Search strategy of Umbrella Review

Search Syntax PubMed 1:

("Severe Acute Respiratory Syndrome Coronavirus 2" [Supplementary Concept] OR "COVID-19" [Supplementary Concept] OR "covid 19 diagnostic testing" [Supplementary Concept] OR "covid 19 drug treatment" [Supplementary Concept] OR "covid 19 serotherapy"[Supplementary Concept] OR "covid 19 vaccine" [Supplementary Concept] OR "Severe Acute Respiratory Syndrome Coronavirus 2"[tiab] OR ncov*[tiab] OR covid*[tiab] OR sars-cov-2[tiab] OR "sars cov 2"[tiab] OR "SARS Coronavirus 2"[tiab] OR "Severe Acute Respiratory Syndrome CoV 2"[tiab] OR "Wuhan coronavirus"[tiab] OR "Wuhan seafood market pneumonia virus"[tiab] OR "SARS2"[tiab] OR "2019-nCoV"[tiab] OR "hcov-19"[tiab] OR „novel 2019 coronavirus“[tiab] OR "2019 novel coronavirus*"[tiab] OR „novel coronavirus 2019*“[tiab] OR "2019 novel human coronavirus*"[tiab] OR „human coronavirus 2019“[tiab] OR "coronavirus disease-19"[tiab] OR "corona virus disease-19"[tiab] OR "coronavirus disease 2019"[tiab] OR "corona virus disease 2019"[tiab] OR "2019 coronavirus disease"[tiab] OR "2019 corona virus disease"[tiab] OR „novel coronavirus disease 2019“[tiab] OR „novel coronavirus infection 2019“[tiab] OR "new coronavirus*"[tiab] OR "coronavirus outbreak"[tiab] OR "coronavirus epidemic"[tiab] OR "coronavirus pandemic"[tiab] OR "pandemic of coronavirus"[tiab]) AND ("2019/12/01"[PDAT] : "2099/12/31"[PDAT])

Search Syntax PubMed 2:

("wuhan"[tiab] or china[tiab] or hubei[tiab]) AND ("Severe Acute Respiratory Syndrome Coronavirus 2"[Supplementary Concept] OR "COVID-19" [Supplementary Concept] OR "covid 19 diagnostic testing"[Supplementary Concept] OR "covid 19 drug treatment"[Supplementary Concept] OR "covid 19 serotherapy"[Supplementary Concept] OR "covid 19 vaccine"[Supplementary Concept] OR "coronavirus*"[tiab] OR "corona virus*"[tiab] OR ncov[tiab] OR covid*[tiab] OR sars*[tiab])

Search Syntax Embase 1:

('severe acute respiratory syndrome coronavirus 2':ti,ab OR 'severe acute respiratory syndrome coronavirus 2'/exp OR 'covid 19'/exp OR ncov*:ti,ab OR covid*:ti,ab OR 'sars cov 2':ti,ab OR 'sars-cov-2':ti,ab OR 'sars coronavirus 2':ti,ab OR 'sars coronavirus 2'/exp OR 'severe acute respiratory syndrome cov 2':ti,ab OR 'wuhan coronavirus':ti,ab OR 'wuhan seafood market pneumonia virus':ti,ab OR sars2:ti,ab OR '2019-ncov':ti,ab OR 'hcov-19':ti,ab OR 'novel 2019 coronavirus':ti,ab OR '2019 novel coronavirus*':ti,ab OR 'novel coronavirus 2019'/exp OR '2019 novel human coronavirus*':ti,ab OR 'human coronavirus 2019':ti,ab OR 'coronavirus disease-19':ti,ab OR 'corona virus disease-19':ti,ab OR 'coronavirus disease 2019':ti,ab OR 'coronavirus disease 2019'/exp OR 'corona virus disease 2019':ti,ab OR '2019 coronavirus disease':ti,ab OR 'novel coronavirus 2019*':ti,ab OR 'novel coronavirus disease 2019':ti,ab OR 'novel coronavirus infection 2019':ti,ab OR '2019 corona virus disease':ti,ab OR 'new coronavirus*':ti,ab OR 'coronavirus outbreak':ti,ab OR 'coronavirus epidemic':ti,ab OR 'coronavirus pandemic':ti,ab OR 'pandemic of coronavirus':ti,ab OR 'severe acute respiratory syndrome coronavirus 2 vaccine'/exp OR 'covid 19 vaccine'/exp) AND 2020:py

Search Syntax Embase 2:

(wuhan:ti,ab OR china:ti,ab OR hubei:ti,ab) AND ('severe acute respiratory syndrome coronavirus 2':ti,ab OR 'severe acute respiratory syndrome coronavirus 2'/exp OR 'severe acute respiratory

syndrome coronavirus 2' OR 'covid*':ti,ab OR 'covid 19'/exp OR 'covid 19' OR coronavirus*:ti,ab OR 'corona virus*':ti,ab OR ncov:ti,ab OR covid*:ti,ab OR sars*:ti,ab OR 'sars coronavirus 2'/exp)

These search terms were combined with “systematic review OR meta-analysis”[all fields] to identify eligible systematic reviews.

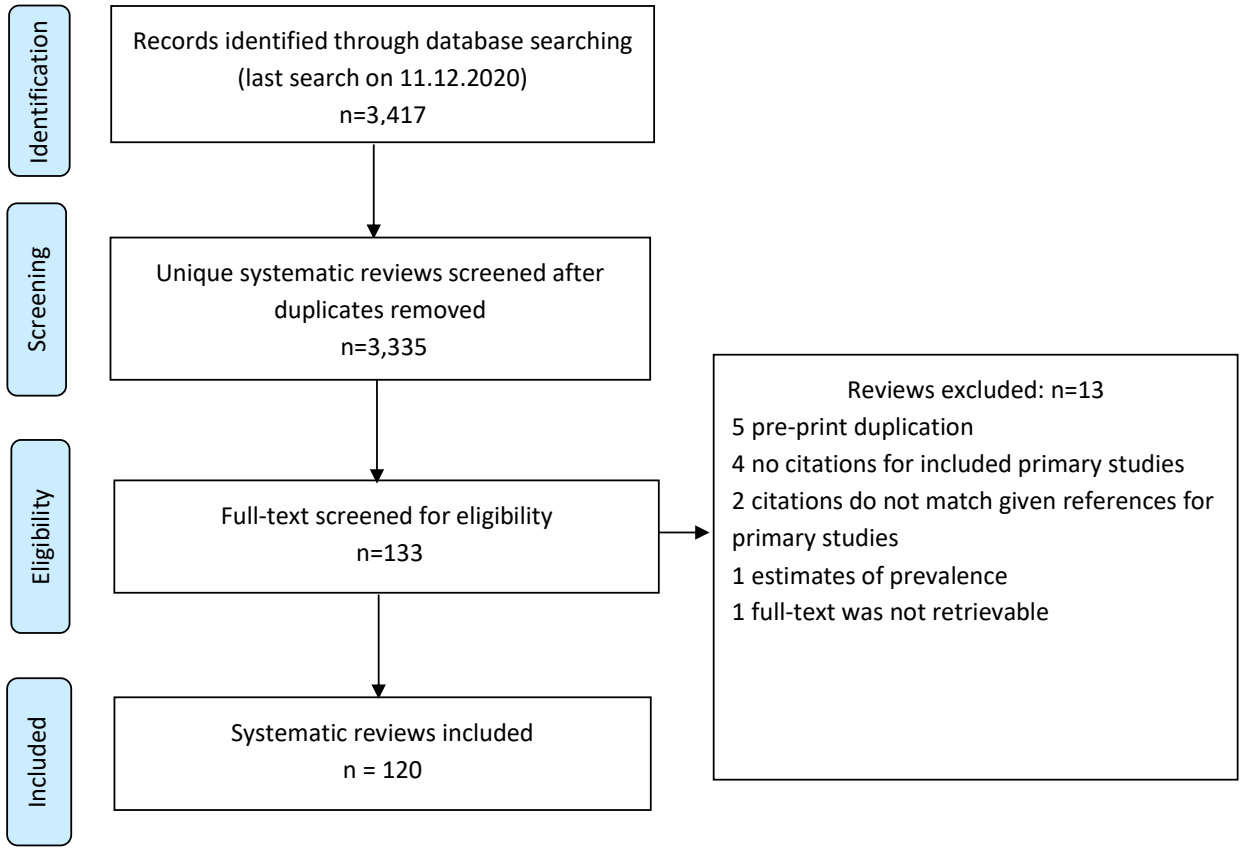

Figure S1. Selection of systematic reviews of Umbrella Review (Treskova et al. 2021)

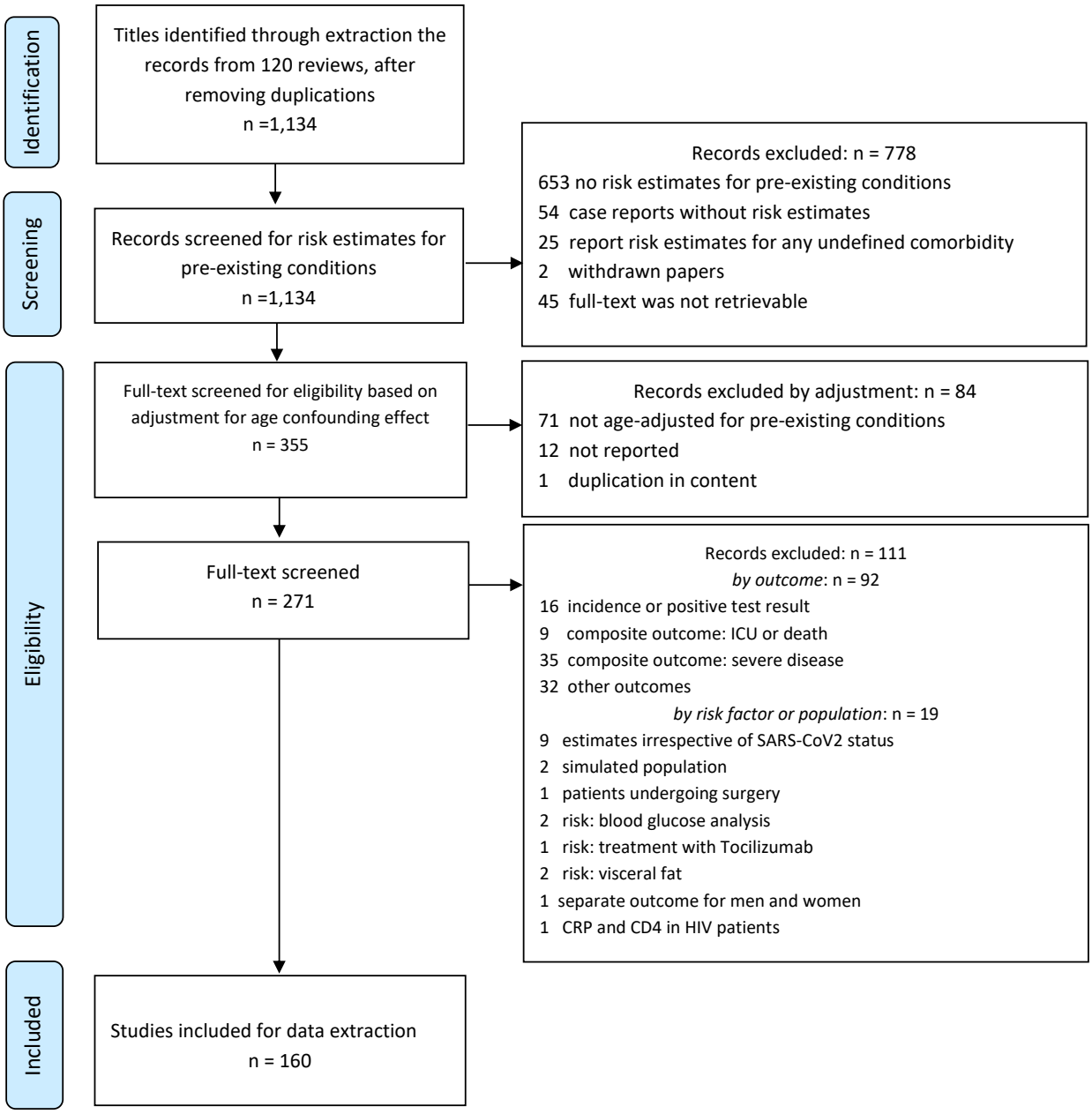

Figure S2. Selection of primary studies in umbrella review (Treskova et al. 2021)

Risk of Bias Instrument and Explanation

Major risk of bias domains	Risk	Criteria	Hints/ notes
1. Recruitment procedure and follow-up (in cohort studies) ***For ecological studies or other analytical studies†*** *HINT: We are looking for selection bias:* *Examples of possible selection bias:* • *If positive COVID-19 participants are recruited, positivity tested by clinical evaluation, such as typical symptoms. Ideally, participants were tested with RT-PCR laboratory tests to have a low risk of bias.* *Examples of baseline difference:* • *Protocols for recruitment or inclusion/exclusion criteria were applied differently across study groups* • *Study participants/populations were recruited at different times* • *Study participants/populations were recruited at different times* • *Study participants were recruited from different populations and proportions of participants from each population in each study group are not uniform (consider study base principle)* • *Participation rates were inadequate or not comparable across study groups*	low	☐ There were no baseline differences among study groups or adjustment techniques were used to correct for the differences, OR there is insufficient information about participant selection, but there is indirect evidence that suggests that participant recruitment and inclusion/exclusion criteria was consistent, as described by the criteria for a judgment of low risk of bias. ☐ For cohort studies: Loss to follow-up is below 20% in total and not different between the two groups (up to 10% difference). *	
	high	There were baseline differences among study groups and no adjustment was used to correct for differences, such as (select all that apply): ☐ Protocols for recruitment or inclusion/exclusion criteria were applied differently across study groups. ☐ Study participants/populations were recruited at different times. ☐ Study participants were recruited from different populations and proportions of participants from each population in each study group are not uniform (study base principle not considered). ☐ Participation rates were inadequate or not comparable across study groups. ☐ For cohort studies: total loss to follow-up is larger than acceptable (20% or more)* OR drop out differs between the groups by more than 10%* OR the reasons for drop out considerably differ between exposed and non-exposed groups.*	
	unclear	☐ There is insufficient information about participant selection to permit a judgment.	

Major risk of bias domains	Risk	Criteria	Hints/ notes
2. Exposure definition and measurement	low	☐ There is high confidence in the accuracy of the exposure assessment[#] or less established/ less direct exposure measurements are validated against well-established of direct methods[†] AND ☐ Exposure measured per year or by 5- or 10-year categories.	
	high	☐ Exposure was not accurately measured. [#] ☐ Less established or less direct exposure measurements are not validated and are suspected to introduce bias, which may affect the outcome assessment. [†] ☐ Exposure used "large/rough" categories (i.e., ≥60 vs. <60 years)	
	unclear	☐ Not reported.	
3. Outcome "hospitalization, ICU admission, mechanical ventilation, case mortality, deaths/mortality" Source and validation	low	☐ Outcome was objectively ascertained to minimize bias through objective sources (hospital/medical records). [#] ☐ Measurement methods were similar in the different groups. [#]	
	high	☐ Outcome was not objectively ascertained. [#] ☐ Measurement methods were different in the groups. [#]	
	unclear	☐ Not reported.	
4. Confounding	low	☐ Major age-related risk factors were assessed and accounted for (diabetes, cardiovascular disease, immunosuppression, kidney disease, liver disease, chronic pulmonary disease).	Confounders not assessed:
	high	☐ Major age-related risk factors were not assessed nor were they accounted for.	
	unclear	☐ Not reported.	
5. Analysis method: methods to reduce research specific bias	low	☐ Authors used adequate statistical models to reduce bias (e.g., standardization, adjustment in multivariate model, propensity scoring).	
	high	☐ Authors did not use adequate statistical models to reduce bias.	
	unclear	☐ Not reported.	

Minor risk of bias domains*	Risk	Criteria	Hints/ notes
6. Chronology	low	☐ Temporal relation may be established (age-related risk factors precede the outcome).	

Minor risk of bias domains*	Risk	Criteria	Hints/ notes
	high	☐ Temporal relation cannot be established. (laboratory values or other covariates reflecting disease severity are used in model)	Please specify:
	unclear	☐ Not reported.	
7. Funding	low	☐ Grant/ non-profit-organizations* ☐ Study was clearly not affected by sponsors. *	
	high	☐ Sponsoring organization participated in data analysis. ☐ Study was probably affected by sponsors.	
	unclear	☐ Industry, combined industry+grant*, unclear if study was affected by sponsors. ☐ Not reported.	
8. Conflict of interest	low	☐ Reported not having conflict of interest or clear from report/communication that study was not affected by author(s) affiliation.*	
	high	☐ Conflict of interest exists (at least one author).*	
	unclear	☐ Not reported.	

Overall risk of bias assessment: General rule for rating domains: if at least one box in domain is marked for "high risk", the domain is high risk.			**Low Risk**	**High Risk**	**Unclear Risk**
Major domains	1. Recruitment procedure and follow-up (in cohort studies)				
	2. Exposure assessment				
	3. Outcome source and validation				
	4. Confounding				
	5. Analysis method: methods to reduce research specific bias				
Minor domains	6. Chronology				
	7. Funding				
	8. Conflict of interest				
General rule for overall rating:	**Low risk of bias:** low risk in all major domains **High risk of bias:** if not low risk	**Overall assessment:**			

Description of Risk of Bias Domains (1-8)

1. Recruitment procedure and follow-up

A low-risk study should have minimized selection bias by ensuring that there were no baseline differences among the study groups, or if there were, adjustment techniques were used to correct for the difference. If there was indirect evidence suggesting that participant recruitment and that the inclusion and exclusion criteria were consistent, the domain was assessed as having a low risk of bias. In cohort studies, the loss to follow-up should have been less than 20% and this loss should not be different between the groups. If the studies recruited COVID-19 positive participants, preferably a real-time reverse transcription polymerase chain reaction (RT-PCR) test would have been used to test for COVID-19 positivity. If COVID-19 ascertainment methods were unreliable, such as relying on clinical symptoms, the domain was also considered as high risk. If there were baseline differences among the study groups, such as using different inclusion/exclusion criteria, inadequate participation rates or rates that were not comparable across the group, or if the study participants were recruited from different populations and the proportions of participants from each population in each study were not uniform, the domain was considered as high risk.

2. **Exposure definition and measurement**

If age was accurately measured and finely categorized, such as in per year, or in five or ten-year categories, this domain was considered to have a low risk of bias. If age was measured in rough or large categories, greater than in 10-year categories or such as >60 years vs ≤60 years, the domain was considered as having a high risk of bias.

3. Outcome source and validation

If the outcome was objectively measured to minimize bias, such as through hospital or medical records, and the assessment was similar for the comparison groups, this domain was assessed as having a low risk of bias.

4. Age-dependent risk factors

In order for studies to be considered as having a low risk of bias, the following age-dependent factors should have been considered, based on the current evidence (7, 8): (1) diabetes, (2) cardiovascular disease, (3) immunosuppression/cancer, (4) chronic respiratory diseases, such as chronic obstructive pulmonary disease (COPD), (5) chronic kidney disease, and (6) chronic liver disease. Risk factors for COVID-19 disease severity with no or little age-dependency (such as sex, obesity, smoking) were not considered age-dependent risk factors.

5. Analysis methods

If adequate statistical models were used to reduce bias and control for confounding, this domain was considered as having a low risk of bias.

6. Chronology

If temporal relation may be established, especially considering that the age-related risk factors used in the model precede the outcome, this domain was assessed as having a low risk of bias. If there were covariates in the model reflecting disease severity (such as fever, lymphocite counts, D-dimer level, etc,) the domain was considered as having high risk.

7. Funding

Funding was assessed in two areas, namely the funding source and its involvement in the research. If a study was funded by non-profit organization(s) and it was not affected by sponsors, the domain was considered low risk. If the funding organization participated in the data analysis or the study was probably affected by the sponsors, the domain had a high risk of bias.

8. Conflict of interest

If the authors reported no conflicts of interest, this domain was low risk. If one author had a conflict of interest, this domain was assessed as having a high risk of bias.

Overall Risk of Bias

From the above domains, domains 1-5 were set as major domains, while domains 6-8 were minor domains. A study could obtain an overall low risk of bias if all major domains were assessed as having low risk of bias.

Table S1. Excluded studies and reasons for exclusion

Reference (st: Stratification of age only (no adjustment in model); co: Comorbidities missing; p: Special population (i.e. cancer patients, patients with diabetes); a: Age effect estimate not provided; ag: age category unclear; o: Other)	Reason for exclusion					
	st	co	p	a	ag	o
Al-Sabah, S., Al-Haddad, M., Al-Youha, S., Jamal, M., & Almazeedi, S. (2020). COVID-19: Impact of obesity and diabetes on disease severity. Clinical Obesity, 10(6), e12414.		x				
Al-Salameh, A., Lanoix, J. P., Bennis, Y., Andrejak, C., Brochot, E., Deschasse, G., ... & Lalau, J. D. (2020). Characteristics and outcomes of COVID-19 in hospitalized patients with and without diabetes. Diabetes/Metabolism Research and Reviews, e3388.		x				
Amit, M., Sorkin, A., Chen, J., Cohen, B., Karol, D., Tsur, A. M., ... & Benov, A. (2020). Clinical course and outcomes of severe Covid-19: a national scale study. Journal of clinical medicine, 9(7), 2282.		x				
Bellan, M., Patti, G., Hayden, E., Azzolina, D., Pirisi, M., Acquaviva, A., ... & Sainaghi, P. P. (2020). Fatality rate and predictors of mortality in an Italian cohort of hospitalized COVID-19 patients. Scientific reports, 10(1), 1-10.		x				
Berenguer, J., Ryan, P., Rodríguez-Baño, J., Jarrín, I., Carratalà, J., Pachón, J., ... & Jofre, C. S. (2020). Characteristics and predictors of death among 4035 consecutively hospitalized patients with COVID-19 in Spain. Clinical Microbiology and Infection, 26(11), 1525-1536.		x				
Bezzio, C., Saibeni, S., Variola, A., Allocca, M., Massari, A., Gerardi, V., ... & Fiorino, G. (2020). Outcomes of COVID-19 in 79 patients with IBD in Italy: an IG-IBD study. Gut, 69(7), 1213-1217.			x			
Bianchetti, A., Rozzini, R., Guerini, F., Boffelli, S., Ranieri, P., Minelli, G., ... & Trabucchi, M. (2020). Clinical presentation of COVID19 in dementia patients. The journal of nutrition, health & aging, 24, 560-562.		x				
Borghesi, A., Zigliani, A., Golemi, S., Carapella, N., Maculotti, P., Farina, D., & Maroldi, R. (2020). Chest X-ray severity index as a predictor of in-hospital mortality in coronavirus disease 2019: A study of 302 patients from Italy. International Journal of Infectious Diseases, 96, 291-293.		x				
Busetto, L., Bettini, S., Fabris, R., Serra, R., Dal Pra, C., Maffei, P., ... & Vettor, R. (2020). Obesity and COVID-19: an Italian snapshot. Obesity, 28(9), 1600-1605.		x				
Cariou, B., Hadjadj, S., Wargny, M., Pichelin, M., Al-Salameh, A., Allix, I., ... & Gourdy, P. (2020). Phenotypic characteristics and prognosis of inpatients with COVID-19 and diabetes: the CORONADO study. Diabetologia, 63(8), 1500-1515.			x			
Caussy, C., Pattou, F., Wallet, F., Simon, C., Chalopin, S., Telliam, C., ... & Disse, E. (2020). Prevalence of obesity among adult inpatients with COVID-19 in France. The Lancet Diabetes & Endocrinology, 8(7), 562-564.				x		
Chen, F., Sun, W., Sun, S., Li, Z., Wang, Z., & Yu, L. (2020). Clinical characteristics and risk factors for mortality among inpatients with COVID-19 in Wuhan, China. Clinical and translational medicine.		x				
Chen, R., Liang, W., Jiang, M., Guan, W., Zhan, C., Wang, T., ... & for COVID, M. T. E. G. (2020). Risk factors of fatal outcome in hospitalized subjects with coronavirus disease 2019 from a nationwide analysis in China. Chest, 158(1), 97-105.		x				
Ciceri, F., Castagna, A., Rovere-Querini, P., De Cobelli, F., Ruggeri, A., Galli, L., ... & Zangrillo, A. (2020). Early predictors of clinical outcomes of COVID-19 outbreak in Milan, Italy. Clinical Immunology, 217, 108509.		x				
Crouse, A. B., Grimes, T., Li, P., Might, M., Ovalle, F., & Shalev, A. (2021). Metformin use is associated with reduced mortality in a diverse population with COVID-19 and diabetes. Frontiers in Endocrinology, 11, 1081.		x				
D'Silva, K. M., Serling-Boyd, N., Wallwork, R., Hsu, T., Fu, X., Gravallese, E. M., ... & Wallace, Z. S. (2020). Clinical characteristics and outcomes of patients with coronavirus disease 2019 (COVID-19) and rheumatic disease: a comparative cohort study from a US 'hot spot'. Annals of the rheumatic diseases, 79(9), 1156-1162.				x		

