

Supplementary Table S1 Search strategies and results in each database. Detailed search strategies and results across multiple databases (Embase, PubMed, Cochrane Library, Web of Science, and Scopus) for studies investigating the relationship between gut microbiota and COVID-19 outcomes.

Supplementary Table S2 Summary table of the impact of different bacterial taxa and metabolites on COVID-19 susceptibility, infection, hospitalization, and severity, including odds ratios (OR) with 95% confidence intervals (CI) from Mendelian randomization (MR) analyses.

Supplementary Table S3 Summary of bacterial flora of COVID-19 with different severities. Comprehensive summary of bacterial flora associated with COVID-19 outcomes stratified by disease severity, including MR results for specific microbial genera, families, and orders.

Supplementary Table S1 Search strategies and results in each database

Database	Search number	Search terms	Search results
(a)Emb ase	1	coronavirus disease 2019'/exp	401,460
	2	'intestine flora'/exp	110,919
	3	'mendelian randomization analysis'/exp	11,844
	4	covid 19':ti,ab,kw OR '2019-ncov infection':ti,ab,kw OR '2019 ncov infection':ti,ab,kw OR '2019-ncov infections':ti,ab,kw OR 'infection, 2019-ncov':ti,ab,kw OR 'sars-cov-2 infection':ti,ab,kw OR 'infection, sars-cov-2':ti,ab,kw OR 'sars cov 2 infection':ti,ab,kw OR 'sars-cov-2 infections':ti,ab,kw OR '2019 novel coronavirus disease':ti,ab,kw OR '2019 novel coronavirus infection':ti,ab,kw OR 'covid-19 virus infection':ti,ab,kw OR 'covid 19 virus infection':ti,ab,kw OR 'covid-19 virus infections':ti,ab,kw OR 'infection, covid-19 virus':ti,ab,kw OR 'virus infection, covid-19':ti,ab,kw OR 'covid19':ti,ab,kw OR 'coronavirus disease 2019':ti,ab,kw OR 'disease 2019, coronavirus':ti,ab,kw OR 'coronavirus disease-19':ti,ab,kw OR 'coronavirus disease 19':ti,ab,kw OR 'severe acute respiratory syndrome coronavirus 2 infection':ti,ab,kw OR 'covid-19 virus disease':ti,ab,kw OR 'covid 19	433,886

virus disease':ti,ab,kw OR
'covid-19 virus
diseases':ti,ab,kw OR 'disease,
covid-19
virus':ti,ab,kw OR 'virus disease,
covid-19':ti,ab,kw OR 'sars
coronavirus 2
infection':ti,ab,kw OR '2019-ncov
disease':ti,ab,kw OR '2019 ncov
disease':ti,ab,kw
OR '2019-ncov diseases':ti,ab,kw
OR 'disease,
2019-ncov':ti,ab,kw OR 'covid-19
pandemic':ti,ab,kw OR 'covid 19
pandemic':ti,ab,kw OR
'pandemic,
covid-19':ti,ab,kw OR 'covid-19
pandemics':ti,ab,kw

5	gastrointestinal microbiomes':ti,ab,kw OR 'microbiome, gastrointestinal':ti,ab,kw OR 'gut microbiome':ti,ab,kw OR 'gut microbiomes':ti,ab,kw OR 'microbiome, gut':ti,ab,kw OR 'gut microflora':ti,ab,kw OR 'microflora, gut':ti,ab,kw OR 'gut microbiota':ti,ab,kw OR 'gut microbiotas':ti,ab,kw OR 'microbiota, gut':ti,ab,kw OR 'gastrointestinal flora':ti,ab,kw OR 'flora, gastrointestinal':ti,ab,kw OR 'gut flora':ti,ab,kw OR 'flora, gut':ti,ab,kw OR 'gastrointestinal microbiota':ti,ab,kw OR 'gastrointestinal microbiotas':ti,ab,kw OR 'microbiota, gastrointestinal':ti,ab,kw OR 'gastrointestinal microbial community':ti,ab,kw OR 'gastrointestinal microbial communities':ti,ab,kw OR 'microbial community, gastrointestinal':ti,ab,kw OR 'gastrointestinal microflora':ti,ab,kw OR 'microflora, gastrointestinal':ti,ab,kw OR 'gastric microbiome':ti,ab,kw OR 'gastric microbiomes':ti,ab,kw OR 'microbiome, gastric':ti,ab,kw OR 'intestinal microbiome':ti,ab,kw OR 'intestinal microbiomes':ti,ab,kw OR 'microbiome, intestinal':ti,ab,kw OR 'intestinal	106,240
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microbiota':ti,ab,kw OR
'intestinal
microbiotas':ti,ab,kw OR
'microbiota,
intestinal':ti,ab,kw OR 'intestinal
microflora':ti,ab,kw OR
'microflora,
intestinal':ti,ab,kw OR 'intestinal
flora':ti,ab,kw OR 'flora,
intestinal':ti,ab,kw
OR 'enteric bacteria':ti,ab,kw OR
'bacteria,
enteric':ti,ab,kw

(b)Pub Med	6	'mendelian randomization':ti,ab,kw	11,059
	7	#3 OR #6	13,193
	8	#2 OR #5	141,900
	9	#1 OR #4	487,122
	10	#7 AND #8 AND #9	17
	1	"COVID-19"[MeSH Terms]	263,433
	2	"Gastrointestinal Microbiome"[MeSH Terms]	43,684
	3	"Mendelian Randomization Analysis"[MeSH Terms]	5,829
	4	"COVID-19"[Title/Abstract] OR "2019 ncov infection"[Title/Abstract] OR "2019 ncov infection"[Title/Abstract] OR "2019 ncov infections"[Title/Abstract] OR "infection 2019 ncov"[Title/Abstract] OR "sars cov 2 infection"[Title/Abstract] OR "infection	383,985

sars cov 2"[Title/Abstract] OR "sars
cov 2 infection"[Title/Abstract] OR
"sars cov 2 infections"[Title/Abstract]
OR "2019 novel coronavirus
disease"[Title/Abstract] OR "2019
novel coronavirus
infection"[Title/Abstract] OR "covid 19
virus infection"[Title/Abstract] OR
"covid 19 virus
infection"[Title/Abstract] OR "covid 19
virus infections"[Title/Abstract] OR
"infection covid 19
virus"[Title/Abstract] OR "virus
infection covid 19"[Title/Abstract] OR
"coronavirus disease
2019"[Title/Abstract] OR "disease 2019
coronavirus"[Title/Abstract] OR
"coronavirus disease 19"[Title/Abstract]
OR "coronavirus disease
19"[Title/Abstract] OR "severe acute
respiratory syndrome coronavirus 2
infection"[Title/Abstract] OR "covid 19
virus disease"[Title/Abstract] OR
"covid 19 virus disease"[Title/Abstract]
OR (("COVID-19"[All Fields] OR
"COVID-19"[MeSH Terms] OR "covid
19 vaccines"[All Fields] OR "covid 19
vaccines"[MeSH Terms] OR "covid 19
serotherapy"[All Fields] OR "covid 19
nucleic acid testing"[All Fields] OR
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Terms] OR "covid 19 serological
testing"[All Fields] OR "covid 19
serological testing"[MeSH Terms] OR
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"covid 19 testing"[MeSH Terms] OR
"SARS-CoV-2"[All Fields] OR
"SARS-CoV-2"[MeSH Terms] OR
"severe acute respiratory syndrome
coronavirus 2"[All Fields] OR
"nCoV"[All Fields] OR
"2019-nCoV"[All Fields] OR
(("Coronavirus"[MeSH Terms] OR
"Coronavirus"[All Fields] OR

	"CoV"[All Fields]) AND 2019/11/01:3000/12/31[Date - Publication])) AND "virus diseases"[Title/Abstract]) OR "disease covid 19 virus"[Title/Abstract] OR "virus disease covid 19"[Title/Abstract] OR "sars coronavirus 2 infection"[Title/Abstract] OR "2019 ncov disease"[Title/Abstract] OR "2019 ncov disease"[Title/Abstract] OR "2019 ncov diseases"[Title/Abstract] OR "disease 2019 ncov"[Title/Abstract] OR "covid 19 pandemic"[Title/Abstract] OR "covid 19 pandemic"[Title/Abstract] OR "pandemic covid 19"[Title/Abstract] OR "covid 19 pandemics"[Title/Abstract]	
5	"gastrointestinal microbiomes"[Title/Abstract] OR "microbiome gastrointestinal"[Title/Abstract] OR "gut microbiome"[Title/Abstract] OR "gut microbiomes"[Title/Abstract] OR "microbiome gut"[Title/Abstract] OR "gut microflora"[Title/Abstract] OR "microflora gut"[Title/Abstract] OR "gut microbiota"[Title/Abstract] OR "gut microbiotas"[Title/Abstract] OR "microbiota gut"[Title/Abstract] OR "gastrointestinal flora"[Title/Abstract] OR "flora gastrointestinal"[Title/Abstract] OR "gut flora"[Title/Abstract] OR "flora gut"[Title/Abstract] OR "gastrointestinal microbiota"[Title/Abstract] OR "gastrointestinal microbiotas"[Title/Abstract] OR "microbiota gastrointestinal"[Title/Abstract] OR "gastrointestinal microbial community"[Title/Abstract] OR "gastrointestinal microbial	91,113

communities"[Title/Abstract] OR
 ("Microbiota"[MeSH Terms] OR
 "Microbiota"[All Fields] OR
 ("Microbial"[All Fields] AND
 "Community"[All Fields]) OR
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 AND "Gastrointestinal"[Title/Abstract])
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 OR "microbiota
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 OR "microflora
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 "intestinal flora"[Title/Abstract] OR
 "flora intestinal"[Title/Abstract] OR
 "enteric bacteria"[Title/Abstract] OR
 "bacteria enteric"[Title/Abstract]

