Smoking and risk of negative outcomes among COVID-19 patients: A systematic review and meta-analysis

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| Database   | No | Step search algorithm                                                                 | Items found |
|------------|----|----------------------------------------------------------------------------------------|-------------|
| Pubmed     | #1 | Search tobacco                                                                         | 129717      |
|            | #2 | Search smok*                                                                           | 323837      |
|            | #3 | Search (smok*) OR tobacco                                                               | 377822      |
|            | #4 | Search covid                                                                           | 8886        |
|            | #5 | Search coronavirus                                                                     | 20634       |
|            | #6 | Search sars cov                                                                        | 7399        |
|            | #7 | Search ((sars cov) OR coronavirus) OR covid                                             | 17717       |
|            | #8 | Search (((smok*) OR tobacco)) AND (((sars cov) OR coronavirus) OR covid)                | 833         |
| Cochran    | #1 | covid                                                                                  | 4           |
|            | #2 | coronavirus                                                                            | 1           |
|            | #3 | sars cov                                                                               | 3           |
|            | #4 | #1 or #2 or #3                                                                          | 10          |
|            | #5 | tobacco                                                                                | 98          |
|            | #6 | smoking                                                                                | 118         |
|            | #7 | #5 or #6                                                                               | 210         |
|            | #8 | #4 and #7                                                                              | 51          |
| Science Direct | #1 | covid                                                                                  | 4514        |
|            | #2 | coronavirus                                                                            | 17501       |
|            | #3 | sars cov                                                                               | 6721        |
|            | #4 | #1 or #2 or #3                                                                          | 2110        |
|            | #5 | tobacco                                                                                | 247618      |
|            | #6 | smoking                                                                                | 455334      |
|            | #7 | #5 or #6                                                                               | 91948       |
|            | #8 | #4 and #7                                                                              | 102         |
| Google scholar | #1 | covid                                                                                  | 37111       |
|            | #2 | coronavirus                                                                            | 21090       |
|            | #3 | sars cov                                                                               | 16882       |
|            | #4 | #1 or #2 or #3                                                                          | 5290        |
|            | #5 | tobacco                                                                                | 21900       |
|            | #6 | smoking                                                                                | 33011       |
|            | #7 | #5 or #6                                                                               | 5420        |
|            | #8 | #4 and #7                                                                              | 28          |
| Database | No | Step search algorithm | Items found |
|----------|----|------------------------|-------------|
| EMBASE   | #1 | covid                  | 47101       |
|          | #2 | coronavirus            | 22390       |
|          | #3 | sars cov               | 16511       |
|          | #4 | #1 or #2 or #3         | 3260        |
|          | #5 | tobacco                | 21120       |
|          | #6 | smoking                | 31521       |
|          | #7 | #5 or #6               | 4520        |
|          | #8 | #4 and #7              | 234         |
Table S2. Risk of bias assessment of 40 studies included in the meta-analysis by the Newcastle-Ottawa Scale

| Author (Year)         | Adequacy selection of case-control | Comparability of studies | Outcome assessment | Total NOS score |
|----------------------|------------------------------------|--------------------------|--------------------|-----------------|
|                      | Is the case definition adequate?   | Representativeness of the cases | Selection of Controls | Definition of Controls | Study control for age and sex | Additional factors; controlled for ≥ 2 variables including DM, HT, CVD, ACEIs/ ARBs | Ascertainment of exposure | Same method of ascertainment for cases and controls | Non-Response rate |
| Almazeedi S. (2020)  | ✷ ✷ ✷ ✷ | ✷ | ✷ | ✷ | ✷ | ✷ | ✷ ✷ | ✷ | - | 7/9 |
| Bahl A. (2020)       | ✷ ✷ ✷ ✷ | ✷ | ✷ | ✷ | - | - | ✷ | ✷ ✷ | - | 6/9 |
| Bellan M. (2020)     | ✷ ✷ ✷ ✷ | ✷ | ✷ | ✷ | ✷ | - | ✷ | ✷ ✷ | - | 7/9 |
| Bi X. (2020)         | ✷ ✷ ✷ ✷ | ✷ | ✷ | ✷ | - | - | ✷ | ✷ ✷ | - | 6/9 |
| Borobia A. M. (2020) | ✷ ✷ ✷ ✷ | ✷ | ✷ | ✷ | - | ✷ | ✷ | ✷ | - | 6/9 |
| Brenner E.J. (2020)  | ✷ ✷ ✷ ✷ | ✷ | ✷ | ✷ | - | - | ✷ | ✷ | - | 6/9 |
| Castelnuovo A.D. (2020) | ✷ ✷ ✷ ✷ | ✷ | ✷ | ✷ | - | - | ✷ | ✷ | - | 7/9 |
| CDC COVID19          | - ✷ ✷ ✷ ✷ | ✷ | ✷ | ✷ | - | - | ✷ | ✷ | - | 5/9 |
| Author (Year)               | Adequacy selection of case-control | Comparability of studies | Outcome assessment | Total NOS score |
|----------------------------|-----------------------------------|--------------------------|--------------------|-----------------|
|                           | Is the case definition adequate?  | Representativeness of the cases | Definition of Controls | Study control for age and sex | Additional factors; controlled for ≥ 2 variables including DM, HT, CVD, ACEIs/ ARBs | Ascertainment of exposure | Same method of ascertainment for cases and controls | Non-Response rate |
| response team (2020)      |                                  |                          |                    | -                | -                | -                        | -                        | -                     | 6/9             |
| Chand S. (2020)           | ✷                                   | ✷                        | ✷                   | -                | ✷                | ✷                        | -                        | -                     | 6/9             |
| Chen L. (2020)            | ✷                                   | ✷                        | ✷                   | -                | ✷                | ✷                        | -                        | -                     | 8/9             |
| Dashti H. (2020)          | ✷                                   | ✷                        | ✷                   | -                | ✷                | ✷                        | -                        | -                     | 6/9             |
| Grechukhina O. (2020)     | ✷                                   | ✷                        | ✷                   | -                | ✷                | ✷                        | ✷                        | ✷                     | 7/9             |
| Gu T. (2020)              | ✷                                   | ✷                        | ✷                   | ✷                | ✷                | ✷                        | ✷                        | ✷                     | 8/9             |
| Guan W (2020)             | ✷                                   | ✷                        | ✷                   | -                | ✷                | ✷                        | -                        | -                     | 6/9             |
| Hu L. (2020)              | ✷                                   | ✷                        | ✷                   | -                | ✷                | ✷                        | -                        | -                     | 6/9             |
| Huang C (2020)            | ✷                                   | ✷                        | ✷                   | -                | ✷                | ✷                        | -                        | -                     | 6/9             |
| Kalligeros                | ✷                                   | ✷                        | ✷                   | ✷                | ✷                | ✷                        | -                        | -                     | 8/9             |
| Author (Year) | Adequacy selection of case-control | Comparability of studies | Outcome assessment | Total NOS score |
|---------------|-----------------------------------|--------------------------|-------------------|----------------|
| M. (2020)     |                                   |                          |                   |                |
| Kim E.S. (2020) | -                                 | ✔                        | ✔                 | 5/9            |
| Kishaba T. (2020) | ✔                                 | -                        | ✔                 | 6/9            |
| Klang E. (2020) | ✔                                 | ✔                        | ✔                 | 8/9            |
| Langer-Gould A. (2020) | ✔                                 | ✔                        | ✔                 | 7/9            |
| Li X. (2020)   | ✔                                 | ✔                        | ✔                 | 6/9            |
| Li YK. (2020)  | ✔                                 | ✔                        | ✔                 | 6/9            |
| Liu D. (2020)  | -                                 | ✔                        | ✔                 |                |
| Liu J. (2020)  | ✔                                 | ✔                        | ✔                 | 6/9            |
| Monteiro      | ✔                                 | ✔                        | ✔                 | 6/9            |
| Author (Year)          | Adequacy selection of case-control | Comparability of studies | Outcome assessment | Total NOS score |
|-----------------------|-----------------------------------|--------------------------|-------------------|-----------------|
|                       | Is the case definition adequate?  | Representativeness of the cases | Selection of Controls | Definition of Controls | Study control for age and sex | Additional factors; controlled for ≥ 2 variables including DM, HT, CVD, ACEIs/ ARBs | Ascertainment of exposure | Same method of ascertainment for cases and controls | Non-Response rate |
| A.C. (2020)           | ✖                                | ✖                         | ✖                  | ✖                | -                           | -                          | ✖                        | ✖                  | ✖                | -               | 6/9              |
| Parra-Bracamonte G. M. (2020) | ✖                                | ✖                         | ✖                  | ✖                | -                           | -                          | ✖                        | ✖                  | ✖                | -               | 6/9              |
| Shi Y. (2020)         | ✖                                | ✖                         | ✖                  | ✖                | -                           | -                          | ✖                        | ✖                  | ✖                | -               | 6/9              |
| Sun DW. (2020)        | ✖                                | ✖                         | ✖                  | ✖                | -                           | -                          | ✖                        | ✖                  | ✖                | -               | 6/9              |
| Torres-Macho J. (2020) | ✖                                | ✖                         | ✖                  | ✖                | -                           | -                          | ✖                        | ✖                  | ✖                | -               | 6/9              |
| Wang R. (2020)        | ✖                                | ✖                         | ✖                  | ✖                | -                           | -                          | ✖                        | ✖                  | ✖                | -               | 6/9              |
| Yang X. (2020)        | ✖                                | ✖                         | ✖                  | ✖                | -                           | -                          | ✖                        | ✖                  | ✖                | -               | 6/9              |
| Yu Q.                 | ✖                                | ✖                         | ✖                  | ✖                | -                           | -                          | ✖                        | ✖                  | ✖                | -               | 7/9              |
| Author          | (Year) | Adequacy selection of case-control | Comparability of studies | Outcome assessment |
|----------------|--------|-----------------------------------|--------------------------|-------------------|
|                |        | Is the case definition adequate?  | Representativeness of the cases | Selection of Controls | Definition of Controls | Study control for age and sex | Additional factors; controlled for ≥ 2 variables including DM, HT, CVD, ACEIs/ ARBs | Ascertainment of exposure | Same method of ascertainment for cases and controls | Non-Response rate | Total NOS score |
| Yu T.          | (2020) | ✻ | ✻ | ✻ | ✻ | - | - | ✻ | ✻ | - | 6/9 |
| Zhan T.        | (2020) | ✻ | ✻ | ✻ | ✻ | - | - | ✻ | ✻ | - | 6/9 |
| Zhang JJ.      | (2020) | ✻ | ✻ | ✻ | ✻ | - | - | ✻ | ✻ | - | 6/9 |
| Zhao Z.        | (2020) | ✻ | ✻ | ✻ | ✻ | - | - | ✻ | ✻ | ✻ | 7/9 |
| Zheng Y.       | (2020) | ✻ | ✻ | ✻ | ✻ | - | - | ✻ | ✻ | - | 6/9 |
| Zhou F.        | (2020) | ✻ | ✻ | ✻ | ✻ | - | - | ✻ | ✻ | - | 6/9 |
| Zinellu A.     | (2020) | ✻ | ✻ | ✻ | ✻ | ✻ | - | ✻ | ✻ | - | 7/9 |
Table S3. Description of outcomes in studies included in meta-analysis

