Supplementary

Appendix: References of all included studies

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Table S1 Quality of included studies

References	Quality Score	Selection (☆☆☆☆)				Comparability (☆☆)		Outcome (☆☆☆)		
Aggarwal S (2020)	7	☆	☆	☆	/	☆	☆	☆	/	☆
Barrasa H (2020)	6	☆	–	☆	☆	/	/	☆	☆	☆
Benussi A (2020)	5	☆	☆	☆	/	/	☆	☆	/	/
Bhatraju P (2020)	5	☆	/	☆	/	/	/	☆	☆	☆
Bianchetti A (2020)	4	☆	☆	☆	/	/	/	☆	/	/
Borghesi A (2020)	5	☆	☆	☆	/	/	/	☆	/	/
Buckner F (2020)	6	☆	☆	☆	/	/	/	☆	☆	☆
Cai Q (2020)	6	☆	☆	☆	/	/	/	☆	☆	☆
Cecconi M (2020)	5	☆	/	☆	/	/	/	☆	☆	☆
Chen R (2020)	6	☆	☆	☆	/	/	/	☆	☆	☆
Andrea C (2020)	6	☆	☆	☆	/	/	/	☆	☆	☆
Cummings M (2020)	6	☆	/	☆	☆	/	/	☆	☆	☆
Deng Y (2020)	4	☆	☆	☆	/	/	/	☆	/	/
Dong X (2020)	5	☆	☆	☆	/	/	/	☆	/	☆
Du R (2020)	7	☆	☆	☆	☆	/	/	☆	☆	☆
Gao L (2020)	7	☆	☆	☆	/	/	☆	☆	☆	☆
Giacomelli A (2020)	7	☆	☆	☆	☆	/	/	☆	☆	☆
Guo T (2020)	4	☆	☆	☆	/	/	/	☆	/	/
Hong K (2020)	7	☆	☆	☆	/	/	☆	☆	☆	☆
Hou W (2020)	5	☆	☆	☆	/	/	☆	☆	/	/
Hu H (2020)	4	☆	☆	☆	/	/	/	☆	/	/
Hu L (2020)	7	☆	☆	☆	/	☆	/	☆	☆	☆
Huang J (2020)	4	☆	☆	☆	/	/	/	☆	/	/
Inciardi R (2020)	7	☆	☆	☆	/	☆	/	☆	☆	☆
Israelsen S (2020)	8	☆	☆	☆	/	☆	☆	☆	☆	☆
Itelman E (2020)	4	☆	☆	☆	/	/	/	☆	/	/
Javanian M (2020)	6	☆	☆	☆	/	/	/	☆	☆	☆
Ji D (2020)	6	☆	☆	☆	/	/	/	☆	☆	☆
Klang E cohort1 (2020)	4	☆	☆	☆	/	/	/	☆	/	/
Klang E cohort2 (2020)	4	☆	☆	☆	/	/	/	☆	/	/
Li J (2020)	5	☆	☆	☆	/	☆	/	☆	/	/
Li R (2020)	5	☆	/	☆	/	/	/	☆	☆	☆
Li X (2020)	3	☆	/	☆	/	/	/	☆	/	/
Ling L (2020)	5	☆	/	☆	/	/	/	☆	☆	☆
Liu J (2020)	5	☆	/	☆	/	/	/	☆	☆	☆
Liu K (2020)	6	☆	☆	☆	/	☆	☆	☆	/	/
Liu K (2020)	3	☆	/	☆	/	/	/	☆	/	/
Long L (2020)	7	☆	☆	☆	☆	/	/	☆	☆	☆
Luo X (2020)	6	☆	☆	☆	/	/	/	☆	☆	☆
Mehta V (2020)	6	☆	☆	☆	/	/	/	☆	☆	☆
Nikpouraghdam M (2020)	3	☆	/	☆	/	/	/	☆	/	/
Nowak B (2020)	6	☆	☆	☆	/	/	/	☆	☆	☆
Qi X (2020)	8	☆	☆	☆	/	☆	☆	☆	☆	☆
Renieris G (2020)	7	☆	☆	☆	/	/	☆	☆	☆	☆
Shekerdemian L (2020)	5	☆	/	☆	/	/	/	☆	☆	☆
Sun H (2020)	7	☆	☆	☆	☆	/	/	☆	☆	☆
Tan N (2020)	8	☆	☆	☆	/	☆	☆	☆	☆	☆
Tang N (2020)	7	☆	☆	☆	/	/	☆	☆	☆	☆
Tian S (2020)	6	☆	☆	☆	/	/	/	☆	☆	☆
Wan S (2020)	7	☆	☆	☆	☆	/	/	☆	☆	☆
Wang D (2020)	6	☆	☆	☆	/	/	/	☆	☆	☆
Wang K (2020)	6	☆	☆	☆	/	/	/	☆	☆	☆
Wang Z (2020)	6	☆	☆	☆	/	/	/	☆	☆	☆
Wei J (2020)	5	☆	☆	☆	☆	/	/	☆	/	/
Wu J (2020)	6	☆	☆	☆	/	/	/	☆	☆	☆
Xie J (2020)	6	☆	☆	☆	/	/	/	☆	☆	☆
Xu B (2020)	4	☆	☆	☆	/	/	/	☆	/	/
Yang Q (2020)	4	☆	☆	☆	/	/	/	☆	/	/
Yu Y (2020)	6	☆	/	☆	☆	/	/	☆	☆	☆
Zhang H (2020)	5	☆	/	☆	/	/	/	☆	☆	☆
Zhang J (2020)	4	☆	☆	☆	/	/	/	☆	/	/
Zhang J (2020)	6	☆	☆	☆	/	/	/	☆	☆	☆
Zhang L (2020)	4	☆	☆	☆	/	/	/	☆	/	/
Zhang Y (2020)	7	☆	☆	☆	/	☆	/	☆	☆	☆
Zhang Y (2020)	6	☆	☆	☆	/	/	/	☆	☆	☆
Zhao X (2020)	6	☆	☆	☆	/	/	/	☆	☆	☆
Zhou F (2020)	6	☆	☆	☆	/	/	/	☆	☆	☆
Zhou X (2020)	4	☆	☆	☆	/	/	/	☆	/	/
An W (2020)	5	☆	☆	☆	/	/	☆	☆	/	/
Chang Z (2020)	7	☆	☆	/	☆	☆	/	☆	☆	☆
Foy B (2020)	6	☆	☆	☆	/	/	/	☆	☆	☆
Guo F (2020)	7	☆	☆	☆	/	☆	☆	☆	/	☆
Li J (2020)	6	☆	☆	☆	/	/	/	☆	☆	☆
Luo M (2020)	7	☆	☆	☆	/	☆	/	☆	☆	☆
Fang X (2020)	6	☆	☆	☆	/	/	/	☆	☆	☆
Yang H (2020)	7	☆	☆	☆	/	☆	/	☆	☆	☆
Yang J (2020)	6	☆	☆	☆	/	/	/	☆	☆	☆
Zhang C (2020)	7	☆	☆	☆	/	☆	/	☆	☆	☆
Zhang F (2020)	7	☆	☆	☆	/	/	/	☆	☆	☆
Zhang G (2020)	7	☆	☆	☆	/	☆	/	☆	☆	☆
Zhang J (2020)	6	☆	☆	☆	/	☆	☆	☆	/	/

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Table S2 Results of meta-regression analyses

Covariates	P value
Sample size (≥100 versus <100)	0.456
Region (Asia versus Europe versus North America)	0.0001
Source of cases (single-center versus multiple-center)	0.756
NOS (>6 versus ≤6)	0.956
Study design (retrospective versus prospective)	0.403
Longest follow-up (>30 versus ≤30 days)	0.624
Proportion of patients with severe disease (>50% versus ≤50%)	<0.001

NOS, Newcastle-Ottawa Scale.

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Table S3 Risk of factors in COVID-19 patients