6	"mendelian randomization"[Title/Abstract]	9,211
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7	"COVID-19"[MeSH Terms] OR ("COVID-19"[Title/Abstract] OR "2019 ncov infection"[Title/Abstract] OR "2019 ncov infection"[Title/Abstract] OR "2019 ncov infections"[Title/Abstract] OR "infection 2019 ncov"[Title/Abstract] OR "sars cov 2 infection"[Title/Abstract] OR "infection sars cov 2"[Title/Abstract] OR "sars	409,685
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cov 2 infection"[Title/Abstract] OR
"sars cov 2 infections"[Title/Abstract]
OR "2019 novel coronavirus
disease"[Title/Abstract] OR "2019
novel coronavirus
infection"[Title/Abstract] OR "covid 19
virus infection"[Title/Abstract] OR
"covid 19 virus
infection"[Title/Abstract] OR "covid 19
virus infections"[Title/Abstract] OR
"infection covid 19
virus"[Title/Abstract] OR "virus
infection covid 19"[Title/Abstract] OR
"coronavirus disease
2019"[Title/Abstract] OR "disease 2019
coronavirus"[Title/Abstract] OR
"coronavirus disease 19"[Title/Abstract]
OR "coronavirus disease
19"[Title/Abstract] OR "severe acute
respiratory syndrome coronavirus 2
infection"[Title/Abstract] OR "covid 19
virus disease"[Title/Abstract] OR
"covid 19 virus disease"[Title/Abstract]
OR (("COVID-19"[All Fields] OR
"COVID-19"[MeSH Terms] OR "covid
19 vaccines"[All Fields] OR "covid 19
vaccines"[MeSH Terms] OR "covid 19
serotherapy"[All Fields] OR "covid 19
nucleic acid testing"[All Fields] OR
"covid 19 nucleic acid testing"[MeSH
Terms] OR "covid 19 serological
testing"[All Fields] OR "covid 19
serological testing"[MeSH Terms] OR
"covid 19 testing"[All Fields] OR
"covid 19 testing"[MeSH Terms] OR
"SARS-CoV-2"[All Fields] OR
"SARS-CoV-2"[MeSH Terms] OR
"severe acute respiratory syndrome
coronavirus 2"[All Fields] OR
"nCoV"[All Fields] OR
"2019-nCoV"[All Fields] OR
("Coronavirus"[MeSH Terms] OR
"Coronavirus"[All Fields] OR
"CoV"[All Fields])) AND

	2019/11/01:3000/12/31[Date - Publication])) AND "virus diseases"[Title/Abstract]) OR "disease covid 19 virus"[Title/Abstract] OR "virus disease covid 19"[Title/Abstract] OR "sars coronavirus 2 infection"[Title/Abstract] OR "2019 ncov disease"[Title/Abstract] OR "2019 ncov disease"[Title/Abstract] OR "2019 ncov diseases"[Title/Abstract] OR "disease 2019 ncov"[Title/Abstract] OR "covid 19 pandemic"[Title/Abstract] OR "covid 19 pandemic"[Title/Abstract] OR "pandemic covid 19"[Title/Abstract] OR "covid 19 pandemics"[Title/Abstract])	
8	"Gastrointestinal Microbiome"[MeSH Terms] OR ("gastrointestinal microbiomes"[Title/Abstract] OR "microbiome gastrointestinal"[Title/Abstract] OR "gut microbiome"[Title/Abstract] OR "gut microbiomes"[Title/Abstract] OR "microbiome gut"[Title/Abstract] OR "gut microflora"[Title/Abstract] OR "microflora gut"[Title/Abstract] OR "gut microbiota"[Title/Abstract] OR "gut microbiotas"[Title/Abstract] OR "microbiota gut"[Title/Abstract] OR "gastrointestinal flora"[Title/Abstract] OR "flora gastrointestinal"[Title/Abstract] OR "gut flora"[Title/Abstract] OR "flora gut"[Title/Abstract] OR "gastrointestinal microbiota"[Title/Abstract] OR "gastrointestinal microbiotas"[Title/Abstract] OR "microbiota gastrointestinal"[Title/Abstract] OR "gastrointestinal microbial community"[Title/Abstract] OR "gastrointestinal microbial	98,061

	communities"[Title/Abstract] OR (("Microbiota"[MeSH Terms] OR "Microbiota"[All Fields] OR ("Microbial"[All Fields] AND "Community"[All Fields]) OR "microbial community"[All Fields]) AND "Gastrointestinal"[Title/Abstract]) OR "gastrointestinal microflora"[Title/Abstract] OR "microflora gastrointestinal"[Title/Abstract] OR "gastric microbiome"[Title/Abstract] OR "gastric microbiomes"[Title/Abstract] OR "microbiome gastric"[Title/Abstract] OR "intestinal microbiome"[Title/Abstract] OR "intestinal microbiomes"[Title/Abstract] OR "microbiome intestinal"[Title/Abstract] OR "intestinal microbiota"[Title/Abstract] OR "intestinal microbiotas"[Title/Abstract] OR "microbiota intestinal"[Title/Abstract] OR "intestinal microflora"[Title/Abstract] OR "microflora intestinal"[Title/Abstract] OR "intestinal flora"[Title/Abstract] OR "flora intestinal"[Title/Abstract] OR "enteric bacteria"[Title/Abstract] OR "bacteria enteric"[Title/Abstract])	
9	"Mendelian Randomization Analysis"[MeSH Terms] OR "mendelian randomization"[Title/Abstract]	9,862
10	("COVID-19"[MeSH Terms] OR ("COVID-19"[Title/Abstract] OR "2019 ncov infection"[Title/Abstract] OR "2019 ncov infection"[Title/Abstract] OR "2019 ncov infections"[Title/Abstract] OR "infection 2019 ncov"[Title/Abstract] OR "sars cov 2	9

infection"[Title/Abstract] OR "infection
sars cov 2"[Title/Abstract] OR "sars
cov 2 infection"[Title/Abstract] OR
"sars cov 2 infections"[Title/Abstract]
OR "2019 novel coronavirus
disease"[Title/Abstract] OR "2019
novel coronavirus
infection"[Title/Abstract] OR "covid 19
virus infection"[Title/Abstract] OR
"covid 19 virus
infection"[Title/Abstract] OR "covid 19
virus infections"[Title/Abstract] OR
"infection covid 19
virus"[Title/Abstract] OR "virus
infection covid 19"[Title/Abstract] OR
"coronavirus disease
2019"[Title/Abstract] OR "disease 2019
coronavirus"[Title/Abstract] OR
"coronavirus disease 19"[Title/Abstract]
OR "coronavirus disease
19"[Title/Abstract] OR "severe acute
respiratory syndrome coronavirus 2
infection"[Title/Abstract] OR "covid 19
virus disease"[Title/Abstract] OR
"covid 19 virus disease"[Title/Abstract]
OR ("COVID-19"[All Fields] OR
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19 vaccines"[All Fields] OR "covid 19
vaccines"[MeSH Terms] OR "covid 19
serotherapy"[All Fields] OR "covid 19
nucleic acid testing"[All Fields] OR
"covid 19 nucleic acid testing"[MeSH
Terms] OR "covid 19 serological
testing"[All Fields] OR "covid 19
serological testing"[MeSH Terms] OR
"covid 19 testing"[All Fields] OR
"covid 19 testing"[MeSH Terms] OR
"SARS-CoV-2"[All Fields] OR
"SARS-CoV-2"[MeSH Terms] OR
"severe acute respiratory syndrome
coronavirus 2"[All Fields] OR
"nCoV"[All Fields] OR
"2019-nCoV"[All Fields] OR
("Coronavirus"[MeSH Terms] OR