| Author (Year)                      | Outcomes                  | Definitions                                                                                                                                 |
|-----------------------------------|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| Almazeedi S. (2020)               | ICU/non-ICU               | Assessment of Clinical Criteria for Sepsis Using the qSOFA score for sepsis; For the Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3) |
| Bahl A. (2020)                    | Dead/Alive                | -                                                                                                                                           |
| Bellan M. (2020)                  | Dead/Alive                | -                                                                                                                                           |
| Bi X. (2020)                      | Severe/non-severe         | Severe having any of the three conditions: respiratory distress, respiratory rate > 30 breaths/min, in resting state, oxygen saturation is less than 93%, PaO2/ FiO2 ≤300 mmHg. Critical having one of the three conditions; shock incidence, respiratory failure and require mechanical ventilation, admission to ICU with other organ function failure. |
| Borobia A. M. (2020)              | Dead/alive                | -                                                                                                                                           |
| Brenner E.J. (2020)               | Dead/alive                | -                                                                                                                                           |
| Castelnuovo A.D. (2020)           | Dead/Alive                | -                                                                                                                                           |
| CDC COVID19 response team (2020)  | ICU/non ICU + non hospitalization | -                                                                                                                                          |
| Chand S. (2020)                   | Dead/Alive                | -                                                                                                                                           |
| Chen L. (2020)                    | Dead/Alive                | -                                                                                                                                           |
| Dashti H. (2020)                  | Dead/Alive                | -                                                                                                                                           |
| Grechukhina (2020)                | Severe/non-severe         | Signs of severe pneumonia, ie, respiratory rate of 30/minute or more, blood oxygen saturation of < 95% {the threshold for O2 supplementation in pregnancy}, severe |
| Author (Year) | Outcomes | Definitions |
|--------------|----------|-------------|
| Gu T. (2020) | ICU/non-ICU | respiratory distress, and critical (acute respiratory distress syndrome, sepsis, or septic shock) |
| Guan W (2020) | Severe/non-severe | Validated definition includes either one major criterion or three or more minor criteria **Minor criteria** Respiratory rate > 30 breaths/min PaO2/FIO2 ratio < 250 Multilobar infiltrates Confusion/disorientation Uremia (blood urea nitrogen level > 20 mg/dl) Leukopenia* (white blood cell count, 4,000 cells/ml) Thrombocytopenia (platelet count, 100,000/ml) Hypothermia (core temperature, 368°C) Hypotension requiring aggressive fluid resuscitation **Major criteria** Septic shock with need for vasopressors Respiratory failure requiring mechanical ventilation *Due to infection alone (i.e., not chemotherapy induced). |
| Hu L. (2020) | Severe/non-severe | Diagnosis complied with the WHO interim guidance and the guidelines of COVID-19 diagnosis and treatment trial (5th edition), by the National Commission of the people’s Republic of China. |
| Huang C (2020) | ICU/non-ICU | - |
| Author (Year)           | Outcomes                          | Definitions                                                                 |
|------------------------|-----------------------------------|-----------------------------------------------------------------------------|
| Kalligeros M. (2020)   | ICU/non-ICU                       | -                                                                           |
| Kim E.S. (2020)        | Severe/non-severe                 | Need oxygen supplement therapy                                              |
| Kishaba T. (2020)      | Dead/Alive                        | -                                                                           |
| Klang E. (2020)        | Dead/Alive                        | -                                                                           |
| Langer-Gould A. (2020) | Dead/Alive                        | -                                                                           |
| Li X. (2020)           | Severe, critically ill/non-severe | Validated definition includes either one major criterion or three or more minor criteria |
|                        |                                   | **Minor criteria**                                                         |
|                        |                                   | Respiratory rate > 30 breaths/min                                           |
|                        |                                   | PaO2/FIO2 ratio < 250                                                      |
|                        |                                   | Multilobar infiltrates                                                     |
|                        |                                   | Confusion/disorientation                                                   |
|                        |                                   | Uremia (blood urea nitrogen level > 20 mg/dl)                             |
|                        |                                   | Leukopenia* (white blood cell count , 4,000 cells/ml)                      |
|                        |                                   | Thrombocytopenia (platelet count , 100,000/ml)                            |
|                        |                                   | Hypothermia (core temperature , 368C)                                      |
|                        |                                   | Hypotension requiring aggressive fluid resuscitation                       |
|                        |                                   | **Major criteria**                                                        |
|                        |                                   | Septic shock with need for vasopressors                                   |
|                        |                                   | Respiratory failure requiring mechanical ventilation                       |
|                        |                                   | *Due to infection alone (i.e., not chemotherapy induced).                  |
| Li YK. (2020)          | Severe/non-severe                 | Severe stage, 1 of the following criteria existed: (a) shortness of breath, respiratory rate |
| Author (Year)          | Outcomes                  | Definitions                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-----------------------|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Liu D. (2020)         | Dead/Alive                | ≥30 times/min; (b) in resting state, oxygen saturation is less than 93%; (c) PaO2/ FiO2 ≤300 mmHg. CT imaging showed significant lesion progression >50% within 24 to 48 h; (d) Respiratory failure requiring mechanical ventilation; (e) Shock; (f) Complicated with other organ failure requiring ICU care.                                                                                                         |
| Liu J. (2020)         | Severe/mild               | severe patients have 1 of the following conditions; (1) shortness of breath, respiratory rate ≥ 30 times/min (2) O2 sat resting rate ≤ 93% or (3) PaO2/FiO2 ≤ 300 mmHg                                                                                                                                                                                                                                                     |
| Monteiro A.C. (2020)  | ICU/non-ICU               | Any admission to the ICU or any intubation for respiratory failure, regardless of duration, was included in the rate of ICU admissions and intubations, respectively.                                                                                                                                                                                                                                                               |
| Parra-Bracamonte G. M. (2020) | Dead/alive               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Shi Y. (2020)         | Severe/mild               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Sun DW. (2020)        | Severe/non-severe         | Severe patients have 1 of the following conditions; (1) shortness of breath, respiratory rate ≥ 30 times/min (2) O2 sat resting rate ≤ 93% or (3) PaO2/FiO2 ≤ 300 mmHg. Critically severe type was defined if any of the items was presented: Respiratory failure requiring mechanical ventilation; (e) Shock; (f) Complicated with other organ failure requiring ICU care.                                                                                                         |
| Torres-Macho J. (2020)| Dead/Alive                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Wang R. (2020)        | Critical/non critical     | Defined as the general office of national health commission China, version5 , 2020                                                                                                                                                                                                                                                                                                                                                                                                     |
| Yang X. (2020)        | Dead/alive                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Yu Q. (2020)          | Severe/non-severe         | Admission to ICU, acute respiratory failure, and shock during hospitalization                                                                                                                                                                                                                                                                                                                                                                                                     |
| Yu T. (2020)          | with ARDs / without ARDs | Acute respiratory syndrome = O2 index (arterial partial pressure of O2/fraction of inspired oxygen)
| Author (Year)     | Outcomes               | Definitions                                                                 |
|------------------|------------------------|-----------------------------------------------------------------------------|
| Zhan T. (2020)   | Severe/non-severe      | Severity was established based on respiratory functions on admission with one of the below criteria: (a) shortness of breath, respiratory frequency ≥ 30/min, (b) oxygen saturation ≤ 93% at rest and (c) PaO2/FiO2 ≤ 300 mmHg |
| Zhang JJ. (2020) | Severe/non-severe      | Severity was established based on respiratory functions on admission with one of the below criteria: (a) shortness of breath, respiratory frequency ≥ 30/min, (b) oxygen saturation ≤ 93% at rest and (c) PaO2/FiO2 ≤ 300 mmHg |
| Zhao Z. (2020)   | ICU/non-ICU            | -                                                                           |
| Zheng Y. (2020)  | Severe or critical / ordinary | -                                                                           |
| Zhou F. (2020)   | Dead/alive            | -                                                                           |
| Zinellu A. (2020)| Dead/alive            | -                                                                           |
Table S4. Description of participants of included studies.