Reference (st: Stratification of age only (no adjustment in model); co: Comorbidities missing; p: Special population (i.e. cancer patients, patients with diabetes); a: Age effect estimate not provided; ag: age category unclear; o: Other)	Reason for exclusion					
	st	co	p	a	ag	o
Dai, M., Liu, D., Liu, M., Zhou, F., Li, G., Chen, Z., ... & Cai, H. (2020). Patients with cancer appear more vulnerable to SARS-CoV-2: a multicenter study during the COVID-19 outbreak. Cancer discovery, 10(6), 783-791.		x				
Denova-Gutiérrez, E., Lopez-Gatell, H., Alomia-Zegarra, J. L., López-Ridaura, R., Zaragoza-Jimenez, C. A., Dyer-Leal, D. D., ... & Barquera, S. (2020). The association of obesity, type 2 Diabetes, and hypertension with severe coronavirus disease 2019 on admission among Mexican patients. Obesity, 28(10), 1826-1832.		x				
Du, R. H., Liang, L. R., Yang, C. Q., Wang, W., Cao, T. Z., Li, M., ... & Shi, H. Z. (2020). Predictors of mortality for patients with COVID-19 pneumonia caused by SARS-CoV-2: a prospective cohort study. European Respiratory Journal, 55(5).		x				
Escalera-Antezana, J. P., Lizon-Ferrufino, N. F., Maldonado-Alanoca, A., Alarcon-De-la-Vega, G., Alvarado-Arnez, L. E., Balderrama-Saavedra, M. A., ... & Rodriguez-Morales, A. J. (2020). Risk factors for mortality in patients with Coronavirus Disease 2019 (COVID-19) in Bolivia: An analysis of the first 107 confirmed cases. Infez Med, 28(2), 238-242.		x				
Galloway, J. B., Norton, S., Barker, R. D., Brookes, A., Carey, I., Clarke, B. D., ... & Cantle, F. (2020). A clinical risk score to identify patients with COVID-19 at high risk of critical care admission or death: an observational cohort study. Journal of Infection, 81(2), 282-288.	x					
Gao, C., Cai, Y., Zhang, K., Zhou, L., Zhang, Y., Zhang, X., ... & Li, F. (2020). Association of hypertension and antihypertensive treatment with COVID-19 mortality: a retrospective observational study. European heart journal, 41(22), 2058-2066.		x				
Garassino, M. C., Whisenant, J. G., Huang, L. C., Trama, A., Torri, V., Agustoni, F., ... & Horn, L. (2020). COVID-19 in patients with thoracic malignancies (TERAVOLT): first results of an international, registry-based, cohort study. The Lancet Oncology, 21(7), 914-922.		x				
Garcia, P. D. W., Fumeaux, T., Guerci, P., Heuberger, D. M., Montomoli, J., Roche-Campo, F., ... & RISC-19-ICU Investigators. (2020). Prognostic factors associated with mortality risk and disease progression in 639 critically ill patients with COVID-19 in Europe: Initial report of the international RISC-19-ICU prospective observational cohort. EClinicalMedicine, 25, 100449.	x					
Gayam, V., Chobufo, M. D., Merghani, M. A., Lamichhane, S., Garlapati, P. R., & Adler, M. K. (2021). Clinical characteristics and predictors of mortality in African-Americans with COVID-19 from an inner-city community teaching hospital in New York. Journal of medical virology, 93(2), 812-819.		x				
Geretti, A. M., Stockdale, A. J., Kelly, S. H., Cevik, M., Collins, S., Waters, L., ... & Semple, M. G. (2020). Outcomes of COVID-19 related hospitalization among people with HIV in the ISARIC WHO Clinical Characterization Protocol (UK): a prospective observational study. Clinical Infectious Diseases.			x			
Goicoechea, M., Cámara, L. A. S., Macías, N., de Morales, A. M., Rojas, Á. G., Bascuñana, A., ... & Aragoncillo, I. (2020). COVID-19: clinical course and outcomes of 36 hemodialysis patients in Spain. Kidney international, 98(1), 27-34.		x				
Goyal, P., Ringel, J. B., Rajan, M., Choi, J. J., Pinheiro, L. C., Li, H. A., ... & Safford, M. M. (2020). Obesity and COVID-19 in New York City: a retrospective cohort study. Annals of Internal Medicine, 173(10), 855-858.				x		
Halasz, G., Leoni, M. L., Villani, G. Q., Nolli, M., & Villani, M. (2020). Obesity, overweight and survival in critically ill patients with SARS-CoV-2 pneumonia: is there an obesity paradox? Preliminary results from Italy. European Journal of Preventive Cardiology, 2047487320939675.				x		
Harmouch, F., Shah, K., Hippen, J. T., Kumar, A., & Goel, H. (2021). Is it all in the heart? Myocardial injury as major predictor of mortality among hospitalized COVID-19 patients. Journal of medical virology, 93(2), 973-982.		x				
Huang, S., Wang, J., Liu, F., Liu, J., Cao, G., Yang, C., ... & Xiong, B. (2020). COVID-19 patients with hypertension have more severe disease: a multicenter retrospective observational study. Hypertension Research, 43(8), 824-831.		x				

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	st	co	p	a	ag	o
Hur, K., Price, C. P., Gray, E. L., Gulati, R. K., Maksimoski, M., Racette, S. D., ... & Khanwalkar, A. R. (2020). <? covid19?> Factors Associated With Intubation and Prolonged Intubation in Hospitalized Patients With COVID-19. Otolaryngology–Head and Neck Surgery, 163(1), 170-178.		x				
Kim, M. K., Jeon, J. H., Kim, S. W., Moon, J. S., Cho, N. H., Han, E., ... & Lee, J. H. (2020). The clinical characteristics and outcomes of patients with moderate-to-severe coronavirus disease 2019 infection and diabetes in Daegu, South Korea. Diabetes & metabolism journal, 44(4), 602.				x		
Kuderer, N. M., Choueiri, T. K., Shah, D. P., Shyr, Y., Rubinstein, S. M., Rivera, D. R., ... & Loaiza-Bonilla, A. (2020). Clinical impact of COVID-19 on patients with cancer (CCC19): a cohort study. The Lancet, 395(10241), 1907-1918.		x				
Lee, L. Y., Cazier, J. B., Starkey, T., Turnbull, C. D., Team, U. C. C. M. P., Kerr, R., & Middleton, G. (2020). COVID-19 mortality in patients with cancer on chemotherapy or other anticancer treatments: a prospective cohort study. The Lancet, 395(10241), 1919-1926.			x			
Lee, L. Y., Cazier, J. B., Starkey, T., Briggs, S. E., Arnold, R., Bisht, V., ... & Wyatt, S. (2020). COVID-19 prevalence and mortality in patients with cancer and the effect of primary tumour subtype and patient demographics: a prospective cohort study. The lancet oncology, 21(10), 1309-1316.				x		
Li, Q., Chen, L., Li, Q., He, W., Yu, J., Chen, L., ... & Hu, Y. (2020). Cancer increases risk of in-hospital death from COVID-19 in persons< 65 years and those not in complete remission. Leukemia, 34(9), 2384-2391.		x				
Lieberman-Cribbin, W., Rapp, J., Alpert, N., Tuminello, S., & Taioli, E. (2020). The impact of asthma on mortality in patients with COVID-19. Chest, 158(6), 2290-2291.		x				
Mahdavinia, M., Foster, K. J., Jauregui, E., Moore, D., Adnan, D., Andy-Nweye, A. B., ... & Bishehsari, F. (2020). Asthma prolongs intubation in COVID-19. The Journal of Allergy and Clinical Immunology: In Practice, 8(7), 2388-2391.				x		
Mato, A. R., Roeker, L. E., Lamanna, N., Allan, J. N., Leslie, L., Pagel, J. M., ... & Eyre, T. A. (2020). Outcomes of COVID-19 in patients with CLL: a multicenter international experience. Blood, The Journal of the American Society of Hematology, 136(10), 1134-1143.			x			
McCarty, T. R., Hathorn, K. E., Redd, W. D., Rodriguez, N. J., Zhou, J. C., Bazarbashi, A. N., ... & Chan, W. W. (2020). How do presenting symptoms and outcomes differ by race/ethnicity among hospitalized patients with COVID-19 infection? Experience in Massachusetts. Clinical Infectious Diseases.					x	
Mehta, V., Goel, S., Kabarriti, R., Cole, D., Goldfinger, M., Acuna-Villaorduna, A., ... & Verma, A. (2020). Case fatality rate of cancer patients with COVID-19 in a New York hospital system. Cancer discovery, 10(7), 935-941.			x			
Mendy, A., Apewokin, S., Wells, A. A., & Morrow, A. L. (2020). Factors associated with hospitalization and disease severity in a racially and ethnically diverse population of COVID-19 patients. MedRxiv.		x				
Mikami, T., Miyashita, H., Yamada, T., Harrington, M., Steinberg, D., Dunn, A., & Siau, E. (2021). Risk factors for mortality in patients with COVID-19 in New York City. Journal of general internal medicine, 36(1), 17-26.		x				
Miyashita, H., & Kuno, T. (2020). Prognosis of coronavirus disease 2019 (COVID-19) in patients with HIV infection in New York City. HIV medicine.		x				
Miyashita, H., Mikami, T., Chopra, N., Yamada, T., Chernyavsky, S., Rizk, D., & Cruz, C. (2020). Do patients with cancer have a poorer prognosis of COVID-19? An experience in New York City. Annals of Oncology.		x				
Miyashita, S., Yamada, T., Mikami, T., Miyashita, H., Chopra, N., & Rizk, D. (2020). Impact of dementia on clinical outcomes in elderly patients with coronavirus 2019 (COVID-19): an experience in New York. Geriatrics & Gerontology International, 20(7), 732.				x		
Moon, S. S., Lee, K., Park, J., Yun, S., Lee, Y. S., & Lee, D. S. (2020). Clinical characteristics and mortality predictors of COVID-19 patients hospitalized at nationally-designated treatment hospitals. Journal of Korean Medical Science, 35(36).		x				

Reference (st: Stratification of age only (no adjustment in model); co: Comorbidities missing; p: Special population (i.e. cancer patients, patients with diabetes); a: Age effect estimate not provided; ag: age category unclear; o: Other)	Reason for exclusion					
	st	co	p	a	ag	o
Nakeshbandi, M., Maini, R., Daniel, P., Rosengarten, S., Parmar, P., Wilson, C., ... & Breitman, I. (2020). The impact of obesity on COVID-19 complications: a retrospective cohort study. International Journal of Obesity, 44(9), 1832-1837.		x				
Okoh, A. K., Sossou, C., Dangayach, N. S., Meledathu, S., Phillips, O., Raczek, C., ... & Grewal, H. S. (2020). Coronavirus disease 19 in minority populations of Newark, New Jersey. International journal for equity in health, 19(1), 1-8.		x				
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Reference (st: Stratification of age only (no adjustment in model); co: Comorbidities missing; p: Special population (i.e. cancer patients, patients with diabetes); a: Age effect estimate not provided; ag: age category unclear; o: Other)	Reason for exclusion					
	st	co	p	a	ag	o
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Reference (st: Stratification of age only (no adjustment in model); co: Comorbidities missing; p: Special population (i.e. cancer patients, patients with diabetes); a: Age effect estimate not provided; ag: age category unclear; o: Other)	Reason for exclusion					
	st	co	p	a	ag	o
Yun, F., Yun, L., Tao, B., Yusang, X., Jie, H., Jian, L., ... & Hongzhou, L. (2020). COVID-19 with Different Severity: A Multi-center Study of Clinical Features.		x				
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Table S2. Characteristics of the included studies

Author, Year Country (Ref)	Study Design	Population Sampling Participants	Age/Sex Characteristics	Time period of study	Age categories used	Outcome Outcome ascertainment
Antwi-Amoabeng 2020 USA (165)	Retrospective cohort	Patients in Renown Regional Medical Center (a referral hospital serving most of Northern Nevada) and affiliated satellite hospitals. All people who had a positive nasopharyngeal RT-PCR test for SARS-COV-2. N= 172	Mean age: 53 yrs. Range: 33.5-68 yrs. Male: 96 (55.8%) Female: 76 (44.2%)	March 12- May 8, 2020	≤61 yrs. vs. >61 yrs.	Mortality (in hospital) Data extracted from electronic health records
Argenziano 2020 USA (166)	Prospective cohort	First 1000 consecutive adult COVID-19 patients at New York-Presbyterian/ Columbia University Irving Medical Center (NYP/CUIMC) registered in the emergency department or as inpatients. Laboratory-confirmed COVID-19 infection confirmed by SARS-CoV-2 RT-PCR test N=1000	Median age: 63.0 yrs. IQR: 50.0-75.0 yrs. Male: 596 (59.6%) Female: 404 (41.4%)	March 11-April 6th, 2020 followed up until April 30, 2020	Per year	ICU admission In-hospital mortality Hospital records
Azar 2020 USA (167)	Retrospective cohort	Sutter health system, delivering comprehensive medical services in ambulatory clinics and acute care hospitals in North California. Patients aged 18 or older with a positive test result in the HER laboratory records or patients who had a documented ICD-10 diagnosis of confirmed COVID-19 in the electronic health record without a positive test result. N= 1052	Mean age: 53.0 yrs. 95% CI: 51.8-54.1 yrs. Male: 518 (49.2%) Female: 534 (50.8%)	COVID-19 diagnosis January 1 – April 8, 2020	18-39 years 40-49 yrs. 50-59 yrs. 60-69 yrs. 70-79 yrs. 80+ yrs.	Hospitalization Data extracted from the Sutter electronic health records
Baqui 2020 Brazil (168)	Retrospective cohort	Hospitalized patients in North Region and Central-south region in Brazil with a positive RT-PCR test for severe acute respiratory syndrome coronavirus 2 and who had ethnicity information in the data set SIVEP-Grip (Sistema de Informação de Vigilância Epidemiológica da Gripe).	Mean age (SD) North region: Survivors: 46.9 yrs. (19.3) Non-survivors: 65.3 yrs. (16.0) Central-south region: Survivors: 52.2 yrs. (16.6)	February 27-May 4, 2020	<40 yrs. 40-50 yrs. 50-60 yrs. 60-70 yrs. ≥70 yrs.	Mortality (in-hospital) Information on death through SIVEP-Grip

Author, Year Country (Ref)	Study Design	Population Sampling Participants	Age/Sex Characteristics	Time period of study	Age categories used	Outcome Outcome ascertainment
		N= 6882	Non-survivors: 67.9 yrs. (15.8) Male: 58.2% Female: 42.8%			
Bello-Chavolla 2020 Mexico (170)	Retrospective cohort	Individuals with confirmed cases of COVID-19 from the General Directorate of Epidemiology of the Mexican Ministry of Health. N= 51, 633	Mean age (SD) 46.65 yrs. (15.83) Male: 29,803 (57.7%) Female:21,830 (42.3%)	Until May 18, 2020	<40 yrs. ≥40yrs. - ≤65 yrs. >65 yrs.	30-day mortality (population based) Data from Mexican Ministry of Health
Bi, Hong, and Meng 2020 China (173)	Prospective cohort	Patients at Shenzhen Third People's Hospital, the designated hospital to treat all patients diagnosed with COVID-19 in Shenzhen, China, regardless of clinical severity and symptom profile. N= 420	Mean age (IQR) 45 yrs. (34.60) Male: 200 (47.6%) Female: 220 (52.4%)	January 11-March 10, 2020	0-39 yrs. 40-59 yrs. 60+	ICU Admission (hospital based) Hospital records
Boulle 2020 South Africa (176)	Prospective cohort	Public sector patients aged ≥20 years with documented sex and not known to have died before March 1, 2020 (before first diagnosed COVID-19 case) in the Western Cape Provincial Health Data Centre (WCPHDC). COVID-19 diagnosis based on a positive SARS-CoV-2 PCR test, available to all until June 1, 2020 and then restricted to patients requiring admission or aged >55 years or with comorbidities. All public-sector SARS-Cov-2 cases diagnosed before June 1, 2020 N= 15,203 Hospitalized public-sector SARS-CoV-2 cases N= 2978	Age All public-sector SARS-Cov-2 cases diagnosed before June 1, 2020 Survivors 20-39 yrs: 8,653 (59%) 40-49 yrs.: 2,991 (20%) 50-59 yrs.: 1,881 (13%) 60-69 yrs.: 739 (5%) ≥70 yrs.: 429 (3%) Non-survivors 20-39 yrs: 35 (7%) 40-49 yrs.: 51 (10%) 50-59 yrs.: 137 (27%) 60-69 yrs.: 150 (29%) ≥ 70 yrs.: 137 (27%)	Deaths 100 days since March 1, 2020	20-39 yrs. 40-49 yrs. 50-59 yrs. 60-69 yrs. ≥70 yrs.	Mortality by 100 days for: -all adult cases diagnosed before June 1, 2020 (population-based mortality) and -hospitalized adult COVID-19 cases (in-hospital mortality) Ascertainment through WCPHDC
Burn 2020 Spain (177)	Retrospective cohort	Individuals recorded in the Information System for Research in Primary Care database (SIDIAP) in Catalonia, Spain, with at least one year of prior history available, no prior diagnosis for COVID-19	Median age Whole study population 44 yrs., IQR: 25-60 yrs. Diagnosed with COVID-19	March 1, 2020 to May 6, 2020	5-year age categories starting with 20 years to 95 years	Hospitalization with COVID-19 (population based) Hospitalization with COVID-19 (diagnosed cases)

Author, Year Country (Ref)	Study Design	Population Sampling Participants	Age/Sex Characteristics	Time period of study	Age categories used	Outcome Outcome ascertainment
		and who were not hospitalized on March 1, 2020 included. SIDIAP captures patient records from 80% of the Catalan population, and is representative in geography, age, and gender. Linkage was made at an individual level to COVID-19 PT-PCR testing data, hospital data, and regional mortality data. General population: N= 5,586,521 Diagnosed with COVID-19: N= 102,002 Hospitalized with COVID-19: N= 16,901	47 yrs., IQR: 36-61 Hospitalized after diagnosis 61 yrs. (50-75 yrs.) Died after being hospitalized 81 yrs. (73-87 yrs.) Sex Diagnosed with COVID-19 Female: 59 % Male: 41% Hospitalized after diagnosis Female: 4,357 (46.2%) Male: 5080 (53.8%)			Mortality (from diagnosed to death/population based) Mortality (hospital-based) Outcome ascertainment through SIDIAP.
Carrillo-Vega* 2020 Mexico (180)	Retrospective cohort	All records of positive cases of COVID-19 from the Epidemiological Surveillance System for Viral Respiratory Diseases of the Mexican Ministry of Health N= 9946	Mean age (SD) 48.15 yrs. (14.35) Sex Male: 5753 (57.8%) Female: 4193 (42.2%)	Until April 23, 2020	25-49 yrs. 50-74 yrs. ≥75 yrs.	Hospitalization by individuals testing positive (population-based) Mortality (population-based) Records from Mexican Ministry of Health
Carter and Collins** 2020 UK and Italy (181)	Prospective cohort	Network of clinical teams with an interest in frailty from ten UK sites and one Italian site as part of the COVID-19 in Older People (COPE) study. All consecutive patients admitted to hospitals aged ≥18 years with diagnosis of COVID-19. Diagnosis through swabs or by clinical diagnosis. N= 1564 UK: 1410 (90.2%) Italy: 154 (9.8%)	Median age: 74 yrs. IQR: 61-83 Male: 903 (57.7%) Female: 661 (42.3%)	Admitted between February 27-April 28, 2020	<65 yrs. 65-79 yrs. >80 yrs.	Mortality from the date of admission or date of diagnosis (in-hospital mortality) Day 7 mortality (in-hospital) Hospital records
Chen and Bai 2020 China (184)	Retrospective cohort	Hospitalized patients in three branches of Tongji Hospital with confirmed COVID-19 N= 3309	Median age: 62 yrs. IQR: 49-69 yrs. Male: 1642 (49.6%) Female: 1667 (50.4%)	January 18-March 27, 2020	≤ 45 yrs. > 45 yrs.	Mortality (in-hospital) Hospital records

Author, Year Country (Ref)	**Study Design**	**Population Sampling Participants**	**Age/Sex Characteristics**	**Time period of study**	**Age categories used**	**Outcome** **Outcome ascertainment**
Cchiba and Patel‡ 2020 USA (186)	Retrospective cohort	Patients of all ages (two <18 years) with confirmed diagnosis of COVID-19 with RT-PCR in 10 hospitals affiliated with Northwestern Medicine (Chicago and surrounding Illinois suburbs) N= 1526	<40 yrs.: 414 (27.1%) 40-69 yrs.: 844 (55.3%) ≥70 yrs.: 268 (17.6%) Male: 718 (47%) Female: 808 (53%)	March 1- April 15, 2020; mortality determined up to April 30, 2020	<40 yrs. 40-69 yrs. ≥70 yrs.	Hospitalization Ascertainment by electronic records
Chilimuri 2020 USA (187)	Retrospective cohort	Consecutive patients 18 years and above diagnosed with COVID-19 by RT-PCR test and admitted to the Bronxcare Health System (BCHS) hospital in the South Bronx, New York City. N= 375	Median age: 63 yrs. IQR: 52-72 Male: 236 (63%) Female: 139 (37%)	March 9 – April 9, 2020	Per year	Mortality (in-hospital) Hospital and electronic health records
Ciardullo 2020 Italy (188)	Retrospective cohort	Patients aged 18 years or older admitted to Policlinico di Monza hospital in Monza, Italy diagnosed with COVID-19 through RT-PCR tests and/or clinically by the presence of typical symptoms, exposures to known affected individuals and radiographic findings of interstitial pneumonia. N=371 (339 for analysis due to missing data)	Mean age: 72 yrs. SD= 14 Male: 210 (65.4%) Female: 129 (34.6%)	February 22-May 15, 2020	Per year	Mortality (in-hospital) Hospital and electronic records
Conversano and Melillo 2020 Italy (190)	Retrospective cohort	All patients admitted to San Raffaele Hospital in Milan with a confirmed diagnosis of SARS-CoV-2 pneumonia by chest radiograph or computed tomographic scan and real-time polymerase chain reaction. N=191	Mean age: 63.4 yrs. SD: 14.9 Male: 131 (68.6%) Female: 60 (31.4%)	February 27- March 17, 2020 followed up until April 8, 2020	Per year	Mortality (in-hospital) Hospital electronic records
Costa Monteiro 2020 USA (191)	Retrospective cohort	First 112 hospitalized patients 18 years or older with a positive PCR test or mini-bronchoalveolar lavage test at the University of California, Los Angeles (UCLA) hospital system (Ronald Reagan UCLA Medical Center and Santa Monica UCLA Medical Center N=112	Median age: 61 yrs. IQR: 45-74 Male: 74 (66%) Female: 38 (34%)	March 12- April 16, 2020	Per year	Mechanical ventilation Electronic health records/ hospital records
Cummings 2020	Prospective cohort	Adult patients (aged 18 years or older) admitted to one of two New York-Presbyterian hospitals	Median age: 62 yrs. IQR: 51-72	March 2- April 1, 2020 followed	Per 10-year increase	In-hospital mortality among critically ill patients

Author, Year Country (Ref)	**Study Design**	**Population Sampling Participants**	**Age/Sex Characteristics**	**Time period of study**	**Age categories used**	**Outcome** **Outcome ascertainment**
USA (193)		affiliated with Columbia University Irving Medical Center in northern Manhattan, New York City and diagnosed with laboratory-confirmed (RT-PCR) COVID-19 and were critically ill with acute hypoxaemic respiratory failure. N= 257		up until April 28, 2020		Medical/hospital records
Di Castelnuovo 2020 Italy (197)	Retrospective cohort	Hospitalized Patients in 30 Italian clinical centres. Laboratory-confirmed SARS-CoV-2 infection confirmed by polymerase chain reaction on a nasopharyngeal swab. N=3894	Median age: 67 yrs. IQR: 55-79 yrs. Male: 2403 (61.7%) Female: 1491 (38.3%)	February 19-May 23, 2020 assessed on May 29, 2020	18-44 yrs. 45-64 yrs. 65-74 yrs. 75-84 yrs. 85+ yrs.	In-hospital mortality or palliative discharge Clinical data were abstracted from electronic medical records or charts
Docherty 2020 United Kingdom (198)	Prospective cohort	Admitted patients to one of 208 acute care hospitals in England, Scotland, and Wales who tested positive for SARS-CoV-2. RT-PCT was the only mode of testing available during the period of study. The decision to test was at the discretion of the clinician attending the patient, and not defined by protocol. Only patients who tested positive for Covid-19 were eligible for enrolment. N= 20,133 (34% of covid-19 admissions in the 3 countries)	Median age: 73 yrs. IQR: 58-82 yrs. Range: 0-104 yrs. Male: 12,068 (59.9%) Female: 8065 (40.1%)	February 6 - April 19, 2020 followed up until May 3, 2020	<50 yrs. 50-59 yrs. 60-69 yrs. 70-79 yrs. ≥80 yrs.	In-hospital mortality Hospital records
Du 2020 China (199)	Prospective cohort	Hospitalized patients in Wuhan Pulmonary Hospital (Wuhan, Hubei Province, China). All patients with confirmed or suspected COVID-19 pneumonia enrolled in this study were tested by RT-PCR test. N=179	Mean age: 53.0 yrs. SD: ±13.7 yrs. Median age: 57.6 yrs. IQR: 49-68 yrs. Range: 18-87 yrs. Male: 97 (54.2%)	December 25, 2019 - February 7, 2020 followed up until February 14, 2020	<60 yrs. 60-69 yrs. ≥70 yrs.	In-hospital risk of severity at admission (critically ill patients having one of respiratory failure and requirement for mechanical ventilation, or shock or combined with other organ system failure which warrant ICU admission)