"Coronavirus"[All Fields] OR
"CoV"[All Fields]) AND
2019/11/01:3000/12/31[Date -
Publication])) AND "virus
diseases"[Title/Abstract]) OR "disease
covid 19 virus"[Title/Abstract] OR
"virus disease covid 19"[Title/Abstract]
OR "sars coronavirus 2
infection"[Title/Abstract] OR "2019
ncov disease"[Title/Abstract] OR "2019
ncov disease"[Title/Abstract] OR "2019
ncov diseases"[Title/Abstract] OR
"disease 2019 ncov"[Title/Abstract] OR
"covid 19 pandemic"[Title/Abstract]
OR "covid 19
pandemic"[Title/Abstract] OR
"pandemic covid 19"[Title/Abstract]
OR "covid 19
pandemics"[Title/Abstract])) AND
("Gastrointestinal Microbiome"[MeSH
Terms] OR ("gastrointestinal
microbiomes"[Title/Abstract] OR
"microbiome
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"gut microbiome"[Title/Abstract] OR
"gut microbiomes"[Title/Abstract] OR
"microbiome gut"[Title/Abstract] OR
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"microflora gut"[Title/Abstract] OR
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"gut microbiotas"[Title/Abstract] OR
"microbiota gut"[Title/Abstract] OR
"gastrointestinal flora"[Title/Abstract]
OR "flora
gastrointestinal"[Title/Abstract] OR
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gut"[Title/Abstract] OR
"gastrointestinal
microbiota"[Title/Abstract] OR
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microbiotas"[Title/Abstract] OR
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gastrointestinal"[Title/Abstract] OR
"gastrointestinal microbial

		community"[Title/Abstract] OR "gastrointestinal microbial communities"[Title/Abstract] OR (("Microbiota"[MeSH Terms] OR "Microbiota"[All Fields] OR ("Microbial"[All Fields] AND "Community"[All Fields]) OR "microbial community"[All Fields]) AND "Gastrointestinal"[Title/Abstract]) OR "gastrointestinal microflora"[Title/Abstract] OR "microflora gastrointestinal"[Title/Abstract] OR "gastric microbiome"[Title/Abstract] OR "gastric microbiomes"[Title/Abstract] OR "microbiome gastric"[Title/Abstract] OR "intestinal microbiome"[Title/Abstract] OR "intestinal microbiomes"[Title/Abstract] OR "microbiome intestinal"[Title/Abstract] OR "intestinal microbiota"[Title/Abstract] OR "intestinal microbiotas"[Title/Abstract] OR "microbiota intestinal"[Title/Abstract] OR "intestinal microflora"[Title/Abstract] OR "microflora intestinal"[Title/Abstract] OR "intestinal flora"[Title/Abstract] OR "flora intestinal"[Title/Abstract] OR "enteric bacteria"[Title/Abstract] OR "bacteria enteric"[Title/Abstract])) AND ("Mendelian Randomization Analysis"[MeSH Terms] OR "mendelian randomization"[Title/Abstract])	
(c)CochraneLibrary	1	MeSH descriptor: [COVID-19] explode all trees	7739
	2	MeSH descriptor: [Gastrointestinal Microbiome] explode all trees	1658
	3	MeSH descriptor: [Mendelian Randomization Analysis] explode all	862

	trees	
4	("COVID 19"):ti,ab,kw OR ("2019-nCoV Infection"):ti,ab,kw OR ("2019 nCoV Infection"):ti,ab,kw OR ("2019-nCoV Infections"):ti,ab,kw OR ("Infection, 2019-nCoV"):ti,ab,kw OR ("SARS-CoV-2 Infection"):ti,ab,kw OR ("Infection, SARS-CoV-2"):ti,ab,kw OR ("SARS CoV 2 Infection"):ti,ab,kw OR ("SARS-CoV-2 Infections"):ti,ab,kw OR ("2019 Novel Coronavirus Disease"):ti,ab,kw OR ("2019 Novel Coronavirus Infection"):ti,ab,kw OR ("COVID-19 Virus Infection"):ti,ab,kw OR ("COVID 19 Virus Infection"):ti,ab,kw OR ("COVID-19 Virus Infections"):ti,ab,kw OR ("Infection, COVID-19 Virus"):ti,ab,kw OR ("Virus Infection, COVID-19"):ti,ab,kw OR ("Coronavirus Disease 2019"):ti,ab,kw OR ("Disease 2019, Coronavirus"):ti,ab,kw OR ("Coronavirus Disease-19"):ti,ab,kw OR ("Coronavirus Disease 19"):ti,ab,kw OR ("Severe Acute Respiratory Syndrome Coronavirus 2 Infection"):ti,ab,kw OR ("COVID-19 Virus Disease"):ti,ab,kw OR ("COVID 19 Virus Disease"):ti,ab,kw OR ("COVID-19 Virus Diseases"):ti,ab,kw OR ("Disease, COVID-19 Virus"):ti,ab,kw OR ("Virus Disease, COVID-19"):ti,ab,kw OR ("SARS Coronavirus 2 Infection"):ti,ab,kw OR ("2019-nCoV Disease"):ti,ab,kw OR ("2019 nCoV Disease"):ti,ab,kw OR ("2019-nCoV Diseases"):ti,ab,kw OR ("Disease, 2019-nCoV"):ti,ab,kw OR ("COVID-19 Pandemic"):ti,ab,kw OR ("COVID 19 Pandemic"):ti,ab,kw OR ("Pandemic, COVID-19"):ti,ab,kw OR ("COVID-19 Pandemics"):ti,ab,kw	20435
5	("Gastrointestinal	8662

Microbiome"):ti,ab,kw OR
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Gastrointestinal"):ti,ab,kw OR ("Gut
Microbiome"):ti,ab,kw OR ("Gut
Microbiomes"):ti,ab,kw OR
("Microbiome, Gut"):ti,ab,kw OR
("Gut Microflora"):ti,ab,kw OR
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("Gut Microbiota"):ti,ab,kw OR ("Gut
Microbiotas"):ti,ab,kw OR
("Microbiota, Gut"):ti,ab,kw OR
("Gastrointestinal Flora"):ti,ab,kw OR
("Flora, Gastrointestinal"):ti,ab,kw
OR ("Gut Flora"):ti,ab,kw OR
("Flora, Gut"):ti,ab,kw OR
("Gastrointestinal Microbiota"):ti,ab,kw
OR ("Gastrointestinal
Microbiotas"):ti,ab,kw OR
("Microbiota,
Gastrointestinal"):ti,ab,kw OR
("Gastrointestinal Microbial
Community"):ti,ab,kw OR
("Gastrointestinal Microbial
Communities"):ti,ab,kw OR
("Microbial Community,
Gastrointestinal"):ti,ab,kw OR
("Gastrointestinal Microflora"):ti,ab,kw
OR ("Microflora,
Gastrointestinal"):ti,ab,kw OR
("Gastric Microbiome"):ti,ab,kw OR
("Gastric Microbiomes"):ti,ab,kw OR
("Microbiome, Gastric"):ti,ab,kw OR
("Intestinal Microbiome"):ti,ab,kw
OR ("Intestinal Microbiomes"):ti,ab,kw
OR ("Microbiome, Intestinal"):ti,ab,kw
OR ("Intestinal Microbiota"):ti,ab,kw
OR ("Intestinal Microbiotas"):ti,ab,kw
OR ("Microbiota, Intestinal"):ti,ab,kw
OR ("Intestinal Microflora"):ti,ab,kw
OR ("Microflora, Intestinal"):ti,ab,kw
OR ("Intestinal Flora"):ti,ab,kw OR
("Flora, Intestinal"):ti,ab,kw OR

(d) Web of science		("Enteric Bacteria"):ti,ab,kw OR ("Bacteria, Enteric"):ti,ab,kw	
	6	(Mendelian randomization):ti,ab,kw	1711
	7	#1 or #4	20435
	8	#2 or #5	8662
	9	#3 or #6	1711
	10	#7 and #8 and #9	0
	1	coronavirus disease 2019(Topic) OR COVID-19(Topic) OR covid 19(Topic) OR covid 19(Topic) OR 2019-ncov infection(Topic) OR 2019-ncov infection(Topic) OR 2019 ncov infection(Topic) OR 2019 ncov infection(Topic) OR 2019-ncov infections(Topic) OR infection, 2019-ncov(Topic) OR sars-cov-2 infection(Topic) OR sars-cov-2 infection(Topic) OR infection, sars-cov-2(Topic) OR sars cov 2 infection(Topic) OR sars cov 2 infection(Topic) OR sars-cov-2 infections(Topic) OR 2019 novel coronavirus disease(Topic) OR 2019 novel coronavirus disease(Topic) OR 2019 novel coronavirus infection(Topic) OR 2019 novel coronavirus infection(Topic) OR covid-19 virus infection(Topic) OR covid 19 virus infection(Topic) OR covid-19 virus infections(Topic) OR infection, covid-19 virus(Topic) OR virus infection, covid-19(Topic) OR covid19(Topic) OR covid19(Topic) OR coronavirus disease 2019(Topic) OR coronavirus disease 2019(Topic) OR disease 2019, coronavirus(Topic) OR coronavirus disease-19(Topic) OR coronavirus disease-19(Topic) OR coronavirus disease 19(Topic) OR coronavirus disease 19(Topic) OR severe acute respiratory syndrome coronavirus 2 infection(Topic) OR severe acute respiratory syndrome coronavirus 2 infection(Topic) OR	539373