| Author, Year | Outcomes | Criteria | Age of participants (years old) | Sex of participants | Comorbidity of participants |
|--------------|----------|----------|---------------------------------|---------------------|-----------------------------|
|              |          |          | Inclusion | Exclusion | Interventions | Comparators | Sex | Interventions | Comparators | Diseases | Interventions (%) | Comparators (%) |
| Almazeedi S. (2020) | ICU/non-ICU | All patients admitted to JaberAl-AhmadAl-Sabah hospital in Kuwait, with a diagnosis of COVID-19, based on the World Health Organization (WHO) interim guidance and have been confirmed by laboratory testing using PCR testing, | Patients who had equivocal PCR test results or were suspected cases were excluded from the study. | 54.8±11 | 37.1±16 | Male | 32 (3.6%) | 856 (96.4%) | Hypertension | 17 (9.6) | 160 (90.4) |
|              |          |          |          |          | Interventions | Comparators | Sex | Interventions | Comparators | Diseases | Interventions (%) | Comparators (%) |
|              |          |          |          |          | Diabetes mellitus | 18 (11.6) | 137 (88.4) |
|              |          |          |          |          | Dyslipidemia | 7 (10.8) | 58 (89.2) |
|              |          |          |          |          | Asthma | 6 (14.0) | 37 (86.0) |
|              |          |          |          |          | Coronary artery disease/ischemic heart disease | 8 (19.5) | 33 (80.5) |
|              |          |          |          |          | Hypothyroidism | 3 (12.0) | 22 (88.0) |
|              |          |          |          |          | Cancer | 1 (7.1) | 13 (92.9) |
|              |          |          |          |          | Chronic renal disease | 3 (27.3) | 8 (72.7) |
|              |          |          |          |          | Cerebrovascular disease | 1 (14.3) | 6 (85.7) |
|              |          |          |          |          | Hepatitis | 1 (16.7) | 5 (83.3) |
|              |          |          |          |          | Chronic obstructive pulmonary disease | 2 (40.0) | 3 (60.0) |
|              |          |          |          |          | Recent surgery (30 days prior to initial presentation) | 0 (0.0) | 4 (100.0) |
| Author, Year | Outcomes | Criteria | Age of participants (years old) | Sex of participants | Comorbidity of participants |
|-------------|----------|----------|---------------------------------|--------------------|-----------------------------|
|             | Inclusion | Exclusion | Interventions | Comparators | Sex | Interventions | Comparators | Diseases | Interventions (%) | Comparators (%) |
| Dead/alive  | between February 24th 2020 and the study’s cutoff date of April 20th 2020 were included in the study | 55.0±10.1 | 38.7±15.1 | Male | 16 (1.8%) | 872 (98.2%) | | Immunodeficiency | 0 (0.0) | 1 (0.0) |
|             |                      | | | | | | | Other | 5 (15.6) | 27 (84.4) |
|             |                      | | | | | | | Hypertension | 8 (4.5) | 169 (95.5) |
|             |                      | | | | | | | Diabetes mellitus | 6 (3.9) | 149 (96.1) |
|             |                      | | | | | | | Dyslipidemia | 3 (4.6) | 62 (95.4) |
|             |                      | | | | | | | Asthma | 4 (9.3) | 39 (90.7) |
|             |                      | | | | | | | Coronary artery disease/ischemic heart disease | 5 (12.2) | 36 (87.8) |
|             |                      | | | | | | | Hypothyroidism | 1 (4.0) | 24 (96.0) |
|             |                      | | | | | | | Cancer | 0 (0.0) | 14 (100.0) |
|             |                      | | | | | | | Chronic renal disease | 3 (27.3) | 8 (72.7) |
|             |                      | | | | | | | Cerebrovascular disease | 0 (0.0) | 7 (100.0) |
|             |                      | | | | | | | Hepatitis | 1 (16.7) | 5 (83.3) |
|             |                      | | | | | | | Chronic obstructive pulmonary disease | 1 (20.0) | 4 (80.0) |
|             |                      | | | | | | | Recent surgery (30 days prior to initial presentation) | 0 (0.0) | 4 (100.0) |
| Author, Year | Outcomes | Criteria | Age of participants (years old) | Sex of participants | Comorbidity of participants |
|-------------|----------|----------|---------------------------------|---------------------|----------------------------|
|            |          | Inclusion | Exclusion | Interventions | Comparators | Interventions | Comparators | Diseases | Interventions (%) | Comparators (%) |
|            |          |           |           |              |              |             |             |          |                   |                 |
| Bahl A. (2020) | Dead/alive | Patients over 18 years of age who were admitted with COVID-19 from March 1st through March 31st 2020 were included | Exclusion consisted of patients who left the hospital against medical advice, transfers to external hospitals, or if hospital course was ongoing beyond April 23, 2020 | 73 | 59 | Male | 180 (55.0%) | 590 (52.0%) | Asthma | 30 (9.2) | 124 (10.9) |
|            |          |           |           |              |              |             |             |          |                   |                 |
|            |          |           |           |              |              |             |             | Cancer | 44 (13.5) | 110 (9.7) |
|            |          |           |           |              |              |             |             | Coronary artery disease | 59 (18.0) | 104 (9.2) |
|            |          |           |           |              |              |             |             | Chronic heart failure | 37 (11.3) | 63 (5.6) |
|            |          |           |           |              |              |             |             | Chronic kidney disease | 33 (10.1) | 42 (3.7) |
|            |          |           |           |              |              |             |             | Chronic obstructive pulmonary disease | 48 (14.7) | 84 (7.4) |
|            |          |           |           |              |              |             |             | Cerebrovascular accident | 30 (9.2) | 58 (5.1) |
|            |          |           |           |              |              |             |             | Diabetes mellitus | 127 (38.8) | 303 (26.7) |
|            |          |           |           |              |              |             |             | End-stage renal disease | 15 (4.6) | 21 (1.9) |
|            |          |           |           |              |              |             |             | Human immunodeficiency virus | 1 (0.3) | 7 (0.6) |
|            |          |           |           |              |              |             |             | Hypertension | 200 (61.2) | 551 (48.6) |
|            |          |           |           |              |              |             |             | Immunodeficiency | 0 (0.0) | 1 (100.0) |
|            |          |           |           |              |              |             |             | Other | 3 (9.4) | 29 (90.6) |
| Author, Year | Outcomes | Criteria | Age of participants (years old) | Sex of participants | Comorbidity of participants |
|-------------|----------|----------|---------------------------------|--------------------|----------------------------|
|             |          | Inclusion | Exclusion | Interventions | Comparators | Sex | Interventions | Comparators | Diseases | Interventions (%) | Comparators (%) |
| Bellan M. (2020) | Dead/alive | From hospital administrative data revision, we selected all consecutive patients older than 18 years of age, admitted to the hospital after Emergency Room evaluation, with a | - | 77 | 65 | Male | 74 | 165 | Arterial Hypertension | 83 | 138 |
|              |          | 2020      |          |              |              |     |     |              |              | Obstructive Sleep Apnea | 29 (8.9) | 90 (7.9) |
|              |          |           |          |              |              |     |     | Pulmonary Hypertension | 6 (1.8) | 6 (0.5) |
|              |          |           |          |              |              |     |     | Venous thromboembolism | 29 (8.9) | 52 (4.6) |
|              |          |           |          |              |              |     |     | Arterial Hypertension | 83 | 138 |
|              |          |           |          |              |              |     |     | Diabetes | 31 | 58 |
|              |          |           |          |              |              |     |     | Ischemic cardiopathy | 24 | 30 |
|              |          |           |          |              |              |     |     | Obesity | 28 | 32 |
|              |          |           |          |              |              |     |     | COPD | 21 | 39 |
|              |          |           |          |              |              |     |     | Active Malignancy | 14 | 23 |
|              |          |           |          |              |              |     |     | Chronic liver disease | 18 | 15 |
|              |          |           |          |              |              |     |     | Autoimmune disease | 7 | 6 |
|              |          |           |          |              |              |     |     | Atrial fibrillation disease | 5 | 6 |
|              |          |           |          |              |              |     |     | Interstitial lung disease | 19 | 26 |
|              |          |           |          |              |              |     |     | Dementia | 4 | 6 |
| Author, Year | Outcomes | Criteria | Age of participants (years old) | Sex of participants | Comorbidity of participants |
|-------------|----------|----------|---------------------------------|--------------------|---------------------------|
|             |          | Inclusion Exclusion Interventions Comparators | Sex Interventions Comparators | Diseases Interventions (%) Comparators (%) |
| Bi X. (2020) | Severe/non-severe | confirmed diagnosis of SARS-CoV-2 infection by reverse-transcriptase polymerase chain reaction (RT-PCR) of a nasopharyngeal swab, between 1st March 2020 and 28th April 2020. | - 54 44 | Male 13 (59.1%) 51 (56.0%) | Chronic kidney disease 29 28 | 27 22 |
| Author, Year | Outcomes | Criteria | Age of participants (years old) | Sex of participants | Comorbidity of participants |
|-------------|----------|----------|---------------------------------|---------------------|-----------------------------|
| Borobia A.M. (2020) | Dead/alive | Study included 18 years and older, who were hospitalized in the ward of La Paz university hospital with a diagnosis of covid-19 and patients discharged from the emergency department after stay of less than 24 h were not considered | 82.5 | 56 | Male 286 (62.2%) 788 (44.6%) |
| | | | | | Arterial hypertension 195 (42.4) 318 (69.1) |
| | | | | | Chronic heart disease 157 (34.1) 195 (42.4) |
| | | | | | Diabetes mellitus 80 (17.4) 157 (34.1) |
| | | | | | Rheumatological disease 93 (20.2) 157 (34.1) |
| | | | | | Solid malignant disease 66 (14.3) 93 (20.2) |
| | | | | | Obesity 66 (14.3) 318 (69.1) |
| | | | | | Chronic Kidney 602 (34.1) 66 (14.3) |
| Author, Year | Outcomes | Criteria | Age of participants (years old) | Sex of participants | Comorbidity of participants |
|--------------|----------|----------|--------------------------------|--------------------|-----------------------------|
|              |          |          | Inclusion                      | Exclusion          | Interventions (%) | Comparators (%) |
|              |          |          | Interventions                  | Comparators        | Diseases                | Interventions (%) | Comparators (%) |
| renner E.J.  | Dead/alive | We created the Surveillance Epidemiology of Coronavirus Under Research Exclusion for Inflammatory Bowel | - | - | - | Male | 11 (4%) | 514 (89%) |
| (2020)       |          |           |                                |                    | Disease                |                  |                |
|              |          |           |                                |                    | COPD                   | 94 (20.4) | 80 (4.5) |
|              |          |           |                                |                    | Other chronic lung disease | 65 (14.1) | 88 (5.0) |
|              |          |           |                                |                    | Hematological malignant disease | 49 (10.7) | 94 (5.3) |
|              |          |           |                                |                    | Asthma                 | 46 (10.0) | 87 (4.9) |
|              |          |           |                                |                    | Liver disease          | 17 (3.7)  | 98 (5.5) |
|              |          |           |                                |                    | HIV infection          | 23 (5.0)  | 66 (3.7) |
|              |          |           |                                |                    |                        | 4 (0.9)    | 9 (0.5)  |
|              |          |          |                                |                    | Any condition          | 192 (36.6) | 38 (7.2) |
|              |          |          |                                |                    | Cardiovascular disease (eg, CAD, heart failure, arrhythmia) |                  |                |
|              |          |          |                                |                    | Diabetes               | 29 (5.5)   |                |
|              |          |          |                                |                    | Lung disease (eg, asthma, COPD) | 44 (8.4) |                |
|              |          |          |                                |                    | Hypertension           | 63 (12.0) |                |
|              |          |          |                                |                    | Cancer                 | 10 (1.9)   |                |
|              |          |          |                                |                    | History of stroke      | 4 (0.8)    |                |