Author, Year Country (Ref)	Study Design	Population Sampling Participants	Age/Sex Characteristics	Time period of study	Age categories used	Outcome Outcome ascertainment
			Female: 82 (45.8%)			Data were collected from the electronic medical records using a piloted case report form from the time of hospital admission.
Ebinger 2020 USA (201)	Retrospective cohort	Patients who had a laboratory-confirmed diagnosis of SARS-CoV-2 via RT-PCR while being evaluated or treated for signs or symptoms at the Cedars-Sinai Health System Los Angeles (California). It includes Cedars-Sinai Medical Center (CSMC), Marina Del Rey Hospital (MDRH), and affiliated clinics. N=442	Mean age: 52.72 yrs. SD: 19.65 yrs. Male: 256 (57.9%) Female: 186 (42.1%)	March 8 - March 21, 2020	Per 10 years	Illness severity in 3 categories: Hospitalized/non-ICU, ICU/Non-intubated, ICU/intubated Electronic health records
Giacomelli 2020 Italy (209)	Prospective cohort	Hospitalized adult Covid-19 patients to Luigi Sacco Hospital in Milan (Italy). All of the study patients had Covid-19 confirmed by a positive RT-PCR test on a nasopharyngeal swab. N=233	Median age: 61 yrs. IQR: 50-72 yrs. Male: 72 (30.9%) Female: 161 (69.1%)	February 21 - March 19, 2020 followed up until April 20, 2020	Per 10 years	In-hospital mortality Data were extracted from the patients' clinical charts on a daily basis. The life status of the patients discharged before the censoring date was ascertained by means of telephone calls made by two physicians on 20 April, 2020.
Giannouchos* 2020 Mexico (210)	Retrospective cohort	Patients initially classified as “suspected cases of viral respiratory disease” during point of service at medical facilities in Mexico, from a dataset released by the Mexican Health Ministry and compiled by the General Bureau of Epidemiology through the System of Epidemiological Surveillance of Viral Respiratory Diseases (comprising of 475 monitoring units). Patients included had laboratory-confirmed diagnosis by RT-PCR if they had serious symptoms.	Mean age: 46.2 yrs. SD: 16.0 yrs. Male: 56.4% Female: 43.6%	Dataset released on May 31, 2020	0-17 yrs. 18-44 yrs. 45-64 yrs. ≥65 yrs.	Population-based hospitalization, Electronic/medical records

Author, Year Country (Ref)	Study Design	Population Sampling Participants	Age/Sex Characteristics	Time period of study	Age categories used	Outcome Outcome ascertainment
		N=89,756				
Grasselli 2020 Italy (213)	Retrospective cohort	All 4209 consecutive patients with confirmed SARS-CoV-2 infection were admitted to one of the COVID-19 Lombardy Network's ICUs. All the critically ill patients requiring ICU admission in Lombardy have been referred to the Regional Coordinating Center. Laboratory-confirmed diagnosis of SARS-CoV-2 infection by RT-PCR test. N = 3988	Median age: 63 yrs. IQR: 56-69 yrs. Male: 3188 (79.9%) Female: 800 (20.1%)	February 20 - April 22, 2020 followed up until May 30, 2020	Per 10 years	In-hospital mortality of ICU patients The staff of the Regional Coordinating Center contacted each ICU of the Network daily by telephone and recorded on an electronic worksheet the demographic and clinical patient data.
Gu 2020 China (214)	Nested case-control	Source data from 12,973 publicly reported laboratory-confirmed patients with Covid-19 in 31 province-level regions outside of Hubei Province in mainland China by the National Health Committee during the study period. Deaths included as cases and each case was matched with up to three controls on gender and age +/- 1 year old. Asymptomatic people not included. N=275	Median age: 68.0 yrs. IQR: 22 yrs. Male: 173 (62.9%) Female: 102 (37.1%)	December 18, 2019 - March 8, 2020	Per year	Population-based mortality National/provincial/municipal health commission websites, the official COVID-19 data reporting websites in China.
Gu 2020 USA (215)	Retrospective cohort	Patients who were tested at University of Michigan Health System (MM), transfer patients from other hospitals, and patients who were tested elsewhere but treated at MM. Diagnostic tests: RT-PCR (88.6%), commercial antibody test, COVID-19 nasopharynx or oropharynx PCR tests. Prioritized testing N=1139 (Positive tests) N= 523 (hospitalized)	Median age: 53 yrs. IQR: 39-66 yrs. Male: 531 (46.6%) Female: 608 (53.4%)	March 10 - April 22, 2020 followed up until July 28, 2020	Per 10 yrs. <18 yrs. 18- <35 yrs. 35- <50 yrs. 50- <65 yrs. 65- <80 yrs. ≥80 yrs.	Hospitalization ICU (population-based) Mortality (population-based) Electronic health records
Gupta 2020 USA (216)	Prospective cohort	Adult patients (≥18 years of age) with Covid-19 to participating admited to ICUs in 65 hospitals in the USA.	Mean age: 60.5 yrs. SD: 14.5 yrs.	March 4 - April 4, 2020 followed up until June 4, 2020	18-39 yrs. 40-49 yrs. 50-59 yrs. 60-69 yrs.	28-day in-hospital mortality for ICU patients

Author, Year Country (Ref)	Study Design	Population Sampling Participants	Age/Sex Characteristics	Time period of study	Age categories used	Outcome Outcome ascertainment
		Laboratory-confirmed diagnosis by nasopharyngeal or oropharyngeal swab. N= 2215	Male: 1436 (64.8%) Female: 779 (35.2%)		70-79 yrs. ≥80 yrs.	Mechanical ventilation for ICU patients Electronic medical records.
Harrison 2020 USA (219)	Retrospective cohort	Patients 18 years or older with Covid-19 from 24 participating healthcare organizations (inpatient and outpatient care settings), distributed between the four large Census Bureau–designated regions of the US (Northeast/Midwest/South/West). Identified based on a positive laboratory test (not specified) in their records and ICD-classification based on Centers for Disease Control and Prevention (CDC) coding guidelines. False positives excluded. N=31,461	Median age: 50 yrs. IQR: 35-63 yrs. Male: 14,306 (45.5%) Female: 17,155 (54.5%)	January 20 - May 26, 2020	Per year	Population-based mortality Electronic medical records
Hashemi 2020 USA (220)	Retrospective cohort	Adult patients hospitalized to nine hospitals (two large tertiary centres and seven community hospitals) in a single healthcare system in Massachusetts. Laboratory-confirmed diagnosis of SARS-CoV-2 infection via polymerase chain reaction (PCR) nasopharyngeal swab or tracheal aspirate. N=363	Mean age:63.4 yrs. SD: 16.5 yrs. Male: 201 (55.4%) Female: 162 (44.6%)	March 11 – April 2, 2020	Per year	In-hospital mechanical ventilation In-hospital ICU admission In-hospital mortality Electronic medical records.
Hewitt** 2020 United Kingdom and Italy (221)	Prospective cohort	Adult patients (≥18 years) admitted with Covid-19 to ten participating hospitals in the UK and one in Italy, based on the COVID-19 in Older People (COPE) study. Inclusion criteria were complete hospital records and laboratory-confirmed SARS-CoV-2-positive swabs or a clinical diagnosis made by the parent clinical team and based on signs, symptoms, or radiology consistent with Covid-19.	Median age: 74 yrs. IQR: 61-83 yrs. Male: 903 (57.7%) Female: 661 (42.3%)	February 27 - April 28, 2020	<65 yrs. 65-79 yrs. ≥80 yrs.	In-hospital mortality Day 7 ortality Hospital/medical records

Author, Year Country (Ref)	Study Design	Population Sampling Participants	Age/Sex Characteristics	Time period of study	Age categories used	Outcome Outcome ascertainment
		N=1564				
Hwang 2020 South Korea (224)	Retrospective cohort	Included two cohorts of adult inpatients (≥ 18 years old) with near severe stage of Covid-19 from Kyungpook National University Hospital and Kyungpook National University Chilgok Hospital in Daegu. Confirmed diagnosis of SARS-CoV-2 infection by RT-PCR N=103	Mean age: 67.62 yrs. SD: 15.32 yrs. Range: 24-97 yrs. Male: 52 (50%) Female: 51 (50%)	February 1 - March 25, 2020	Per year	In-hospital mortality (among moderate/severely diseased) Electronic medical records.
Imam 2020 USA (225)	Retrospective cohort	Hospitalized patients in eight hospitals of Beaumont Health, the largest healthcare system in Southeast Michigan caring for over a third of patients in Detroit. Laboratory-confirmed diagnosis of SARS-CoV-2 infection by using RT-PCR on nasopharyngeal swab. N=1305	Mean age: 61 yrs. SD: 16.3 yrs. Range: 24-97 yrs. Male: 702 (53.8%) Female: 603 (46.2%)	March 1 - April 1, 2020 Assessed on April 17, 2020	>60 yrs. vs. <60 yrs.	In-hospital mortality Electronic medical records. Manual chart review toconfirm mortality to ensure accuracy and completeness.
Jun 2020 USA (226)	Prospective cohort	Admitted patients with Covid-19 to five Mount Sinai hospitals in New York City: Three in Manhattan; 1 in Brooklyn; 1in Queens, through the emergency department Nucleic acid-based test to detect SARS-CoV-2 infection in nasopharyngeal or oropharyngeal swab specimens. N=3086	Median age: 66 yrs. IQR: 56-77 yrs. Male: 1825 (59.1%) Female: 1261 (40.9%)	Admitted on or before April 13, 2020 Followed through June 2, 2020	Per year	In-hospital mortality Electronic health records
Kabarriti 2020 USA (227)	Retrospective cohort	Patients with Covid-19 who received care at the Montefiore Medical Center, a large academic medical center located in the Bronx (New York), whether or not they were admitted as patients.	Median age: 58 yrs. IQR: 44-71 yrs. Male: 2773 (47%)	March 14 - April 15, 2020 final data collection on April 27, 2020	≤ 40 yrs. 41-60 yrs. 61-80 yrs. >80 yrs.	Mortality (population-based) Data were obtained from electronic medical records.

Author, Year Country (Ref)	Study Design	Population Sampling Participants	Age/Sex Characteristics	Time period of study	Age categories used	Outcome Outcome ascertainment
		SARS-CoV-2 positive status was determined based on reverse transcription quantitative polymerase chain reaction assay. N=5902	Female: 3129 (53%)			
Kalligeros 2020 USA (228)	Retrospective cohort	Patients 18 years or older admitted with Covid-19 to Rhode Island Hospital, The Miriam Hospital, or Newport Hospital, in Rhode Island (USA). Laboratory-confirmed diagnosis of SARS-CoV-2 infection by using a reverse transcriptase-polymerase chain reaction assay. N=103	Median age: 60 yrs. IQR: 52-70 yrs. Male: 63 (61.17%) Female: 67 (38.83%)	February 17 - April 5, 2020	Per year	ICU admission within 10 days of hospital admission Mechanical ventilation within 10 days of hospital admission Electronic chart review
Khalil 2020 UK (229)	Prospective cohort	Adult patients (≥18 years old) with laboratory-confirmed RT-PCR test COVID-19 admitted to Chelsea & Westminster Hospital, a central London teaching hospital. N= 220	Mean age: 66.9 years 95% CI: 64.7–69.2 years Male: 130 (59.1%) Female: 90 (40.9%)	March 7 -April 7, 2020 Followed up until May 8, 2020	Per year	In-hospital mortality at 28 days Medical records, death certificates
Killerby 2020 USA (230)	Retrospective cohort	Hospitalized patients selected sequentially from hospital-provided lists of patients aged ≥18 years with laboratory (RT-PCR) confirmed COVID-19 and non-hospitalized patients aged ≥18 years with laboratory (RT-PCR) confirmed COVID-19-evaluated at outpatient clinics or an emergency department and not admitted. Data from six acute care hospitals and associated outpatient clinics in metropolitan Atlanta, Georgia. N=531 (220 hospitalized, 311 non-hospitalized)	Non-hospitalized Mean age: 45 years IQR: 33.0-58.0 years Hospitalized Mean age: 61 years IQR: 45.0-70.0 years Non-hospitalized Male: 114 (36.7%) Female: 197 (63.3%) Hospitalized Male: 114 (51.8%) Female: 106 (48.2%)	Hospitalized: March 1 – March 30, 2020 Non-hospitalized: April 8-May 1, 2020	18-44 yrs. 45-64 yrs. ≤65 yrs.	Hospitalization (included stays for observation and deaths that occurred in an emergency department (ED)) Medical records
Kim 2020 USA	Retrospective cohort	Patients 18 years or older hospitalized with laboratory-confirmed COVID-19	Median age: 62 yrs. IQR: 50-75 yrs.	March 1 – May 2, 2020	18-39 yrs. 40-49 yrs. 50-64 yrs.	Intensive care unit (ICU) In-hospital mortality

Author, Year Country (Ref)	Study Design	Population Sampling Participants	Age/Sex Characteristics	Time period of study	Age categories used	Outcome Outcome ascertainment
(231)		Identified through the Coronavirus Disease 2019-Associated Hospitalization Surveillance Network (COVID-NET) covering 154 acute-care hospital in 74 counties and 13 states in the USA and who had complete chart review. N= 2491	Male: 1326 (53.2%) Female: 1165 (46.8%)	Assessed on May 2, 2020	65-74 yrs. 75-84 yrs. ≥85 yrs.	COVID-NET surveillance
Klang 2020 USA (233)	Retrospective cohort	Hospitalized adult patients in a large academic hospital system in New York City (Mount Sinai, 5 hospitals) with positive RT-PCR test for COVID-19 and had definite outcomes (discharged or died). Patients with missing BMI data were excluded. N= 3406	Age ≤50 years: 572 (16.8%) Age >50 years: 2834 (83.2%) Age ≤50 years Male: 397 (69.4%) Female: 175 (30.6%) Age >50 years Male: 1564 (55.1%) Female: 1270 (44.9%)	March 1- May 17, 2020	Per decile, stratified by ≤50 years and >50 years	In-hospital mortality Electronic medical records
Lee 2020 South Korea (235)	Retrospective cohort	Patients hospitalized or isolated with laboratory-confirmed SARS-CoV2-infection via RT-PCR Data from Korea Centers for Disease Control and Prevention (KCDC) N= 8,266	Mean age: 44.36 years SD: 19.13 years Male: 3181 (39.48%) Female: 5085 (61.52 %)	January 19 - March 16, 2020 assessed on March 24, 2020	Per year	Mortality within 60 days (hospitalized or isolated) Electronic health records from the National Health Information Databas
Li 2020 China (238)	Retrospective cohort	Patients with laboratory-confirmed SARS-CoV-2 infection via RT-PCR at Wuhan Seventh People's Hospital, Wuhan, China. N= 596	Median age: 58 years IQR: 47–68 years Male: 280 (47.0 %) Female: 316 (53.0 %)	January 23 - March 14, 2020	<65 years ≥ 65 years	In-hospital mortality Electronic health records
Magleby 2020 USA (241)	Retrospective cohort	Patients with coronavirus disease confirmed via RT-PCR tests hospitalized at two hospitals in New York City (New York Presbyterian Hospital/Weill Cornell Medical Center and affiliated Lower Manhattan Hospital). N= 678	Median age (IQR) high viral load: 72 yrs. (60-81 yrs.) medium viral load: 69 yrs. (58-79 yrs.) low viral load: 63 yrs. (50-73 yrs.)	March 30 - April 30, 2020	Per year	In-hospital mortality Electronic medical records

Author, Year Country (Ref)	Study Design	Population Sampling Participants	Age/Sex Characteristics	Time period of study	Age categories used	Outcome Outcome ascertainment
			high viral load Male: 139 (63.2%) Female: 81 (36.8%) Medium viral load Male: 132 (61.1%) Female: 84 (38.9%) Low viral load Male: 143 (59.1%) Female: 99 (40.9%)			
Meng 2020 China (248)	Retrospective cohort‡	Patients with pathogen-confirmed COVID-19 via RT-PCR who were hospitalized at Tongji Hospital in Wuhan, China diagnosed with moderate to severe pathogen-confirmed COVID-19 N= 2556	Age[1]: ≤49 years: 707 (26.53%) 50-64 years: 907 (34.93%) 65-79 years: 868 (32.57%) ≥80 years: 185 (06.94%) Male: 1328 (49.83%) Female: 1337 (50.17%)	January 18 - March 27, 2020	≤49 Years 50-64 years 65-79 years ≥80 years	In-hospital mortality Medical records
Merzon 2020 Israel (249)	Retrospective cohort	Population-based epidemiological study utilizing data from the Leumit Health Services (LHS) database. The study population included the 14,000 members of LHS tested for COVID-19 infection by PCR test. N= 782 people with positive PCR test	Mean age: 35.58 years (95% CI: 34.49-36.67) Male: 385 (49.23%) Female: 397 (50.77%)	February 1 - April 30, 2020	≤50 years >50 years	Hospitalization
Murillo-Zamora and Hernandez-Suarez†† 2020 Mexico (255)	Retrospective cohort	Hospitalized adult patients (18 and older) with a laboratory-confirmed case of COVID-19 within 14 days before symptoms onset identified from epidemiological surveillance of viral respiratory diseases, belonging to the Mexican Institute of Social Security (IMSS). IMSS provides health care services to more than 1/3 of population of Mexico. N= 66,123	Age (years) 20-29: 2264 (3.4%) 30-34: 10,616 (16.1%) 45-59: 22,415 (33.9%) 60+: 30,828 (46.6%) Male: 40,124 (60.7%) Female: 25,999 (39.3%)	March 4-August 15, 2020	20-29 yrs. 30-34 yrs. 45-59 yrs. 60+ yrs.	In-hospital mortality Medical records and death certificates
Narain 2020 USA (257)	Retrospective cohort	Patients admitted to the 12 hospitals and emergency departments within the Northwell Health system, the largest private nonprofit health system in New York State, who were diagnosed with	For standard of care group: Median age: 64.6 yrs. IQR: 53.5-76.4	March 1- April 24, 2020	Per year	In-hospital mortality among CCS patients Electronic health records

Author, Year Country (Ref)	Study Design	Population Sampling Participants	Age/Sex Characteristics	Time period of study	Age categories used	Outcome Outcome ascertainment
		COVID-19 by RT-PCR tests and who were older than 18 years, and meeting COVID-19 cytokine storm (CCS) criteria. N= 5,776	Male: 3702 (64.1%) Female: 2075 (35.9%)			
Palaiodimos 2020 USA (259)	Retrospective cohort	First 200 patients who presented to the emergency room and were admitted to the inpatient medicine service or the intensive care unit at the Montefiore Medical Center in the Bronx, New York with laboratory-confirmed COVID-19. N= 200	Median age: 64 years IQR: 50-73.5 Male: 98 (49%) Female: 102 (51%)	Admission between March 09- March 22, 2020 followed up until April 12, 2020	Per year and per quartiles (results shown for per year only)	In-hospital mortality Medical records
Patel‡ 2020 USA (261)	Retrospective cohort	Adult patients 18 years or older hospitalized with COVID-19 in one of ten hospitals affiliated with Northwestern Medicine in Chicagoland, with or without anticoagulation treatment. They were discharged or died during study period. N=1716	Age distribution 18-44 yrs.: 22.1% 45- 59 yrs.: 29.6% 60-69 yrs.: 21.6% 70-79 yrs.: 14.1% >80 yrs.: 12.6% Male: 935 (54.5%) Female: 781 (45.5%)	March 9- June 26, 2020	18-44 yrs. 45- 59 yrs. 60-69 yrs. 70-79 yrs. >80 yrs.	In-hospital mortality Mechanical ventilation Death in critical illness Data extracted from Northwestern University Enterprise Data Warehouse (NUEDW) (medical records)
Perez-Guzman 2020 UK (262)	Retrospective cohort	All admission with RT-PCR-positive SARS-CoV-2 infection to the Imperial College Healthcare National Health Service Trust (ICHNT), one of the largest hospital trusts in England serving North West London. N= 559 with completed outcomes (death or discharge) until May 1, 2020	Median age: 69 years IQR: 54-79 years Male: 382 (62%) Female: 232 (38%)	February 25- April 5, 2020 followed up until May 1, 2020	Per year	In-hospital mortality Hospital records
Petrilli 2020 USA (263)	Prospective cohort	Patients with all data available (besides age and sex) with positive RT-PCT test for SARS-CoV-2, containing four acute care hospitals (two in Manhattan, one in Brooklyn, and one in Long Island). N= 5279 (positive test) N= 2741 (hospitalized)	Median age: 54 years IQR: 38-66 years Men: 2615 (49.5%) Women: 2674 (50.5%)	March 1-April 8, 2020, followed up until May 5, 2020	19-44 yrs. 45-54 yrs. 55-64 yrs. 65-74 yrs. ≥75 yrs.	Hospital admission In-hospital mortality (discharge to hospice or death) Electronic health records.

Author, Year Country (Ref)	**Study Design**	**Population Sampling Participants**	**Age/Sex Characteristics**	**Time period of study**	**Age categories used**	**Outcome** **Outcome ascertainment**
Price-Haywood 2020 USA (266)	Retrospective cohort	Patients seen at an Ochsner Health facility in Louisiana, who tested positive for SARS-CoV-2 on PCR assay and identified themselves as white non-hispanic or as black non-hispanic. Excluded were those with any other ethnicity. N= 3481 (for hospitalization) N = 1382 (for in-hospital mortality)	Mean age (SD) White non-hispanic 55.5 yrs (18.5) Black non-hispanic 53.6 yrs. (16.1) White non-hispanic Male: 471 (45.7%) Female: 559 (54.3%) Black non-hispanic Male: 923 (37.7%) Female: 1528 (62.3%)	March 1- April 11, 2020 followed through May 7, 2020	Age, per 5-year units	Hospitalization ICU In-hospital mortality Electronic medical record system.
Reilev 2020 Denmark (269)	Retrospective cohort	People in the Danish population who tested positive for SARS-CoV-2 via PCR tests, whose results were in the Danish Microbiology Database. A unique personal identifier assigned to all Danish citizens was used to link to health registries for information. N= 11,122 (positive cases, for hospitalization, death within 30 days) N= 2254 hospitalized (for ICU, in-hospital mortality)	Positive cases: Median age: 48 yrs. IQR: 33-62 yrs. Men: 4692 (42%) Women: 6430 (58%)	February 27- May 19, 2020	0-9 yrs. 10-19 yrs. 20-29 yrs. 30-39 yrs. 40-49 yrs. 50-59 yrs. 60-69 yrs. 70-79 yrs. 80-89 yrs. 90+ yrs.	Hospitalization Mortality (population-based) In-hospital mortality Danish administrative and health registries.
Rentsch 2020 USA (270)	Retrospective cohort	Members of the VA Birth Cohort aged 54 to 75 years with a laboratory confirmed positive SARS-CoV-2/Covid-19 nasopharyngeal swab (1% were from other sources) result. N=3789 N=585 (positive cases, for hospitalization and ICU)	Median age: 66.1 yrs. IQR: 60.4-71 yrs. Male: 27 (4.6 %) Female: 558 (95.4 %)	February 8 - March 30, 2020	Age, per 5-year increase	Hospitalization ICU Electronic health record data from Veterans Affairs Healthcare System/Veterans Health Administration
Rossi 2020 Italy (274)	Retrospective cohort	All symptomatic patients who tested positive with PCR in the province of Reggio Emilia registered in a special dedicated SARS-CoV-2 database. Asymptomatic cases excluded. N= 2653	Median age: 63.2 yrs. Male: 1328 (50,1 %) Female: 1325 (49,9 %)	February 27- April 2, 2020- assessed until April 3, 2020.	<51 yrs. 51-60 yrs. 61-70 yrs. 71-80 yrs. ≥81 yrs.	Hospitalization Death (population-based) Data obtained through routinely available administrative databases of the Health Authority

Author, Year Country (Ref)	Study Design	Population Sampling Participants	Age/Sex Characteristics	Time period of study	Age categories used	Outcome Outcome ascertainment
Salacup 2020 USA (277)	Retrospective cohort	All patients older than 18 years old with a confirmed diagnosis of COVID-19 via RT-PCR diagnosis presenting at the Einstein Medical Center in Philadelphia. Included data for patients with definite outcome (discharge or death) N= 242	Median age: 66 yrs. IQR: 58-76 yrs. Male: 93 (51%) Female: 119 (49%)	March 1- April 24, 2020	Per year	In-hospital mortality
Sapey 2020 England (279)	Retrospective cohort	All patients with a confirmed positive SARS-CoV-2 swab (nasopharyngeal and oropharyngeal) result admitted to the University Hospitals Birmingham NHS Foundation Trust at the time or up to 2 weeks following their first positive test. Not specified if lateral flow test or PCR test. N=2169	Median age: 73 yrs. IQR: 58-84 yrs. Male: 1290 (58.2%) Female: 927 (41.8%)	March 10- April 17, 2020 assessed on May 12, 2020	z-score	In-hospital mortality Electronic health records
Seiglie 2020 USA (280)	Prospective cohort	Patients presenting to care with COVID-19 symptoms and who were subsequently hospitalized at Massachusetts General Hospital (MGH) with PCR confirmed SARS-CoV-2 infection. N=450	Mean age (SD) No diabetes: 61.1 yrs. (18.8) Diabetes: 66.7 yrs. (14.2) Male: 259 (57.6%) Female: 191 (42.4%)	March 11- April 30, 2020 followed up for 14 days from date of initial presentation	<50 yrs. 50-59 yrs. 60-69 yrs. ≥70 yrs.	14-day ICU admission 14-day mechanical ventilation 14-day in-hospital mortality COVID-19 data registry
Shah 2020 USA (281)	Retrospective cohort	All hospitalized patients in Phoebe Putney Health System in Southwest Georgia, with confirmed COVID-19 through a PCR test and a definite outcome N= 522	Median age: 63 yrs. IQR: 50-72 yrs. Male: 218 (41.8%) Female: 304 (58.2%)	March 2- May 6, 2020 Assessed on May 6, 2020	<65 yrs. ≥65 yrs.	In-hospital mortality Electronic medical records
Shi† 2020 China (285)	Retrospective cohort study	Consecutive patients admitted to Renmin Hospital of Wuhan University in Wuhan with laboratory-confirmed COVID-19 using RT-PCR tests. Patients were excluded if they did not have cardiac biomarkers (N= 229 excluded). N= 416	Median age: 64 yrs. Range: 21-95 yrs, Male: 205 (49.3%) Female: 211 (50.7%)	January 20- February 10, 2020 followed up February 15 2020 (mortality)	Per year	In-hospital mortality Electronic medical records
Soares 2020 Brazil (293)	Retrospective cohort	All patients diagnosed with a RT-PCR or serological test, or if they were a suspected case that previously came into close contact or resided with someone with a confirmed laboratory diagnosis in the state of	Age distribution <60 yrs.: 8676 (81.0%) ≥60 yrs. 2037 (19.0%)	February 29- June 11, 2020 Assessed on June 11, 2020	<60 yrs. ≥60 yrs.	Hospitalization due to COVID-19

Author, Year Country (Ref)	Study Design	Population Sampling Participants	Age/Sex Characteristics	Time period of study	Age categories used	Outcome Outcome ascertainment
		Espíritu Santo, with complete data for predictive variables. N= 10,713				Health Secretariat of Espíritu Santo state
Solís 2020 Mexico (294)	Retrospective cohort	7497 patients who tested positive for COVID-19 in Mexico, a subset of a larger dataset of 49167 patients with COVID-19 related symptoms who sought attention in medical units and were tested with positive, negative and pending results. N=7497	Median age: 46 yrs. Male: 4341 (57.9%) Female: 3156 (42.1%)	Until April 18, 2020	0-24 yrs. 25-29 yrs. 30-34 yrs. 35-39 yrs. 40-44 yrs. 45-49 yrs. 50-54 yrs. 55-59 yrs. 60-64 yrs. 65-69 yrs. 70+ yrs.	Population-based mortality at 35 days Information about patients is reported on a daily basis to the Secretaría de Salud and released by the Mexican Ministry of Health.
Sousa 2020 Brazil (295)	Retrospective cohort	People that presented flu-like syndrome in Fortaleza (Ceará's capital city) and tested positive for Covid-19. Only people that needed medical assistance and went to healthcare services were tested; from those, moderate and severe cases were hospitalized and received health assistance. N=2070	Median age: 44 yrs. IQR: 34-59 yrs. Male: 1017 (49.1%) Female: 1053 (50.9%)	Until April 14, 2020 (endpoint)	<60 yrs. ≥60 yrs.	Population-based mortality Data were obtained by using IntegraSUS data, a free-access website that holds daily updated data and indicators of Covid-19 in the Ceará State. The cause of death was determined by the physician given positive laboratory tests to COVID-19 and the clinical manifestation of the disease.
Suleyman 2020 USA (296)	Retrospective cohort	Adult patients hospitalized at Henry Ford Health System (HFHS), a 5-hospital system that serves metropolitan Detroit, and diagnosed with COVID-19. Laboratory-confirmed SARS-CoV-2 infection by PCR test. N=355 hospital admission	Mean age (SD): 61.4 yrs. (15.4 yrs.) Male: 165 (46.5%) Female: 190 (53.5%)	March 9 - March 27, 2020, clinical outcomes monitored for 30 days.	<60 yrs. >60 yrs.	ICU Mechanical ventilation Data were obtained from electronic health records on a standardized data collection form.