	covid-19 virus disease(Topic) OR covid 19 virus disease(Topic) OR covid-19 virus diseases(Topic) OR disease, covid-19 virus(Topic) OR virus disease, covid-19(Topic) OR sars coronavirus 2 infection(Topic) OR sars coronavirus 2 infection(Topic) OR 2019-ncov disease(Topic) OR 2019-ncov disease(Topic) OR 2019 ncov disease(Topic) OR 2019 ncov disease(Topic) OR 2019-ncov diseases(Topic) OR disease, 2019-ncov(Topic) OR covid-19 pandemic(Topic) OR covid 19 pandemic(Topic) OR pandemic, covid-19(Topic) OR covid-19 pandemics(Topic)	
2	intestine flora(Topic) OR Gastrointestinal Microbiome(Topic) OR Gastrointestinal Microbiomes(Topic) OR Microbiome, Gastrointestinal(Topic) OR Gut Microbiome(Topic) OR Gut Microbiomes(Topic) OR Microbiome, Gut(Topic) OR Gut Microflora(Topic) OR Microflora, Gut(Topic) OR Gut Microbiota(Topic) OR Gut Microbiotas(Topic) OR Microbiota, Gut(Topic) OR Gastrointestinal Flora(Topic) OR Flora, Gastrointestinal(Topic) OR Gut Flora(Topic) OR Flora, Gut(Topic) OR Gastrointestinal Microbiota(Topic) OR Gastrointestinal Microbiotas(Topic) OR Microbiota, Gastrointestinal(Topic) OR Gastrointestinal Microbial Community(Topic) OR Gastrointestinal Microbial Communities(Topic) OR Microbial Community, Gastrointestinal(Topic) OR Gastrointestinal Microflora(Topic) OR Microflora, Gastrointestinal(Topic) OR Gastric Microbiome(Topic) OR Gastric Microbiomes(Topic) OR Microbiome,	144279

(e)Scopus		Gastric(Topic) OR Intestinal Microbiome(Topic) OR Intestinal Microbiomes(Topic) OR Microbiome, Intestinal(Topic) OR Intestinal Microbiota(Topic) OR Intestinal Microbiotas(Topic) OR Microbiota, Intestinal(Topic) OR Intestinal Microflora(Topic) OR Microflora, Intestinal(Topic) OR Intestinal Flora(Topic) OR Flora, Intestinal(Topic) OR Enteric Bacteria(Topic) OR Bacteria, Enteric(Topic)	
	3	mendelian randomization analysis(Topic) OR mendelian randomization(Topic)	12965
	4	#3 AND #2 AND #1	11
	1	TITLE-ABS-KEY ("coronavirus disease" OR "covid-19" OR "covid 19" OR "covid 19" OR "2019-ncov infection" OR "2019-ncov infection" OR "2019 ncov infection" OR "2019 ncov infection" OR "2019-ncov infections" OR "infection, 2019-ncov" OR "sars-cov-2 infection" OR "sars-cov-2 infection" OR "infection, sars-cov-2" OR "sars cov 2 infection" OR "sars cov 2 infection" OR "sars-cov-2 infections" OR "2019 novel coronavirus disease" OR "2019 novel coronavirus disease" OR "2019 novel coronavirus infection" OR "2019 novel coronavirus infection" OR "covid-19 virus infection" OR "covid 19 virus infection" OR "covid-19 virus infections" OR "infection, covid-19 virus" OR "virus infection, covid-19" OR "covid19" OR "covid19" OR "coronavirus disease 2019" OR "coronavirus disease 2019" OR "disease 2019, coronavirus" OR "coronavirus disease-19" OR "coronavirus disease-19" OR "coronavirus disease 19" OR "coronavirus disease 19" OR	640934

	"severe acute respiratory syndrome coronavirus 2 infection" OR "severe acute respiratory syndrome coronavirus 2 infection" OR "covid-19 virus disease" OR "covid 19 virus disease" OR "covid-19 virus diseases" OR "disease, covid-19 virus" OR "virus disease, covid-19" OR "sars coronavirus 2 infection" OR "sars coronavirus 2 infection" OR "2019-ncov disease" OR "2019-ncov disease" OR "2019 ncov disease" OR "2019 ncov disease" OR "2019-ncov diseases" OR "disease, 2019-ncov" OR "covid-19 pandemic" OR "covid 19 pandemic" OR "pandemic, covid-19" OR "covid-19 pandemics")	
2	TITLE-ABS-KEY ("intestine flora" OR "gastrointestinal microbiome" OR "gastrointestinal microbiomes" OR "microbiome, gastrointestinal" OR "gut microbiome" OR "gut microbiomes" OR "microbiome, gut" OR "gut microflora" OR "microflora, gut" OR "gut microbiota" OR "gut microbiotas" OR "microbiota, gut" OR "gastrointestinal flora" OR "flora, gastrointestinal" OR "gut flora" OR "flora, gut" OR "gastrointestinal microbiota" OR "gastrointestinal microbiotas" OR "microbiota, gastrointestinal" OR "gastrointestinal microbial community" OR "gastrointestinal microbial communities" OR "microbial community, gastrointestinal" OR "gastrointestinal microflora" OR "microflora, gastrointestinal" OR "gastric microbiome" OR "gastric microbiomes" OR "microbiome, gastric" OR "intestinal microbiome" OR "intestinal microbiomes" OR "microbiome, intestinal" OR "intestinal microbiota" OR "intestinal microbiotas"	139934

	OR "microbiota, intestinal" OR "intestinal microflora" OR "microflora, intestinal" OR "intestinal flora" OR "flora, intestinal" OR "enteric bacteria" OR "bacteria, enteric")	
3	TITLE-ABS-KEY ("mendelian randomization analysis" OR "mendelian randomization")	11199
4	(TITLE-ABS-KEY("mendelian randomization analysis" OR "mendelian randomization")) AND (TITLE-ABS-KEY("intestine flora" OR "Gastrointestinal Microbiome" OR "Gastrointestinal Microbiomes" OR "Microbiome, Gastrointestinal" OR "Gut Microbiome" OR "Gut Microbiomes" OR "Microbiome, Gut" OR "Gut Microflora" OR "Microflora, Gut" OR "Gut Microbiota" OR "Gut Microbiotas" OR "Microbiota, Gut" OR "Gastrointestinal Flora" OR "Flora, Gastrointestinal" OR "Gut Flora" OR "Flora, Gut" OR "Gastrointestinal Microbiota" OR "Gastrointestinal Microbiotas" OR "Microbiota, Gastrointestinal" OR "Gastrointestinal Microbial Community" OR "Gastrointestinal Microbial Communities" OR "Microbial Community, Gastrointestinal" OR "Gastrointestinal Microflora" OR "Microflora, Gastrointestinal" OR "Gastric Microbiome" OR "Gastric Microbiomes" OR "Microbiome, Gastric" OR "Intestinal Microbiome" OR "Intestinal Microbiomes" OR "Microbiome, Intestinal" OR "Intestinal Microbiota" OR "Intestinal Microbiotas" OR "Microbiota, Intestinal" OR "Intestinal Microflora" OR "Microflora, Intestinal" OR "Intestinal Flora" OR "Flora, Intestinal" OR "Enteric Bacteria" OR "Bacteria, Enteric")) AND	16

(TITLE-ABS-KEY("coronavirus disease" OR "COVID-19" OR "covid 19" OR "covid 19" OR "2019-ncov infection" OR "2019-ncov infection" OR "2019 ncov infection" OR "2019 ncov infection" OR "2019-ncov infections" OR "infection, 2019-ncov" OR "sars-cov-2 infection" OR "sars-cov-2 infection" OR "infection, sars-cov-2" OR "sars cov 2 infection" OR "sars cov 2 infection" OR "sars-cov-2 infections" OR "2019 novel coronavirus disease" OR "2019 novel coronavirus disease" OR "2019 novel coronavirus infection" OR "2019 novel coronavirus infection" OR "covid-19 virus infection" OR "covid 19 virus infection" OR "covid-19 virus infections" OR "infection, covid-19 virus" OR "virus infection, covid-19" OR "covid19" OR "covid19" OR "coronavirus disease 2019" OR "coronavirus disease 2019" OR "disease 2019, coronavirus" OR "coronavirus disease-19" OR "coronavirus disease-19" OR "coronavirus disease 19" OR "coronavirus disease 19" OR "severe acute respiratory syndrome coronavirus 2 infection" OR "severe acute respiratory syndrome coronavirus 2 infection" OR "covid-19 virus disease" OR "covid 19 virus disease" OR "covid-19 virus diseases" OR "disease, covid-19 virus" OR "virus disease, covid-19" OR "sars coronavirus 2 infection" OR "sars coronavirus 2 infection" OR "2019-ncov disease" OR "2019-ncov disease" OR "2019 ncov disease" OR "2019 ncov disease" OR "2019-ncov diseases" OR "disease, 2019-ncov" OR "covid-19 pandemic" OR "covid 19 pandemic" OR "pandemic, covid-19" OR "covid-19 pandemics"))