First author (year)	Risk factors of death in the univariate analysis	Risk factors of death in the multivariate analysis
Benussi A (2020)	Older age, hypertension, qSOFA score, thrombocytopenia, elevated C-reactive protein, and lactate dehydrogenase	qSOFA score, thrombocytopenia, elevated lactate dehydrogenase
Borghesi A (2020)	Older age, male, Brixia score, hypertension, cardiovascular disease, diabetes, oncologic history within the past 5 years, immunosuppressive conditions	Older age, Brixia score, immunosuppressive conditions
Chen R (2020)	Age ≥75, Male, CHD, CVD, COPD, diabetes, hypertension, malignancy, chronic renal diseases, abnormal chest X-ray, Dyspnea, PCT >0.5 ng/mL, LDH ≥250 U/L, AST >40 U/L, ALT >40 U/L, TBIL ≥17.1, creatinine kinase ≥200, creatinine ≥133, D-dimer ≥0.5	Age ≥75, CHD, CVD, dyspnea, PCT >0.5 ng/mL, AST >40 U/L
Andrea C (2020)	Older age, hypertension, heart failure, diabetes, COPD, cancer, CKD, ACEI/ARBs and B-blocker	Older age, heart failure and CKD
Cummings M (2020)	Older age, hypertension, chronic cardiac disease, chronic pulmonary disease, diabetes, higher concentrations of IL-6 and D-dimer	Older age, chronic cardiac disease, chronic pulmonary disease, higher concentrations of IL-6 and D-dimer
Du R (2020)	Age ≥65 years, hypertension, cardiovascular or cerebrovascular diseases, dyspnea, fatigue, sputum production, headache, WBC >10×10^9/L, neutrophil counts >6.3×10^9/L, $CD3^+CD8^+$ T cells ≤75 cell/mL, cardiac troponin I ≥0.05 ng/mL, myoglobin>100 ng/mL, creatinine ≥133 μmol/L, D-dimer ≥0.5 mg/L, PaO_2 ≥80 or <60 mmHg	Age ≥65 years, cardiovascular or cerebrovascular diseases, $CD3^+CD8^+$ T cells ≤75 cell/μL, cardiac troponin I ≥0.05 ng/mL
Gao L (2020)	Older age, male, hypertension, leukocytosis, lymphopenia, elevated NT-proBNP, Myoglobin, creatine kinase-MB, hs-TnI, urea, creatinine, CRP and procalcitonin	Elevated NT-proBNP and procalcitonin, leukocytosis, lymphopenia
Giacomelli A (2020)	Older age, comorbidity, obesity, treated with at least one anti-hypertensive, severe disease, critical disease, anemia, lymphopenia, elevated D-dimer, CRP, creatinine, and creatine kinase	Older age, obesity, critical disease, elevated CRP, creatine kinase
Huang J (2020)	Older age, any comorbidity, lymphopenia, hypoalbuminemia	Any comorbidity, lymphopenia, hypoalbuminemia
Klang E cohort 1 (2020)	BMI ≥40 kg/m^2	Age, BMI ≥40 kg/m^2, congestive heart failure, chronic kidney disease, intubation and mechanical ventilation
Klang E cohort 2 (2020)	Coronary artery disease, congestive heart failure, hypertension, diabetes mellitus, hyperlipidemia, chronic kidney disease	Older age, male sex, BMI ≥40 kg/m^2, coronary artery disease, diabetes mellitus, chronic kidney disease, intubation and mechanical ventilation
Mehta V (2020)	Age >65 years, ICU admission, hypertension, chronic lung disease, CAD, CHF, reduced baseline hemoglobin and nadir hemoglobin, leukocytosis, lymphopenia, elevated D-dimer, lactate and LDH	Age >65 years, higher composite comorbidity score, ICU admission, elevated D-dimer, lactate and LDH
Renieris G (2020)	Age ≥64 years, Charlson's comorbidity index ≥3, APACHE II score ≥10, pneumonia severity index ≥11, SOFA ≥4, serum H_2S on day 1 ≥150.44 μM, severe respiratory failure	Serum H2S on day 1 ≥150.44 μM, severe respiratory failure
Sun H (2020)	Older age, Male, SpO_2, increased heart rate and respiratory rate, consciousness disorders, hypertension, previous respiratory diseases, leukocytosis, lymphopenia, elevated NT-proBNP, PCT, hs-TnI, D-dimer, AST, ALT, creatinine, eGFR, and hs-CRP	Older age, leukocytosis, lymphopenia
Tang N (2020)	Older age, male, higher PT, lower platelet count, higher D-dimer, more sepsis-induced coagulopathy	Older age, higher PT, lower platelet count, higher D-dimer
Wang D (2020)	Older age, male, hypertension, diabetes, cardiovascular disease, leukocytosis, thrombocytopenia, elevated neutrophil counts, CK-MB, lactate dehydrogenase, ALT, AST, and creatinine	Older age, male
Wang K (2020)	Older age, hypertension, CHD, elevated neutrophil, hs-CRP, D-dimer, AST, and GFR, decreased SpO_2, lymphopenia	Older age, decreased SpO_2, elevated neutrophil, hs-CRP, and GFR
Xie J (2020)	Age ≥60 years, male, hypertension, dyspnea, SpO_2 ≤90%, leukocytosis, thrombocytopenia, elevated CRP, D-dimer, and neutrophil count	Dyspnea, SpO_2 ≤90%, leukocytosis, elevated neutrophil count, and CRP
Xu B (2020)	Lower T lymphocyte subsets levels (lower T lymphocyte subsets lymphocyte <500/μL, $CD3^+$ T-cell <200/μL, $CD4^+$ T cell <100/μL, $CD8^+$ T cell <100/μL, NK-cell <50/μL, and B-cell <50/μL counts)	Lower T lymphocyte subsets levels (lower T lymphocyte subsets lymphocyte <500/μL, $CD3^+$ T cell <200/μL, $CD4^+$ T cell <100/μL, $CD8^+$ T cell <100/μL, NK-cell <50/μL, and B-cell <50/μL counts)
Zhou F (2020)	Older age, coronary heart disease, diabetes, hypertension, respiratory rate >24/min, lymphopenia, leukocytosis, and elevated ALT, lactate dehydrogenase, hs-TnI, creatine kinase, D-dimer, serum ferritin, IL-6, prothrombin time, creatinine, and procalcitonin, SOFA score, qSOFA score	Age, SOFA score, D-dimer >1
Foy B (2020)	Older age, elevated RDW, lymphopenia, D-dimer	Elevated RDW (>14.5%)
Luo M (2020)	Male, age ≥70 years, use traditional Chinese medicine, clinical classification (severe/critical), hypertension, coronary heart disease, diabetes, tumors, uremia, nucleic acid test (+)	Use traditional Chinese medicine, clinical classification (severe/critical), hypertension, coronary heart disease, diabetes, tumors, uremia
Yang H (2020)	Older age, SpO_2, lymphocyte, myocardial injury, IL-2R >710 U/mL, IL-6 >35 ng/L, IL-10 >9.1 ng/L	Older age, SpO_2, IL-10 >9.1 ng/L
Yang J (2020)	Male, fasting blood glucose ≥7 mmol/L, Elevated lactate dehydrogenase, creatinine, and hydroxybutyrate dehydrogenase	Fasting blood glucose ≥7 mmol/L.
Zhang F (2020)	Decreased SpO_2, elevated creatinine, D-dimer, and hs-TnI	Decreased SpO_2, elevated D-dimer and hs-TnI

qSOFA, quick Sequential Organ Failure Assessment; CHD, coronary heart disease; CVD, cerebrovascular disease; COPD, chronic obstructive pulmonary disease; CAD, coronary artery disease; CHF, chronic heart failure; ICU, intensive care unit; ACEI, angiotensin converting enzyme inhibitors; ARBs, angiotensin receptor blockers; CKD, chronic kidney disease; RDW, red blood cell distribution width; IL-6, interleukin-6; NT-proBNP, N-terminal pro-brain natriuretic peptide; CK-MB, creatine kinase-MB; HsTnI, high-sensitivity troponin-I; WBC, white blood cell; CRP, C-reactive protein; PCT, procalcitonin; LDH, lactate dehydrogenase; BUN, blood urea nitrogen; AST, aspartate aminotransferase; TBIL, total bilirubin; Brixia score, chest X-ray scoring system; APACHE, acute physiology and chronic health evaluation; SOFA, sequential organ failure; SpO_2, peripheral capillary oxygen saturation.

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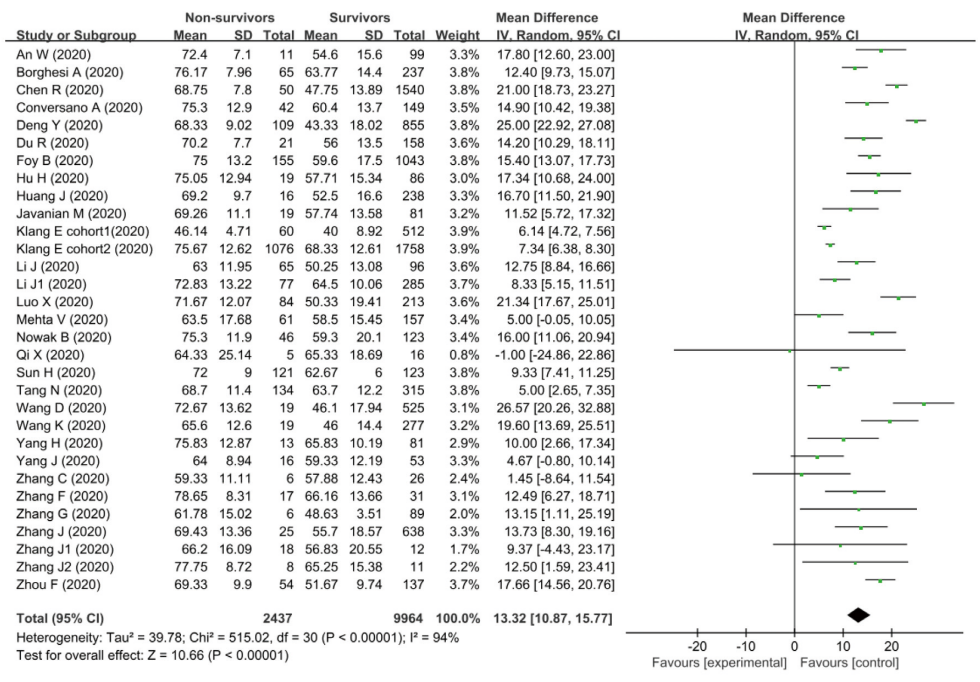
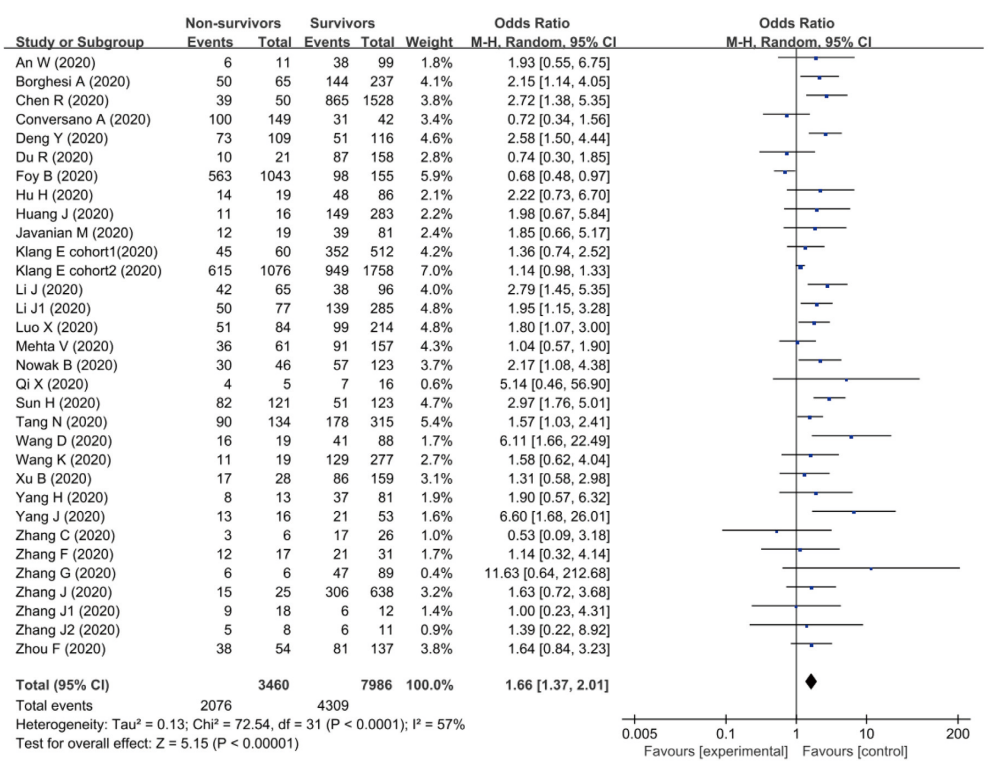
Supplementary material