Author, Year Country (Ref)	**Study Design**	**Population Sampling Participants**	**Age/Sex Characteristics**	**Time period of study**	**Age categories used**	**Outcome** **Outcome ascertainment**
Tai 2020 China (299)	Retrospective cohort	Admitted patients to Wuchang temporary hospital with laboratory-confirmed COVID-19, but having mild COVID-19. Critical patients were transferred to other hospitals for ICU care. (RT-PCR) test. N= 332	Median age: 51 yrs. IQR: 40-59 yrs. Male: 132 (39.8%) Female: 200 (61.2%)	February 5 - March 10, 2020 followed until March 25, 2020	Per year	ICU (for mild COVID-19) Electronic medical records.
Tartof 2020 USA (300)	Retrospective cohort	All Kaiser Permanente Southern California (KPSC) members with 6-month continuous membership and diagnosed with COVID-19 by diagnostic codes or positive laboratory test results (82%). Pregnant women were excluded.):KPSC is anintegrated health care organization located throughout 9 counties in Southern California with more than 4.7 million members. N=6916	Mean age (SD): 49.1 yrs. (16.6 yrs.) Median age: 49 yrs. IQR: 36-60 yrs. Male: 3111 (44.98%) Female: 3805 (55.02%)	February 13 - May 2, 2020, last date patient was enrolled was set to 21 days before study date end	0-40 yrs. 41-50 yrs. 51-60 yrs. 61-70 yrs. 71-80 yrs. >80 yrs.	Population-based mortality (within 21 days) Electronic health records.
van Gerwen 2020 USA (301)	Retrospective cohort	All patients 18 years or older with laboratory-confirmed diagnosis (hospitalized and ambulatory) identified via a large New York City health system with sufficient clinical documentation available or accessible, including confidential patient records. Laboratory-confirmed diagnosis of COVID-19 by a RT-PCR test N=3703 (all patients) N= 2015 (hospitalized)	Mean age (SD): 56.8 yrs. (18.2 yrs.) Male: 2049 (55.3%) Female: 1654 (44.7%)	March 1 2020 – April 1, 2020 followed until May 13, 2020 (6 weeks)	18-40 yrs. 40-60 yrs. >60 yrs.	Hospitalization Mechanical ventilation In-hospital mortality Electronic medical records.
Wang 2020 USA (302)	Retrospective cohort	All confirmed COVID-19 patients within the Mount Sinai Health System (MSHS) in New York City. MSHS is the largest integrated healthcare delivery system in the New York City metropolitan region serving 3499000 million outpatients and 152520 inpatients annually. Confirmed diagnosis of SARS-CoV-2 by lab tests (not specified).	Age, without comorbidity N (%): <18 yrs: 39 (76%) 18-39 yrs: 1315 (85%) 40-49 yrs: 709 (75%) 50-59 yrs: 841 (64%) 60-69 yrs: 830 (52%) 70-79 yrs: 510 (45%) 80+ yrs: 472 (46%)	Until April 15, 2020	<40 yrs. 40-49 yrs. 50-59 yrs. 60-69 yrs. 70-79 yrs. 80+ yrs.	Population-based mortality Electronic health records.

Author, Year Country (Ref)	Study Design	Population Sampling Participants	Age/Sex Characteristics	Time period of study	Age categories used	Outcome Outcome ascertainment
		N=7592	Age, with comorbidity N (%): <18 yrs: 12 (24%) 18-39 yrs: 224 (15%) 40-49 yrs: 234 (25%) 50-59 yrs: 465 (36%) 60-69 yrs: 753 (48%) 70-79 yrs: 627 (55%) 80+ yrs: 564 (54%) Male: 4165 (54.9%) Female: 3427 (45.1%)			
Wang 2020 China (305)	Retrospective cohort	All confirmed cases of COVID-19 over 60 years old admitted at isolation ward of Renmin Hospital of Wuhan University. Laboratory-confirmed SARS-CoV-2 nucleic acid by RT-PCR test. N=339	Median age: 69 yrs. IQR: 65-76 yrs. Male: 166 (49%) Female: 173 (51%)	January 1 – February 6, 2020 followed until March 5, 2020	Per year	In-hospital mortality in patients over 60 yrs. old Data were obtained from patient`s medical records.
Yehia 2020 USA (312)	Retrospective cohort	Adults (18 years or older) with laboratory-confirmed SARS-CoV-2 infection by PCR hospitalized at one of 92 Ascension hospitals (located in 12 states). N=7139	Median age: 68 yrs. IQR: 56-79 yrs. Male: 3664 (51.3%) Female: 3470 (48.6%)	February 19 - May 31, 2020 followed until June 25, 2020	18-49 yrs. 50-64 yrs. 65-84 yrs. ≥85 yrs.	In-hospital mortality Electronic health records and administrative data.
Zhao† 2020 China (319)	Retrospective cohort	COVID-19 patients admitted to both the Shouyi and East districts of Renmin Hospital of Wuhan University. Laboratory-confirmed diagnosis of SARS-CoV-2 by positive nucleic acid test and sequencing of viral genes, highly homologous to known SARS-CoV-2. N=1000	Median age: 61 yrs. IQR: 46-70 yrs. Male: 466 (46.6%) Female: 534 (53.4%)	January 1 - February 14, 2020	<60 yrs. 60-75 yrs. ≥75 yrs.	In-hospital mortality Hospital's medical record system.

†, ††, ‡, *, ** Studies marked with same symbol have the same population or a sub-group of the same population
IQR: interquartile range; yrs.: years; reverse-transcriptase polymerase chain reaction: RT-PCR; ICU: intensive care unit; COPD: chronic obstructive pulmonary disease; BMI: body mass index; yrs.: years; SOFA score: sequential organ failure assessment score; OR: odds ratio; HR: hazards ratio; CI: confidence intervals; NA: not available; IQR: inter-quartile range

Table S3. Results of studies investigating in-hospital mortality

Author, Year (Ref)	Confounders and age-dependent risk factors used in the model	Type of analysis # cases / # non-cases	N in analysis Total deaths In age group: # cases/total	Results Unadjusted effect estimates (if available)	Results Adjusted effect estimates
Antwi-Amoabeng 2020 (165)	Sex, ethnicity (Hispanic), diabetes, hypertension, obesity, chronic kidney disease, COPD, ICU stay	Logistic regression	N= 172 Deaths: 18 (10.5%) Age ≤61 yrs.: NA Age>61 yrs.: NA	NA	Mortality (in hospital) OR (95% CI) Age ≤61 yrs.: Reference Age>61 yrs.: 5.63 (0.41-77.51)
Argenziano 2020 (166)	Sex, BMI, smoking, coronary artery disease, congestive heart failure, history of stroke, diabetes mellitus, hypertension, cirrhosis, HIV, inflammatory bowel disease, pulmonary disease, renal disease, viral hepatitis, active malignancy, transplant history, rheumatological disease, immunosuppressed state, no comorbidities	Cox proportional hazards analysis only with complete data (n=841)	N= 1000 Deaths: 211 (21%)	NA	In-hospital mortality HR (95% CI) Age (per year): 1.07 (1.05-1.08)
Baqui 2020 (168)	Sex, ethnicity (black, Pardo, East Asian), neurological disease, obesity, pulmonary disease, renal disease, diabetes, immunosuppression, liver disease, cardiovascular disease, asthma	Mixed-effects Cox regression	N= 6882 Deaths: 3254 <40 yrs.: NA 40-50 yrs.: NA 50-60 yrs.: NA 60-70 yrs.: NA ≥70 yrs.: NA	NA	In-hospital mortality HR (95% CI) <40 yrs.: Reference 40-50 yrs.: 1.19 (1.00-1.43) 50-60 yrs.: 1.59 (1.34-1.87) 60-70 yrs.: 2.06 (1.76-2.41) ≥70 yrs.: 3.02 (2.59-3.52)
Boulle 2020 (176)	Sex, diabetes, hypertension, chronic kidney disease, chronic pulmonary disease/asthma, tuberculosis, HIV, antiretroviral therapy, CD4 count during COVID-19	Cox proportional hazards model	Hospitalized public-sector SARS-CoV-2 cases N= 2,978 Deaths: 550 20-39 yrs.: 45/849 40-49 yrs.: 56/528 50-59 yrs.: 142/665 60-69 yrs.: 158/518 ≥70 yrs.: 149/418	NA	In-hospital mortality HR (95% CI) Hospitalized public-sector SARS-CoV-2 cases (in-hospital mortality) 20-39 yrs.: Reference 40-49 yrs.: 1.83 (1.23-2.72) 50-59 yrs.: 3.81 (2.68-5.42) 60-69 yrs.: 6.11 (4.27-8.75) ≥70 yrs.: 7.53 (5.23-10.84)
Burn 2020 (177)	Autoimmune condition, chronic kidney disease, COPD, dementia, heart disease, hyperlipidemia, hypertension,	Cox proportional hazards model using a non-linear	N= 16,901 Deaths: 2692 >18 yrs.: <5/74 18–39 yrs.: 11/1276	In-hospital mortality HR (95% CIs) Age only model:	In-hospital mortality HR (95% CIs) Age and comorbidity model: 20-24 yrs.: 0.072 (0.028 to 0.19)

Author, Year (Ref)	Confounders and age-dependent risk factors used in the model	Type of analysis # cases / # non-cases	N in analysis Total deaths In age group: # cases/total	Results Unadjusted effect estimates (if available)	Results Adjusted effect estimates
	malignant neoplasm, obesity, Type 2 diabetes, Charlson Index	relationship with age	40-59 yrs.: 142/5217 60-69 yrs.: 292/3231 70-79 yrs.: 822/3764 ≥80 yrs.: 1424/3339	20-24 yrs.: 0.052 (0.02 to 0.14) 25-29 yrs.: 0.066 (0.03 to 0.15) 30-34 yrs.: 0.084 (0.045 to 0.16) 35-39 yrs.: 0.11 (0.068 to 0.17) 40-44 yrs.: 0.14 (0.099 to 0.19) 45-49 yrs.: 0.18 (0.14 to 0.23) 50-54 yrs.: 0.25 (0.20 to 0.31) 55-59 yrs.: 0.37 (0.30 to 0.44) 60-64 yrs.: 0.59 (0.54 to 0.65) 65-69 yrs.: Reference 70-74 yrs.: 1.69 (1.61 to 1.78) 75-79 yrs.: 2.75 (2.47 to 3.06) 80-84 yrs.: 4.16 (3.64 to 4.75) 85-89 yrs.: 5.93 (5.23 to 6.73) 90-94 yrs.: 8.28 (7.34 to 9.34) 95+ yrs.: 11.53 (10.10 to 13.17)	25-29 yrs.: 0.088 (0.041 to 0.19) 30-34 yrs.: 0.11 (0.059 to 0.20) 35-39 yrs.: 0.13 (0.086 to 0.21) 40-44 yrs.: 0.17 (0.12 to 0.23) 45-49 yrs.: 0.21 (0.16 to 0.27) 50-54 yrs.: 0.28 (0.22 to 0.35) 55-59 yrs.: 0.40 (0.34 to 0.49) 60-64 yrs.: 0.63 (0.58 to 0.69) 65-69 yrs.: Reference 70-74 yrs.: 1.54 (1.46 to 1.62) 75-79 yrs.: 2.25 (2.01 to 2.52) 80-84 yrs.: 3.15 (2.74 to 3.62) 85-89 yrs.: 4.25 (3.71 to 4.88) 90-94 yrs.: 5.68 (4.97 to 6.50) 95+ yrs.: 7.58 (6.53 to 8.81)
Carter and Collins* 2020 (181)	Location infection acquired, sex, smoking status, C-reactive protein, diabetes, coronary artery diseases, hypertension, reduced renal function, clinical frailty scale	Mortality: mixed-effects multivariable Cox proportion baseline hazards regression	N= 1564 Deaths: 425 (27.2%) <65 yrs.: 55/488 65-79 yrs.: 168/535 >80 yrs.: 202/541	In-hospital mortality HR (95% CI) <65 yrs.: Reference 65-79 yrs.: 3.30 (2.40-4.55) >80 yrs.: 4.05 (2.95-5.57)	In-hospital mortality HR (95% CI) <65 yrs.: Reference 65-79 yrs.: 2.70 (1.91-3.81) >80 yrs.: 3.30 (2.28-4.78)
Chen and Bai 2020 (184)	Sex, hypertension (for overall analysis and for male only stratified analysis), cardiovascular disease, cerebrovascular disease, malignancy, chronic kidney disease, COPD, days from onset to admission	Logistic regression	N= 3309 Deaths: 307 (9.3%) ≤45 yrs.: NA >45 yrs.: NA	In-hospital mortality OR (95% CI) Overall ≤ 45 yrs.: Reference > 45 yrs.: 8.37 (4.43–15.81) Women ≤ 45 yrs.: 0.32 (0.15-0.70) > 45 yrs.: Reference Men ≤ 45 yrs.: 0.04 (0.01-0.38) > 45 yrs.: Reference	In-hospital mortality OR (95% CI) Overall ≤ 45 yrs.: Reference > 45 yrs.: 9.08 (4.44-18.59) Women ≤ 45 yrs.: 0.29 (0.12-0.67) > 45 yrs.: Reference Men ≤ 45 yrs.: 0.04 (0.01-0.16) > 45 yrs.: Reference
Chilimuri 2020	Sex, hypertension, diabetes, cardiovascular disease, chronic kidney disease, absolute neutrophil count,	Multiple regression analysis (not specified)	N= 375 Deaths: 160 (43%)	In-hospital mortality	In-hospital mortality OR (95% CI) Per year: 1.04 (1.01-1.06)

Author, Year (Ref)	Confounders and age-dependent risk factors used in the model	Type of analysis # cases / # non-cases	N in analysis Total deaths In age group: # cases/total	Results Unadjusted effect estimates (if available)	Results Adjusted effect estimates
(187)	absolute lymphocyte count, lactate dehydrogenase, C-reactive protein, D-dimer, ferritin			Per year: OR= 1.05 (95% CI: 1.03-1.73)	
Ciardullo 2020 (188)	Sex, diabetes, hypertension, chronic kidney disease, cardiovascular disease, COPD	Binomial logistic regression	N=371 (339 for analysis due to missing data) Deaths: 142 (38.1%)	In-hospital mortality	In-hospital mortality OR (95% CI) Per year: 1.065 (1.029-1.086)
Conversano and Melillo 2020 (190)	COPD, cancer, chronic kidney disease, beta blocker	Cox regression analysis	N=191 Deaths: 42 (22%)	In-hospital mortality Per year: HR = 1.1 (1.0–1.2)	In-hospital mortality HR (95% CI) Per year: 1.1 (1.0-1.1)
Cummings 2020 (193)	Sex, symptom duration before hospital presentation, hypertension, chronic cardiac disease, COPD or interstitial lung disease, diabetes, interleukin-6, D-dimer	Cox proportional hazards model	N=257 Deaths: 101 (39%)	In-hospital mortality among critically ill patients HR (95% CI) Per 10-year increase: 1.49 (1.29–1.73) Per yr. increase (own calculations): 1.04 (1.03-1.06)	In-hospital mortality among critically ill patients HR (95% CI) Per 10-year increase: 1.31 (1.09-1.57) Per yr. increase (own calculations): 1.03 (1.01-1.05)
Di Castelnuovo 2020 (197)	Gender, hypertension, diabetes, myocardial infarction, heart failure, cancer, lung disease, obesity, smoking, CRP, eGRF/chronic kidney disease stage	Cox proportional hazard regression models with multiple imputation. Several sensitivity analyses on multiple imputations and accounting for clustering	N=3894 Deaths: 712 (18.3%) 18-44 yrs.: 6/348 45-64 yrs.: 75/1413 65-74 yrs.: 145/808 75-84 yrs.: 266/849 85+ yrs.: 220/476	In-hospital mortality (main analysis) HR (95% CI) 18-44 yrs.: Reference 45-64 yrs.: 2.40 (1.04-5.51) 65-74 yrs.: 7.13 (3.14-16.14) 75-84 yrs.: 13.56 (6.03-30.52) 85+ yrs.: 21.65 (9.60-48.82)	In-hospital mortality (main analysis) HR (95% CI) 18-44 yrs.: Reference 45-64 yrs.: 1.77 (0.84-3.71) 65-74 yrs.: 3.87 (2.03-7.37) 75-84 yrs.: 6.05 (3.17-11.55) 85+ yrs.: 8.24 (4.61-14.74)
Docherty 2020 (198)	Sex at birth, chronic cardiac disease, chronic pulmonary disease, chronic kidney disease, diabetes, obesity, chronic neurological disorder, dementia, malignancy, moderate/severe liver disease	Cox proportional hazards models including geographical region as random intercept	N= 20,133 Deaths: 5165 (25.7%) <50 yrs.: 121/2795 50-59 yrs.: 274/2708 60-69 yrs.: 662/3296 70-79 yrs.: 1506/4692	In-hospital mortality HR (95% CI) <50 yrs.: Reference 50-59 yrs.: 2.55 (2.06-3.17) 60-69 yrs.: 5.45 (4.48-6.63) 70-79 yrs.: 9.76 (8.09-11.77) ≥80 yrs.: 13.47 (11.20-16.20)	In-hospital mortality HR (95% CI) <50 yrs.: Reference 50-59 yrs.: 2.63 (2.06-3.35) 60-69 yrs.: 4.99 (3.99-6.25) 70-79 yrs.: 8.51 (6.85-10.57) ≥80 yrs.: 11.09 (8.93-13.77)

Author, Year (Ref)	Confounders and age-dependent risk factors used in the model	Type of analysis # cases / # non-cases	N in analysis Total deaths In age group: # cases/total	Results Unadjusted effect estimates (if available)	Results Adjusted effect estimates
			≥80 yrs.: 2602/6642		
Giacomelli 2020 (209)	Gender, age unadjusted Charlson comorbidity index, obesity, being treated with at least one anti-hypertensive agent, disease severity, presence of anaemia, lymphocyte count, D-dimer, C-reactive protein, creatinine, creatinine kinase	Cox proportional hazards	N=233 Deaths: 48 (20.6%)	In-hospital mortality HR (95% CI) Age (per 10 years): 1.81 (1.44-2.28) Age (per year, own calculations): 1.06 (1.04-1.09)	In-hospital mortality HR (95% CI) Age (per 10 years): 2.08 (1.48-2.92) Age (per year, own calculations): 1.08 (1.04-1.11)
Grasselli 2020 (213)	Sex, respiratory support, hypertension, hypercholesterolemia, heart disease, type 2 diabetes, malignancy, COPD, ACE inhibitor therapy, ARB therapy, statin, diuretic, PEEP at admission, FiO2 at admission, PaO2/FiO2 at admission	Cox proportional hazards regression	N = 3988 Deaths: 1926 (48.29%) <56 yrs.: 245/997 56-63 yrs.: 416/997 64-69 yrs.: 562/997 >69 yrs.: 703/997	In-hospital mortality HR (95% CI) <56 yrs.: Reference 56-63 yrs.: 1.91 (1.63-2.24) 64-69 yrs.: 2.98 (2.56-3.46) >69 yrs.: 4.25 (3.68-4.92)	In-hospital mortality HR (95% CI) Age (per 10 years): 1.75 (1.60-1.92) Age (per year, own calculations): 1.06 (1.05-1.07)
Gupta 2020 (216)	Sex, race, hypertension, diabetes, BMI, coronary artery disease, congestive heart failure, chronic obstructive pulmonary disease, current smoker, active cancer, ≤3 d from symptom onset to ICU day 1, lymphocyte count <1000/μL on ICU day 1, invasive mechanical ventilation support/O2 level, shock on ICU day 1, coagulation component of SOFA score, liver component of SOFA score, renal component of SOFA score, no. of ICU beds	Multilevel logistic regression modelling to account for hospitals Cox regression	N= 2215 Deaths: 784 (35.4%) Mechanical ventilation: 1494 (67.44%) 28-day in-hospital mortality 18-39 yrs.: 31/209 40-49 yrs.: 64/282 50-59 yrs.: 124/487 60-69 yrs.: 239/614 70-79 yrs.: 201/424 ≥80 yrs.: 125/199	NA	28-day in-hospital mortality for ICU patients OR (95% CI) Multilevel logistic regression 18-39 yrs.: Reference 40-49 yrs.: 1.65 (0.97-2.80) 50-59 yrs.: 1.71 (1.05-2.80) 60-69 yrs.: 3.18 (1.95-5.18) 70-79 yrs.: 5.36 (3.20-9.00) ≥80 yrs.: 11.15 (6.19-20.06) Cox regression model (time-to-event analyses) HR (95% CI) 18-39 yrs.: Reference 40-49 yrs.: 1.29 (0.85-1.96) 50-59 yrs.: 1.39 (0.94-2.04) 60-69 yrs.: 2.09 (1.43-3.04) 70-79 yrs.: 2.70 (1.83-3.98) ≥80 yrs.: 4.55 (3.00-6.92)

Author, Year (Ref)	Confounders and age-dependent risk factors used in the model	Type of analysis # cases / # non-cases	N in analysis Total deaths In age group: # cases/total	Results Unadjusted effect estimates (if available)	Results Adjusted effect estimates
					28-day mortality in mechanically ventilated patients OR (95% CI) Multilevel logistic regression 18-39 yrs.: Reference 40-49 yrs.: 1.28 (0.70-2.33) 50-59 yrs.: 1.47 (0.84-2.58) 60-69 yrs.: 2.39 (1.37-4.18) 70-79 yrs.: 3.39 (1.86-6.20) ≥80 yrs.: 9.20 (4.55-18.60)
Hashemi 2020 (220)	Chronic liver disease, obesity, sex, cardiac diseases, hypertension, diabetes, hyperlipidaemia, pulmonary disorders	Logistic regression	N=363 Deaths: NA	NA	In-hospital mortality OR (95% CI) Age (per year): 1.08 (1.05-1.12)
Hewitt* 2020 (221)	Sex, smoking status, increased C-reactive protein, diabetes, coronary artery disease, hypertension, impaired renal function, clinical frailty scale	Cox proportional baseline hazards model (Mortality) Logistic regression (Day-7 Mortality)	N=1564 Deaths: 425 (27.2%) <65 yrs.: 55/488 65-79 yrs.: 168/535 ≥80 yrs.: 202/541	In-hospital mortality HR (95% CI) <65 yrs.: Reference 65-79 yrs.: 3.30 (2.40-4.55) ≥80 yrs.: 4.05 (2.95-5.57) Day-7 mortality OR (95% CI) <65 yrs.: Reference 65-79 yrs.: 4.62 (2.89-7.39) ≥80 yrs.: 6.68 (4.18-10.67)	In-hospital mortality HR (95% CI) <65 yrs.: Reference 65-79 yrs.: 2.58 (1.82-3.64) ≥80 yrs.: 2.92 (2.02-4.22) Day-7 mortality OR (95% CI) <65 yrs.: Reference 65-79 yrs.: 2.79 (1.66-4.72) ≥80 yrs.: 3.51 (2.01-6.15)
Hwang 2020 (224)	Diabetes mellitus, chronic lung disease, cardiovascular disease, Alzheimer's dementia, stroke	Cox proportional hazards regression	N=103 Deaths: 26 (25%)	NA	In-hospital mortality HR (95% CI) Age (per year): 1.055 (1.003-1.109)
Imam 2020 (225)	Charlson Comorbidity Index, non-steroidal anti-inflammatory medication, angiotensin converting enzyme-inhibitor/angiotensin receptor blocker	Logistic regression	N=1305 Deaths: 200 (15.3%) Age<60: NA Age>60: NA	In-hospital mortality OR (95%CI) Age<60: Reference Age>60: 3.66 (2.57-5.20)	In-hospital mortality OR (95%CI) Age<60: Reference Age>60: 1.93 (1.26-2.94)
Jun 2020 (226)	Sex, race, Manhattan facility, hypertension, diabetes, coronary artery disease, heart failure, atrial fibrillation, chronic kidney disease, COPD/asthma, obesity, cancer, oxygen saturation	Logistic regression	N=3086 Deaths: 885 (28.7%)	In-hospital mortality OR (95% CI) Age (per year): 1.06 (1.05-1.06)	In-hospital mortality OR (95% CI) Age (per year): 1.06 (1.05-1.07)