Supplementary Table S2 Summary table of the impact of different microflora on new crown pneumonia

Bacterial flora/Metabolites	Label	Disease	SNP Quantities	OR (95%CI) IVW Results
Phylum				
phylum Cyanobacteria	Weifeng Shang 2023 ^[20]	COVID-19 severity	8	0.85(0.76–0.96)
	Meng-Mei Zhong 2023 ^[21]	COVID-19 severity	8	0.852(0.760–0.955)
phylum Actinobacteria.id.400	Yingjian Liu 2024 ^[17]	BP(bacterial pneumonia)	16	2.09(1.13,3.88)
	Jukun Song 2023 ^[25]	COVID-19 hospitalization	20	1.121487(1.028754-1.22258)
		COVID-19 severity	17	1.202516(1.015075-1.42457)
	Zengbin Li 2023 ^[22]	COVID-19 infection	9	0.93(0.87–0.99)
phylum Lentisphaerae	Jukun Song 2023 ^[25]	COVID-19 susceptibility	15	1.021896(1.00006-1.044209)
Class				
class Negativicutes	Weifeng Shang 2023 ^[20]	COVID-19 susceptibility	12	1.05(1.01–1.10)
	Meng-Mei Zhong 2023 ^[21]	COVID-19 susceptibility	13	1.054(1.005–1.105)
	Zengbin Li 2023 ^[22]	COVID-19 infection	12	1.13(1.02–1.26)
	Jukun Song 2023 ^[25]	COVID-19 susceptibility	11	1.069307(1.016779-1.124549)
		COVID-19 hospitalization	11	1.234846(1.112774-1.37031)
		COVID-19 severity	8	1.292966(1.075591-1.554273)
	Weifeng Shang 2023 ^[20]	COVID-19 susceptibility	7	0.94(0.89–0.99)
	Meng-Mei Zhong 2023 ^[21]	COVID-19 susceptibility	6	0.933(0.879–0.991)
class Gammaproteobacteria	Jukun Song 2023 ^[25]	COVID-19 susceptibility	10	0.943826(0.898701-0.991217)
class Actinobacteria	Han Chen 2023 ^[23]	COVID-19 susceptibility	21	1.156(1.062–1.258)
	Jukun Song 2023 ^[25]	COVID-19 hospitalization	21	1.104484(1.031225-1.182947)

Order	Hanyu Zhang 2023 ^[26]	COVID-19 hospitalization	1	1.57493389505008(0 .504-4.92)	
		COVID-19 severity	1	2.53280022758574(1 .228-5.224)	
order	Yingjian Liu 2024 ^[17]	BP(bacterial pneumonia)	9	1.67(1.02,2.74)	
Gastranaerophilales	Hanyu Zhang 2023 ^[26]	COVID-19 infection	1	1.19602074416788(0 .999-1.432)	
		COVID-19 hospitalization	1	1.14110831926724(0 .47-2.773)	
		COVID-19 severity	1	0.7795799733847(0. 45-1.35)	
order	Weifeng Shang 2023 ^[20]	COVID-19 susceptibility	12	1.05(1.01–1.10)	
Selenomonadales	Meng-Mei Zhong 2023 ^[21]	COVID-19 susceptibility	12	1.054(1.005–1.105)	
	Zengbin Li 2023 ^[22]	COVID-19 infection	12	1.13(1.02–1.26)	
	Jukun Song 2023 ^[25]	COVID-19 susceptibility	15	1.053979(1.010557-1 .099266)	
COVID-19 hospitalization		15	1.134561(1.026603-1 .253872)		
COVID-19 severity		12	1.188812(1.01203-1. 396475)		
order	Weifeng Shang 2023 ^[20]	COVID-19 severity	15	0.87(0.76–0.98)	
Lactobacillales	Meng-Mei Zhong 2023 ^[21]	COVID-19 severity	15	0.867(0.764–0.983)	
	Weifeng Shang 2023 ^[20]	COVID-19 severity	13	1.14(1.01–1.29)	
order	Meng-Mei Zhong 2023 ^[21]	COVID-19 severity	13	1.141(1.009–1.291)	
MollicutesRF9	Jukun Song 2023 ^[25]	COVID-19 hospitalization	12	1.126898(1.044468-1 .215834)	
		COVID-19 severity	15	1.168451(1.017332-1 .342018)	
	Hanyu Zhang 2023 ^[26]	COVID-19 hospitalization	1	0.648560491804976(0.219-1.917)	
Bifidobacteriales	Hanyu Zhang 2023 ^[26]	COVID-19 severity	2	0.471(0.286-0.774)	
		Family			
family	Victivallaceae	Yuxin Zou 2024 ^[19]	COVID-19 severity	12	0.888 (0.801-0.984)

family Streptococcaceae	Zengbin Li 2023 ^[22]	COVID-19 hospitalization	12	1.11(1.00–1.24)
	Weifeng Shang 2023 ^[20]	COVID-19 susceptibility	14	0.95(0.92–1.00)
	Meng-Mei Zhong 2023 ^[21]	COVID-19 susceptibility	14	0.955(0.916–0.995)
family Streptococcaceae	Hanyu Zhang 2023 ^[26]	COVID-19 infection	1	1.12075212488415(0 .837-1.501)
		COVID-19 severity	1	0.999972600375377(0.429-2.332)
	Weifeng Shang 2023 ^[20]	COVID-19 susceptibility	14	0.95(0.92–1.00)
family Streptococcaceae	Meng-Mei Zhong 2023 ^[21]	COVID-19 susceptibility	14	0.955(0.916–0.995)
	Hanyu Zhang 2023 ^[26]	COVID-19 infection	1	1.12075212488415(0 .837-1.501)
		COVID-19 severity	1	0.999972600375377(0.429-2.332)
family Bacteroidaceae	Weifeng Shang 2023 ^[20]	COVID-19 susceptibility	9	1.06(1.01–1.12)
	Meng-Mei Zhong 2023 ^[21]	COVID-19 susceptibility	9	1.06(1.007–1.125)
	Jukun Song 2023 ^[25]	COVID-19 susceptibility	8	1.072539(1.011616-1 .137131)
family Christensenellaceae	Meng-Mei Zhong 2023 ^[21]	COVID-19 severity	11	0.87(0.77–0.99)
	Jukun Song 2023 ^[25]	COVID-19 hospitalization	13	0.918613(0.846107-0 .997332)
family unknownfamily.id.1 000005471	Jukun Song 2023 ^[25]	COVID-19 hospitalization	12	1.11355(1.026157-1. 208386)
		COVID-19 severity	11	1.23367(1.047721-1. 452621)
family Oxalobacteraceae	Hanyu Zhang 2023 ^[26]	COVID-19 infection	1	0.973361241524337(0.818-1.159)
		COVID-19 hospitalization	1	1.68539507129741(0 .716-3.969)
		COVID-19 severity	1	1.23244499853025(0 .755-2.012)
family Peptostreptococcaceae	Hanyu Zhang 2023 ^[26]	COVID-19 infection	1	1.00904062177387(0 .767-1.328)
		COVID-19 severity	1	1.79858455998767(0 .824-3.924)
family Bifidobacteriaceae	Yingjian Liu 2024 ^[17]	Pneumonia	13	0.68(0.54,0.85)

	Yingjian Liu 2024 ^[17]	BP(bacterial pneumonia)	15	2.05(1.17,3.58)
	Hanyu Zhang 2023 ^[26]	COVID-19 infection	1	1.06235820628227(0 .875-1.29)
		COVID-19 hospitalization	1	1.54120056443399(0 .521-4.56)
		COVID-19 severity	2	2.124(1.152-3.915)
family FamilyXI.id.1936	Yingjian Liu 2024 ^[17]	Pneumonia	8	1.18(1.01,1.38)
	Jukun Song 2023 ^[25]	COVID-19 hospitalization	12	0.95861(0.919248-0. 999658)
Genus				
genus Anaerofilum.id.2053	Yingjian Liu 2024 ^[17]	Pneumonia	7	1.34(1.04,1.72)
	Jukun Song 2023 ^[25]	COVID-19 hospitalization	12	0.945835(0.896604-0 .997769)
genus Marvinbryantia	Yingjian Liu 2024 ^[17]	BLA(bronchop neumonia、lung abscess)	9	0.41(0.17,1)
	Meng-Mei Zhong 2023 ^[21]	COVID-19 hospitalization	10	0.886(0.812–0.967)
genus RuminococcaceaeU CG011	Weifeng Shang 2023 ^[20]	COVID-19 severity	8	0.91(0.83–0.99)
	Jukun Song 2023 ^[25]	COVID-19 severity	8	0.906709(0.832425-0 .987621)
	Meng-Mei Zhong 2023 ^[21]	COVID-19 severity		0.907(0.832–0.988)
genus Tyzzerella3	Weifeng Shang 2023 ^[20]	COVID-19 severity	13	0.89(0.81–0.97)
	Meng-Mei Zhong 2023 ^[21]	COVID-19 severity	13	0.885(0.810–0.967)
	Jukun Song 2023 ^[25]	COVID-19 hospitalization	18	0.951996(0.910977-0.9 94862)
		COVID-19 severity	14	0.896826(0.82266-0.97 768)
	Hanyu Zhang 2023 ^[26]	COVID-19 severity	1	2.21142565432121(1.2 46-3.924)
genus Subdoligranulum	Meng-Mei Zhong 2023 ^[21]	COVID-19 severity	11	0.807(0.699–0.932)
	Jukun Song 2023 ^[25]	COVID-19 severity	13	0.855125(0.749524-0.9 75604)