1. Demographics and clinical characteristics

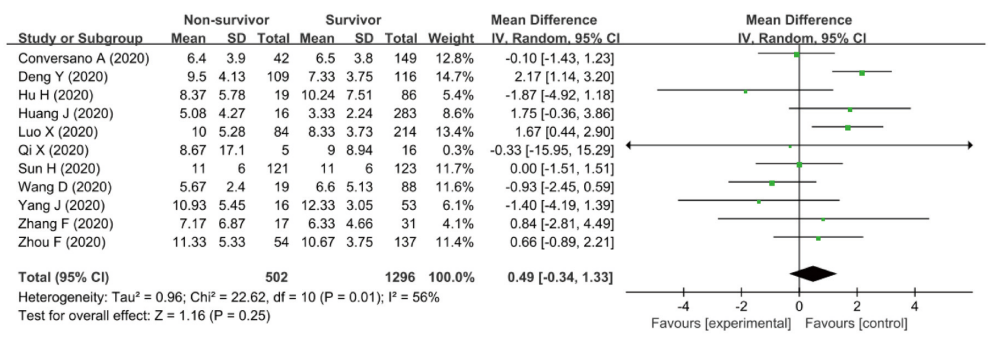
1.1 Old age



1.2 Male

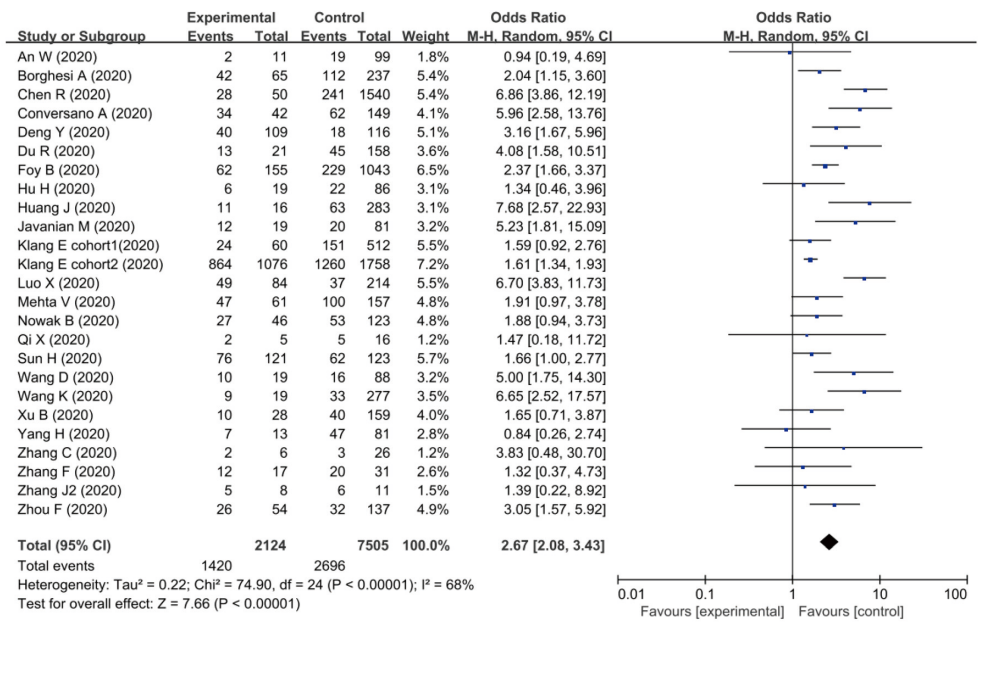


1.3 Time from illness onset to hospital admission, days

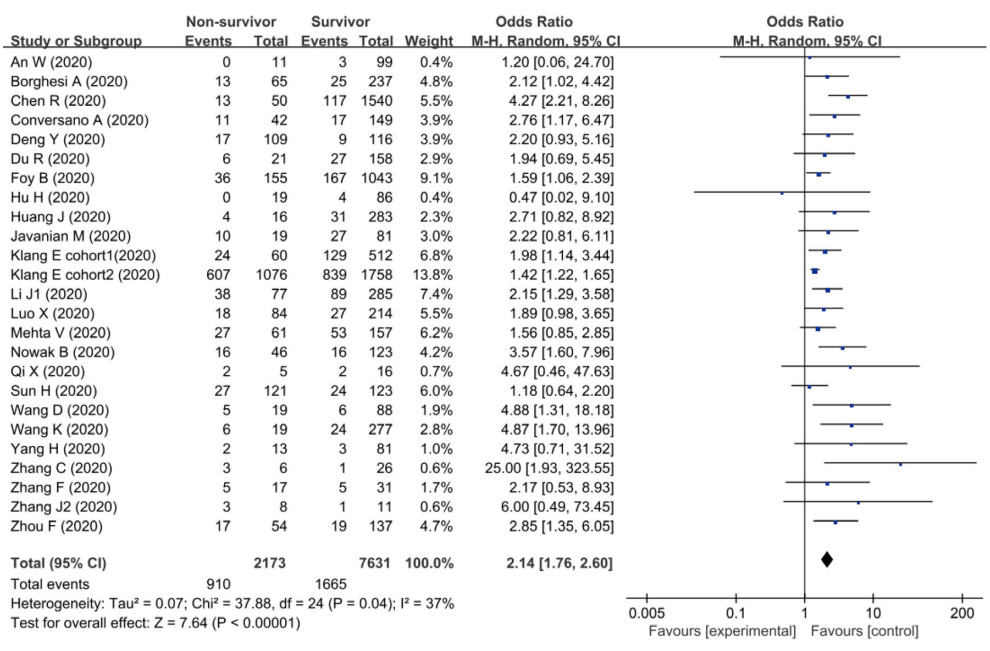


1.4 Comorbidities

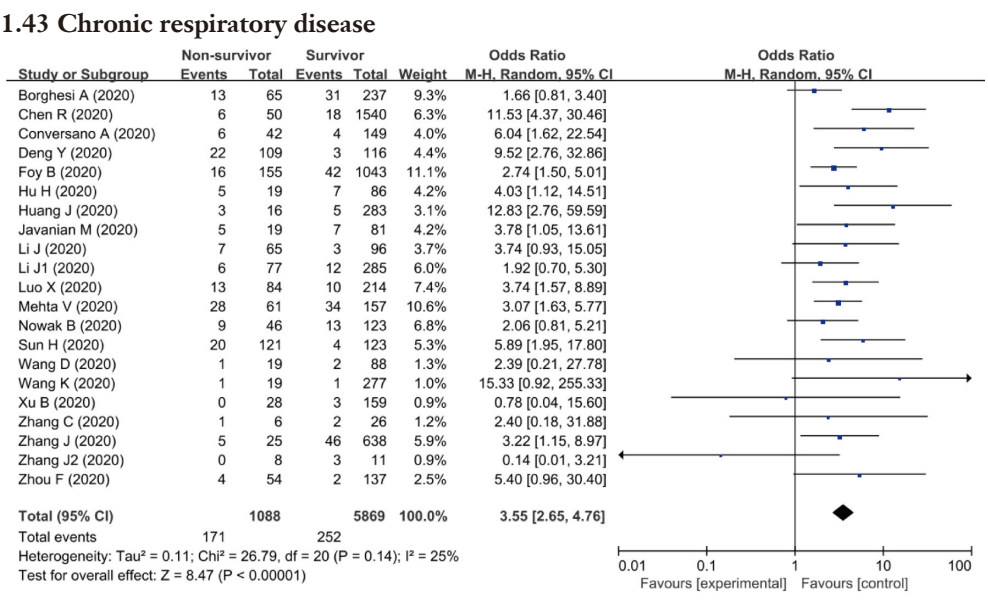
1.41 Hypertension



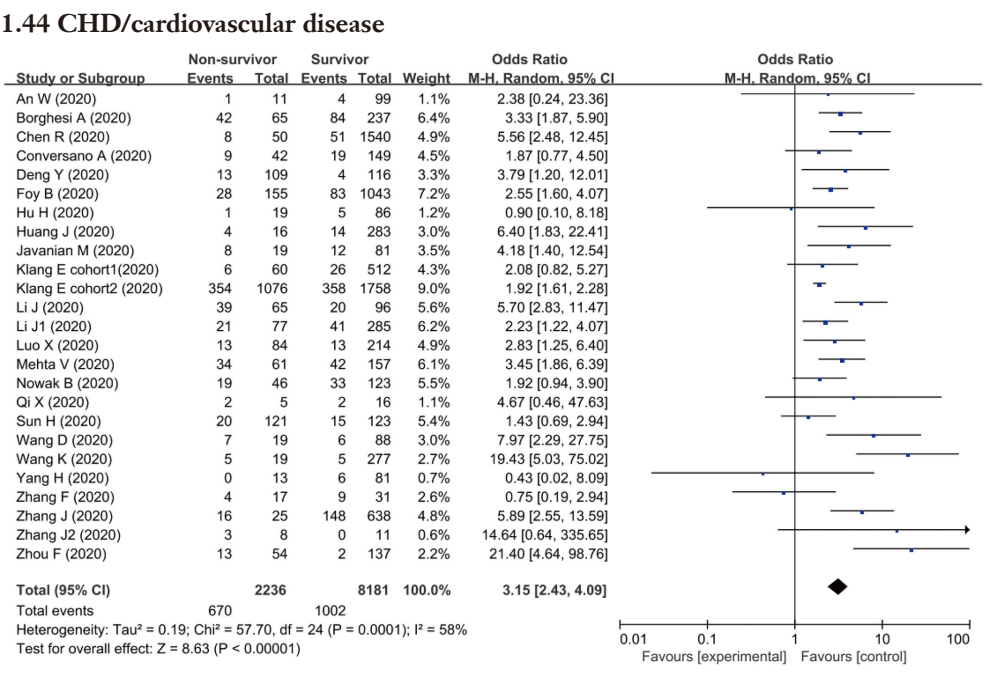