Author, Year (Ref)	**Confounders and age-dependent risk factors used in the model**	**Type of analysis # cases / # non-cases**	**N in analysis Total deaths In age group: # cases/total**	**Results Unadjusted effect estimates (if available)**	**Results Adjusted effect estimates**
Khalil 2020 (229)	11 in total, not all specified Sex, comorbidities (2-3/4+, including asthma, COPD, cardiovascular disease, hypertension, hyperlipidemia, diabetes, kidney disease, cerebrovascular accident, dementia, malignancy, liver disease, other comorbidities), respiratory rate, systolic blood pressure, lymphocyte count, platelet count, CRP, urea, creatinine, albumin	Cox proportional hazards regression	N= 220 Deaths: 58 (26,4%)	NA	28-days in-hospital mortality HR (95% CI) Age (per year): 1.04 (1.01-1.07)
Kim 2020 (231)	Sex, race, ethnicity, smoker, hypertension, obesity, diabetes, chronic lung disease, cardiovascular disease, neurologic, renal, immunosuppression, gastrointestinal or liver, hematologic, rheumatologic or autoimmune, outpatient ACE-inhibitor use, angiotensin receptor blocker use prior to hospitalization	Log-linked Poisson generalized estimating equation regressions with an exchangeable correlation matrix	N= 2490 Deaths: 420 (16.9%) 18-39 yrs.: 6/302 40-49 yrs.: 10/318 50-64 yrs.: 74/744 65-74 yrs.: 103/478 75-84 yrs.: 120/397 ≥85 yrs.: 107/251	In-hospital mortality RR (95% CI) 18-39 yrs.: Reference 40-49 yrs.: 1.51 (0.59-3.85) 50-64 yrs.: 4.62 (2.1-10.18) 65-74 yrs. : 9.88 (4.28-22.85) 75-84 yrs.: 13.89 (6.12-31.52) ≥85 yrs.: 19.46 (9.39-40.35)	In-hospital-mortality RR (95% CI) 18-39 yrs.: Reference 40-49 yrs.: 1.23 (0.51-2.99) 50-64 yrs.: 3.11 (1.50-6.46) 65-74 yrs.: 5.77 (2.64-12.64) 75-84 yrs.: 7.67 (3.35-17.59) ≥85 yrs.: 10.98 (5.09 -23.69)
Klang 2020 (233)	Sex, cancer, coronary artery disease, congestive heart failure, hypertension, diabetes, hyperlipidemia, chronic kidney disease, smoking, BMI, race	Multivariable logistic regression	N= 3406 Deaths: 1136 (33.3%) Age ≤50 yrs.: 60/572 Age >50 yrs.: 1076/2834	NA	In-hospital mortality OR (95% CIs) Age ≤50yrs. Per decile: 3.0 (1.9-4.8) Age >50 yrs. Per decile: 1.7 (1.6-1.8)
Li 2020 (238)	Sex, diabetes, malignancy, hypertension, coronary heart disease, arrhythmia, cerebrovascular disease	Cox regression analysis	N= 596 Deaths: 54 (9.1%) <65 yrs.: NA ≥65 yrs.: NA	In-hospital mortality HR (95% CI) Age <65 years: Reference Age ≥65 years: 4.284 (2.385–7.694)	In-hospital mortality HR (95% CI) Age <65 years: Reference Age ≥65 years: 3.007 (1.634–5.533)
Magleby 2020 (241)	Sex, race, coronary artery disease, congestive heart failure, cerebrovascular disease, hypertension, COPD, days of symptoms prior to admission, fever, cough, headache, myalgias, nausea/vomiting, altered mental status, ageusia, highest level of	Logistic regression	N= 678 Deaths: 127 (18.7%)	NA	In-hospital mortality OR (95% CI) Per year: 1.10 (1.07-1.13)

Author, Year (Ref)	Confounders and age-dependent risk factors used in the model	Type of analysis # cases / # non-cases	N in analysis Total deaths In age group: # cases/total	Results Unadjusted effect estimates (if available)	Results Adjusted effect estimates
	supplemental oxygen, X-ray findings, viral load				
Meng 2020 (248)	Sex, hypertension, coronary heart disease, diabetes, COPD, chronic kidney disease, cerebrovascular disease, hepatitis, tuberculosis, tumor	Logistic regression	N= 2556 (non-cancer patients) N= 2665 (cancer and non-cancer patients) Deaths: 293 (11.0%) ≤49 yrs.: 14/707 50-64 yrs.: 80/907 65-79 yrs.: 142/866 ≥80 yrs.: 57/185	In-hospital mortality OR (95% CI) ≤49 years: Reference 50-64 years: 4.79 (2.69-8.52) 65-79 years: 9.70 (5.55-16.96) ≥80 years: 22.03 (11.92-40.71)	In-hospital mortality OR (95% CI) ≤49 years: Reference 50-64 years: 5.06 (2.82-9.06) 65-79 years: 9.97 (5.64-17.63) ≥80 years: 20.33 (10.76-38.44)
Murillo-Zamora and Hernandez-Suarez 2020 (255)	Sex, tobacco use, obesity, asthma, COPD, diabetes, hypertension, immunosuppression, chronic kidney disease, clinically diagnosed pneumonia at hospital	Cox proportional hazards model	N= 66,123 Deaths: 32,039 (48,5%) 20-29 yrs.: 367/2,264 30-44 yrs.: 2,788/10,616 45-59 yrs.: 9,367/22,415 60+ yrs.: 19,517/30,828	NA (Bivariate analyses)	In-hospital mortality HR (95% CI) 20-29 yrs.: Reference 30-44 yrs.: 1.60 (1.44-1.79) 45-59 yrs.: 2.37 (2.13-2.63) 60+ yrs.: 3.55 (3.20-3.94)
Narain 2020 (257)	CCS treatment group, sex, race, ethnicity, insurance, smoking status, mechanical ventilation, vasopressors, eosinophils, platelets, hemoglobin, eGFR, AST, ALT, sodium, ferritin, CRP, D-dimer, LDH, NLR, hospital, Charlson index, asthma, COPD, chronic liver disorder, diabetes, autoimmune disorder, cardiovascular disease, hypertension, interstitial lung disease, kidney disease, hemodialysis, BMI	Cox regression model	N= 5,776 Deaths: NA	NA	In-hospital mortality among CCS patients Per year increase: HR= 1.03 (95% CI: 1.02-1.04)
Palaiodimos 2020 (259)	Sex, BMI, heart failure, coronary artery disease, diabetes, chronic kidney disease or end stage renal disease, COPD, smoking status	Logistic regression, forward stepwise approach	N= 200 Deaths: 48 (24.0%)	In-hospital mortality OR (95%CI) Per year increase: 1.03 (1.01–1.06)	In-hospital mortality OR (95%CI) Per year increase: 1.03 (1.00-1.07)

Author, Year (Ref)	**Confounders and age-dependent risk factors used in the model**	**Type of analysis # cases / # non-cases**	**N in analysis Total deaths In age group: # cases/total**	**Results Unadjusted effect estimates (if available)**	**Results Adjusted effect estimates**
Patel 2020 (261)	Therapeutic anticoagulation, home antiplatelet, race, BMI, Charlson score, glucose level	Poisson regression model and logistic regression	N=1716 Deaths= 125 (7.3%) Deaths in critical: 125 (7.3%) 18-44 yrs.: NA 45- 59 yrs.: NA 60-69 yrs.: NA 70-79 yrs.: NA >80 yrs.: NA	NA	In-hospital mortality 18-44 yrs.: IRR= 1.36 (95% CI: 0.57-3.28) 45-59 yrs.: Reference 60-69 yrs.: IRR= 1.30 (95% CI: 0.69-2.46) 70-79 yrs.: IRR= 1.31 (95% CI: 0.65-2.65) >80 yrs.: IRR= 2.36 (95% CI: 1.12-2.47) Death in critical 18-44 yrs.: OR= 1.43 (95% CI: 0.49-4.17) 45- 59 yrs.: Reference 60-69 yrs.: OR= 1.82 (95% CI: 0.83-3.97) 70-79 yrs.: OR= 1.36 (95% CI: 0.55-3.37) >80 yrs.: OR= 2.74 (95% CI: 1.03-7.32)
Perez-Guzman 2020 (262)	Race, sex, Eixhauser index	Logistic regression	N= 559 Deaths: 178 (32%)	NA	In-hospital mortality: Per year: OR= 1.05 (1.03-1.06)
Petrilli 2020 (263)	Week, race/ethnicity, smoking status, BMI, coronary artery disease, heart failure, hyperlipidemia, hypertension, diabetes, asthma or COPD, chronic kidney disease, cancer, sex	Competing risk model	N= 5279 (positive test) N= 2741 (hospitalized) Deaths: 665 (24.3%) 19-44 yrs.: NA 45-54 yrs.: NA 55-64 yrs.: NA 65-74 yrs.: NA ≥75 yrs.: NA	NA	In-hospital death or discharge to hospice: HR (95% CIs) Adjusted 19-44 yrs.: Reference 45-54 yrs.: 2.59 (1.66-4.32) 55-64 yrs.: 4.40 (2.73-7.11) 65-74 yrs.: 6.99 (4.34-11.27) ≥75 yrs.: 10.34 (6.37-16.79)

Author, Year (Ref)	**Confounders and age-dependent risk factors used in the model**	**Type of analysis # cases / # non-cases**	**N in analysis Total deaths In age group: # cases/total**	**Results Unadjusted effect estimates (if available)**	**Results Adjusted effect estimates**
Price-Haywood 2020 (266)	Race, sex, Charlson Comorbidity Index score, low-income residency, obesity	Cox proportional-hazards models For variables for which less than 25% of data missing, values were imputed	N = 1382 Deaths: 326 (23.6%)	In-hospital mortality: HR (95% CI) Adjusted for race and sex: Per 5-yr. unit increase: 1.18 (1.13-1.23) Per 1-yr unit increase (own calculations): 1.03 (1.02-1.04)	In-hospital mortality: HR (95% CI) Fully adjusted: Per 5-yr. unit increase: 1.19 (1.13-1.24) Per 1-yr unit increase (own calculations): 1.04 (1.02-1.04)
Reilev 2020 (269)	Number of comorbidities (0,1,2,3,4+ of chronic lung disease, hypertension, ischaemic heart disease, heart failure, atrial fibrillation, stroke, diabetes, dementia, cancer, chronic liver disease, hospital-diagnosed kidney disease, alcohol abuse, substance abuse, major psychiatric disorders, organ transplantation, medical overweight and obesity, rheumatoid arthritis/connective-tissue disease), sex	Logistic regression	N= 2254 hospitalized (for ICU, in-hospital mortality) Deaths: NA 0-9 yrs.: NA/11 10-19 yrs.: NA/14 20-29 yrs.: NA/55 30-39 yrs.: NA/90 40-49 yrs.: NA/192 50-59 yrs.: NA/337 60-69 yrs.: NA/374 70-79 yrs.: NA/578 80-89 yrs.: NA/476 90+ yrs.: NA/127	In-hospital mortality OR (95% CI) Unadjusted 0-9 yrs.: NA 10-19 yrs.: NA 20-29 yrs.: NA 30-39 yrs.: NA 40-49 yrs.: NA 50-59 yrs.: Reference 60-69 yrs.: 3.5 (1.9-6.4) 70-79 yrs.: 7.2 (4.1-12.8) 80-89 yrs.: 13.3 (7.5-23.4) 90+ yrs.: 32.2 (17.0-61.1)	In-hospital mortality OR (95% CI) Adjusted 0-9 yrs.: NA 10-19 yrs.: NA 20-29 yrs.: NA 30-39 yrs.: NA 40-49 yrs.: NA 50-59 yrs.: Reference 60-69 yrs.: 2.9 (1.6-5.4) 70-79 yrs.: 5.2 (2.9-9.2) 80-89 yrs.: 10.2 (5.7-18.2) 90+ yrs.: 29.1 (15.0-56.5)
Salacup 2020 (277)	Sex, BMI, ethnicity, COPD and asthma, diabetes, hypertension, cirrhosis, heart failure, chronic kidney disease	Logistic regression	N= 242 Deaths: 52 (21,5%)	NA	In hospital mortality OR (95% CI) Per year: 1.056 (1.023-1.090)
Sapey 2020 (279)	Ethnicity, sex, deprivation, comorbidity number group 0, 1-2, 3+ (hypertension, cerebrovascular disease, atrial fibrillation, ischaemic heart disease/angina/myocardial infarct, diabetes (type 1 and 2), asthma, COPD, interstitial lung disease, chronic kidney disease, any active malignancy, dementia, obesity)	Cox proportional hazard regression	N=2169 Deaths: 769 (34.6%)	NA	In-hospital mortality HR (95% CI) Age (z-score): 2.4 (1.8-3.2) Age (z-score) x sex(male): 1.2 (1.0-1.5) Age (z-score) x comorbidity group 1-2: 0.9 (0.7-1.2) Age (z-score) x comorbidity group 3+: 0.7 (0.5-0.9)
Seiglie 2020 (280)	BMI, sex, race/ethnicity, diabetes, coronary artery disease or myocardial infarction, chronic heart failure,	Logistic regression	N=450 Deaths: 49 (10.9%) <50 yrs.: NA 50-59 yrs.: NA	14-day in-hospital death OR (95% CIs) <50 yrs.: Reference 50-59 yrs.: 7.05 (0.81-61.7)	14-day in-hospital death OR (95% CI) <50 yrs.: Reference 50-59 yrs.: 3.74 (0.40-34.54) 60-69 yrs.: 4.57 (0.50-41.9)

Author, Year (Ref)	**Confounders and age-dependent risk factors used in the model**	**Type of analysis # cases / # non-cases**	**N in analysis Total deaths In age group: # cases/total**	**Results Unadjusted effect estimates (if available)**	**Results Adjusted effect estimates**
	hypertension, COPD/asthma, active cancer, liver disease, renal disease		60-69 yrs.: NA ≥70 yrs.: NA	60-69 yrs.: 8.35 (0.98-70.8) ≥70 yrs.: 27.03 (3.65-200.2)	≥70 yrs.: 12.66 (1.50-106.56)
Shah 2020 (281)	BMI, sex, ethnicity, hypertension, coronary artery disease, congestive heart failure, COPD, asthma, chronic kidney disease, diabetes, immunosuppression, chronic liver disease, cancer, tobacco smoking	Logistic regression	N= 522 Deaths: 92 (17.6%) <65 yrs: NA ≥65 yrs.: NA ------ <20 yrs.: 0 20-29 yrs.: 1/19 30-39 yrs.: 1/34 40-49 yrs.: 8/58 50-59 yrs.: 7/111 60-69 yrs.: 29/137 70-79 yrs.: 27/104 80-89 yrs.: 13/42 90-99 yrs.: 6/17	NA	In-hospital mortality OR (95% CI) <65 yrs: Reference ≥ 65 yrs.: 3.1 (1.7-5.6)
Shi 2020 (285)	Cardiovascular disease, cerebrovascular disease, diabetes, COPD, renal failure, cancer, acute respiratory distress syndrome, cardiac injury, creatinine, N-terminal pro-B-type natriuretic peptide	Cox proportional hazard regression model	N= 416 Deaths: 57 (13.7%)	NA	In-hospital mortality From symptom onset HR (95% CI) Age (per year): 1.02 (0.99-1.05) From admission HR (95% CI) Age (per year): 1.02 (0.99-1.04)
van Gerwen 2020 (301)	Sex, race, smoking, BMI, hypertension, coronary artery disease, atrial fibrillation, congestive heart failure, peripheral vascular disease, cerebrovascular accident/transient ischemic attack, dementia, diabetes, hypothyroidism, chronic kidney disease, malignancy, asthma, COPD, prior venous thromboembolism	Logistic regression	N=3703 (all patients) N=2015 (hospitalized) Deaths: 616 (30.6% of hospitalized) 18-40 yrs.: 8/207 40-60 yrs.: 101/539 >60 yrs.: 507/1269	In-hospital mortality OR (95% CI) 18-40 yrs.: Reference 40-60 yrs.: 5.74 (2.74-12.01) >60 yrs.: 16.55 (8.09-33.85)	In-hospital mortality OR (95% CI) 18-40 yrs.: Reference 40-60 yrs.: 5.29 (2.51-11.15) >60 yrs.: 13.04 (6.25-27.24)
Wang 2020 (305)	Model 1: Cardiovascular disease, cerebrovascular disease, COPD	Cox regression	N=7592 Deaths: 65 (19.2%)	In-hospital mortality in patients over 60 years old HR (95% CI) Age (per year): 1.084 (1.055-1.114)	In-hospital mortality in patients over 60 years old HR (95% CI) Age (per year): 1.064 (1.034-1.096)

Author, Year (Ref)	**Confounders and age-dependent risk factors used in the model**	**Type of analysis # cases / # non-cases**	**N in analysis Total deaths In age group: # cases/total**	**Results Unadjusted effect estimates (if available)**	**Results Adjusted effect estimates**
Yehia 2020 (312)	Model 2: Race, sex, insurance, neighborhood deprivation index, Elixhauser Comorbidity Index (ECI score) Model 3: Race, sex, insurance, neighborhood deprivation index, ECI score, asthma, cancer, chronic kidney disease, COPD, congestive heart failure, coronary artery disease, diabetes, obesity	Cox proportional hazards regression	N=7139 Deaths: 1446 (20.3%) 18-49 yrs.: NA 50-64 yrs.: NA 65-84 yrs.: NA ≥85 yrs.: NA	In-hospital mortality HR (95% CI) Model 1 (unadjusted) 18-49 yrs.: Reference 50-64 yrs.: 1.54 (1.17-2.03) 65-84 yrs.: 3.36 (2.61-4.34) ≥85 yrs.: 5.65 (4.32-7.38)	In-hospital mortality HR (95% CI) Model 2 (adjusted) 18-49 yrs.: Reference 50-64 yrs.: 1.40 (1.13-1.73) 65-84 yrs.: 2.44 (1.79-3.33) ≥85 yrs.: 4.00 (2.95-5.47) Model 3 (adjusted) 18-49 yrs.: Reference 50-64 yrs.: 1.36 (1.11-1.67) 65-84 yrs.: 2.38 (1.73-3.26) ≥85 yrs.: 3.96 (2.82-5.55)
Zhao 2020 (319)	Sex, comorbidities (hypertension, diabetes, coronary heart disease, COPD, asthma, cerebrovascular disease, chronic renal disease, chronic liver disease, malignancy, autoimmune disease, organ transplantation)	Cox proportional hazard regression	N=1000 Deaths: 119 (11.9%) <60 yrs.: 24/473 60-75 yrs.: 42/359 ≥75 yrs.: 53/168	NA	In-hospital mortality HR (95% CI) Model 1 (cumulative death risk after admission): <60 yrs.: Reference 60-75 yrs.: 1.944 (1.156-3.271) ≥75 yrs.: 4.777 (2.850-8.008) Model 2 (cumulative death risk after disease onset): <60 yrs.: Reference 60-75 yrs.: 1.849 (1.1-3.108) ≥75 yrs.: 4.770 (2.841-8.008)

*: same study population

ICU: intensive care unit; COPD: chronic obstructive pulmonary disease; BMI: body mass index; yrs.: years; SOFA score: sequential organ failure assessment score; OR: odds ratio; HR: hazards ratio; CI: confidence intervals; NA: not available

Table S4. Risk of bias summary for studies investigating in-hospital mortality

Study	Major domains					Minor domains			OVERALL
	Recruitment procedure	Exposure assessment	Outcome source and validation	Confounding	Analysis method	Chronology	Funding	Conflict of interest	
Antwi-Amoabeng et al. 2020 (165)	✓	✗	✓	✗	✓	⚠	⚠	⚠	✗
Argenziano et al. 2020 (166)	✓	✓	✓	✓	✓	✓	✓	✗	✓
Baqui et al. 2020 (168)	✓	✓	✓	✓	✓	✓	✓	✓	✓
Boulle et al. 2020 (176)	✓	✓	✓	✗	✓	✓	✓	✗	✗
Burn et al. 2020 (177)	✓	✓	✓	✓	✓	✓	✓	✗	✓
Carter et al. 2020 (181)	✓	✗	✓	✗	✓	✗	✓	✓	✗
Chen et al. 2020 (184)	✓	✗	✓	✗	✓	✓	⚠	✓	✗
Chilimuri et al. 2020 (187)	✓	✓	✓	✗	✓	✗	✓	✓	✗
Ciardullo et al. 2020 (188)	✓	✓	✓	✗	✓	✓	✓	✓	✗
Conversano et al. 2020 (190)	✓	✓	✓	✗	✓	✓	✓	✓	✗
Cummings et al. 2020 (193)	✓	✓	✓	✗	✓	✗	✓	✓	✗
Di Castelnuovo et al. 2020 (197)	✓	✓	✓	✗	✓	✗	✓	✓	✗
Docherty et al. 2020 (198)	✗	✓	✓	✓	✓	✓	✓	✓	✗
Giacomelli et al. 2020 (209)	✓	✓	✓	✓	✓	✗	⚠	✓	✓
Grasselli et al. 2020 (213)	✓	✓	✓	✗	✓	✗	✓	✗	✗
Gupta et al. 2020 (216)	✓	✓	✓	✗	✓	✗	⚠	✗	✗

Study	Major domains					Minor domains			OVERALL
	Recruitment procedure	Exposure assessment	Outcome source and validation	Confounding	Analysis method	Chronology	Funding	Conflict of interest	
Hashemi et al. 2020 (220)	✓	✓	✓	✗	✓	✓	✓	✓	✗
Hewitt et al. 2020 (221)	✓	✗	✓	✗	✓	✗	✓	✓	✗
Hwang et al. 2020 (224)	✗	✓	✓	✗	✓	✓	✓	✓	✗
Imam et al. 2020 (225)	✓	✗	✓	✗	✓	✓	✓	✓	✗
Jun et al. 2020 (226)	✓	✓	✓	✗	✓	✗	✓	✓	✗
Khalil et al. 2020 (229)	✓	✓	✓	✗	✓	✗	✓	✓	✗
Kim et al. 2020 (231)	✓	✓	✓	✓	✓	✓	✓	✗	✓
Klang et al. 2020 (233)	✓	✓	✓	✗	✓	✓	⚠	✓	✗
Li et al. 2020 (238)	✓	✗	✓	✗	✓	✓	✓	✓	✗
Magleby et al. 2020 (241)	✓	✓	✓	✗	✓	✗	✓	✗	✗
Meng et al. 2020 (248)	✓	✓	✓	✗	✓	✓	✓	✓	✗
Murillo-Zamora et al. 2020 (255)	✓	✗	✓	✗	✓	✗	✓	✓	✗
Narain et al. 2020 (257)	✓	✓	✓	✓	✓	✗	✓	✓	✓
Palaiodimos et al. 2020 (259)	✓	✓	✓	✗	✓	✓	✓	✓	✗
Patel et al. 2020 (261)	⚠	✓	✓	✓	✓	✗	✓	✓	✗
Perez-Guzman et al. 2020 (262)	✓	✓	✓	✓	✓	✓	✓	✗	✓
Petrilli et al. 2020 (263)	✓	✓	✓	✗	✓	✓	✓	✓	✗
Price-Haywood et al. 2020 (266)	✓	✓	✓	✓	✓	✓	✓	✗	✓

Study	Major domains					Minor domains			OVERALL
	Recruitment procedure	Exposure assessment	Outcome source and validation	Confounding	Analysis method	Chronology	Funding	Conflict of interest	
Reilev et al. 2020 (269)	✓	✓	✓	✗	✓	✓	⚠	✗	✗
Salacup et al. 2020 (277)	✓	✓	✓	✗	✓	✓	⚠	✓	✗
Sapey et al. 2020 (279)	✓	✗	✓	✗	✓	✓	✓	✗	✗
Seiglie et al. 2020 (280)	✓	✗	✓	✓	✓	✓	✓	✗	✗
Shah et al. 2020 (281)	✓	✗	✓	✓	✓	✓	⚠	✓	✗
Shi et al. 2020 (285)	✓	✓	✓	✗	✓	✗	✓	✓	✗
van Gerwen et al. 2020 (301)	✓	✗	✓	✗	✓	✓	✓	✓	✗
Wang et al. 2020 (305)	✓	✓	✓	✗	✓	✓	✓	✓	✗
Yehia et al. 2020 (312)	✓	✗	✓	✓	✓	✓	⚠	✗	✗
Zhao et al. 2020 (319)	✓	✗	✓	✓	✓	✓	✓	✓	✗

✓ = low risk of bias ⚠ = unclear risk of bias ✗ = high risk of bias

Figure S3. Relationship between median age and log of relative risk among studies using age as a categorical value (linear and cubic models, variance weighted): in-hospital mortality