We created the Surveillance Epidemiology of Coronavirus Under Research Exclusion for Inflammatory Bowel who either died or were discharged by 19 April. Data of patients were extracted from the electronic prescription system.

Died or were hospitalized and were not included in this analysis.
| Author, Year | Outcomes | Criteria | Age of participants (years old) | Sex of participants | Comorbidity of participants |
|-------------|----------|----------|-------------------------------|-------------------|---------------------------|
| Castelnuovo A.D. (2020) | Dead/alive | Data for the present analyses were provided by 30 hospitals distributed throughout Italy. Each hospital provided data 77 Patients were excluded from the analysis because of missing data () | - | Male 469 (19.5%) | Chronic renal disease (eg, CKD) 10 (1.9) Chronic liver disease (eg, PSC, NAFLD, cirrhosis) 26 (5.0) Other 53 (10.1) | Hypertension 461 (23.7) Diabetes 203 (27.5) Myocardial infarction 140 (36.1) Heart failure 165 (38.3) Cancer 128 (32.1) Lung disease 167 (29.6) Obesity 69 (18.4) |
| Author, Year | Outcomes | Criteria | Age of participants (years old) | Sex of participants | Comorbidity of participants |
|-------------|----------|----------|---------------------------------|---------------------|----------------------------|
|             |          | Inclusion | Exclusion | Interventions | Comparators | Sex | Interventions | Comparators | Diseases | Interventions (%) | Comparators (%) |
| CDC COVID19 | ICU/non  | A total of US states and | - | $\geq 19$ | - | - | - | Diabetes mellitus | 784 (10.9) | 656 (9.2) |
|             | ICU + non| from hospitalised adult (18 years of age) patients who all had a positive test result for the SARS-CoV-2 virus at any time during their hospitalisation from February 19th to May 23rd, 2020. The follow-up continued through May 29th, 2020. | - | - | - | - | - | Chronic lung | | |
| Author, Year | Outcomes | Criteria | Age of participants (years old) | Sex of participants | Comorbidity of participants |
|--------------|----------|----------|-------------------------------|---------------------|-----------------------------|
|              |          | **Inclusion** | **Exclusion** | **Interventions** | **Comparators** | **Diseases** | **Interventions (%)** | **Comparators (%)** |
| Chand S. (2020) | Dead/alive | Consecutive adult patients aged 18 years | - | 60.6 | 55.6 | Male | 60.4 (11.9%) | 54.1 (11.7%) | None | 22 (14) | 1 (0.6) | 35 (24.5) | 1 (0.7) | 61 (42.7) |
| response team (2020) | hospitalization | territories have reported 122,653 US CPVID-19 cases to CDC, including 7,162 for whom data on underlying health conditions and other known risk factors for severe outcomes from respiratory infections were reported. | | | | | | | Cardiovascular disease | 647 (9.0) |
| | | | | | | Immunocompromised conditions | | | 264 (3.7) |
| | | | | | | Chronic renal disease | | | 213 (3.0) |
| | | | | | | Pregnancy | | | 143 (2.0) |
| | | | | | | Neurologic disorder, neurodevelopmental, intellectual disability | | | 52 (0.7) |
| | | | | | | Chronic liver disease | | | 41 (0.6) |
| | | | | | | Other chronic disease | | | 1,182 (16.5) |
| Author, Year | Outcomes | Criteria | Age of participants (years old) | Sex of participants | Comorbidity of participants |
|-------------|----------|----------|-------------------------------|--------------------|----------------------------|
|             |          | Inclusion | Exclusion | Interventions | Comparators | Sex | Interventions | Comparators | Diseases | Interventions (%) | Comparators (%) |
|             | and older admitted to 9 ICUs within the 3 main hospitals comprising Montefiore Medical Center (Bronx, NY) with documented SARS-CoV-2 infection were identified and their electronic medical records manually reviewed for extraction of | | | | | | | | | | | |
|             | | Hypertension | 115 (73.2) | 85 (59.4) |
|             | | Asthma | 17 (10.8) | 22 (15.4) |
|             | | Chronic obstructive pulmonary disease | 11 (7) | 6 (4.2) |
|             | | Coronary Artery disease | 24 (15.3) | 17 (11.9) |
|             | | ESRD on hemodialysis | 12 (7.6) | 4 (2.8) |
|             | | CKD | 22 (14.0) | 17 (11.9) |
|             | | HIV | 2 (1.3) | 3 (2.1) |
|             | | Heart Failure with reduced ejection fraction | 11 (7) | 5 (3.5) |
|             | | Heart Failure with preserved ejection fraction | 7 (4.5) | 1 (0.7) |
|             | | Cancer | 13 (8.3) | 5 (3.5) |
| Author, Year | Outcomes | Criteria | Age of participants (years old) | Sex of participants | Comorbidity of participants |
|-------------|---------|----------|-------------------------------|-------------------|-----------------------------|
| Chen L. (2020) | Dead/alive | Relevant demographic and medical data | - | Female | Atherosclerotic cardio and cerebro-vascular disease |
| | Between February 4 and February 18, 2020 persons with clinical symptoms and a lung computed tomography (CT) scan consistent with COVID-19 were diagnosed as having COVID-19 without | Subjects in whom we could not confirm SARS-CoV-2-infection by a qRT-PCR, IgM/IgG assay, or either were excluded from the study | - | 55 (26%) | Hypertension |
| | | | | 870 (53%) | Diabetes |
| | | | | | 63 (30) | 104 (50) |
| | | | | | 205 (12) | 475 (29) |
| | | | | | | 203 (12) |
| | | | | | | 12 (6) |
| | | | | | | 49 (3) |
| | | | | | | 59 (28) |
| | | | | | | 203 (12) |
| | | | | | | 12 (6) |
| | | | | | | 49 (3) |
| | | | | | | 17 (8) |
| | | | | | | 52 (3) |
| | | | | | | 20 (10) |
| | | | | | | 25 (2) |
| | | | | | | 16 (8) |
| | | | | | | 82 (5) |
| | | | | | | 9 (1) |
| | | | | | | 6 (0.5) |
| | | | | | | | 1 (1) |
| Author, Year | Outcomes | Criteria | Age of participants (years old) | Sex of participants | Comorbidity of participants |
|-------------|----------|----------|---------------------------------|--------------------|-----------------------------|
|             |          | Inclusion | Exclusion | Interventions | Comparators | Sex | Interventions | Comparators | Diseases | Interventions (%) | Comparators (%) |
|             |          | confirmation of SARS-CoV-2-infection by quantitative reverse transcript polymerase chain reaction (qRT-PCR). After hospitalization subjects were tested by qRT-PCR to confirm the diagnosis and monitor their course. Beginning 4 March, 2020, anti- SARS- | | | | | | | | | |
| Author, Year | Outcomes | Criteria | Age of participants (years old) | Sex of participants | Comorbidity of participants |
|--------------|----------|----------|--------------------------------|---------------------|-----------------------------|
|              |          | Inclusion | Exclusion | Interventions | Comparators | Sex | Interventions | Comparators | Diseases | Interventions (%) | Comparators (%) |
| Dashti H. (2020) | Dead/alive | CoV-2 IgM and/or IgG antibodies were assayed at Union Hospital and Wuhan Central Hospital by the centers to confirm the diagnosis and to evaluate suspected cases of COVID-19 which were qRT-PCR-negative | - | 78 | 62 | Female | 215 (42.2%) | 1616 (47.5%) | - | - | - |
| Author, Year | Outcomes | Criteria | Age of participants (years old) | Sex of participants | Comorbidity of participants |
|-------------|----------|----------|-------------------------------|---------------------|---------------------------|