1.42 Diabetes



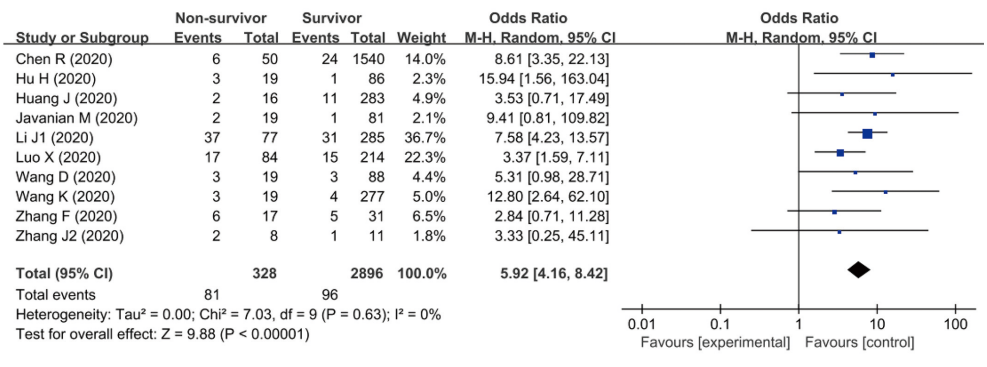
1.43 Chronic respiratory disease



1.44 CHD/cardiovascular disease



1.45 Cerebrovascular disease



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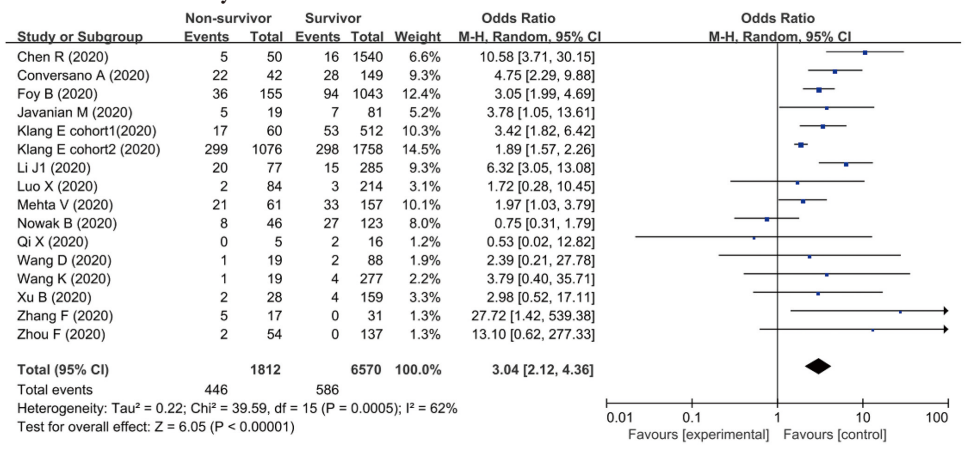
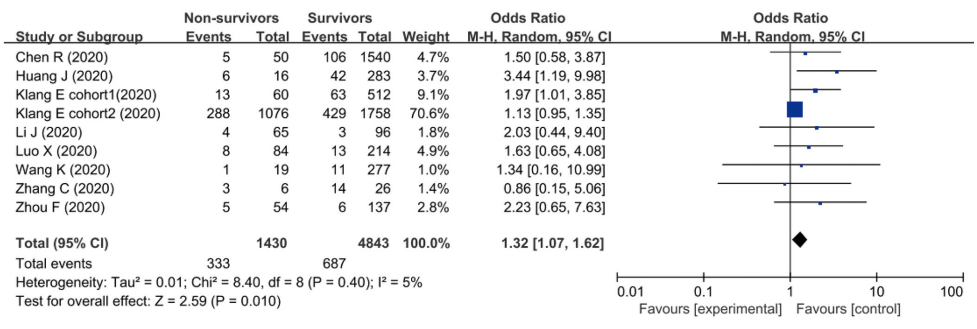
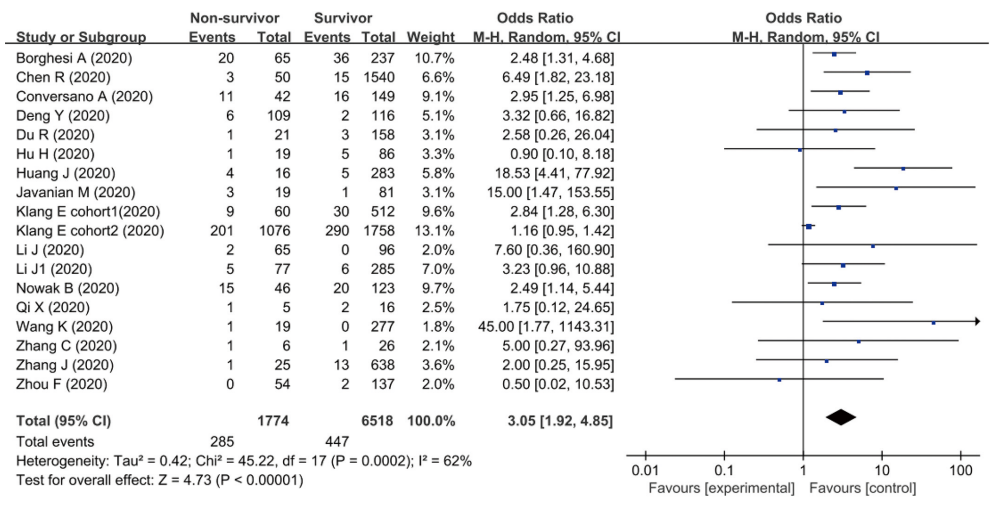
1.46 Chronic kidney disease