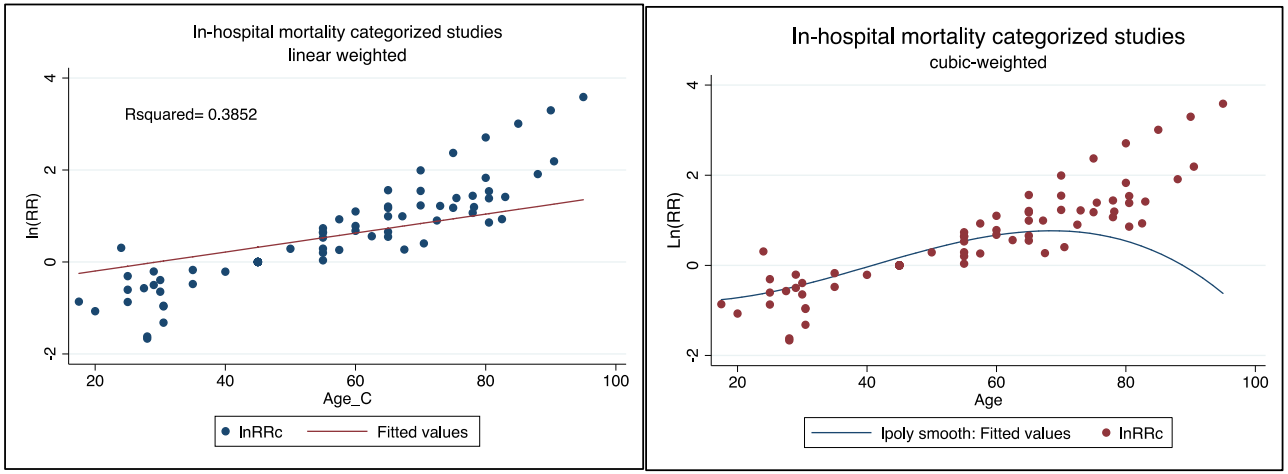
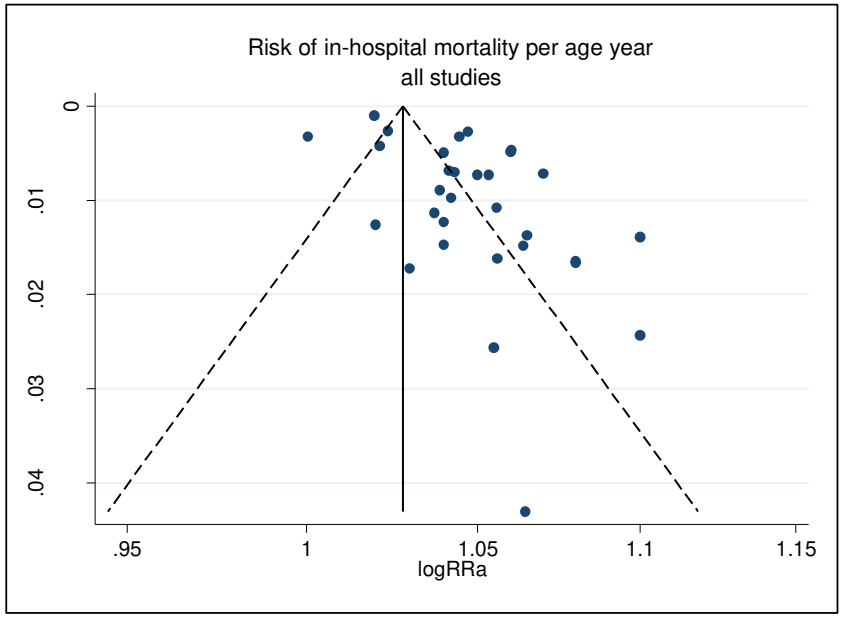
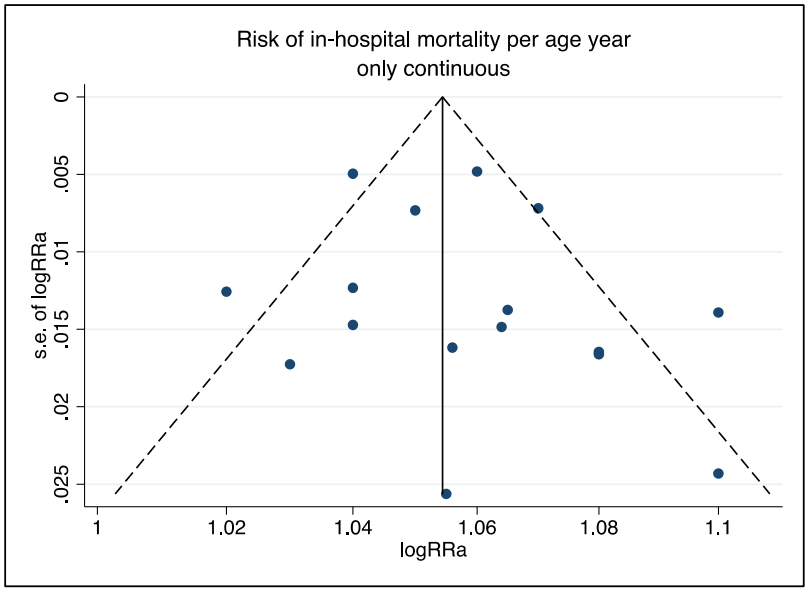


Figure S4. Funnel plot of studies investigating in-hospital mortality



Figures S5a-b. Funnel plot of studies investigating in-hospital mortality with age as continuous variable (a) and as categorical value (b)

(a)



(b)

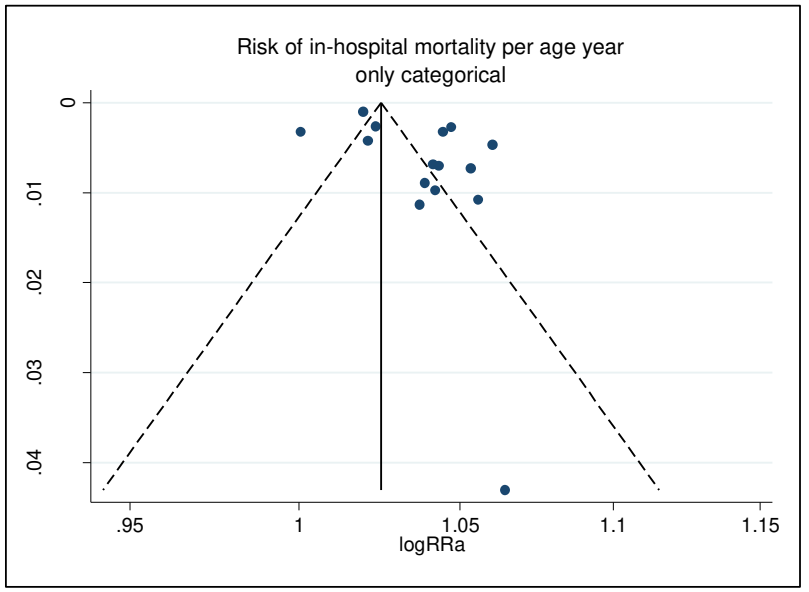


Table S5. Results of studies investigating case mortality

Author, Year (Ref)	Confounders and age-dependent risk factors used in the model	Type of analysis # cases / # non-cases	N in analysis Total deaths In age group: # cases/total	Results Unadjusted effect estimates (if available)	Results Adjusted effect estimates
Bello-Chavolla† 2020 (170)	Diabetes, diabetes (interaction with age<40 yrs.), smoking, immunosuppression, COPD, asthma, CVD, chronic kidney disease, hypertension, sex, obesity	Cox proportional risk regression	N= 51,633 Deaths: 5332 (10.3%) <40 yrs.: NA ≥40yrs. - ≤65 yrs.: NA >65 yrs.: NA		30-day mortality (population based) Results available in figures.
Boulle 2020 (176)	Sex, diabetes, hypertension, chronic kidney disease, chronic pulmonary disease/asthma, tuberculosis, HIV, antiretroviral therapy, CD4 count during COVID-19	Cox proportional hazards model	All public-sector SARS-CoV-2 cases diagnosed before June 1, 2020 N= 15,203 Deaths: 510 20-39 yrs.: 35/8688 40-49 yrs.: 51/3042 50-59 yrs.: 137/2018 60-69 yrs.: 150/889 ≥70 yrs.: 137/566	NA	Mortality HR (95% CI) All public-sector SARS-CoV-2 cases diagnosed before June 1, 2020 20-39 yrs.: Reference 40-49 yrs.: 3.19 (2.06-4.93) 50-59 yrs.: 10.84 (7.34-16.01) 60-69 yrs.: 24.87 (16.67-37.11) ≥70 yrs.: 38.32 (25.47-57.64)
Burn 2020 (177)	Autoimmune condition, chronic kidney disease, COPD, dementia, heart disease, hyperlipidemia, hypertension, malignant neoplasm, obesity, Type 2 diabetes, Charlson Index	Cox proportional hazards model using a non-linear relationship with age	From diagnosed with COVID-19 to death N= 102,002 Deaths: 2581 >18 yrs.: <5/4536 18–39 yrs.: 5/30,530 40-59 yrs.: 63/44,493 60-69 yrs.: 131/10,305 70-79 yrs.: 406/6120 ≥80 yrs.: 1976/6018	Population based mortality HR (95% CIs) From diagnosed with COVID-19 to death (Age only model): 20-24 yrs.: 0.0074 (0.0023 to 0.024) 25-29 yrs.: 0.0089 (0.0038 to 0.021) 30-34 yrs.: 0.01 (0.0044 to 0.022) 35-39 yrs.: 0.0097 (0.0044 to 0.021) 40-44 yrs.: 0.0081 (0.0046 to 0.014) 45-49 yrs.: 0.009 (0.006 to 0.014) 50-54 yrs.: 0.023 (0.016 to 0.033) 55-59 yrs.: 0.095 (0.077 to 0.12) 60-64 yrs.: 0.35 (0.33 to 0.38)	Population based mortality HR (95% CIs) From diagnosed with COVID-19 to death (Age and comorbidity model): 20-24 yrs.: 0.0083 (0.0024 to 0.03) 25-29 yrs.: 0.0099 (0.004 to 0.025) 30-34 yrs.: 0.011 (0.0047 to 0.027) 35-39 yrs.: 0.012 (0.005 to 0.027) 40-44 yrs.: 0.011 (0.006 to 0.02) 45-49 yrs.: 0.013 (0.0088 to 0.02) 50-54 yrs.: 0.033 (0.023 to 0.047) 55-59 yrs.: 0.12 (0.099 to 0.15) 60-64 yrs.: 0.40 (0.37 to 0.43) 65-69 yrs.: Reference 70-74 yrs.: 2.05 (1.96 to 2.13) 75-79 yrs.: 3.62 (3.41 to 3.85) 80-84 yrs.: 5.91 (5.48 to 6.36) 85-89 yrs.: 9.38 (8.54 to 10.29)

Author, Year (Ref)	**Confounders and age-dependent risk factors used in the model**	**Type of analysis # cases / # non-cases**	**N in analysis Total deaths In age group: # cases/total**	**Results Unadjusted effect estimates (if available)**	**Results Adjusted effect estimates**
				65-69 yrs.: Reference 70-74 yrs.: 2.30 (2.21 to 2.39) 75-79 yrs.: 4.56 (4.30 to 4.82) 80-84 yrs.: 8.29 (7.76 to 8.85) 85-89 yrs.: 14.69 (13.58 to 15.89) 90-94 yrs.: 26.00 (23.62 to 28.62) 95+ yrs.: 46.03 (40.97 to 51.71)	90-94 yrs.: 14.88 (13.25 to 16.70) 95+ yrs.: 23.60 (20.52 to 27.16)
Carrillo-Vega† 2020 (180)	Sex, chronic kidney disease, COPD, diabetes & hypertension & obesity, diabetes & hypertension, diabetes & obesity, only hypertension, only obesity, only diabetes, pneumonia, pregnancy, immune-suppressed, hospitalized, intubated, ICU, health services	Logistic regression	N= 9946 (by outcome) N= 10544 (in total) Deaths: 963 (9.7%) (by outcome) Deaths: 968 (9.2%) (in total) <25 yrs.: 5/598 25-49 yrs.: 255/5640 50-74 yrs.: 573/3823 ≥75 yrs.: 135/483	NA	Mortality (population based) OR (95% CI) 25-49 yrs.: Reference 50-74 yrs.: 1.96 (1.63-2.34) ≥75 yrs.: 3.74 (2.80-4.98)
Gu 2020 (214)	Model 1 Sex, pandemic period, comorbidity score (considered coronary heart disease, hypertension, cardiac failure, cerebral infarction, chronic bronchitis, COPD, diabetes, renal failure, history of surgery) Model 2 Sex, period of the pandemic, coronary heart disease, cerebral infarction, COPD, renal failure	Inverse probability-weighted Cox proportional hazard regression	N= 275 Deaths: 94 (21%) Controls: 181	Population-based mortality HR (95% CI) Age (per year): 1.05 (1.0-1.1)	Population-based mortality HR (95% CI) Model 1 Age (per year): 1.04 (1.02-1.07) Model 2 Age (per year): 1.04 (1.02-1.06)
Gu 2020 (215)	Sex, BMI, smoking status, alcohol consumption, race/ethnicity, neighborhood socioeconomic disadvantage index, population density, comorbidity score, respiratory disease, circulatory disease, any cancer, type 2	Logistic regression analyses, firth bias-corrected estimates	N=1139 (Positive tests) Deaths: 88 (7.7%) <18 yrs.: 0/9 18- <35 yrs.: 2/203 35- <50 yrs.: 5/257 50- <65 yrs.: 16/349	Mortality (population-based) OR (95 % CI) Age (per 10 years): 2.21 (1.87-2.62) Age (per 1-year, own calculation): 1.08 (1.06-1.10)	Mortality (population-based) OR (95 % CI) Age (per 10 years): 2.31 (1.78-3) Age (per 1-year, own calculation): 1.09 (1.06-1.12) <18 yrs.: -

Author, Year (Ref)	Confounders and age-dependent risk factors used in the model	Type of analysis # cases / # non-cases	N in analysis Total deaths In age group: # cases/total	Results Unadjusted effect estimates (if available)	Results Adjusted effect estimates
	diabetes, kidney disease, liver disease, autoimmune disease		65- <80 yrs.: 31/233 ≥80 yrs.: 34/88	<18 yrs.: - 18- <35 yrs.: Reference 35- <50 yrs.: 1.76 (0.39-7.95) 50- <65 yrs.: 3.99 (1.04-15.3) 65- <80 yrs.: 12.5 (3.40-46.3) ≥80 yrs.: 51.0 (13.6-191)	18- <35 yrs.: Reference 35- <50 yrs.: 1.22 (0.166-9.01) 50- <65 yrs.: 1.91 (0.33-11) 65- <80 yrs.: 6.22 (1.14-33.9) ≥80 yrs.: 37.5 (6.71-209)
Harrison 2020 (219)	Sex, ethnicity, comorbidities within the Charlson comorbidity index (myocardial infarction, congestive heart failure, peripheral vascular disease, cerebrovascular disease, dementia, chronic pulmonary disease, rheumatic disease, peptic ulcer disease, mild liver disease, moderate/severe liver disease, diabetes mellitus, hemiplegia or paraplegia, renal disease, any malignancy, metastatic solid tumour, AIDS/HIV	Logistic regression	N=31,461 Deaths: 1,296 (4.1%) <50 yrs.: 104/15,578 50-69 yrs.: 430/10,698 70-90 yrs.: 762/5,185	Population-based mortality OR (95% CI) Whole population Age (per year): 1.074 (1.069-1.078) Adults aged <50 yrs.: Age (per year): 1.06 (1.05-1.09) Adults aged 50-69 yrs.: Age (per year): 1.10 (1.08-1.12) Adults aged 70-90 yrs.: Age (per year): 1.03 (1.01-1.04)	Population-based mortality- OR (95% CI) Whole population Age (per year): 1.063 (1.058-1.068) Adults aged <50 yrs. Age (per year): 1.03 (1.01-1.06) Adults aged 50-69 yrs. Age (per year): 1.07 (1.07-1.10) Adults aged 70-90 yrs. Age (per year): 1.02 (1.01-1.04)
Kabarriti 2020 (227)	Sex, socioeconomic status, ethnicity/race, BMI, hypertension, cardiovascular disease, diabetes, cancer, liver disease, dementia, chronic pulmonary disease, peptic ulcer, hemiplegia or paraplegia, kidney disease, HIV/AIDS	Cox proportional hazards models	N=5902 Deaths: 918 (15.5%) ≤ 40 yrs.: 27/1255 41-60 yrs.: 133/2026 61-80 yrs.: 507/2002 >80 yrs.: 251/619	Mortality (population based) OR (95% CI) ≤ 40 yrs.: Reference 41-60 yrs.: 2.42 (1.60-3.66) 61-80 yrs.: 7.63 (5.18-11.2) >80 yrs.: 14.9 (9.98-22.1)	Mortality (population based) OR (95% CI) Model 1 (Complete case) ≤ 40 yrs.: Reference 41-60 yrs.: 1.85 (1.17-2.94) 61-80 yrs.: 5.24 (3.37-8.16) >80 yrs.: 9.48 (5.98-15.0) Model 2 (Multiple imputation) ≤ 40 yrs.: Reference 41-60 yrs.: 2.04 (1.34-3.10) 61-80 yrs.: 5.47 (3.66-8.18) >80 yrs.: 10.3 (6.75-15.6)
Lee 2020 (235)	Sex, hypertension, diabetes, coronary artery disease, stroke, COPD, any cancer, chronic kidney disease, medication (angiotensin receptor blocker, angiotensin converting enzyme)	Generalized linear mixed-effect regression models, including squared term for age	N= 8,266 Deaths: 112 (1.4%)	NA	Population-based mortality within 60 days HR (95% CI) Age per year: 1.372 (1.118-1.683) Age^2: 0.999 (0.997-1.000)

Author, Year (Ref)	**Confounders and age-dependent risk factors used in the model**	**Type of analysis # cases / # non-cases**	**N in analysis Total deaths In age group: # cases/total**	**Results Unadjusted effect estimates (if available)**	**Results Adjusted effect estimates**
Reilev 2020 (269)	Number of comorbidities (0,1,2,3,4+ of chronic lung disease, hypertension, ischaemic heart disease, heart failure, atrial fibrillation, stroke, diabetes, dementia, cancer, chronic liver disease, hospital-diagnosed kidney disease, alcohol abuse, substance abuse, major psychiatric disorders, organ transplantation, medical overweight and obesity, rheumatoid arthritis/connective-tissue disease), sex	Logistic regression	N= 11,122 (positive cases, for hospitalization, death within 30 days) Deaths within 30 days of positive test: 577 (5.2%) 0-9 yrs.: 0/251 10-19 yrs.: 0/495 20-29 yrs.: 0/1523 30-39 yrs.: NA/1588 40-49 yrs.: NA/1970 50-59 yrs.: NA/2035 30-59: 16/5593 60-69 yrs.: 56/1305 70-79 yrs.: 165/950 80-89 yrs.: 220/762 90+ yrs.: 120/243	Death within 30 days among positive cases OR (95% CI) Unadjusted 0-9 yrs.: NA 10-19 yrs.: NA 20-29 yrs.: NA 30-39 yrs.: NA 40-49 yrs.: NA 50-59 yrs.: Reference 60-69 yrs.: 6.0 (3.4-10.7) 70-79 yrs.: 28.3 (16.6-48.3) 80-89 yrs.: 54.7 (32.1-93.0) 90+ yrs.: 131.4 (74.5-231.6)	Death within 30 days among positive cases OR (95% CI) Adjusted 0-9 yrs.: NA 10-19 yrs.: NA 20-29 yrs.: NA 30-39 yrs.: NA 40-49 yrs.: NA 50-59 yrs.: Reference 60-69 yrs.: 4.4 (2.5-7.9) 70-79 yrs.: 15.2 (8.7-26.3) 80-89 yrs.: 29.9 (17.2-51.9) 90+ yrs.: 90.2 (50.2-162.2)
Rossi 2020 (274)	Sex, calendar period, time from symptoms to diagnosis, place of birth, Charlson Comorbidity Index	Cox proportional hazard regression models	N= 2653 COVID-19 cases Deaths (COVID-19 cases): 217 (8.2%) <51 yrs.: 2/696 51-60 yrs.: 7/528 61-70 yrs.: 23/413 71-80 yrs.: 54/420 ≥81 yrs.: 131/596	NA	Population-based mortality HR (95% CI) <51 yrs.: Reference 51-60 yrs.: 1.5 (0.5-4.2) 61-70 yrs.: 3.8 (1.6-9.4) 71-80 yrs.: 9.1 (4.0-20.6) ≥81 yrs.: 27.8 (12.5-61.7)

Author, Year (Ref)	**Confounders and age-dependent risk factors used in the model**	**Type of analysis # cases / # non-cases**	**N in analysis Total deaths In age group: # cases/total**	**Results Unadjusted effect estimates (if available)**	**Results Adjusted effect estimates**
Solís 2020 (294)	Sex, medical unit, week, comorbidities (none or one, two, three or more), hypertension, obesity, cardiovascular disease, diabetes, immunosuppression, COPD, asthma, chronic kidney disease, smoking, other, institution	Piecewise exponential hazards regression model	N=7497 Deaths: 650 (8.67%) 0-24 yrs.: NA 25-29 yrs.: NA 30-34 yrs.: NA 35-39 yrs.: NA 40-44 yrs.: NA 45-49 yrs.: NA 50-54 yrs.: NA 55-59 yrs.: NA 60-64 yrs.: NA 65-69 yrs.: NA 70+ yrs.: NA	NA	Population-based mortality at 35 days HR (95% CI) 0-24 yrs.: 0.038 (0.005-0.270) 25-29 yrs.: 0.202 (0.104-0.392) 30-34 yrs.: 0.218 (0.121-0.394) 35-39 yrs.: 0.357 (0.225-0.566) 40-44 yrs.: 0.756 (0.530-1.078 45-49 yrs.: Reference 50-54 yrs.: 1.171 (0.854-1.605) 55-59 yrs.: 1.411 (1.035-1.923) 60-64 yrs.: 1.304 (0.926-1.836) 65-69 yrs.: 2.016 (1.458-2.787) 70+ yrs.: 2.608 (1.931-3.522)
Sousa 2020 (295)	Sex, cardiovascular disease, diabetes, hematologic disease, neurologic disease, obesity, pneumopathies, renal disease	Robust Poisson regression Cox regression	N=2070 Deaths: 131 (6.33%) <60 yrs.: 32/1573 ≥60 yrs.: 99/497	NA	Population-based mortality IRR (95% CI) <60 yrs.: Reference ≥60 yrs.: 3.1 (1.9-5.0) Population-based mortality HR (95% CI) <60 yrs.: Reference ≥60 yrs.: 3.6 (2.3-5.8)
Tartof 2020 (300)	BMI, sex, race/ethnicity, smoking, comorbidities: metastatic tumor/cancer, hyperlipidemia, myocardial infarction, other immune condition, organ transplant, congestive heart failure, peripheral vascular disease, cerebrovascular disease, chronic pulmonary disease, renal disease, hypertension, asthma, diabetes mellitus, time	Poisson regression with multiple imputation for missing data.	N=6916 Deaths: 206 (3,0%) 0-40 yrs.: 7/2227 41-50 yrs.: 10/1422 51-60 yrs.: 20/1545 61-70 yrs.: 41/1045 71-80 yrs.: 53/427 >80 yrs.: 75/250	NA	Population-based mortality RR (95% CI) 0-40 yrs.: Reference 41-50 yrs.: 1.88 (0.71–4.95) 51-60 yrs.: 3.14 (1.31–7.57) 61-70 yrs.: 7.18 (3.08–16.78) 71-80 yrs.: 16.08 (6.72–38.52) >80 yrs.: 43.21 (17.80–104.92)
Wang 2020	Residential area, smoking status, vital signs, administered medication, asthma,	Logistic regression	N=7592 (total) N=6764 (analysis)	Population-based mortality OR (95% CI)	Population-based mortality OR (95% CI)

Author, Year (Ref)	**Confounders and age-dependent risk factors used in the model**	**Type of analysis # cases / # non-cases**	**N in analysis Total deaths In age group: # cases/total**	**Results Unadjusted effect estimates (if available)**	**Results Adjusted effect estimates**
(302)	chronic kidney disease, number of comorbidities (0, 1-3, 4+) Most prevalent; hypertension, diabetes, chronic kidney disease, obesity, cancer, asthma, COPD.		Deaths: 828 (10.9%) <40 yrs.: 10/1590 40-49 yrs.: 33/940 50-59 yrs.: 80/1306 60-69 yrs.: 167/1583 70-79 yrs.: 217/1137 80+ yrs.: 321/1036	<40 yrs.: Reference 40-49 yrs.: 5.75 (2.82-11.72) 50-59 yrs.: 10.31 (5.32-19.98) 60-69 yrs.: 18.63 (9.81-35.41) 70-79 yrs.: 37.27 (19.67-70.61) 80+ yrs.: 70.93 (37.57-133.93)	<40 yrs.: Reference 40-49 yrs.: 3.48 (1.48-8.17) 50-59 yrs.: 5.53 (2.51-12.19) 60-69 yrs.: 8.44 (3.90-18.26) 70-79 yrs.: 18.29 (8.46-39.51) 80+ yrs.: 33.77 (15.66-72.84)

†: same study population

ICU: intensive care unit; COPD: chronic obstructive pulmonary disease; BMI: body mass index; yrs.: years; SOFA score: sequential organ failure assessment score; OR: odds ratio; HR: hazards ratio; CI: confidence intervals; NA: not available