|             |          | Inclusion | Exclusion | Interventions | Comparators | Sex | Interventions | Comparators | Diseases | Interventions (%) | Comparators (%) |
| Grechukhina O. | Severe/non-severe | Subjects were identified | - | 30.5 | 30 | Female | 6 (-) | 135(-) | Pregestational Diabetes | 1 | 6 |
| Author, Year | Outcomes | Criteria | Age of participants (years old) | Sex of participants | Comorbidity of participants |
|-------------|----------|----------|-------------------------------|-------------------|---------------------------|
| (2020)      |          | Inclusion | Exclusion | Interventions | Comparators | Sex | Interventions | Comparators | Diseases | Interventions (%) | Comparators (%) |
|             |          | using electronic health record. Ambulatory and inpatients testing was included. All pregnant and postpartum women with positive SARS-CoV-2 reverse transcription polymerase chain reaction test between March 3, 2020, and May 11, 2020, from 3 Yale New Haven | | | | | | | Chronic hypertension | 2 | 12 |
|             |          |          |          | Heart disease | 0 | 7 |
|             |          |          |          | Asthma | 2 | 16 |
| Author, Year | Outcomes | Criteria | Age of participants (years old) | Sex of participants | Comorbidity of participants |
|-------------|----------|----------|-------------------------------|--------------------|----------------------------|
|             |          |          | Inclusion | Exclusion | Interventions | Comparators | Sex | Interventions | Comparators |
| Gu T. (2020) | ICU/non-ICU Dead | Health hospitals. | - | 47 | Male | 138(60.8%) | - | - | - | - | - | - |

We extracted the EHR data for patients tested for COVID-19 at the University of Michigan Medicine Health System, also known as Michigan Medicine (MM), from March 10, 2020 to April 22, 2020. To understand how selection bias factored.
| Author, Year | Outcomes                      | Criteria | Age of participants (years old) | Sex of participants | Comorbidity of participants |
|-------------|-------------------------------|----------|---------------------------------|---------------------|-----------------------------|
|             |                               | Inclusion| Exclusion | Interventions | Comparators | Sex | Interventions | Comparators | Diseases | Interventions (%) | Comparators (%) |
| Guan W (2020) | Severe/non-severe | The medical records for hospitalized patients and outpatients with Laboratory | - | 52 | 45 | Female | 73 (42.2%) | 386 (41.8%) | Any Chronic obstructive pulmonary disease Diabetes Hypertension Coronary heart | 67 (38.7) | 6 (3.5) | 194 (21.0) |

into our sample, in addition to comparing COVID-19 positive patients with those testing negative, we created two sets of controls from the MM database.
| Author, Year | Outcomes | Criteria                          | Age of participants (years old) | Sex | Interventions | Comparators | Comorbidity of participants | Diseases | Interventions (%) | Comparators (%) |
|-------------|----------|-----------------------------------|---------------------------------|-----|---------------|-------------|-----------------------------|----------|-----------------|-----------------|
| Hu L. (2020) | Severe/non-severe | confirmed COVID-19 were reviewed | - 67 56 | Male | 91 (53.8%) | 75 (49.7%) | disease 4 (2.3) 17 (1.8) | Cirrhosis 66 (38.5) | 3 (2) |
|            |          | We analyzed the initial clinical presentation and baseline laboratory test results, as well as clinical course, of 323 hospitalized patients with | | | | | | Hypertension 33 (19.18) | 39 (25.8) |
|            |          |                                  | | | | | | Diabetes 5 (2.90) | 14 (9.3) |
|            |          |                                  | | | | | | Malignancy 3 (1.74) | 0 (0) |
|            |          |                                  | | | | | | Cerebrovascular disease 3 (1.74) | 4 (2.6) |
|            |          |                                  | | | | | | Chronic obstructive pulmonary disease 6 (1.48) | 0 (0) |
|            |          |                                  | | | | | | Chronic kidney disease 3 (1.74) | 4 (2.6) |
| Author, Year | Outcomes | Criteria | Age of participants (years old) | Sex of participants | Comorbidity of participants |
|--------------|----------|----------|-------------------------------|-------------------|----------------------------|
|              |          | Inclusion | Exclusion | Interventions | Comparators | Interventions | Comparators | Diseases | Interventions (%) | Comparators (%) |
| Huang C (2020) | Severe/non-severe | COVID-19 in Wuhan, to identify risk factors associated with clinical outcomes for improving management guidelines. | - | 49 | Male | 11 (85%) | 19 (68%) | Diabetes mellitus | 1 (8) | 7 (25) |
|               |          |          |          |              |            |              |            | Hypertension     | 2 (15) | 4 (14) |
|               |          |          |          |              |            |              |            | Cardiovascular disease | 3 (23) | 3 (11) |
|               |          |          |          |              |            |              |            | Cerebrovascular disease | 1 (8) | 0 (0.0) |
|               |          |          |          |              |            |              |            | Digestive system disease | 2 (1.16) | 3 (2) |
|               |          |          |          |              |            |              |            | Endocrine system disease | 33 (19.18) | 8 (5.3) |
|               |          |          |          |              |            |              |            | Nervous system disease | 14 (8.14) | 8 (5.3) |
|               |          |          |          |              |            |              |            | Respiratory system disease | 11 (6.40) | 4 (2.6) |
|               |          |          |          |              |            |              |            | Cardiovascular and cerebrovascular disease | 14 (8.14) | 8 (5.3) |
|               |          |          |          |              |            |              |            | Digestive system disease | 11 (6.40) | 4 (2.6) |
|               |          |          |          |              |            |              |            | Endocrine system disease | 5 (2.90) | 5 (3.3) |
|               |          |          |          |              |            |              |            | Nervous system disease | 21 (12.21) | 8 (5.3) |
|               |          |          |          |              |            |              |            | Respiratory system disease | 21 (12.21) | 8 (5.3) |
|               |          |          |          |              |            |              |            | Cardiovascular and cerebrovascular disease | 14 (8.14) | 8 (5.3) |
|               |          |          |          |              |            |              |            | Digestive system disease | 11 (6.40) | 4 (2.6) |
|               |          |          |          |              |            |              |            | Endocrine system disease | 5 (2.90) | 5 (3.3) |
|               |          |          |          |              |            |              |            | Nervous system disease | 21 (12.21) | 8 (5.3) |
|               |          |          |          |              |            |              |            | Respiratory system disease | 21 (12.21) | 8 (5.3) |