1.47 Smoking

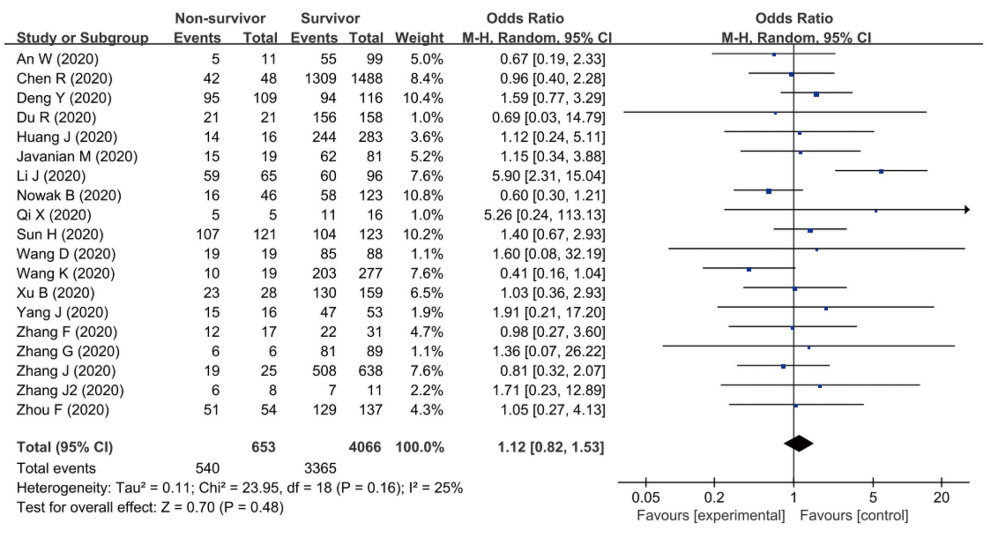


1.48 Cancer

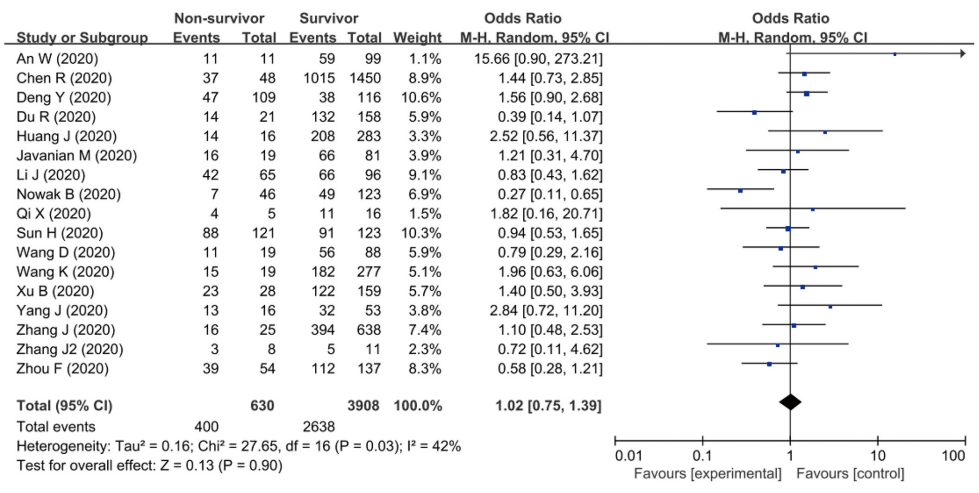


1.5 Clinical symptoms

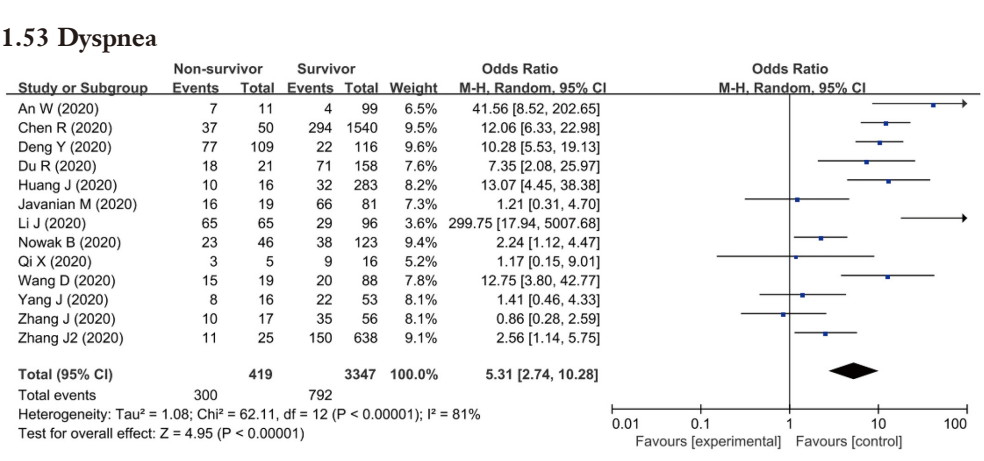
1.51 Fever



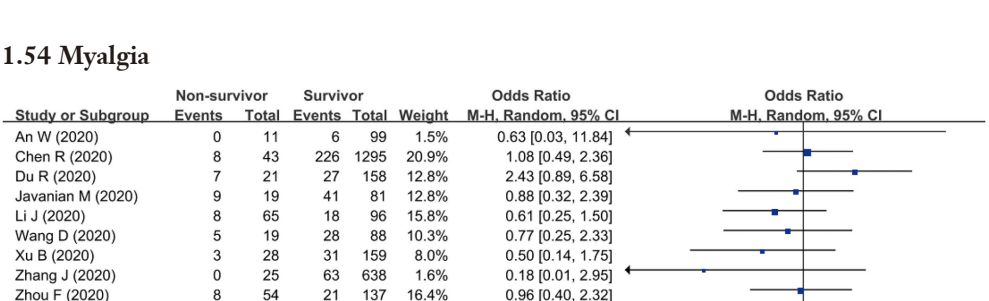
1.52 Cough



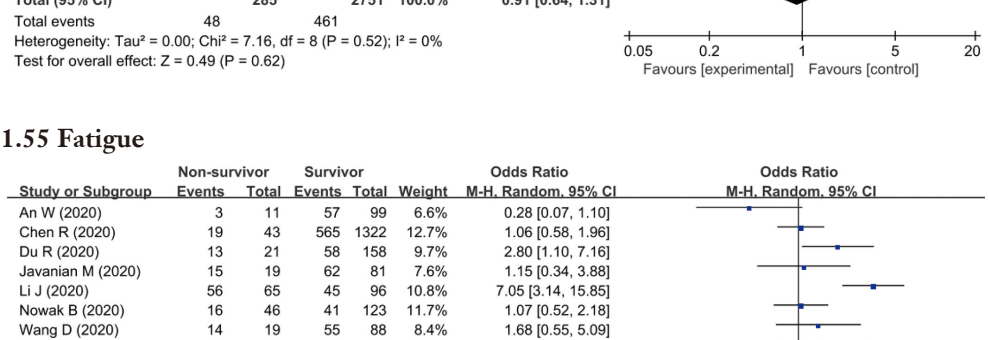
1.53 Dyspnea



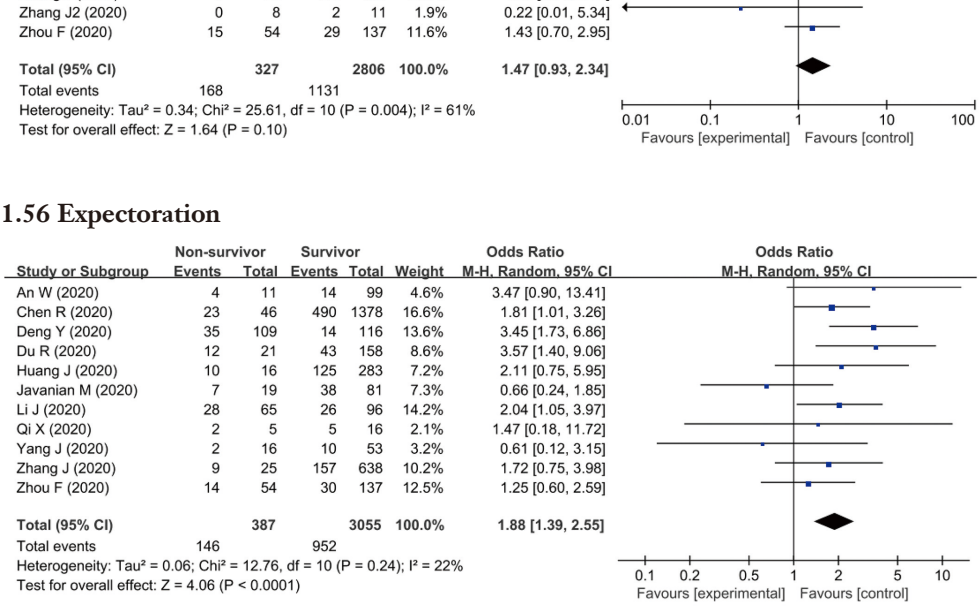
1.54 Myalgia



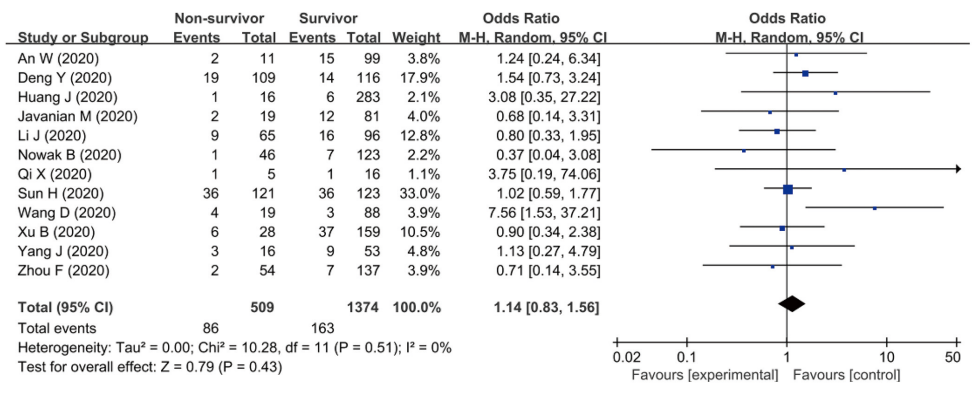
1.55 Fatigue



1.56 Expectoration

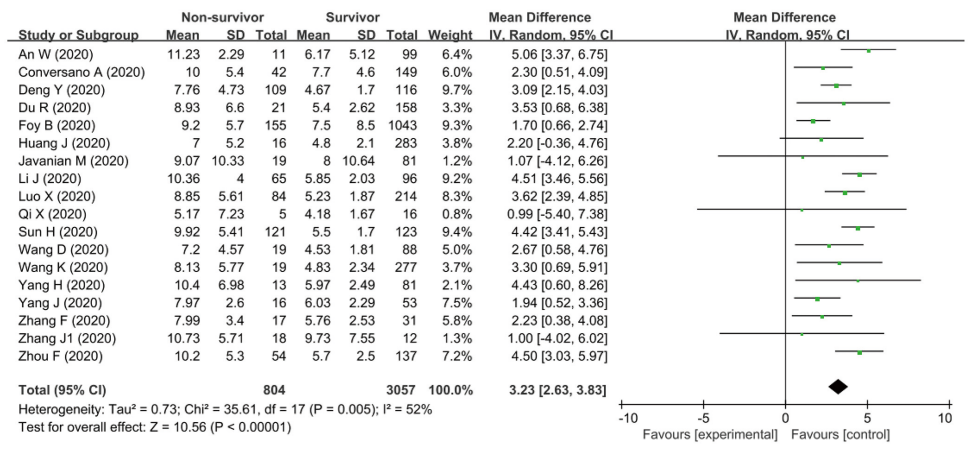


1.57 Diarrhea



2. Laboratory tests

2.1 White blood cell count, ×10⁹/L



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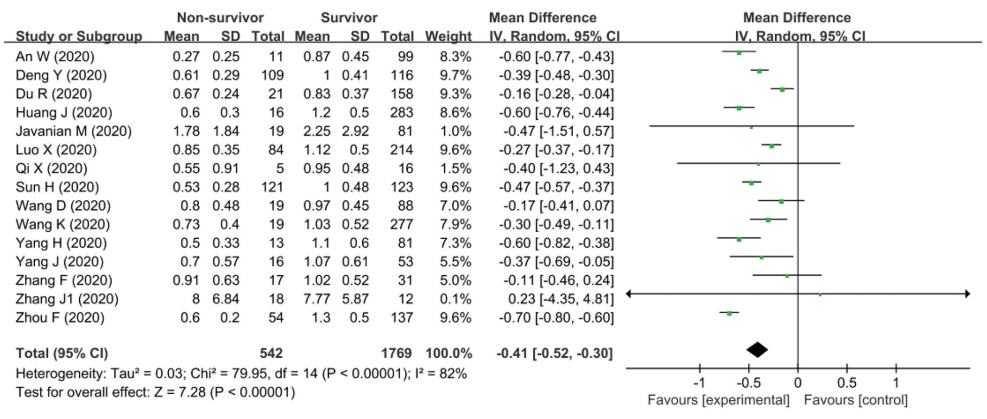
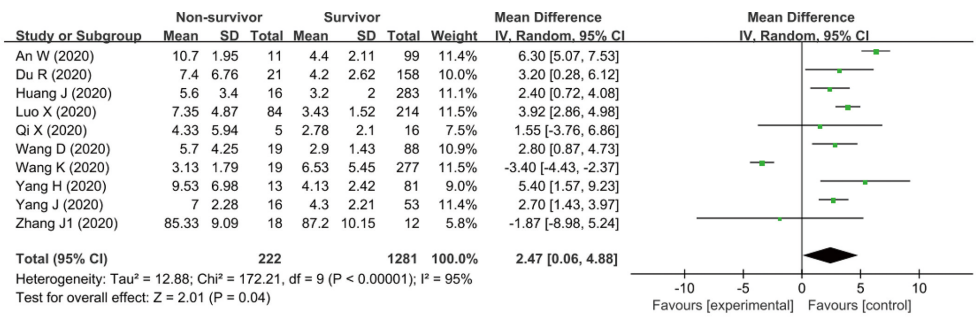