	Weifeng Shang 2023 ^[20]	COVID-19 severity	11	0.8(0.69–0.92)
genus <i>Bacteroides</i>	Weifeng Shang 2023 ^[20]	COVID-19 susceptibility	9	1.06(1.01–1.12)
	Meng-Mei Zhong 2023 ^[21]	COVID-19 susceptibility	9	1.064(1.007–1.125)
	Jukun Song 2023 ^[25]	COVID-19 susceptibility	12	1.059099(1.010079-1.110498)
genus <i>Parasutterella</i>	Yingjian Liu 2024 ^[17]	BP(bacterial pneumonia)	12	2.75(1.49,5.08)
	Zengbin Li 2023 ^[22]	COVID-19 infection	14	0.89(0.83–0.97)
		COVID-19 hospitalization	14	0.84(0.72–0.98)
genus <i>Bifidobacterium</i> .	Han Chen 2023 ^[23]	COVID-19 susceptibility	16	0.902(0.836–0.973)
	Yingjian Liu 2024 ^[17]	BP(bacterial pneumonia)	16	1.93(1.15,3.22)
	Tian, Siyu 2024 ^[18]	COVID-19 hospitalization	13	1.126(1.021–1.242)
genus <i>Rikenellaceae</i> RC9	Jukun Song 2023 ^[25]	COVID-19 susceptibility	21	1.030965(1.000158-1.062721)
	Han Yan 2023 ^[27]	COVID-19 susceptibility	2	2.092(1.149-3.808)
	Tian, Siyu 2024 ^[18]	COVID-19 hospitalization	13	1.081(1.019-1.147)
genus <i>Lachnospiraceae</i> UC G008	Weifeng Shang 2023 ^[20]	COVID-19 severity	11	1.09(1.01–1.17)
	Meng-Mei Zhong 2023 ^[21]	COVID-19 severity	8	1.085(1.009–1.167)
	Weifeng Shang 2023 ^[20]	COVID-19 severity	11	1.12(1.00–1.26)
genus <i>Olsenella</i>	Jukun Song 2023 ^[25]	COVID-19 severity	12	1.110538(1.000231-1.233009)
	Meng-Mei Zhong 2023 ^[21]	COVID-19 hospitalization	11	0.942(0.897–0.990)
	Jukun Song 2023 ^[25]	COVID-19 hospitalization	13	0.938009(0.896461-0.981482)
genus <i>Eubacterium coprostanoligenes</i>	Hanyu Zhang 2023 ^[26]	COVID-19 infection	1	0.839701170368478(0.615-1.146)

group			COVID-19 hospitalization	1	0.568684261257267(0.145-2.223)
			COVID-19 severity	1	0.792819896331787(0.277-2.271)
genus Dorea	Meng-Mei Zhong 2023 ^[21]	COVID-19 hospitalization	10	1.162(1.055–1.279)	
	Jukun Song 2023 ^[25]	COVID-19 susceptibility	14	1.048128(1.006111-1.091899)	
	Zengbin Li 2023 ^[22]	COVID-19 infection	11	0.88(0.80–0.97)	
	Han Chen 2023 ^[23]	COVID-19 hospitalization	11	0.79(0.65–0.97)	
		COVID-19 susceptibility	9	0.878(0.777–0.992)	
genus Ruminococcaceae UCG014	Zengbin Li 2023 ^[22]	COVID-19 hospitalization	5	1.25(1.07–1.45)	
	Han Chen 2023 ^[23]	COVID-19 severity	5	1.67(1.32–2.11)	
		COVID-19 susceptibility	7	1.088(1.021–1.160)	
		Han Yan 2023 ^[27]	COVID-19 severity	4	1.627(1.14-2.323)
	genus Prevotella9	Zengbin Li 2023 ^[22]	COVID-19 hospitalization	14	1.21(1.04–1.41)
Jukun Song 2023 ^[25]		COVID-19 severity	19	1.108017(1.015604-1.208839)	
Zengbin Li 2023 ^[22]		COVID-19 severity	12	0.77(0.62–0.95)	
genus Ruminococcus gnavus group	Han Yan 2023 ^[27]	COVID-19 severity	2	1.703(1.018-2.849)	
	Zengbin Li 2023 ^[22]	COVID-19 severity	11	0.84(0.71–1.00)	
genus Oxalobacter	Han Chen 2023 ^[23]	COVID-19 susceptibility	13	0.842(0.712–0.994)	
		COVID-19 severity	13	0.842 (0.712–0.994)	
	Hanyu Zhang 2023 ^[26]	COVID-19 infection	1	0.872561011613187(0.736-1.035)	
		COVID-19	1	0.706206493883378(	

		hospitalization		0.3-1.661)
		COVID-19 severity	1	1.09557314891857(0.606-1.981)
	Han Yan 2023 ^[27]	COVID-19 severity	11	0.842(0.709-1.000)
			4	0.752(0.578-0.98)
genus Ruminiclostridium6	Zengbin Li 2023 ^[22]	COVID-19 hospitalization	15	0.80(0.69–0.94)
		COVID-19 severity	16	0.78(0.62–0.98)
	Han Yan 2023 ^[27]	COVID-19 severity	14	0.708(0.544-0.921)
genus.unknowngenus.id.1000005472	Jukun Song 2023 ^[25]	COVID-19 hospitalization	15	1.101318(1.028715-1.179046)
		COVID-19 severity	11	1.237166(1.064543-1.437781)
genus Ruminococcustorques group	Hanyu Zhang 2023 ^[26]	COVID-19 infection	1	0.537(0.391–0.738)
		COVID-19 severity	1	0.536877354869706(0.391-0.738)
genus Allisonella	Hanyu Zhang 2023 ^[26]	COVID-19 infection	1	0.999477974302852(0.879-1.137)
		COVID-19 hospitalization	1	0.903849603717244(0.499-1.636)
		COVID-19 severity	1	0.750932133107426(0.464-1.215)
genus Erysipelatoclostridium	Hanyu Zhang 2023 ^[26]	COVID-19 infection	1	0.925967316791888(0.737-1.163)
		COVID-19 severity	1	0.66116800731294(0.298-1.468)
genus Faecalibacterium	Hanyu Zhang 2023 ^[26]	COVID-19 infection	1	0.947829609211915(0.69-1.303)
		COVID-19 severity	1	0.545239789689792(0.184-1.614)
genus Peptococcus	Hanyu Zhang 2023 ^[26]	COVID-19 infection	1	0.957340664124295(0.805-1.138)
		COVID-19 hospitalization	1	0.675976747986784(0.313-1.459)

		COVID-19 severity	1	0.675101722137951(0.419-1.088)
genus Romboutsia	Hanyu Zhang 2023 ^[26]	COVID-19 infection	1	0.991370771376931(0.755-1.302)
		COVID-19 severity	1	1.78794246889422(0.825-3.874)
genus RuminococcaceaeU CG009	Hanyu Zhang 2023 ^[26]	COVID-19 infection	1	0.997685345952551(0.774-1.285)
		COVID-19 severity	1	1.09160755405964(0.494-2.414)
genus Streptococcus	Hanyu Zhang 2023 ^[26]	COVID-19 infection	1	1.11442825766029(0.844-1.471)
		COVID-19 severity	1	0.999973966838869(0.447-2.235)
genus Intestinibacter	Hanyu Zhang 2023 ^[26]	COVID-19 infection	1	1.14628731724782(0.846-1.553)
		COVID-19 hospitalization	1	1.38991028236733(0.301-6.42)
		COVID-19 severity	1	1.57226695768584(0.604-4.094)
genus Enterorhabdus	Hanyu Zhang 2023 ^[26]	COVID-19 infection	1	1.1672334778462(0.958-1.422)
		COVID-19 hospitalization	1	1.02698051702283(0.335-3.146)
		COVID-19 severity	1	0.76744596953411(0.447-1.317)
Gut production of the SCFA butyrate	Wanqiang Lv 2023 ^[24]	COVID-19 hospitalization	8	0.96832539912073(0.94416699163366-0.993101947950892)
		COVID-19 severity	7	1.00845602976638(0.96356320994773-1.05544042515628)
Fecal propionate	Wanqiang Lv 2023 ^[24]	COVID-19 hospitalization	3	0.941469863248343(0.808083479895778-1.09687368379214)
		COVID-19 severity	3	0.968794000309792(0.857951748844421-1.09395640990347)