COVID-19 in Wuhan, to identify risk factors associated with clinical outcomes for improving management guidelines.
| Author, Year | Outcomes | Criteria | Age of participants (years old) | Sex of participants | Comorbidity of participants |
|--------------|----------|----------|-------------------------------|---------------------|-----------------------------|
|              |          | Inclusion | Exclusion | Interventions | Comparators | Interventions | Comparators | Diseases | Interventions (%) | Comparators (%) |
| Kalligeros M. (2020) | ICU/non-ICU | All consecutive adult (≥18 years old) patients who had a laboratory-confirmed (using a reverse transcriptase–polymerase chain reaction assay) SARS-CoV-2 infection and Infection confirmed by real-time RT-PCR and next generation sequencing. | - | 61.5 | 57 | Male | 29 (65.9%) | 34 (57.6%) | Chronic liver disease | 0 (0.0) | 0 (0.0) | 1 (4) | 1 (4) |
|              |          |          |          |              |             |              |              | Cancer | 6 (13.6) |          |          | 3 (5.0) |          |
|              |          |          |          |              |             |              |              | Chronic renal | 4 (9.1) |          | 7 (11.8) |          |
|              |          |          |          |              |             |              |              | Cirrhosis | 0 (0) |          | 3 (5.0) |          |
|              |          |          |          |              |             |              |              | Diabetes | 21 (47.7) |          |          | 17 (28.8) |          |
|              |          |          |          |              |             |              |              | Heart disease | 14 (31.8) |          | 11 (18.6) |          |
|              |          |          |          |              |             |              |              | Hypertension | 31 (70.4) |          | 35 (59.3) |          |
|              |          |          |          |              |             |              |              | Lung disease | 11 (25.0) |          | 9 (15.2) |          |
|              |          |          |          |              |             |              |              | Transplant | 1 (2.2) |          | 1 (1.6) |          |
| Author, Year | Outcomes | Criteria | Age of participants (years old) | Sex of participants | Comorbidity of participants |
|-------------|----------|----------|---------------------------------|---------------------|----------------------------|
|             |          | Inclusion | Exclusion | Interventions | Comparators | Sex | Interventions | Comparators | Diseases | Interventions (%) | Comparators (%) |
| Kim E.S. (2020) | Severe/non-severe | who were admitted to Rhode Island Hospital, The Miriam Hospital, or Newport Hospital in Rhode Island between February 17 and April 5, 2020, were considered eligible for inclusion | - | 42.6±13.4 | Male | 15 (53.6) | Diabetes mellitus without complication | 2 (7.1) |
|             |          |          |                      |                      |              |     | Asthma |                      |          |
|             |          |          |                      |                      |              |     | Liver disease, mild Malignancy |          | 1 (3.6) |

28 hospitalized patients with confirmed COVID-19. All cases
| Author, Year | Outcomes | Criteria | Age of participants (years old) | Sex of participants | Comorbidity of participants |
|-------------|----------|----------|---------------------------------|---------------------|-----------------------------|
|             |          | Inclusion | Exclusion | Interventions | Comparators | Sex | Interventions | Comparators | Diseases | Interventions (%) | Comparators (%) |
| Kishaba T. (2020) | Dead/alive | confirmed by real-time polymerase chain reaction. | - | 75 | 73 | Male | 2 | 3 | - | - | - |
| Klang E. (2020) | Dead/alive | Data from critical COVID-19 pneumonia patients at the Okinawa Chubu Hospital who required mechanical ventilation were used. | - | \( \leq 50 \) | | Male | 45 (75.0%) | 352 (68.8%) | Coronary artery disease Heart failure Hypertension | 6 (10) | 10 (16.7) | 24 (40.0) | 26 (5.1) | 25 (4.9) | 151 (29.5) |
| Author, Year | Outcomes | Criteria | Age of participants (years old) | Sex of participants | Comorbidity of participants |
|-------------|----------|----------|---------------------------------|---------------------|--------------------------|
| Langer-Gould A. (2020) | Dead/alive | Patients treated with tocilizumab or anakinra were confirmed by electronic databases. | Patients were excluded if they received tocilizumab or | 61.9 | 58.1 | Male | 27 (81.8) | 37 (77.1) | Diabetes 24 (40.0) | Hyperlipidemia 11 (18.3) | Chronic kidney disease 17 (28.3) | Cancer 9 (15.0) | Obesity 19 | Diabetes 18 | Hypertension 26 | Asthma/COPD 2 | 36 | 27 | 32 | 7 |
| Author, Year | Outcomes      | Criteria                                                                 | Age of participants (years old) | Sex of participants | Comorbidity of participants |
|--------------|---------------|--------------------------------------------------------------------------|---------------------------------|---------------------|-----------------------------|
| Li X. (2020) | Severe/non-severe | COVID19-CS was defined clinically by increasing O2 requirements and bilateral infiltrates on chest X-ray or CT. anakinra for other indication, the dose and/or duration of treatment were not inadequate and not related to adverse even. | Sex | Interventions | Comparators | Diseases | Interventions (%) | Comparators (%) |
|              |               |                                                                          | Interventions | Comparators |       | Diseases | Interventions (%) | Comparators (%) |
|              |               |                                                                          | 65            | 56         | Male | 153 (56.9%) | 126 (45.2%) | Chronic obstructive pulmonary disease | 13 (4.8) | 4 (1.4) |
|              |               |                                                                          |               |            |      |            |                | Asthma | 3 (1.1) | 2 (0.7) |
|              |               |                                                                          |               |            |      |            |                | Tuberculosis | 4 (1.5) | 5 (1.8) |
|              |               |                                                                          |               |            |      |            |                | Diabetes mellitus | 52 (19.3) | 31 (11.1) |
|              |               |                                                                          |               |            |      |            |                | Hypertension | 104 (38.7) | 62 (22.2) |
|              |               |                                                                          |               |            |      |            |                | Coronary heart | 28 (10.4) | 6 (2.2) |
| Author, Year | Outcomes | Criteria | Age of participants (years old) | Sex of participants | Comorbidity of participants |
|-------------|----------|----------|----------------|-------------------|--------------------------|
| Li YK. (2020) | Severe/non-severe | guidance and the diagnostic and treatment guideline for COVID-19 by the Chinese National Health Committee. (version 5) | 25 cases of COVID-19 (including; 13 hospitalized patients and 12 health care staff) were enrolled in the study. All of them had traceable positive | Male | 6 (66.67%) 6 (37.5%) |
| | | | - 51 | | Diseases | Interventions (%) | Comparators (%) |
| | | | | | Hypertension | 1 (1.1) |
| | | | | | Diabetes | 1 (1.1) |
| | | | | | | 1 (4.0) |
| | | | | | Chronic obstructive pulmonary disease | 4 (2.2) |
| | | | | | Coronary heart disease | 4 (1.4) |
| | | | | | Tumor | 14 (5.5) |
| | | | | | | 10 (3.9) |
| | Dead/alive | | | | Hypertension | 1 (1.0) |
| | | | | | Diabetes | 1 (1.0) |
| | | | | | | 0 (0.0) |
| Author, Year | Outcomes | Criteria                      | Age of participants (years old) | Sex of participants | Comorbidity of participants |
|-------------|----------|-------------------------------|---------------------------------|---------------------|----------------------------|
|             |          | Inclusion | Exclusion | Interventions | Comparators | Sex | Interventions | Comparators | Diseases                               | Interventions (%) | Comparators (%) |
|             |          |           |           |              |             |     |              |             | Chronic obstructive pulmonary disease  | 3 | 2 |
|             |          |           |           |              |             |     |              |             | Coronary heart disease                  | 1 | 3 |
| Liu D. (2020) | Dead/alive | -         | 72        | 61           | Female | 31 (37.3) | 243 (47.6) | Hypertension                             | 8 (9.8) | 79 (15.5) |
|             |          |           |           |              |             |     |              |             | Diabetes                                | 8 (9.8) | 49 (9.6) |
|             |          |           |           |              |             |     |              |             | Chronic heart disease                   | 9 (11.0) | 61 (12.0) |
|             |          |           |           |              |             |     |              |             | Chronic lung disease                    | 3 (3.7) | 22 (4.3) |
|             |          |           |           |              |             |     |              |             | Cerebrovascular disease                 | 2 (2.4) | 13 (2.5) |
|             |          |           |           |              |             |     |              |             | Chronic kidney disease                  | 2 (2.4) | 0 (0) |
|             |          |           |           |              |             |     |              |             | Chronic liver disease                   | 14 (2.4) | 11 (2.2) |
|             |          |           |           |              |             |     |              |             | Chronic respiratory disease             | 1 (1.2) | 11 (2.2) |