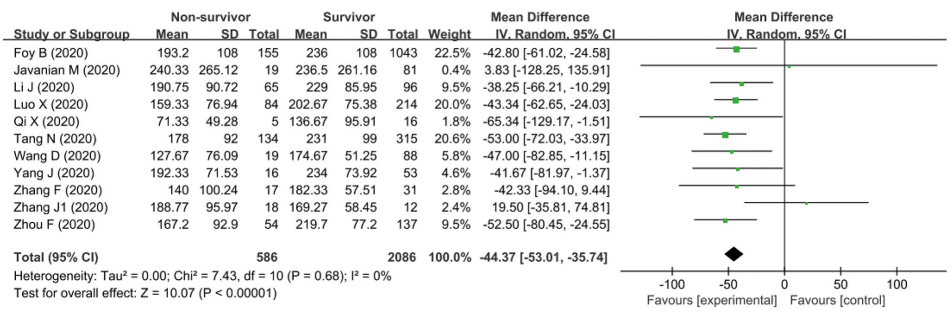
2.2 Lymphocyte count, $\times 10^9$/L



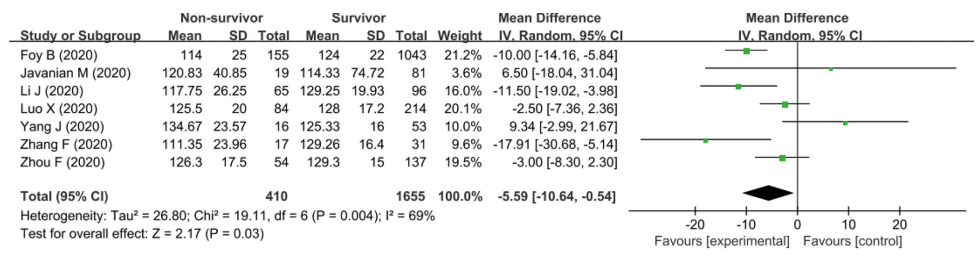
2.3 Neutrophil count, $\times 10^9$/L



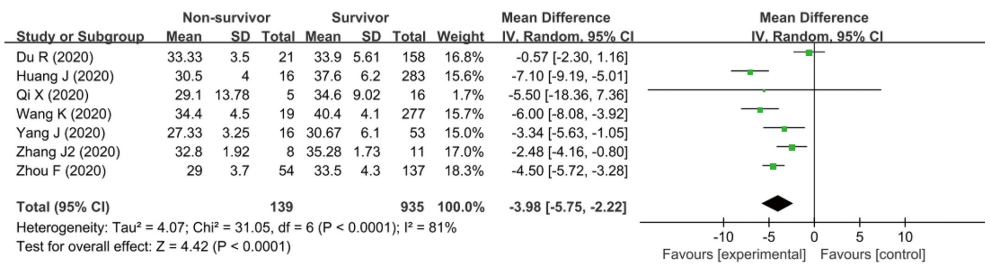
2.4 Platelet count, $\times 10^9$/L



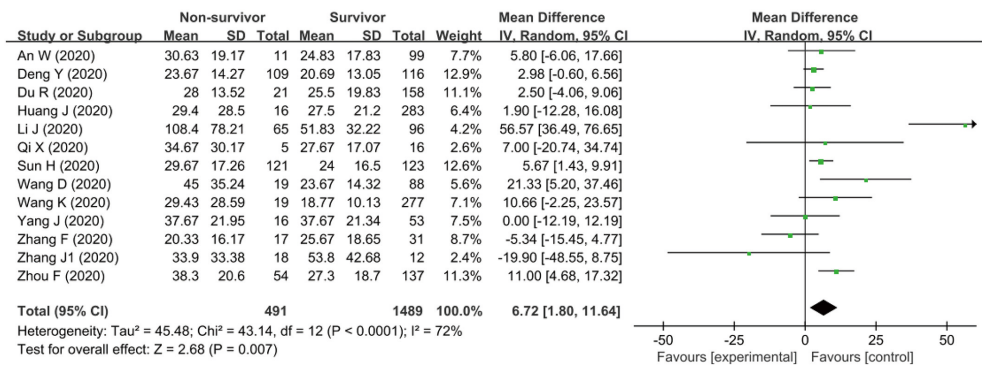
2.5 Hemoglobin, g/L



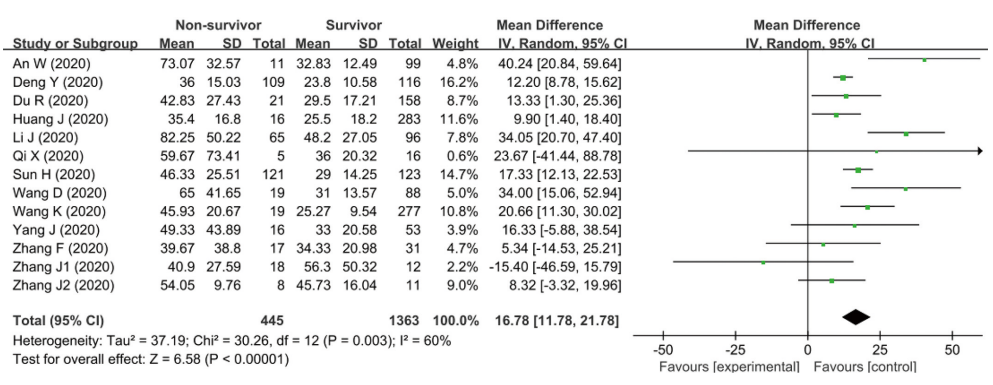
2.6 Albumin, g/L



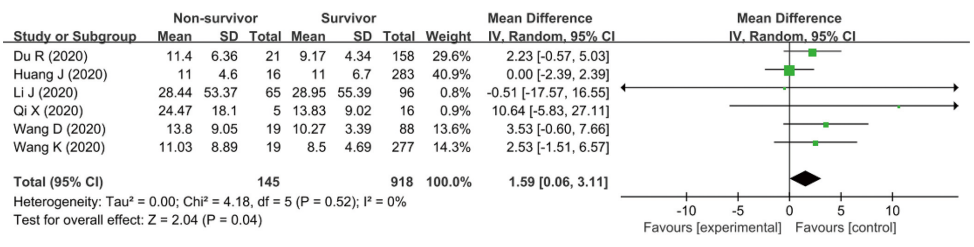
2.7 ALT, U/L



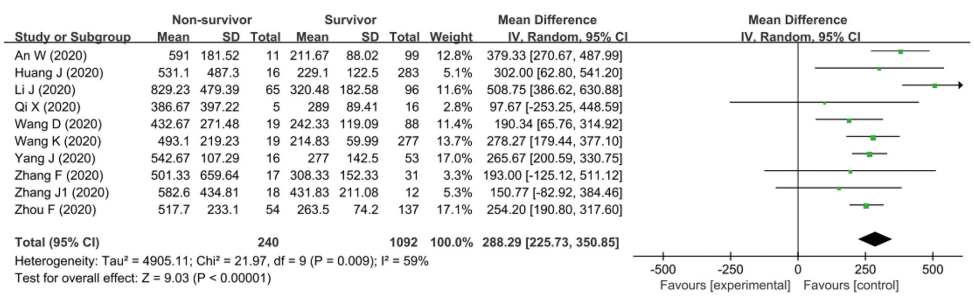
2.8 AST, U/L



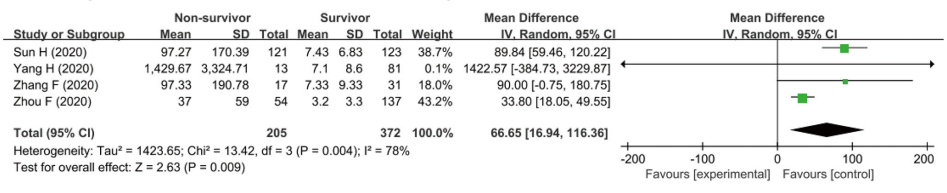
2.9 TBIL, μmol/L



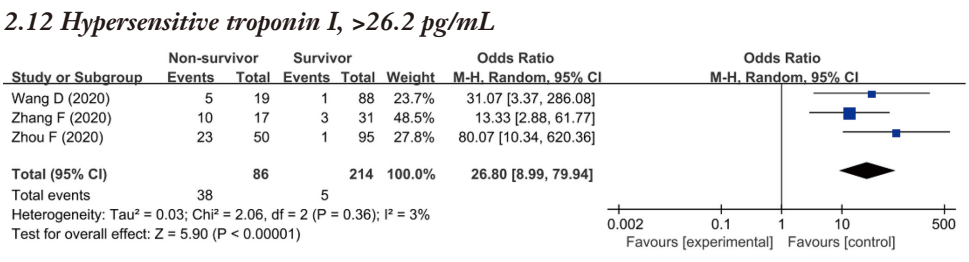
2.10 LDH, U/L



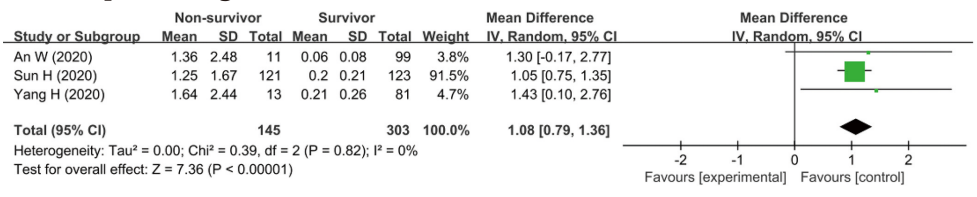
2.11 High-sensitive cardiac troponin I, pg/mL