Supplementary Table S3 Summary of bacterial flora of COVID-19 with different severities

Disease	Label	Bacterial flora/Metabolites	SNP Quantities	OR (95%CI) IVW Results
COVID-19 susceptibility	Weifeng Shang 2023 ^[20]	class Negativicutes	12	1.05(1.01–1.10)
		class Gammaproteobacteria	7	0.94(0.89–0.99)
		order Selenomonadales	12	1.05(1.01–1.10)
		family Streptococcaceae	14	0.95(0.92–1.00)
		family Bacteroidaceae	9	1.06(1.01–1.12)
		genus Bacteroides	9	1.06(1.01–1.12)
	Meng-Mei Zhong 2023 ^[21]	class Gammaproteobacteria	6	0.933(0.879–0.991)
		family Streptococcaceae	14	0.955(0.916–0.995)
		class Negativicutes	13	1.054(1.005–1.105)
		order Selenomonadales	12	1.054(1.005–1.105)
		family Bacteroidaceae	9	1.06(1.007–1.125)
		genus Bacteroides	9	1.064(1.007–1.125)
	Jukun Song 2023 ^[25]	class.Gammaproteobacteria.id.3303	10	0.943826(0.898701-0.991217)
		phylum.Lentisphaerae .id.2238	15	1.021896(1.00006-1.044209)
		genus.Eisenbergiella.id.11304	12	1.027563(1.000392-1.055472)
		genus.unknowngenus.id.2041	13	1.03016(1.000408-1.060798)
		genus.Bifidobacterium.id.436	21	1.030965(1.000158-1.062721)
		genus.unknowngenus.id.2001	11	1.039753(1.002465-1.078429)
		genus.Flavonifractor.id.2059	10	1.044181(1.002618-1.087467)
		genus.Dorea.id.1997	14	1.048128(1.006111-1.091899)
		order.Selenomonadales.id.2165	15	1.053979(1.010557-1.099266)

COVID-19 infection	Han Chen 2023 ^[23]	class.Deltaproteobacteria.id.3087	13	1.055903(1.003375-1.11118)
		genus.Bacteroides.id.918	12	1.059099(1.010079-1.110498)
		class.Negativicutes.id.2164	11	1.069307(1.016779-1.124549)
		family.Bacteroidaceae.id.917	8	1.072539(1.011616-1.137131)
		Genus Butyricimonas	13	0.919(0.847–0.998)
		Genus Parasutterella	16	0.902(0.836–0.973)
		Genus Ruminococcaceae UCG014	9	0.878(0.777–0.992)
		Genus Oxalobacter	13	0.842(0.712–0.994)
		Class Actinobacteria	21	1.156(1.062–1.258)
		Class Alphaproteobacteria	9	1.102(1.004–1.211)
	Zengbin Li 2023 ^[22]	Genus Alloprevotella	7	1.088(1.021–1.160)
		Genus Coprococcus	10	1.159(1.030–1.304)
		Genus Erysipelatoclostridium	13	1.083(1.001–1.172)
		phylum Lentisphaerae	9	0.93(0.87–0.99)
		family Alcaligenaceae	12	0.87(0.78–0.96)
		family Lachnospiraceae	17	0.91(0.84–1.00)
		genus Dialister	11	0.91(0.82–1.00)
		genus Parasutterella	14	0.89(0.83–0.97)
		genus Ruminococcaceae UCG003	12	0.90(0.82–0.99)
		genus Ruminococcaceae UCG014	11	0.88(0.80–0.97)
		class Negativicutes	12	1.13(1.02–1.26)
		order Selenomonadales	12	1.13(1.02–1.26)
		genus Phascolarctobacterium	9	1.13(1.02–1.25)

	Hanyu Zhang 2023 ^[26]	genus Ruminococcustorque sgroup	1	0.537(0.391–0.738)
		genus Ruminococcaceae UCG013	1	1.38206616435633(1.025-1.863)
		genus Ruminococcus1	1	0.734645873967539(0.545-0.99)
		genus Allisonella	1	0.999477974302852(0.879-1.137)
		genus Eubacteriumcoprostan oligenesgroup	1	0.839701170368478(0.615-1.146)
		genus Oxalobacter	1	0.872561011613187(0.736-1.035)
		genus Erysipelatoclostridium	1	0.925967316791888(0.737-1.163)
		genus Faecalibacterium	1	0.947829609211915(0.69-1.303)
		genus Peptococcus	1	0.957340664124295(0.805-1.138)
		family Oxalobacteraceae	1	0.973361241524337(0.818-1.159)
		genus Romboutsia	1	0.991370771376931(0.755-1.302)
		genus RuminococcaceaeUC G009	1	0.997685345952551(0.774-1.285)
		family Peptostreptococcaceae	1	1.00904062177387(0.767-1.328)
		genus Bifidobacteriaceae	1	1.06235820628227(0.875-1.29)
		genus Streptococcus	1	1.11442825766029(0.844-1.471)
		family Streptococcaceae	1	1.12075212488415(0.837-1.501)
		genus Intestinibacter	1	1.14628731724782(0.846-1.553)
		genus Enterorhabdus	1	1.1672334778462(0.958-1.422)
		order Gastranaerophilales	1	1.19602074416788(0.999-1.432)
COVID-19 hospitalizati	Tian, Siyu 2024 ^[18]	Bifidobacterium.id.43 6	13	1.126(1.021–1.242)

on	LachnospiraceaeUCG010.id.11330	10	1.139(1.009-1.287)
	RikenellaceaeRC9gut group.id.11191	13	1.081(1.019-1.147)
	RuminococcaceaeUCG014.id.11371	11	0.822(0.782-0.995)
	genus Marvinbryantia	10	0.886(0.812–0.967)
	genus Olsenella	11	0.942(0.897–0.990)
	family Veillonellaceae	19	1.069(1.002–1.140)
	genus Eubacteriumruminantiumgroup	18	1.065(1.010–1.123)
Meng-Mei Zhong 2023 ^[21]	genus Dorea	10	1.162(1.055–1.279)
	genus Alistipes	14	0.78(0.63–0.96)
	genus Parasutterella	14	0.84(0.72–0.98)
	genus Ruminiclostridium6	15	0.80(0.69–0.94)
	genus Ruminococcaceae UCG014	11	0.79(0.65–0.97)
	family FamilyXIII	10	1.30(1.03–1.64)
	family Victivallaceae	12	1.11(1.00–1.24)
Zengbin Li 2023 ^[22]	genus Alloprevotella	5	1.25(1.07–1.45)
	genus Prevotella9	14	1.21(1.04–1.41)
	Gut production of the SCFA butyrate	8	0.96832539912073(0.94416699163366-0.993101947950892)
	Fecal propionate	3	0.941469863248343(0.808083479895778-1.09687368379214)
	family.Christensenellaceae.id.1866	13	0.918613(0.846107-0.997332)
	genus.Eubacteriumoxidoreducensgroup.id.11339	9	0.934016(0.87255-0.999811)
	genus.Olsenella.id.822	13	0.938009(0.896461-0.981482)
Wanqiang Lv 2023 ^[24]			
Jukun Song 2023 ^[25]			

Hanyu Zhang 2023 ^[26]	genus.Anaerofilum.id. 2053	12	0.945835(0.896604-0.997769)
	genus.Tyzzereella3.id.1 13.35	18	0.951996(0.910977-0.994862)
	family.FamilyXI.id.19 36	12	0.95861(0.919248-0.999658)
	order.Bacteroidales.id. 913	16	1.092775(1.01484-1.176694)
	genus.unknowngenus.id.1000005472	15	1.101318(1.028715-1.179046)
	class.Actinobacteria.id .419	21	1.104484(1.031225-1.182947)
	family.unknownfamily.id.1000005471	12	1.11355(1.026157-1.208386)
	phylum.Actinobacteria.id 400	20	1.121487(1.028754-1.22258)
	order.MollicutesRF9.id.11579	12	1.126898(1.044468-1.215834)
	order.Selenomonadales.id.2165	15	1.134561(1.026603-1.253872)
	class.Negativicutes.id. 2164	11	1.234846(1.112774-1.37031)
	Eubacteriumcoprostanoligenesgroup	1	0.568684261257267(0.145-0.223)
	Bifidobacteriales	1	0.648560491804976(0.219-0.917)
	genus Peptococcus	1	0.675976747986784(0.313-0.459)
	Oxalobacter	1	0.706206493883378(0.3-0.661)
	Allisonella	1	0.903849603717244(0.499-0.636)
	Enterorhabdus	1	1.02698051702283(0.335-0.146)
	Gastranaerophilales	1	1.14110831926724(0.47-0.773)
	Intestinibacter	1	1.38991028236733(0.301-0.642)
	Bifidobacteriaceae	1	1.54120056443399(0.521-0.456)
	class Actinobacteria	1	1.57493389505008(0.504-0.92)
	family Oxalobacteraceae	1	1.68539507129741(0.716-0.969)