We carefully monitored reports of patients infected with COVID-19 on Weibo between January 20 and February 15, 2020, and confirmed case by the follow up.
| Author, Year | Outcomes | Criteria | Age of participants (years old) | Sex of participants | Comorbidity of participants |
|--------------|----------|----------|---------------------------------|--------------------|---------------------------|
|              |          | Inclusion | Exclusion | Interventions | Comparators | Interventions | Comparators | Diseases | Interventions (%) | Comparators (%) |
| Liu J. (2020) | Severe/non-severe | telephone call. 1 month later, we checked the clinical outcomes of patients and other acquired information. Only patients who had a defined outcome (died or recovered) were included in the study. | - | 59.7±10.1 | 43.2±13.9 | Male | 7 (53.8%) | 8 (29.6%) | Cancer | 1 (1.2) | 16 (3.1) |
| Author, Year | Outcomes       | Criteria                                                                 | Inclusion | Exclusion | Interventions | Comparators | Sex | Interventions | Comparators | Diseases                                                                 |
|--------------|----------------|---------------------------------------------------------------------------|-----------|-----------|---------------|-------------|-----|---------------|-------------|---------------------------------------------------------------------------|
| Monteiro A.C. (2020) | Severe/non-severe | Hospitalized patients at RR-UCLA and SM-UCLA > 18 years old with positive SARS-CoV-2 PCR testing from either nasal swab or mini-bronchoalveolar lavage (BAL) testing were included. Data for patients who tested positive for SARS-CoV-2 was manually | -         |           | 58            | 64          | Male | 19 (68%)      | 55 (65%)     | Obesity (17 (61%)) hypertension (17 (61%)) diabetes (19 (68%)) coronary artery disease (2 (7%)) cancer (2 (7%)) asthma (4 (14%)) atrial fibrillation (1 (4%)) chronic kidney disease (3 (11%)) transplant recipient (1 (4%)) |
| Author, Year | Outcomes | Criteria | Age of participants (years old) | Sex of participants | Comorbidity of participants |
|-------------|---------|----------|--------------------------------|---------------------|---------------------------|
|             |         | Inclusion | Exclusion | Interventions | Comparators | Sex | Interventions | Comparators | Diseases | Interventions (%) | Comparators (%) |
|             |         | extracted from the electronic health record and included in a database. | | | | Male | 25015 (65.3%) | 153137 (52.3%) | Hypertension | 16,409 (42.8) | 49,761 (17.0) |
| Parra-Bracamonte G. M. (2020) | Dead/alive | Information from 475 monitoring units all along the country from the public and private health sectors. Positive cases were extracted and edited. Data from 331,298 patients diagnosed positively to | - | - | | | | | Obesity | 9504 (24.8) | 53,955 (18.4) |
| | | | | | | | | | Diabetes | 14,295 (37.3) | 39,417 (13.5) |
| | | | | | | | | | Cardiopathy | 2037 (5.3) | 5314 (1.8) |
| | | | | | | | | | Chronic obstructive pulmonary disease | 1839 (4.8) | 3619 (1.2) |
| | | | | | | | | | Asthma | 777 (2.0) | | |
| | | | | | | | | | Immunosuppressed Chronic kidney disease | 1061 (2.8) | | |
| | | | | | | | | | | | 8206 (2.8) | 4307 (1.5) |
| Author, Year | Outcomes | Criteria | Age of participants (years old) | Sex of participants | Comorbidity of participants |
|-------------|----------|----------|-------------------------------|-------------------|---------------------------|
| Shir Y. (2020) | Severe/non-severe | COVID-19, from the first positive case registered on January 13 to July 17, 2020 (database accessed in July 18, 2020), were analyzed | 487 patients in Zhejiang Province of China were reviewed medical records, laboratory findings, and pulmonary CT scan with | 56 | 45 | Male | 36 (73.5%) | 223 (50.9%) | Hypertension 26 (53.1) | Diabetes 7 (14.3) | Cardiovascular disease 4 (8.2) | Malignancy 2 (4.1) | Chronic liver disease 2 (4.1) | Chronic renal disease 2 (4.1) | Others 5 (10.2) | 73 (16.7) | 22 (5.0) | 7 (1.6) | 3 (0.7) | 20 (4.6) | 5 (1.1) | 27 (6.1) |
| Author, Year | Outcomes       | Criteria      | Age of participants (years old) | Sex of participants | Comorbidity of participants |
|-------------|----------------|---------------|---------------------------------|---------------------|----------------------------|
|             | Inclusion      | Exclusion     | Interventions                  | Comparators         | Diseases                   |
| Sun DW. (2020) | Severe/non-severe | Patients included in this study were 2019-nCoV positive based on nucleic acid detection, from the intensive care unit (ICU) of Tongji hospital affiliated to Huazhong University of Science and Technology. The primary cohort included 45 | -                  | 67 61                     | Male 24 (53.33%) Comparators 5 (41.67%) |
| Author, Year | Outcomes | Criteria | Age of participants (years old) | Sex of participants | Comorbidity of participants |
|-------------|----------|----------|--------------------------------|--------------------|---------------------------|
|             |          | Inclusion | Exclusion | Interventions | Comparators | Sex | Interventions | Comparators | Diseases | Interventions (%) | Comparators (%) |
|             | cases of severe type, who were admitted by our assisting team initially on 10th Feb 2020, serving as study group. 12 cases of no-severe type were admitted into this first-aiding hospital by our team on 8th Mar 2020, serving as control group. | - | 82 | 63 | Male | 222 | (68.7%) | 882 | (54%) | Chronic Heart Disease | 132 | (41.2) | 283 | (17.8) |
| Torres-Macho J. | Dead/alive | The study population | | | | | |
|             | | | | | | | | | | | | | | |
| Author, Year | Outcomes | Criteria | Age of participants (years old) | Sex of participants | Comorbidity of participants |
|-------------|----------|----------|---------------------------------|--------------------|---------------------------|
| (2020)      |          | Inclusion | Exclusion | Interventions | Comparators | Sex | Interventions | Comparators | Diseases | Interventions (%) | Comparators (%) |
|             |          |           |           |               |              |     |               |              |          |                      |                |
|             |          | comprised all patients admitted to hospital with a confirmed diagnosis of COVID-19 based on a positive result in the SARS-CoV-2 reverse transcriptase-polymerase chain reaction assay between 2nd March and 31st May 2020. Samples were obtained via nasopharyngeal swabs. |          |              |              |     |               |              |          |                      |                |
|             |          |           |           |               |              |     |               |              |          | Hypertension       | 226 (70.6)     | 765 (48)     |
|             |          |           |           |               |              |     |               |              |          | Chronic           | 69 (21.8)      | 169 (10.7)    |
|             |          |           |           |               |              |     |               |              |          | Pulmonary Disease  | 18 (5.6)       | 138 (8.7)     |
|             |          |           |           |               |              |     |               |              |          | Asthma             | 42 (13.2)      | 68 (4.3)      |
|             |          |           |           |               |              |     |               |              |          | Stage 4 Chronic Kidney Disease | 13 (4) | 21 (1.3) |
|             |          |           |           |               |              |     |               |              |          | Liver Cirrhosis    | 9 (2.8)        | 22 (1.4)      |
|             |          |           |           |               |              |     |               |              |          | Solid Neoplasm (Active) | 39 (12.3)      | 42 (2.6)      |
|             |          |           |           |               |              |     |               |              |          | Hematologic Neoplasm (Active) | 13 (4) |                |
|             |          |           |           |               |              |     |               |              |          | HIV Infection      | 11 (0.7)       |                |
|             |          |           |           |               |              |     |               |              |          | Obesity            | 0 (0)          |                |
|             |          |           |           |               |              |     |               |              |          | Diabetes           | 45 (17.3)      | 239 (17.8)    |
|             |          |           |           |               |              |     |               |              |          | Dyslipidemia       | 99 (31)        | 337 (21.2)    |
|             |          |           |           |               |              |     |               |              |          | Inflammatory Disease | 97 (53.6)    | 347 (33.8)    |
|             |          |           |           |               |              |     |               |              |          | Dementia           | 25 (7.8)       | 74 (4.7)      |
|             |          |           |           |               |              |     |               |              |          | Malnutrition       | 37 (11.7)      | 71 (4.5)      |
| Author, Year   | Outcomes  | Criteria                                                                 | Sex | Age of participants (years old) | Sex of participants | Comorbidity of participants                                                                 |
|---------------|-----------|---------------------------------------------------------------------------|-----|---------------------------------|--------------------|---------------------------------------------------------------------------------------------|
| Wang R. (2020)| Severe/non-severe | Patients who were diagnosed with COVID-19 at No.2 hospital were enrolled in the study. These patients confirmed by a positive result for real-time RT-PCR in the respiratory tract samples. | Male | 49.40±13.6 4 | 39.47±14.8 4 | Cardiovascular disease 18 (14.4)  
Digestive system disease 8 (6.4)  
Endocrine system disease 10 (8.0)  
Rheumatic immune disease 1 (0.8)  
Respiratory system disease 2 (1.6)  
Hematological system disease 1 (0.8)  
Nervous system disease 1 (0.8)  
Malignant tumor 1 (0.8)  
HIV infection 1 (0.8) |
| Yang X. (2020)| Dead/alive | Patients were diagnosed as SARS-pneumonia, according to WHO interim | Male | 64.6 | 51.9 | Chronic cardiac disease 3 (9)  
Chronic pulmonary disease 2 (6)  
Cerebrovascular disease 7 (22) |