Table S6. Risk of bias summary for studies investigating case mortality

Study	Major domains					Minor domains			OVERALL
	Recruitment procedure	Exposure assessment	Outcome source and validation	Confounding	Analysis method	Chronology	Funding	Conflict of interest	
Bello-Chavolla et al. 2020 (170)	✓	✗	✓	✗	✓	✓	⚠	✓	✗
Boulle et al. 2020 (176)	✓	✓	✓	✗	✓	✓	✓	✗	✗
Burn et al. 2020 (177)	✓	✓	✓	✓	✓	✓	✓	✗	✓
Carrillo-Vega et al. 2020 (180)	✓	✗	✓	✗	✓	✗	✓	✓	✗
Gu et al. 2020 (214)	✗	✓	✓	✗	✓	✓	✓	✓	✗
Gu et al. 2020 (215)	✓	✓	✓	✓	✓	✓	✓	✗	✓
Harrison et al. 2020 (219)	✗	✓	✓	✓	✓	✓	✓	✗	✓
Kabarriti et al. 2020 (227)	✗	✗	✓	✓	✓	✓	⚠	✓	✗
Lee et al. 2020 (235)	✓	✓	✓	✗	✓	✓	✓	✓	✗
Rossi et al. 2020 (274)	✗	✓	✓	✗	✓	✓	✓	✓	✗
Solís et al. 2020 (294)	✓	✓	✓	✗	✓	✓	⚠	⚠	✗
Sousa et al. 2020 (295)	✓	✗	✓	✗	✓	✓	✓	✓	✗
Tartof et al. 2020 (300)	✓	✓	✓	✗	✓	✓	✓	✓	✗
Wang et al. 2020 (302)	✓	✓	✓	✗	✓	✗	✓	✓	✗

✓ = low risk of bias ⚠ = unclear risk of bias ✗ = high risk of bias

Figure S6. Relationship between median age and log relative risk among studies using age as a categorical value (linear and cubic models, variance weighted): case mortality

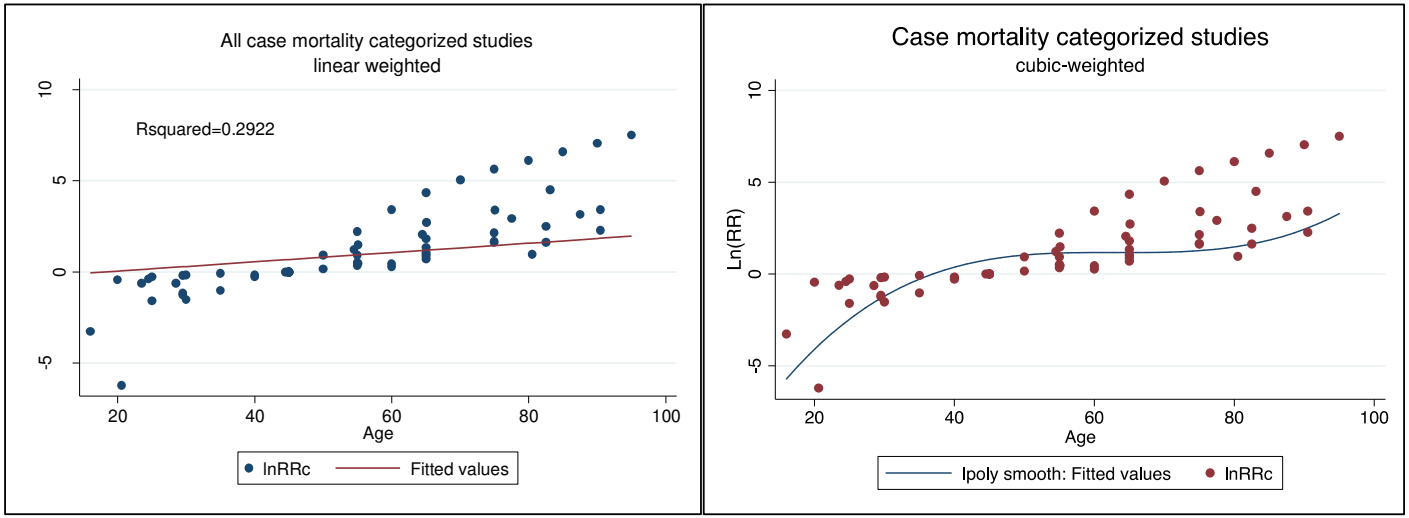


Figure S7. Funnel plot of studies investigating case mortality

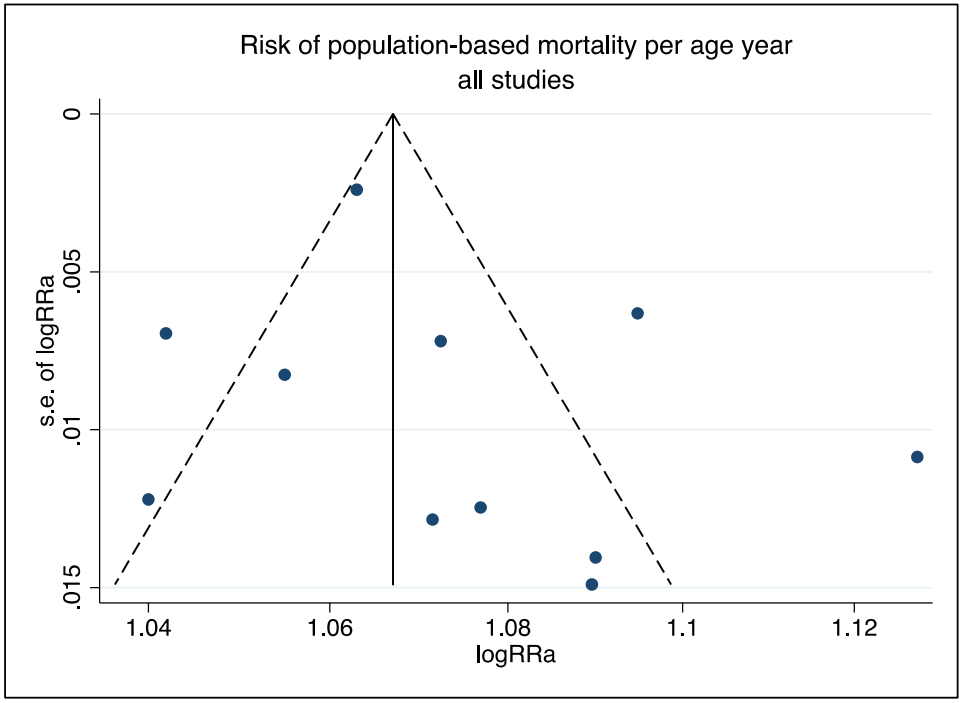


Table S7. Results of studies investigating risk of hospitalization

Author, Year (Ref)	Confounders and age-dependent risk factors used in the model	Type of analysis	N in analysis Total hospitalized In age group: # cases/total	Results Unadjusted effect estimates (if available)	Results Adjusted effect estimates
Azar 2020 (167)	Adjusted Model 2: Race/ethnicity, sex, homeless status, smoking status, type 2 diabetes, hypertension, depression, congestive heart failure, cardiovascular disease, cancer, chronic obstructive pulmonary disease, asthma Adjusted Model 3: Confounders in adjusted model 2 plus insurance status and income	Logistic regression Models built stepwise that incrementally included more covariates.	N= 1052 Admitted to hospital: 256 (24.3%) 18-29 yrs. 2/115 30-39 yrs. 19/170 18-39 yrs. 21/285 40-49 yrs. 25/174 50-59 yrs. 41/201 60-69 yrs. 62/184 70-79 yrs. 47/114 80+ yrs. 60/94	Hospital admission Unadjusted Model 18-39 yrs. Reference 40-49 yrs.: OR= 2.11 (1.14, 3.90) 50-59 yrs.: OR= 3.22 (1.84, 5.65) 60-69 yrs.: OR= 6.39 (3.72, 10.96) 70-79 yrs.: OR= 8.82 (4.94, 15.75) 80+ yrs.: OR= 22.18 (12.03, 40.91)	Hospital admission Model 2 18-39 yrs. Reference 40-49 yrs.: OR= 1.91 (95% CI: 1.00-3.65) 50-59 yrs.: OR= 2.04 (95% CI: 1.10-3.78) 60-69 yrs.: OR= 3.88 (95% CI: 2.10-7.17) 70-79 yrs.: OR= 5.20 (95% CI: 2.61-10.34) 80+ yrs.: OR= 12.94 (95% CI: 6.14-27.26) Model 3 18-39 yrs. Reference 40-49 yrs.: OR= 2.24 (95% CI: 1.13-4.43) 50-59 yrs.: OR= 2.62 (95% CI: 1.37-4.99) 60-69 yrs.: OR= 4.62 (95% CI: 2.39-9.95) 70-79 yrs.: OR= 5.68 (95% CI: 2.60-12.38) 80+ yrs.: OR= 19.08 (95% CI: 7.86-46.32)
Burn 2020 (177)	Autoimmune condition, chronic kidney disease, COPD, dementia, heart disease, hyperlipidemia, hypertension, malignant neoplasm, obesity, Type 2 diabetes, Charlson Index	Cox proportional hazards model using a non-linear relationship with age	Hospitalized with COVID-19 from general population: 8,582 Hospitalized from outpatient diagnosis: 9,437 From outpatient diagnosis: 20-24 yrs. 25-29 yrs. 30-34 yrs. 35-39 yrs. 40-44 yrs. 45-49 yrs. 50-54 yrs. 55-59 yrs. 60-64 yrs. 65-69 yrs. 70-74 yrs. 75-79 yrs.	Hazard ratios (95% CIs) Hospitalized with COVID-19 from general population Age only model: 20-24 yrs.: 0.037 (0.032 to 0.042) 25-29 yrs.: 0.058 (0.052 to 0.064) 30-34 yrs.: 0.089 (0.082 to 0.096) 35-39 yrs.: 0.13 (0.13 to 0.14) 40-44 yrs.: 0.20 (0.19 to 0.21) 45-49 yrs.: 0.28 (0.27 to 0.29) 50-54 yrs.: 0.40 (0.39 to 0.41) 55-59 yrs.: 0.56 (0.55 to 0.56) 60-64 yrs.: 0.75 (0.75 to 0.76) 65-69 yrs.: Reference 70-74 yrs.: 1.30 (1.29 to 1.31) 75-79 yrs.: 1.65 (1.63 to 1.68) 80-84 yrs.: 2.06 (2.01 to 2.11) 85-89 yrs.: 2.51 (2.42 to 2.61)	Hazard ratios (95% CIs) Hospitalized with COVID-19 from general population Age and comorbidity model: 20-24 yrs.: 0.063 (0.055 to 0.072) 25-29 yrs.: 0.094 (0.085 to 0.11) 30-34 yrs.: 0.14 (0.13 to 0.15) 35-39 yrs.: 0.20 (0.19 to 0.21) 40-44 yrs.: 0.28 (0.26 to 0.29) 45-49 yrs.: 0.38 (0.36 to 0.39) 50-54 yrs.: 0.50 (0.49 to 0.51) 55-59 yrs.: 0.64 (0.63 to 0.66) 60-64 yrs.: 0.81 (0.81 to 0.82) 65-69 yrs.: Reference 70-74 yrs.: 1.20 (1.19 to 1.21) 75-79 yrs.: 1.40 (1.38 to 1.43) 80-84 yrs.: 1.60 (1.55 to 1.65) 85-89 yrs.: 1.78 (1.70 to 1.87)

Author, Year (Ref)	Confounders and age-dependent risk factors used in the model	Type of analysis	N in analysis Total hospitalized In age group: # cases/total	Results Unadjusted effect estimates (if available)	Results Adjusted effect estimates
			80-84 yrs. 85-89 yrs. 90-94 yrs. 95+ yrs.	90-94 yrs.: 3.00 (2.84 to 3.16) 95+ yrs.: 3.51 (3.27 to 3.76) Hazard ratios (95% CIs) Hospitalized from outpatient diagnosis Age only model: 20-24 yrs.: 0.076 (0.067 to 0.086) 25-29 yrs.: 0.099 (0.091 to 0.11) 30-34 yrs.: 0.13 (0.12 to 0.14) 35-39 yrs.: 0.16 (0.15 to 0.17) 40-44 yrs.: 0.19 (0.18 to 0.20) 45-49 yrs.: 0.24 (0.22 to 0.25) 50-54 yrs.: 0.34 (0.32 to 0.36) 55-59 yrs.: 0.53 (0.51 to 0.55) 60-64 yrs.: 0.79 (0.78 to 0.80) 65-69 yrs.: Reference 70-74 yrs.: 1.10 (1.09 to 1.11) 75-79 yrs.: 1.07 (1.05 to 1.09) 80-84 yrs.: 0.97 (0.94 to 1.00) 85-89 yrs.: 0.83 (0.79 to 0.87) 90-94 yrs.: 0.70 (0.65 to 0.74) 95+ yrs.: 0.58 (0.54 to 0.64)	90-94 yrs.: 1.93 (1.81 to 2.06) 95+ yrs.: 2.05 (1.88 to 2.23) Hazard ratios (95% CIs) Hospitalized from outpatient diagnosis Age and comorbidity model: 20-24 yrs.: 0.092 (0.08 to 0.10) 25-29 yrs.: 0.12 (0.11 to 0.13) 30-34 yrs.: 0.15 (0.14 to 0.16) 35-39 yrs.: 0.19 (0.18 to 0.20) 40-44 yrs.: 0.23 (0.21 to 0.24) 45-49 yrs.: 0.28 (0.26 to 0.30) 50-54 yrs.: 0.39 (0.36 to 0.41) 55-59 yrs.: 0.58 (0.55 to 0.60) 60-64 yrs.: 0.81 (0.80 to 0.83) 65-69 yrs.: Reference 70-74 yrs.: 1.09 (1.08 to 1.10) 75-79 yrs.: 1.07 (1.05 to 1.10) 80-84 yrs.: 0.99 (0.95 to 1.03) 85-89 yrs.: 0.87 (0.82 to 0.92) 90-94 yrs.: 0.75 (0.70 to 0.82) 95+ yrs.: 0.65 (0.59 to 0.72)
Carrillo-Vega† 2020 (180)	Sex, chronic kidney disease, COPD, diabetes & hypertension & obesity, diabetes & hypertension, diabetes & obesity, only hypertension, only obesity, only diabetes, pneumonia, health services	Logistic regression	N= 9946 Hospitalization: 3922 (39.4%) 25-49 yrs. 1532/5640 50-74 yrs. 2040/3823 ≥75 yrs. 350/483	NA	Risk of hospitalization in COVID-19 positive cases OR (95% CI) 25-49 yrs.: Reference 50-74 yrs.: 2.05 (1.81-2.32) ≥75 yrs.: 3.84 (2.90-5.10)
Cchiba and Patel 2020 (186)	Sex, asthma, race, smoking, obesity, hypertension, diabetes, obstructive sleep apnea, coronary artery disease, COPD, allergic rhinitis, rhinosinusitis, immunodeficiency	Poisson regression	N= 1526 Hospitalized: 853 (55.9%) <40 yrs.: NA/414 40-69 yrs. NA/844 ≥70 yrs.: NA/268	NA	Risk of hospitalization RR (95% CI) <40 yrs.: 0.50 (0.38-0.64) 40-69 yrs. 0.76 (0.64-0.91) ≥70 yrs.: Reference
Ebinger 2020	Sex, race, ethnicity, obesity, hypertension, diabetes mellitus, Elixhauser comorbidity score, prior	Ordinal logistic regression	N= 442 Not Admitted: 228 (51.58%)	Population-based severe illness (Hospitalization) OR (95% CI)	Population-based severe illness (Hospitalization) OR (95% CI)

Author, Year (Ref)	Confounders and age-dependent risk factors used in the model	Type of analysis	N in analysis Total hospitalized In age group: # cases/total	Results Unadjusted effect estimates (if available)	Results Adjusted effect estimates
(201)	myocardial infarction or heart failure, prior COPD or asthma, ACE inhibitor use, angiotensin receptor blocker use		Admitted, Non-ICU: 137 (31%)	*(Three interesting categories not together, difficult to compare for M.A.)* Age (per 10 years): 1.68 (1.52-1.87)	*(Three interesting categories not together, difficult to compare for M.A.)* Age (per 10 years): 1.49 (1.30-1.70)
Giannouchos 2020 (210)	Gender, Mexican, smoker, chronical renal disease, diabetes, immunosuppression, COPD, obese, hypertension, cardiovascular disease, asthma, medical unit is a monitoring health unit for respiratory diseases (USMER), type of facility	Logistic regression analyses	N = 89,756 Hospitalizations: 31,271 (34.8%) 0-17 yrs.: 344/1885 18-44 yrs.: 7505/41,288 45-64 yrs.: 15,073/34,377 ≥65 yrs.: 8349/12,207	NA	Hospitalization OR (95% CI) 0-17 yrs.: 1.73 (1.39-2.14) 18-44 yrs.: Reference 45-64 yrs.: 2.93 (2.76-3.12) ≥65 yrs.: 7.24 (6.22-8.42)
Gu 2020 (215)	Sex, BMI, smoking status, alcohol consumption, race/ethnicity, neighborhood socioeconomic disadvantage index, population density, comorbidity score, respiratory disease, circulatory disease, any cancer, type 2 diabetes, kidney disease, liver disease, autoimmune disease	Logistic regression analyses, firth bias-corrected estimates	N= 765 Hospitalized: 270 <18 yrs.: 4/9 18- <35 yrs.: 38/203 35- <50 yrs.: 83/257 50- <65 yrs.: 171/349 65- <80 yrs.: 154/233 ≥80 yrs.: 73/88	Hospitalization OR (95% CI) Age (per 10 years): 1.69 (1.56-1.84) Age (per year): 1.054 (1.045-1.063) <18 yrs.: 3.52 (0.90-13.7) 18- <35 yrs.: Reference 35- <50 yrs.: 2.06 (1.33-3.19) 50- <65 yrs.: 4.13 (2.74-6.22) 65- <80 yrs.: 8.68 (5.56-13.6) ≥80 yrs.: 25.3 (12.6-50.8)	Hospitalization OR (95% CI) Age (per 10 years): 1.72 (1.53-1.93) Age (per year): 1.056 (1.043-1.068) <18 yrs.: 1.60 (0.21-12.4) 18- <35 yrs.: Reference 35- <50 yrs.: 1.70 (0.90-3.22) 50- <65 yrs.: 3.65 (2.01-6.61) 65- <80 yrs.: 6.61 (3.49-12.6) ≥80 yrs.: 31.6 (12.7-78.5)
Killerby 2020 (230)	Sex, race, obesity, smoking, insurance status, hypertension, diabetes, chronic kidney disease, cardiovascular disease, chronic respiratory disease	Multivariable logistic regression	N=531 Hospitalized: 220 (41.4%) 18-44 yrs. 54/205 45-65 yrs. 76/196 ≥65 yrs. 90/130	NA	Hospitalization OR 95% CIs 18-44 yrs.: Reference 45-65 yrs.: 1.0 (CIs not provided) ≥65 yrs.: 3.4 (1.6-7.4)
Merzon 2020 (249)	Low vitamin D level, sex, SES, smoking, depression/anxiety, schizophrenia, dementia, diabetes, hypertension, cardiovascular disease, chronic lung disorders, BMI	Logistic regression	N= 782 Hospitalizations: NA Age distribution: NA	Hospitalization OR (95% CI) ≤50 years: Reference >50 years: 2.51 (1.21–4.89)	Hospitalization OR (95% CI) ≤50 years: Reference >50 years: 2.71 (1.55–4.78)
Petrilli 2020 (263)	Week, race/ethnicity, smoking status, BMI, coronary artery disease, heart failure, hyperlipidemia, hypertension,	Mixed effects logistic regression models for	N= 5279 Hospitalization: 2741 (51.9%) 19-44 yrs.: 436/1846	Hospital admission: OR (95% CIs) Unadjusted 19-44 yrs.: Reference 45-54 yrs.: 2.69 (2.27-3.18)	Hospital admission: OR (95% CIs) Adjusted 19-44 yrs.: Reference 45-54 yrs.: 2.14 (1.76-2.59)

Author, Year (Ref)	Confounders and age-dependent risk factors used in the model	Type of analysis	N in analysis Total hospitalized In age group: # cases/total	Results Unadjusted effect estimates (if available)	Results Adjusted effect estimates
	diabetes, asthma or COPD, chronic kidney disease, cancer, sex	admission to hospital	45-54 yrs.: 410/902 55-64 yrs.: 605/1021 65-74 yrs.: 621/797 ≥75 yrs.: 668/713	55-64 yrs.: 4.69 (3.98-5.53) 65-74 yrs.: 11.38 (9.33-13.88) ≥75 yrs.: 47.84 (34.73-65.91)	55-64 yrs.: 3.67 (3.01-4.48) 65-74 yrs.: 8.7 (6.77-11.22) ≥75 yrs.: 37.87 (26.1-56.03)
Price-Haywood 2020 (266)	Race, sex, Charlson Comorbidity Index score, low-income residency, insurance, obesity	Hospitalization: logistic regression	N=3481 Admitted to hospital: 1382 (39.7%)	Hospitalization: OR (95% CI) Adjusted for race and sex: Per 5-yr. unit increase: 1.34 (1.30-1.37) Per yr. increase: 1.06(1.05-1.06)	Hospitalization: OR (95% CI) Fully adjusted: Per 5-yr. unit increase: 1.29 (1.25-1.33) Per yr. increase: 1.052(1.045-1.059)
Reilev 2020 (269)	Number of comorbidities (0,1,2,3,4+ of chronic lung disease, hypertension, ischaemic heart disease, heart failure, atrial fibrillation, stroke, diabetes, dementia, cancer, chronic liver disease, hospital-diagnosed kidney disease, alcohol abuse, substance abuse, major psychiatric disorders, organ transplantation, medical overweight and obesity, rheumatoid arthritis/connective-tissue disease), sex	Logistic regression	N= 11,122 Hospitalization: 2254 (20%) 0-9 yrs.: 11/251 10-19 yrs.: 14/495 20-29 yrs.: 55/1523 30-39 yrs.: 90/1588 40-49 yrs.: 192/1970 50-59 yrs.: 337/2035 60-69 yrs.: 374/1305 70-79 yrs.: 578/950 80-89 yrs.: 476/762 90+ yrs.: 127/243	Hospitalization among positive cases OR (95% CI) Unadjusted 0-9 yrs.: 0.2 (0.1-0.4) 10-19 yrs.: 0.1 (0.1-0.3) 20-29 yrs.: 0.2 (0.1-0.3) 30-39 yrs.: 0.3 (0.2-0.4) 40-49 yrs.: 0.5 (0.5-0.7) 50-59 yrs.: Reference 60-69 yrs.: 2.0 (1.7-2.4) 70-79 yrs.: 7.8 (6.6-9.3) 80-89 yrs.: 8.4 (7.0-10.1) 90+ yrs.: 5.5 (4.2-7.3)	Hospitalization among positive cases OR (95% CI) Adjusted 0-9 yrs.: 0.3 (0.2-0.6) 10-19 yrs.: 0.2 (0.1-0.3) 20-29 yrs.: 0.2 (0.2-0.3) 30-39 yrs.: 0.4 (0.3-0.5) 40-49 yrs.: 0.6 (0.5-0.8) 50-59 yrs.: Reference 60-69 yrs.: 1.6 (1.3-1.9) 70-79 yrs.: 4.7 (3.9-5.7) 80-89 yrs.: 4.8 (3.9-5.8) 90+ yrs.: 3.5 (2.6-4.7)
Rentsch 2020 (270)	Adjusted model 1: Race, baseline comorbidities (chronic kidney disease, COPD, diabetes, hypertension, vascular disease), Medication history in year prior to test date (angiotensin converting enzyme inhibitor or angiotensin II receptor blocker, nonsteroidal anti-inflammatory drug), vital signs (systolic blood pressure, oxygen saturation, pulse, temperature), laboratory findings (albumin, eGFR, FIB-4, Hemoglobin, White blood cell count, Lymphocyte count)	Logistic regression	N= 585 Hospitalization: 297 (50.8%) 54-59 yrs.: 58/135 60-64 yrs.: 62/135 65-69 yrs.: 62/120 70-75 yrs.: 115/195	Hospitalization: OR (95% CI) Per 5-yr. increase: 1.26 (1.10-1.44) Per yr. increase: 1.04 (1.02-1.08)	Hospitalization: OR (95% CI) Model 1: Per 5-yr. increase: 0.87 (0.71-1.05) Per yr. increase: 0.97 (0.93-1.01) Model 2: Per 5-yr. increase: 0.64 (0.51-0.80) Per yr. increase: 0.91 (0.87-0.96)

Author, Year (Ref)	**Confounders and age-dependent risk factors used in the model**	**Type of analysis**	**N in analysis Total hospitalized In age group: # cases/total**	**Results Unadjusted effect estimates (if available)**	**Results Adjusted effect estimates**
	Adjusted model 2: Race, baseline comorbidities (chronic kidney disease, COPD, diabetes, hypertension, vascular disease), Medication history in year prior to test date (angiotensin converting enzyme inhibitor or angiotensin II receptor blocker, nonsteroidal anti-inflammatory drug), vital signs (systolic blood pressure, oxygen saturation, pulse, temperature), VACS Index score				
Rossi 2020 (274)	Sex, calendar period, time from symptoms to diagnosis, place of birth, Charlson Comorbidity Index	Cox proportional hazard regression models	N=2653 Hospitalized: 1075 (40.5%) <51 yrs.: 107/696 51-60 yrs.: 128/528 61-70 yrs.: 205/413 71-80 yrs.: 291/420 ≥81 yrs.: 344/596	NA	Hospitalization HR (95% CIs) <51 yrs.: Reference 51-60 yrs.: 1.3 (1.0-1.8) 71-70 yrs.: 3.2 (2.4-4.1) 71-80 yrs.: 5.9 (4.5-7.6) ≥81 yrs.: 7.1 (5.4-9.3)
Soares 2020 (293)	Sex, race, cardiovascular disease, diabetes, kidney disease, obesity, pulmonary disease, smoking, fever, headache, runny nose, shortness of breath, sore throat	Logistic regression	N=10,713 Hospitalized: 1152 (10.8%) <60 yrs.: 546/8676 ≥60 yrs.: 606/2037	Hospitalization due to COVID-19 OR (95% CIs) <60 yrs.: Reference ≥60 yrs.: 6.31 (5.55-7.17)	Hospitalization due to COVID-19 OR (95% CIs) <60 yrs.: Reference ≥60 yrs.: 3.40 (2.91-3.96)
van Gerwen 2020 (301)	Sex, race, smoking, BMI, hypertension, coronary artery disease, atrial fibrillation, congestive heart failure, peripheral vascular disease, cerebrovascular accident/transient ischemic attack, dementia, diabetes, hypothyroidism, chronic kidney disease, malignancy, asthma, COPD, prior venous thromboembolism	Logistic regression	N= 3703 Hospitalized: 2015 (54.4%) 18-40 yrs.: 207/861 40-60 yrs.: 539/1173 >60 yrs.: 1269/1669	Hospitalization OR (95% CI) 18-40 yrs.: Reference 40-60 yrs.: 2.69 (2.21-3.26) >60 yrs.: 10.02 (8.27-12.15)	Hospitalization OR (95% CI) 18-40 yrs.: Reference 40-60 yrs.: 2.02 (1.62-2.50) >60 yrs.: 5.47 (4.29-6.96)