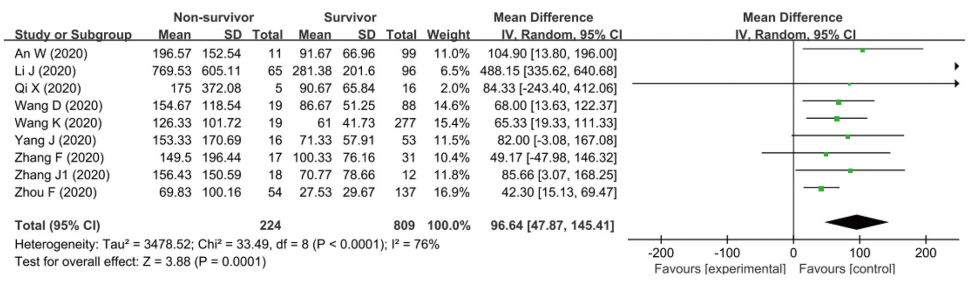
2.12 Hypersensitive troponin I, >26.2 pg/mL



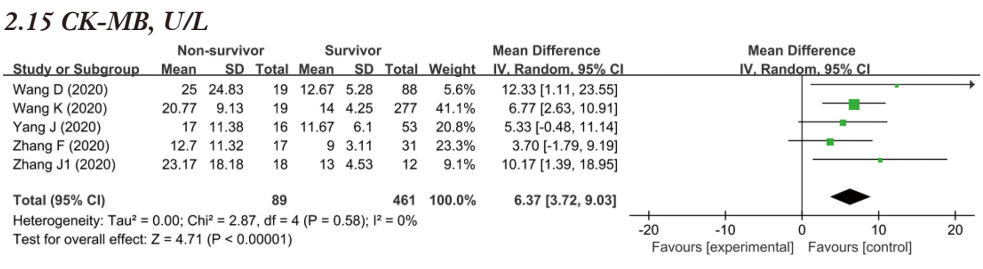
2.13 NT-proBNP, μg/L



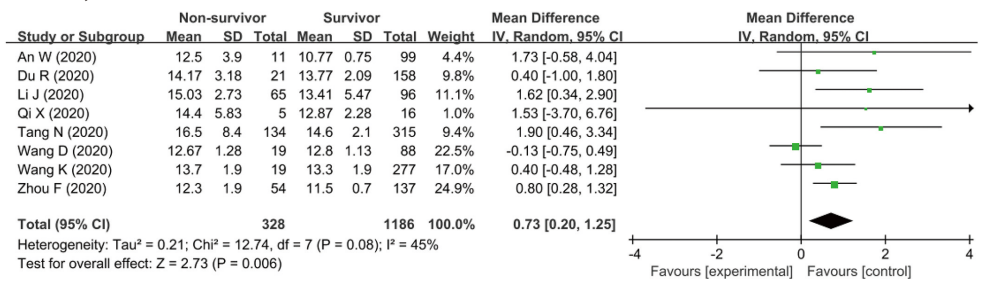
2.14 Creatine kinase



2.15 CK-MB, U/L



2.16 PT, s



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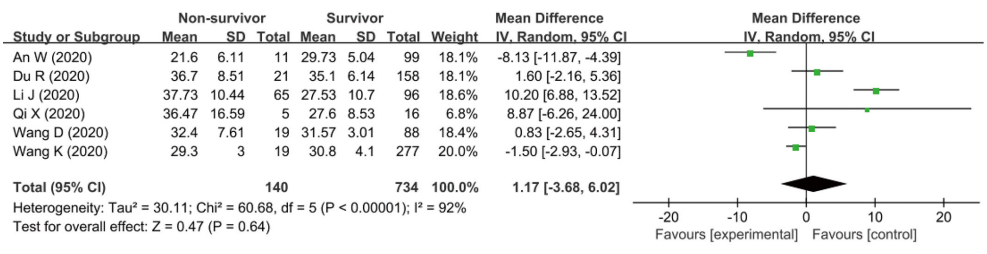
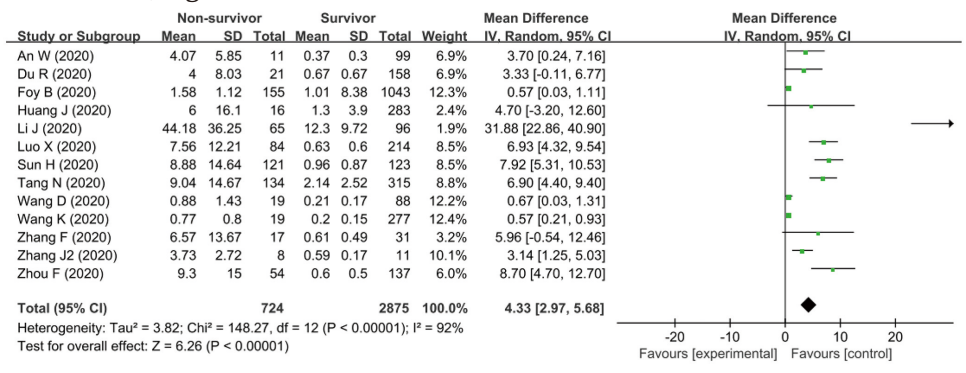
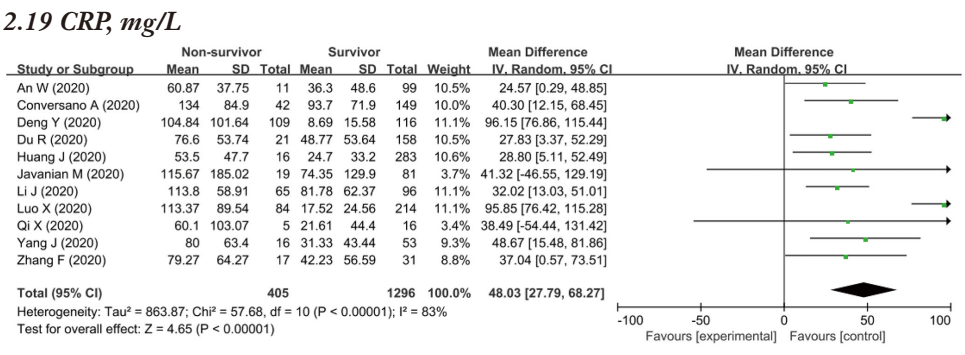
2.17 APTT, s



