow box) were broken down to each adiposity compartment (i.e., SAT, VAT, IMAT, TAT fat mass) to complement our previous figure 4.

Abbreviations: IMAT: intermuscular adipose tissue; SAT: Subcutaneous adipose tissue; TAT: Total adipose tissue; VAT: Visceral adipose tissue