ICU: intensive care unit; COPD: chronic obstructive pulmonary disease; BMI: body mass index; yrs.: years; SOFA score: sequential organ failure assessment score; OR: odds ratio; HR: hazards ratio; CI: confidence intervals; NA: not available

Table S8. Risk of bias summary for studies investigating hospitalization

Study	Major domains					Minor domains			OVERALL
	Recruitment procedure	Exposure assessment	Outcome source and validation	Confounding	Analysis method	Chronology	Funding	Conflict of interest	
Azar et al. 2020 (167)	✓	✓	✓	✗	✓	✓	⚠	⚠	✗
Burn et al. 2020 (177)	✓	✓	✓	✓	✓	✓	✓	✗	✓
Carrillo-Vega et al. 2020 (180)	✓	✗	✓	✗	✓	✓	✓	✓	✗
Cchiba and Patel 2020 (186)	✓	✗	✓	✗	✓	✓	✓	✓	✗
Ebinger et al. 2020 (201)	✓	✓	✓	✓	✓	✓	✓	✓	✓
Giannouchos et al. 2020 (210)	✗	✗	✓	✗	✓	✓	✓	✓	✗
Gu et al. 2020 (215)	✓	✓	✓	✓	✓	✓	✓	✗	✓
Killerby et al. 2020 (230)	✗	✗	✓	✗	✓	✓	⚠	✗	✗
Merzon et al. 2020 (249)	✓	✓	✓	✗	✓	✓	✓	✓	✗
Petrilli et al. 2020 (263)	✓	✓	✓	✗	✓	✓	✓	✓	✗
Price-Haywood et al. 2020 (266)	✓	✓	✓	✓	✓	✓	✓	✗	✓
Reiley et al. 2020 (269)	✓	✓	✓	✗	✓	✓	⚠	✗	✗
Rentsch et al. 2020 (270)	✓	✓	✓	✗	✓	✗	✓	✓	✗
Rossi et al. 2020 (274)	✗	✓	✓	✗	✓	✓	✓	✓	✗
Soares et al. 2020 (293)	✓	✗	✓	✗	✓	✗	✓	✓	✗
van Gerwen et al. 2020 (301)	✓	✗	✓	✗	✓	✓	✓	✓	✗

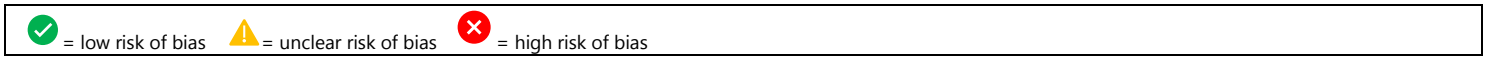
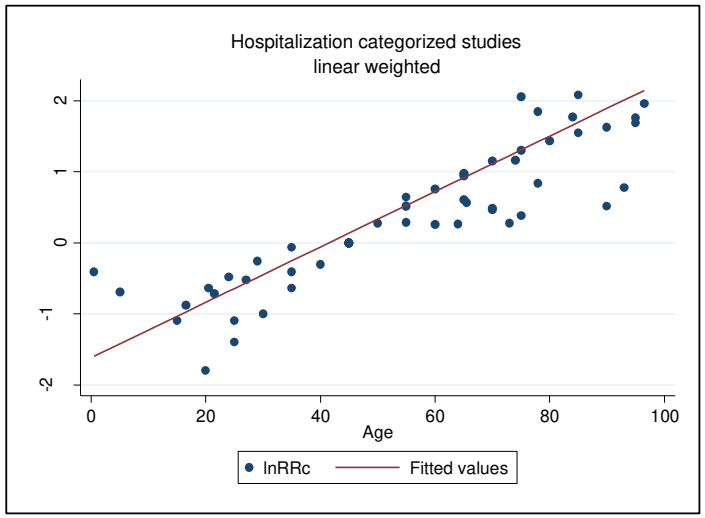

= low risk of bias
= unclear risk of bias
= high risk of bias

Figure S8. Relationship between median age and log of relative risk among studies using age as a categorical value (linear and cubic models, variance weighted): hospitalization



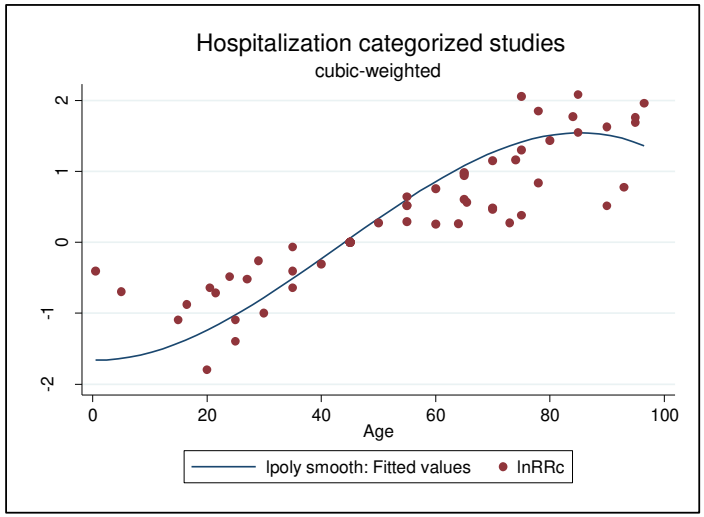


Figure S9. Funnel plot for studies investigating risk of hospitalization

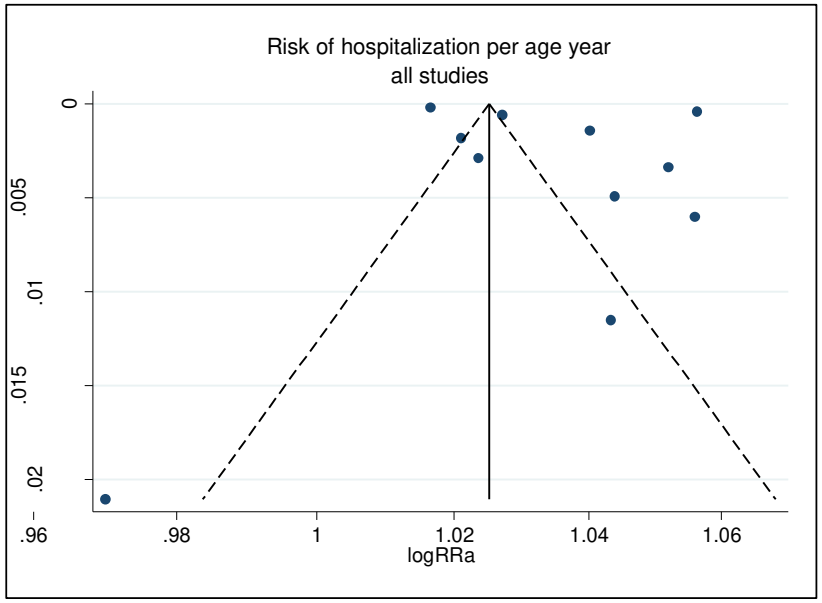


Table S9. Results of studies investigating admission to ICU

Author, Year (Ref)	Confounders and age-dependent risk factors used in the model	Type of analysis	N in analysis Total ICU admissions In age group: # cases/total	Results Unadjusted effect estimates (if available)	Results Adjusted effect estimates
Argenziano 2020 (166)	Sex, BMI, smoking, coronary artery disease, congestive heart failure, history of stroke, diabetes mellitus, hypertension, cirrhosis, HIV, inflammatory bowel disease, pulmonary disease, renal disease, viral hepatitis, active malignancy, transplant history, rheumatological disease, immunosuppressed state, no comorbidities	Cox proportional hazards analysis only with complete data	N= 841 ICU patients: 236 (24%)	NA	ICU HR (95% CI) Age (per year): 0.996 (0.985-1.01)
Bi, Hong, and Meng 2020 (173)	Sex, hypertension, diabetes, coronary heart disease, chronic lung disease, cerebrovascular disease, total comorbidity, fever, cough, shortness of breath, muscle soreness, fatigue, PaO2/FiO2, lymphocyte count, platelet count, C-reactive protein, D-dimer	Competing risk regressions	N= 420 ICU admissions: 19 <39yrs.: 1/163 40-59 yrs.: 4/149 60+ yrs.: 14/108	NA	Risk of ICU admission HR (95% CI) 0-39 yrs.: Reference 40-59 yrs.: 4.4 (0.5-39.6) 60+ yrs.: 22.4 (3.0-168.2)
Du 2020 (199)	Number of comorbidities (0, 1, ≥2), highest temperature, lymphocyte Count, detection of SARS-CoV-2 Comorbidities considered in number of comorbidities: hypertension, diabetes, cardiovascular/cerebrovascular disease, chronic digestive disease, pre-existing pulmonary tuberculosis, chronic liver/kidney disease, chronic obstructive lung disease, peripheral artery disease, malignancy)	Ordinal logit regression	N= 179 Mild-to-moderate: 79 (44.2%) Severe: 57 (31.8%) Critically ill (ICU admission): 43 (24%)	NA	Disease severity (*calculated ORs don't allow us to compare to other studies on ICU admission*) OR (95% CI) <60 yrs.: Reference 60-69 yrs.: 1.58 (1.06-2.37) ≥70 yrs.: 1.69 (1.06-2.68)
Gu 2020 (215)	Sex, BMI, smoking status, alcohol consumption, race/ethnicity, neighborhood socioeconomic disadvantage index, population density, comorbidity score, respiratory disease, circulatory disease, any cancer, type 2 diabetes, kidney disease, liver disease, autoimmune disease	Logistic regression analyses, firth bias-corrected estimates	N= 756 ICU: 141 <18 yrs.: 3/9 18- <35 yrs.: 26/203 35- <50 yrs.: 36/257 50- <65 yrs.: 96/346 65- <80 yrs.: 91/233 ≥80 yrs.: 31/88	ICU OR (95% CI) Age (per 10 years): 1.37 (1.26-1.49) Per yr. increase (own calculations): 1.03 (1.02-1.04) <18 yrs.: 3.61 (0.86-15.1) 18- <35 yrs.: Reference 35- <50 yrs.: 1.10 (0.64-1.89) 50- <65 yrs.: 2.55 (1.59-4.09) 65- <80 yrs.: 4.39 (2.7-7.15) ≥80 yrs.: 3.87 (2.12-7.07)	Population-based ICU OR (95% CI) Age (per 10 years): 1.45 (1.27-1.65) Per yr. increase (own calculations) 1.04 (1.02-1.05) <18 yrs.: 3.67 (0.45-30) 18- <35 yrs.: Reference 35- <50 yrs.: 1.33 (0.57-3.11) 50- <65 yrs.: 2.96 (1.39-6.33) 65- <80 yrs.: 4.44 (2.01-9.82) ≥80 yrs.: 7.70 (3.10-19.1)

Author, Year (Ref)	Confounders and age-dependent risk factors used in the model	Type of analysis	N in analysis Total ICU admissions In age group: # cases/total	Results Unadjusted effect estimates (if available)	Results Adjusted effect estimates
Hashemi 2020 (220)	Chronic liver disease, obesity, sex, cardiac diseases, hypertension, diabetes, hyperlipidaemia, pulmonary disorders	Logistic regression	N= 363 ICU: NA	NA	In-hospital ICU admission OR (95% CI) Age (per year): 1.01 (0.99-1.02)
Kalligeros 2020 (228)	Ethnicity/race, sex, BMI, diabetes, hypertension, heart disease, lung disease	Logistic regression	N= 103 ICU admission: 41 (39.8%)	In-hospital ICU-admission OR (95% CI) Age (per year): 1.02 (1.00-1.05)	In-hospital ICU-admission OR (95% CI) Age (per year): 1.03 (1.00-1.07)
Kim 2020 (231)	Sex, race, ethnicity, smoker, hypertension, obesity, diabetes, chronic lung disease, cardiovascular disease, neurologic, renal, immunosuppression, gastrointestinal or liver, hematologic, rheumatologic or autoimmune, outpatient ACE-inhibitor use, angiotensin receptor blocker use prior to hospitalization	Log-linked Poisson generalized estimating equation regressions with an exchangeable correlation matrix	N=2490 ICU admissions: 798 (32.0%) 18-39 yrs.: 8/302 40-49 yrs.: 91/318 50-64 yrs.: 32/744 65-74 yrs.: 23/478 75-84 yrs.: 19/397 ≥85 yrs.: 8/251	ICU RR (95% CI) 18-39 yrs.: Reference 40-49 yrs.: 1.38 (1.08-1.75) 50-64 yrs.: 1.64 (1.36-1.99) 65-74 yrs.: 1.80 (1.50-2.16) 75-84 yrs.: 1.80 (1.52-2.14) ≥85 yrs.: 1.16 (0.87-1.54)	ICU RR (95% CI) 18-39 yrs.: Reference 40-49 yrs.: 1.22 (0.96-1.56) 50-64 yrs.: 1.53 (1.28-1.83) 65-74 yrs.: 1.65 (1.34-2.03) 75-84 yrs.: 1.84 (1.60-2.11) ≥85 yrs.: 1.43 (1.00-2.04)
Price-Haywood 2020 (266)	Race, sex, Charlson Index, obesity	In-hospital ICU: Cox proportional-hazards models For variables for which less than 25% of data missing, values were imputed	N= 1382 ICU: 474 (34.3%)	ICU: OR (95% CI) Adjusted for race and sex: Per 5-yr. unit increase: 0.99 (0.96-1.02)	ICU: OR (95% CI) Fully adjusted: Per 5-yr. unit increase: 1.01 (0.98-1.05) Per yr.- unit increase (own calculations): 1.002 (0.996-1.010)
Rentsch 2020 (270)	Adjusted model 1: Race, baseline comorbidities (chronic kidney disease, COPD, diabetes, hypertension, vascular disease), Medication history in year prior to test date (angiotensin converting enzyme inhibitor or angiotensin II receptor blocker, nonsteroidal anti-inflammatory drug), vital signs (systolic blood pressure, oxygen saturation, pulse, temperature), laboratory	Logistic regression	N= 585 ICU: 122 (20,9%) 54-59 yrs.: 11/135 60-64 yrs.: 24/135 65-69 yrs.: 28/120 70-75 yrs.: 59/195	Hospitalization: OR (95% CI) Per 5-yr. increase: 1.55 (1.30-1.86) Per yr. increase: 1.09 (1.05-1.13)	Hospitalization: OR (95% CI) Model 1: Per 5-yr. increase: 1.31 (1.03-1.66) Per yr. increase: 1.06 (1.01-1.11) Model 2: Per 5-yr. increase: 0.98 (0.76-1.26) Per yr. increase: 1.0 (0.95-1.05)

Author, Year (Ref)	Confounders and age-dependent risk factors used in the model	Type of analysis	N in analysis Total ICU admissions In age group: # cases/total	Results Unadjusted effect estimates (if available)	Results Adjusted effect estimates
	findings (albumin, eGFR, FIB-4, Hemoglobin, White blood cell count, Lymphocyte count) Adjusted model 2: Race, baseline comorbidities (chronic kidney disease, COPD, diabetes, hypertension, vascular disease), Medication history in year prior to test date (angiotensin converting enzyme inhibitor or angiotensin II receptor blocker, nonsteroidal anti-inflammatory drug), vital signs (systolic blood pressure, oxygen saturation, pulse, temperature), VACS Index score				
Seiglie 2020 USA (280)	BMI, sex, race/ethnicity, diabetes, coronary artery disease or myocardial infarction, chronic heart failure, hypertension, COPD/asthma, active cancer, liver disease, renal disease	Logistic regression	N = 436 ICU: 156 (34.7%) <50 yrs.: NA/104 50-59 yrs.: NA/81 60-69 yrs.: NA/82 ≥70 yrs.: NA /181	14-day ICU admission OR (95% CIs) <50 yrs.: Reference 50-59 yrs.: 1.37 (0.75-2.49) 60-69 yrs.: 1.05 (0.57-1.93) ≥70 yrs.: 0.87 (0.89-1.96)	14-day ICU admission OR (95% CIs) <50 yrs.: Reference 50-59 yrs.: 1.13 (0.57-2.24) 60-69 yrs. 1.22 (0.60-2.49) ≥70 yrs.: 1.41 (1.20-3.88)
Suleyman 2020 (296)	For ICU: Sex, race, severe obesity, chronic kidney disease, cancer, diabetes, hypertension, coronary artery disease	Logistic regression	N= 463 ICU: 141 (39.7%) ≤60 yrs.: 49/245 >60 yrs.: 92/218	NA	ICU OR (95% CI) ≤60 yrs.: Reference >60 yrs.: 1.6 (1.0Bi-2.7)
Tai 2020 (299)	Model 2: Cardiovascular conditions, sex, chest tightness, diabetes mellitus, lung diseases	Logistic regression	N= 332 ICU: 58 (17.5%)	ICU OR (95% CI) Age (per year): 1.006 (0.983-1.030)	ICU OR (95% CI) Model 2 Age (per year): 0.993 (0.966-1.020)

ICU: intensive care unit; COPD: chronic obstructive pulmonary disease; BMI: body mass index; yrs.: years; SOFA score: sequential organ failure assessment score; OR: odds ratio; HR: hazards ratio; CI: confidence intervals; NA: not available

Table S10. Risk of bias summary for studies investigating risk of admission to ICU for hospitalized patients

Study	Major domains					Minor domains			OVERALL
	Recruitment procedure	Exposure assessment	Outcome source and validation	Confounding	Analysis method	Chronology	Funding	Conflict of interest	
Argenziano et al. 2020 (166)	✓	✓	✓	✓	✓	✓	✓	✗	✓
Bi, Hong, and Meng et al. 2020 (173)	✓	✗	✓	⚠	✓	✗	⚠	✓	✗
Du et al. 2020 (199)	✓	✗	✓	⚠	✓	✗	⚠	✓	✗
Gu et al. 2020* (215)	✓	✓	✓	✓	✓	✓	✓	✗	✓
Hashemi et al. 2020 (220)	✓	✓	✓	✗	✓	✓	✓	✓	✗
Kalligeros et al. 2020 (228)	✓	✓	✓	✗	✓	✓	⚠	✓	✗
Kim et al. 2020 (231)	✓	✓	✓	✓	✓	✓	✓	✗	✓
Price-Haywood et al. 2020 (266)	✓	✓	✓	✓	✓	✓	✓	✗	✓
Rentsch et al. 2020 (270)	✓	✓	✓	✗	✓	✗	✓	✓	✗
Sieglie et al. 2020 (280)	✓	✗	✓	✓	✓	✓	✓	✗	✗
Suleyman et al. 2020 (296)	✓	✗	✓	✗	✓	✓	⚠	✓	✗
Tai et al. 2020 (299)	✗	✓	✓	✗	✓	✓	✓	✓	✗

*Positive test-based ICU ✓ = low risk of bias ⚠ = unclear risk of bias ✗ = high risk of bias

Table S11. Results of studies investigating risk of mechanical ventilation

Author, Year (Ref)	Confounders and age-dependent risk factors used in the model	Type of analysis # cases / # non-cases	N in analysis Total mechanical ventilation In age group: # cases/total	Results Unadjusted effect estimates (if available)	Results Adjusted effect estimates
Costa Monteiro 2020 (191)	Sex, race, obesity, diabetes, hypertension, coronary artery disease, chronic kidney disease, smoking	Multivariable logistic regression Past medical history with cohort prevalence of >15% used in the model	N=112 Mechanical ventilation: 28 (25%)	NA	Mechanical ventilation OR (95% CI) Per year: 0.99 (0.96-1.03)
Hashemi 2020 (220)	Chronic liver disease, obesity, sex, cardiac diseases, hypertension, diabetes, hyperlipidaemia, pulmonary disorders	Logistic regression	N=363 Mechanical ventilation: NA	NA	In-hospital mechanical ventilation OR (95% CI) Age (per year): 1.01 (0.99-1.03)
Kalligeros 2020 (228)	Ethnicity/race, sex, BMI, diabetes, hypertension, heart disease, lung disease	Logistic regression	N= 103 Mechanical ventilation: 29 (28.2%)	Mechanical ventilation OR (95% CI) Age (per year): 1.01 (0.98-1.04)	Mechanical ventilation OR (95% CI) Age (per year): 1.02 (0.98-1.06)
Patel‡ 2020 (261)	Therapeutic anticoagulation, home antiplatelet, race, BMI, Charlson score, glucose level	Poisson regression model and logistic regression	N= 1716 Mechanical ventilation= 254 (14.8%) 18-44 yrs.: NA/379 45- 59 yrs.: NA/508 60-69 yrs.: NA/371 70-79 yrs.: NA/242 >80 yrs.: NA/216	NA	Mechanical ventilation 18-44 yrs.: OR= 1.16 (95% CI: 0.71-1.92) 45- 59 yrs.: Reference 60-69 yrs.: OR= 1.24 (95% CI: 0.79-1.94) 70-79 yrs.: OR= 0.89 (95% CI: 0.51-1.54) >80 yrs.: OR= 0.42 (95% CI: 0.21-0.84)
Seiglie 2020 (280)	BMI, sex, race/ethnicity, diabetes, coronary artery disease or myocardial infarction, chronic heart failure, hypertension, COPD/asthma, active cancer, liver disease, renal disease	Logistic regression	N= 436 Intubations: 129 (29.7%) <50 yrs.: NA/104 50-59 yrs.: NA/82 60-69 yrs.: NA/82 ≥70 yrs.: 181	14-day mechanical ventilation OR (95% CIs) <50 yrs.: Reference 50-59 yrs.: 1.11 (0.59-2.09) 60-69 yrs.: 0.99 (0.53-1.87) ≥70 yrs.: 0.85 (0.50-1.45)	14-day mechanical ventilation OR (95% CIs) <50 yrs.: Reference 50-59 yrs.: 1.02 (0.50-2.08) 60-69 yrs.: 1.20 (0.57-2.54) ≥70 yrs.: 1.72 (0.82-3.61)
Suleyman 2020 (296)	For mechanical ventilation: Sex, race, severe obesity, chronic kidney disease, cancer, diabetes,	Logistic regression	N= 355 Mechanical ventilation: 114 (32.1%)	NA	Mechanical ventilation OR (95% CI) ≤60 yrs.: Reference >60 yrs.: 3.5 (1.9-6.4)

Author, Year (Ref)	**Confounders and age-dependent risk factors used in the model**	**Type of analysis # cases / # non-cases**	**N in analysis Total mechanical ventilation In age group: # cases/total**	**Results Unadjusted effect estimates (if available)**	**Results Adjusted effect estimates**
	hypertension, coronary artery disease, congestive heart failure, tobacco use		≤60 yrs.: NA/153 >60 yrs.: NA/202		
van Gerwen 2020 (301)	Sex, race, smoking, BMI, hypertension, coronary artery disease, atrial fibrillation, congestive heart failure, peripheral vascular disease, cerebrovascular accident/transient ischemic attack, dementia, diabetes, hypothyroidism, chronic kidney disease, malignancy, asthma, COPD, prior venous thromboembolism	Logistic regression	N=2015 Mechanical ventilation: 525 (26% of hospitalized) 18-40 yrs.: 29/207 40-60 yrs.: 135/539 >60 yrs.: 361/1269	Mechanical ventilation OR (95% CI) 18-40 yrs.: Reference 40-60 yrs.: 2.05 (1.32-3.18) >60 yrs.: 2.44 (1.62-3.68)	Mechanical ventilation OR (95% CI) 18-40 yrs.: Reference 40-60 yrs.: 2.12 (1.35-3.32) >60 yrs.: 3.26 (2.08-5.11)

ICU: intensive care unit; COPD: chronic obstructive pulmonary disease; BMI: body mass index; yrs.: years; SOFA score: sequential organ failure assessment score; OR: odds ratio; HR: hazards ratio; CI: confidence intervals; NA: not availableICU: intensive care unit; COPD: chronic obstructive pulmonary disease; BMI: body mass index; yrs.: years; SOFA score: sequential organ failure assessment score; OR: odds ratio; HR: hazards ratio; CI: confidence intervals; NA: not available

Table S12. Risk of bias summary for studies investigating risk of mechanical ventilation

Study	Major domains					Minor domains			OVERALL
	Recruitment procedure	Exposure assessment	Outcome source and validation	Confounding	Analysis method	Chronology	Funding	Conflict of interest	
Costa Monteiro et al. 2020 (191)	✓	✓	✓	✗	✓	✓	✗	✓	✗
Hashemi et al. 2020 (220)	✓	✓	✓	✗	✓	✓	✓	✓	✗
Kalligeros et al. 2020 (228)	✓	✓	✓	✗	✓	✓	⚠	✓	✗
Patel et al. 2020 (261)	⚠	✓	✓	✓	✓	✗	✓	✓	✗
Seiglie et al. 2020 (280)	✓	✗	✓	✓	✓	✓	✓	✗	✗
Suleyman et al. 2020 (296)	✓	✗	✓	✗	✓	✓	⚠	✓	✗
van Gerwen et al. 2020 (301)	✓	✗	✓	✗	✓	✓	✓	✓	✗