COVID-19 severe	Tian, Siyu 2024 ^[18]	Intestinimas.id.2062	16	1.179(1.006-1.383)
	Yuxin Zou 2024 ^[19]	Victivallaceae	12	0.888 (0.801-0.984)
	Weifeng Shang 2023 ^[20]	phylum Cyanobacteria	8	0.85(0.76–0.96)
		order Lactobacillales	15	0.87(0.76–0.98)
		family	11	0.87(0.77–0.99)
		Christensenellaceae		
		genus	11	0.8(0.69–0.92)
		Subdoligranulum		
		genus Tyzzerella3	13	0.89(0.81–0.97)
		genus	8	0.91(0.83–0.99)
		RuminococcaceaeUC		
		G011		
		order MollicutesRF9	13	1.14(1.01–1.29)
		genus	11	1.09(1.01–1.17)
		RikenellaceaeRC9		
		genus	11	1.12(1.00–1.26)
		LachnospiraceaeUCG		
		008		
	Meng-Mei Zhong 2023 ^[21]	phylum Cyanobacteria	8	0.852(0.760–0.955)
		order Lactobacillales	15	0.867(0.764–0.983)
		genus	11	0.907(0.832–0.988)
		RuminococcaceaeUC		
		G011		
		genus	11	0.807(0.699–0.932)
		Subdoligranulum		
		genus Tyzzerella3	13	0.885(0.810–0.967)
	Zengbin Li 2023 ^[22]	order MollicutesRF9	13	1.141(1.009–1.291)
		genus	8	1.085(1.009–1.167)
		RikenellaceaeRC9		
		genus Ruminococcus	12	0.77(0.62–0.95)
		gnavus group		
	Han Chen 2023 ^[23]	genus Oxalobacter	11	0.84(0.71–1.00)
		genus	16	0.78(0.62–0.98)
		Ruminiclostridium6		
		genus Alloprevotella	5	1.67(1.32–2.11)
	Wanqiang Lv 2023 ^[24]	Genus Oxalobacter	13	0.842 (0.712–0.994)
		Gut production of the SCFA butyrate	7	1.00845602976638(0.96356 320994773-1.055440425156

Jukun Song 2023 ^[25]			28)
	Fecal propionate	3	0.968794000309792(0.857951748844421-1.09395640990347)
	genus.Subdoligranulom.id.2070	13	0.855125(0.749524-0.975604)
	genus.Tyzzarella3.id.11335	14	0.896826(0.82266-0.97768)
	genus.RuminococcaceaeUCG011.id.11368	8	0.906709(0.832425-0.987621)
	genus.Prevotella9.id.11183	19	1.108017(1.015604-1.208839)
	genus.LachnospiraceaeUCG008.id.11328	12	1.110538(1.000231-1.233009)
	family.BacteroidalesS24.7group.id.11173	10	1.149522(1.02712-1.28651)
	genus.unknowngenus.id.1000005479	6	1.173132(1.004522-1.370044)
	order.Selenomonadales.id.2165	12	1.188812(1.01203-1.396475)
	phylum.Actinobacteria.id.400	17	1.202516(1.015075-1.42457)
	family.unknownfamily.id.1000005471	11	1.23367(1.047721-1.452621)
	genus.unknowngenus.id.1000005472	11	1.237166(1.064543-1.437781)
	class.Negativicutes.id.2164	8	1.292966(1.075591-1.554273)
	order.MollicutesRF9.id.11579	15	1.168451(1.017332-1.342018)
Hanyu Zhang 2023 ^[26]	order	2	0.471(0.286-0.774)
	Bifidobacteriales		
	genus Ruminococcustorque	1	0.536877354869706(0.391-0.738)
	sgroup		
	genus Bifidobacteriaceae	2	2.124(1.152-3.915)
	genus Tyzzarella3	1	2.21142565432121(1.246-3.924)
	class Actinobacteria	1	2.53280022758574(1.228-5.224)
	genus Faecalibacterium	1	0.545239789689792(0.184-1.614)

Han Yan
2023^[27]

genus Erysipelatoclostridium	1	0.66116800731294(0.298-1.468)
genus Peptococcus	1	0.675101722137951(0.419-1.088)
genus Allisonella	1	0.750932133107426(0.464-1.215)
genus Enterorhabdus	1	0.76744596953411(0.447-1.317)
order Gastranaerophilales	1	0.7795799733847(0.45-1.35)
genus Eubacteriumcoprostanoligenesgroup	1	0.792819896331787(0.277-2.271)
family Streptococcaceae	1	0.999972600375377(0.429-2.332)
genus Streptococcus	1	0.999973966838869(0.447-2.235)
genus RuminococcaceaeUCG009	1	1.09160755405964(0.494-2.414)
genus Oxalobacter	1	1.09557314891857(0.606-1.981)
family Oxalobacteraceae	1	1.23244499853025(0.755-2.012)
genus Intestinibacter	1	1.57226695768584(0.604-4.094)
genus Romboutsia	1	1.78794246889422(0.825-3.874)
family Peptostreptococcaceae	1	1.79858455998767(0.824-3.924)
Ruminiclostridium6	14	0.708(0.544-0.921)
unknowngenus.id.1000001215	5	0.72(0.536-0.966)
Oxalobacter	4	0.752(0.578-0.98)
Butyrivibrio	14	0.83(0.69-1.000)

		Oxalobacter	11	0.842(0.709-1.000)
		Howardella	7	1.264(1.009-1.583)
		Alloprevotella	4	1.627(1.14-2.323)
		Ruminococcus gnavus group	2	1.703(1.018-2.849)
		Bifidobacterium	2	2.092(1.149-3.808)
Pneumonia	Yingjian Liu 2024 ^[17]	genus.Anaerofilum.id.2053	7	1.34(1.04,1.72)
		family.Bifidobacteriacae.id.433	13	0.68(0.54,0.85)
		family.Coriobacteriacae.id.811	17	1.34(1,1.81)
		order.Coriobacteriales.id.810	17	1.34(1,1.81)
		class.Coriobacteriia.id.809	17	1.34(1,1.81)
		family.FamilyXI.id.1936	8	1.18(1.01,1.38)
		genus.LachnospiraceaeND3007group.id.11317	3	2.1(1.17,3.78)
BP(bacterial pneumonia)	Yingjian Liu 2024 ^[17]	genus.Parasutterella.id.2892	12	2.75(1.49,5.08)
		phylum.Actinobacteria.id.400	16	2.09(1.13,3.88)
		family.Bifidobacteriacae.id.433	15	2.05(1.17,3.58)
		genus.Bifidobacterium.id.436	16	1.93(1.15,3.22)
		family.Enterobacteriaceae.id.3469	7	3.39(1.35,8.48)
		order.Enterobacteriales	7	3.39(1.35,8.48)

		s.id.3468		
		order.Gastranaerophil	9	1.67(1.02,2.74)
		ales.id.1591		
		family.Rhodospirillac	14	0.55(0.33,0.91)
		eae.id.2717		
		order.Rhodospirillales	13	0.56(0.33,0.95)
		.id.2667		
BLA(bronchopneumonia、lung abscess)	Yingjian Liu 2024 ^[17]	genus.Odoribacter.id.952	3	0.17(0.03,0.97)
		genus.Paraprevotella.i	12	0.54(0.3,0.94)
		d.962		
		phylum.Bacteroidetes.	11	0.32(0.11,0.92)
		id.905		
		genus.Christensenella	9	0.25(0.09,0.73)
		ceaeR.7group.id.1128		
		3		
		genus.Fusicatenibacte	18	2.2(1.03,4.7)
		r.id.11305		
		genus.Marvinbryantia.	9	0.41(0.17,1)
		id.2005		
		class.Methanobacteria	10	1.58(1,2.5)
		.id.119		
		family.Methanobacter	10	1.58(1,2.5)
		iaceae.id.121		
		order.Methanobacteria	10	1.58(1,2.5)
		les.id.120		
		genus.Methanobrevib	6	1.91(1.05,3.47)
		acter.id.123		
		family.Peptococcacea	10	2.03(1.01,4.07)
		e.id.2024		
		family.Porphyromona	9	4.93(1.2,20.15)
		daceae.id.943		
PP(pneumococcal pneumonia)	Yingjian Liu 2024 ^[17]	genus.Adlercreutzia.id	5	0.74(0.56,0.97)
		.812		
		genus.Holdemanella.i	10	1.2(1.02,1.41)
		d.11393		
		genus.Lachnospira.id.	6	0.66(0.47,0.93)
		2004		
		genus.Lachnospiracea	9	0.77(0.65,0.91)
		eNC2004group.id.113		
		16		
		family.Rikenellaceae.i	21	1.31(1.1,1.57)
		d.967		