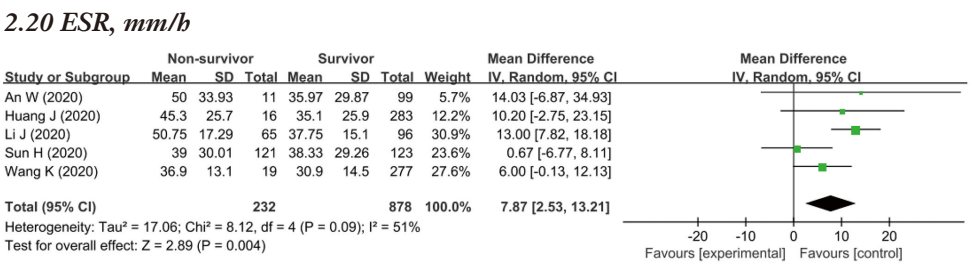
2.18 D-dimer, mg/L



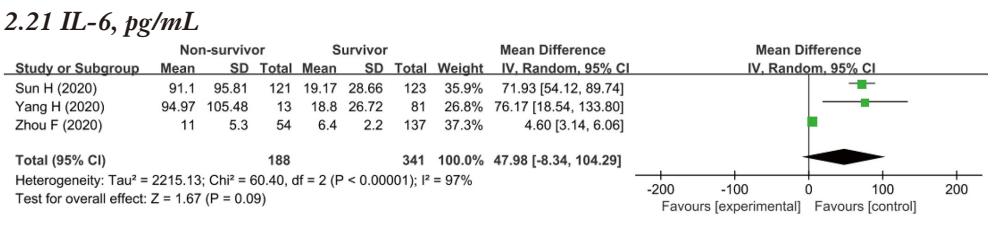
2.19 CRP, mg/L



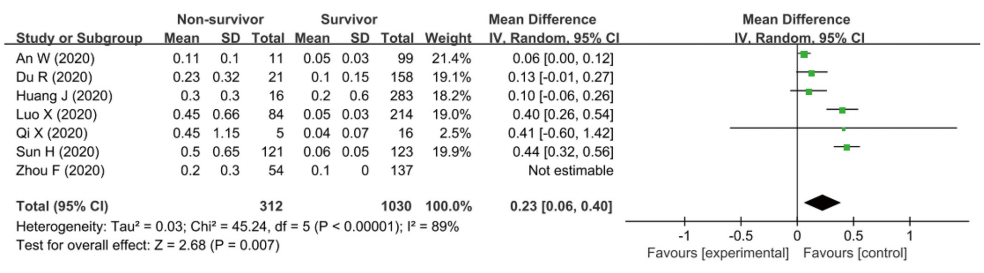
2.20 ESR, mm/h



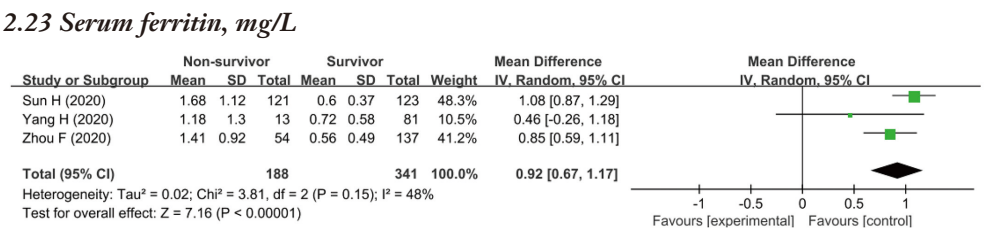
2.21 IL-6, pg/mL



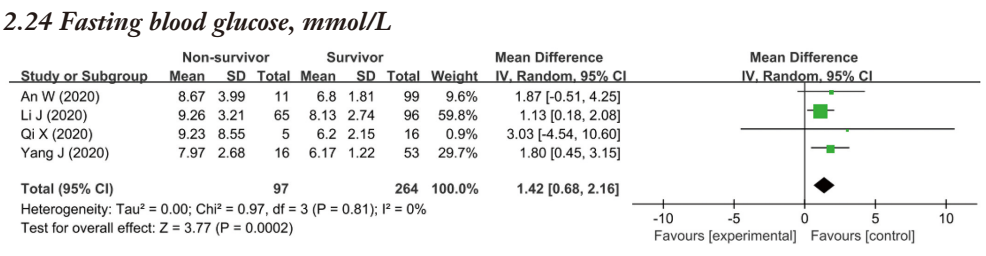
2.22 Procalcitonin, ng/mL



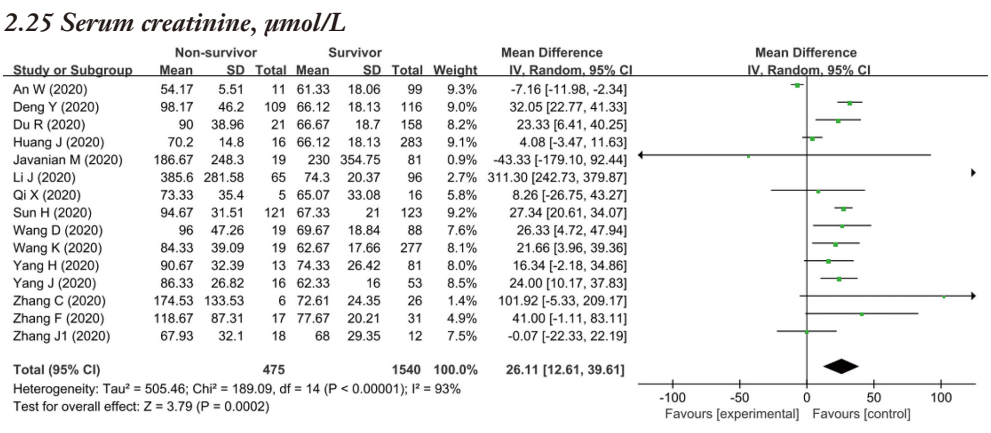
2.23 Serum ferritin, mg/L



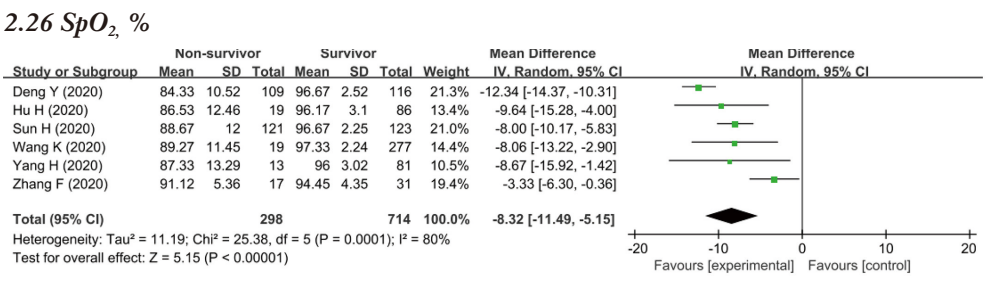
2.24 Fasting blood glucose, mmol/L



2.25 Serum creatinine, μmol/L

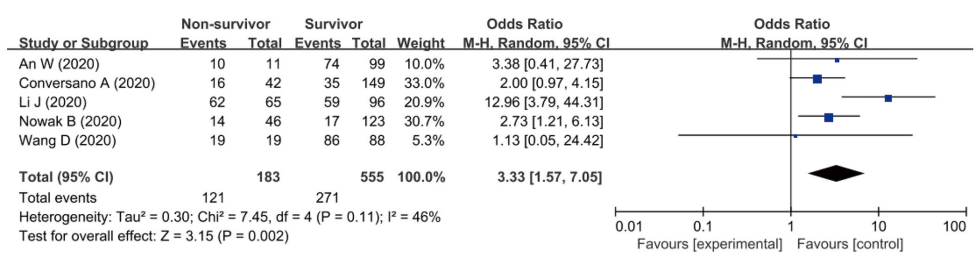


2.26 SpO_2, %

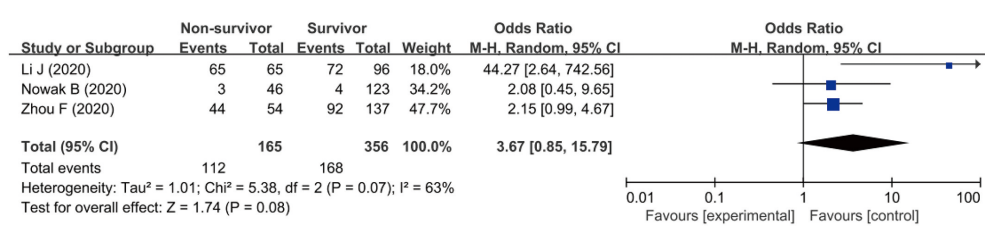


3. Imaging features

3.1 Bilateral involvement

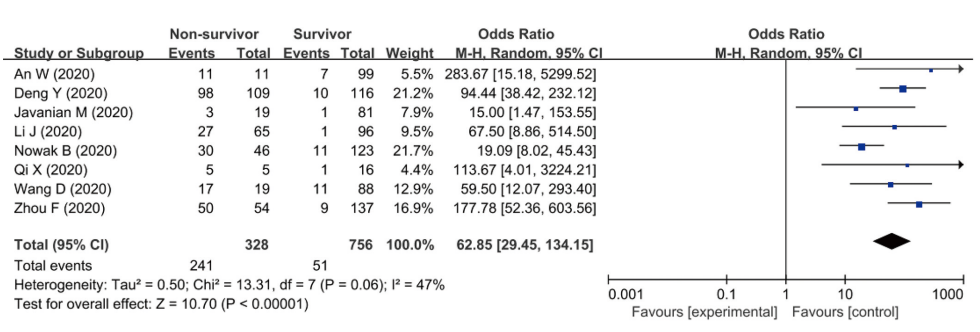


3.2 Ground-glass opacity

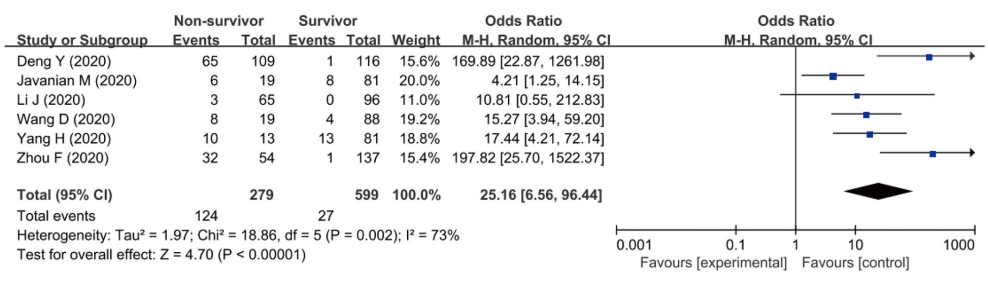


4. Complications

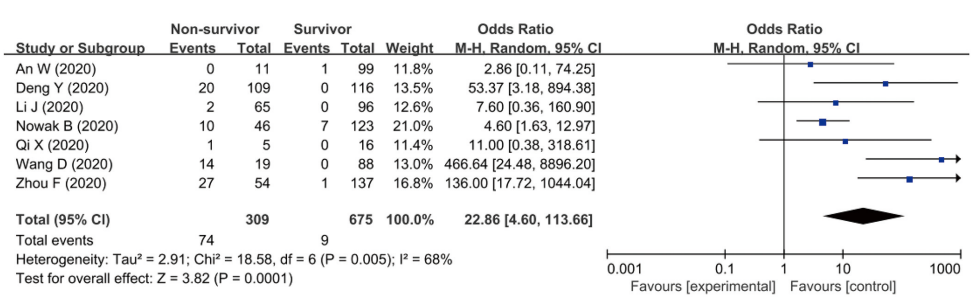
4.1 ARDS



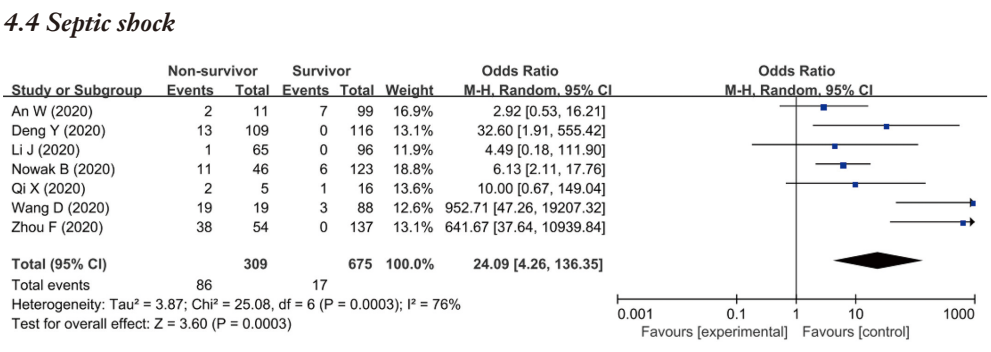
4.2 Acute cardiac injury



4.3 Acute kidney injury



4.4 Septic shock



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