Interventions and Comparators:

**Age of participants**
- Severe: 49.40±13.6 years
- Non-severe: 39.47±14.8 years

**Sex**
- Male: 64% (Severe), 66% (Non-severe)
- Female: 36% (Severe), 34% (Non-severe)

**Comorbidity**
- Cardiovascular disease
- Digestive system disease
- Endocrine system disease
- Rheumatic immune disease
- Respiratory system disease
- Hematological system disease
- Nervous system disease
- Malignant tumor
- HIV infection

**Interventions (%):**
- Cardiovascular disease: 18 (14.4%)
- Digestive system disease: 8 (6.4%)
- Endocrine system disease: 10 (8.0%)
- Rheumatic immune disease: 1 (0.8%)
- Respiratory system disease: 2 (1.6%)
- Hematological system disease: 1 (0.8%)
- Nervous system disease: 1 (0.8%)
- Malignant tumor: 1 (0.8%)
- HIV infection: 1 (0.8%)
| Author, Year | Outcomes | Criteria | Age of participants (years old) | Sex of participants | Comorbidity of participants |
|-------------|---------|----------|-------------------------------|-------------------|---------------------------|
|             |         | Inclusion | Exclusion | Interventions | Comparators | Interventions | Comparators | Diseases | Interventions (%) | Comparators (%) |
|             |         |           |           | Sex |                          |                          |                          | Diabetes | 7 (22) | 2 (10) |
|             |         |           |           |     |                          |                          |                          | Malignancy | 1 (3) | 1 (5) |
|             |         |           |           |     |                          |                          |                          | Dementia | 1 (3) | 0 |
|             |         |           |           |     |                          |                          |                          | Malnutrition | 0 | 0 |
| Yu Q. (2020) | Severe/non-severe | guidance and who were critically ill. | We enrolled patients with laboratory-confirmed COVID-19 in Jiangsu province between 10 January and 18 February 2020. Laboratory confirmation was based on a positive result on high-throughput | We excluded patients aged < 18 years old or with missing clinical or CT records on admission. | 57.2 | 45.0 | Male | 41 (64) | 183 (51) | Hypertension | 20(31) | 50(14) |
|             |         |           |           |     |                          |                          |                          | Coronary heart disease | 4(6) | 3(1) |
|             |         |           |           |     |                          |                          |                          | Cardiac dysfunction | 1(2) | 1(0.3) |
|             |         |           |           |     |                          |                          |                          | III-IV |                          |                          | |
|             |         |           |           |     |                          |                          |                          | Liver dysfunctionb | 1(2) | 1(0.3) |
|             |         |           |           |     |                          |                          |                          | Diabetes | 9(14) | 17(5) |
|             |         |           |           |     |                          |                          |                          | Chronic kidney disease | 1(2) | 3(2) |
|             |         |           |           |     |                          |                          |                          | Malignant tumor | 1(2) | 4(1) |
|             |         |           |           |     |                          |                          |                          | Stoke | 1(2) | 2(0.6) |
| Author, Year | Outcomes | Criteria | Age of participants (years old) | Sex of participants | Comorbidity of participants |
|--------------|----------|----------|---------------------------------|---------------------|-----------------------------|
|              |          | Inclusion | Exclusion | Interventions | Comparators | Sex | Interventions | Comparators | Diseases | Interventions (%) | Comparators (%) |
| Yu T. (2020) | Severe/non-severe | sequencing or real-time reverse transcriptase–polymerase–chain-reaction (RT-PCR) assay of nasal and pharyngeal swab specimens. | 95 infected COVID-19 were enrolled. Diagnostic standard was polymerase chain reaction detection of target genes 2019 n-CoV. | - | 45.92 | 35.73 | Male | 14 (58.3) | 39 (54.9) | - | - | - |
| Author, Year | Outcomes | Criteria | Age of participants (years old) | Sex of participants | Comorbidity of participants |
|-------------|----------|----------|--------------------------------|---------------------|----------------------------|
|             |          | Inclusion | Exclusion | Interventions | Comparators | Sex | Interventions | Comparators | Diseases | Interventions (%) | Comparators (%) |
| Zhan T. (2020) | Severe/non-severe | Clinical, laboratories, radiologic results, and treatment outcomes data were obtained. | - | 64 | 52 | Male | 73 (49.3%) | 113 (43.9%) | - | - | - |
| Author, Year | Outcomes | Criteria | Age of participants (years old) | Sex of participants | Comorbidity of participants |
|-------------|----------|----------|-------------------------------|-------------------|---------------------------|
|             |          | Inclusion | Exclusion | Interventions | Comparators | Sex | Interventions | Comparators | Diseases | Interventions (%) | Comparators (%) |
| Zhang JJ.   | Severe/non- | All 242   | Patients | 64 | 51.5 | Male | 33 (56.9%) | 38 (46.3%) | Hypertension | 22 (37.9) | 20 (24.4) |

19) from 12 January to 8 March 2020 and diagnosed with COVID-19 according to a positive result of high-throughput sequencing or real-time reverse-transcriptase polymerase chain reaction assay using nasal or pharyngeal swab specimens.
| Author, Year | Outcomes | Criteria | Age of participants (years old) | Sex | Interventions | Comparators | Comorbidity of participants | Diseases | Interventions (%) | Comparators (%) |
|-------------|----------|----------|--------------------------------|-----|--------------|------------|--------------------------|---------|------------------|----------------|
| (2020)      | severe   |          |                                |     |              |            |                          |         |                  |                |
|             |          | hospitalized patients in a hospital of Wuhan, clinically diagnosed as “viral pneumonia” based on their clinical symptoms with typical changes in chest radiology and were living in Wuhan during the outbreak period of COVID-19. | | | | | | |                  |                |
|             |          | absent of or with negative SARS-CoV-2 test results were excluded from this study. | | | | | | |                  |                |
|             |          | Diabetes | 8 (13.8)                       | 9 (11.0) | 4 (6.9) | 4 (5.0) |                          |         |                  |                |
|             |          | Fatty liver and abnormal liver function | 2 (3.4) | 5 (6.1) | 4 (6.9) | 3 (3.7) |                          |         |                  |                |
|             |          | Chronic gastritis and gastric ulcer disease | 4 (6.9) |                  |        |              |                          |         |                  |                |
|             |          | Coronary heart disease | 4 (6.9) |                  |        |              |                          |         |                  |                |
|             |          | Hyperlipidemia | 2 (3.4) | 5 (6.1) | 4 (6.9) | 2 (2.4) |                          |         |                  |                |
|             |          | Cholelithiasis | 4 (6.9) |                  |        |              |                          |         |                  |                |
|             |          | Arrhythmia | 4 (6.9) |                  |        |              |                          |         |                  |                |
|             |          | Thyroid disease | 4 (6.9) |                  |        |              |                          |         |                  |                |
|             |          | Electrolyte imbalance | 4 (6.9) |                  |        |              |                          |         |                  |                |
|             |          | Urolithiasis | 1 (1.7) | 2 (2.4) |        |              |                          |         |                  |                |
|             |          | Stroke | 2 (3.4) |                  |        |              |                          |         |                  |                |
|             |          | Chronic renal insufficiency | 2 (3.4) |                  |        |              |                          |         |                  |                |
|             |          | Aorta sclerosis | 1 (1.7) |                  |        |              |                          |         |                  |                |
|             |          | Secondary pulmonary tuberculosis | 2 (3.4) |                  |        |              |                          |         |                  |                |
| Author, Year | Outcomes | Criteria | Age of participants (years old) | Sex of participants | Comorbidity of participants |
|-------------|----------|----------|---------------------------------|---------------------|----------------------------|
|             |          | Inclusion | Exclusion | Interventions | Comparators | Sex | Interventions | Comparators | Diseases | Interventions (%) | Comparators (%) |
|             |          |           |           |              |            |     |              |            | Chronic obstructive pulmonary disease |                      |              |
|             |          |           |           |              |            |     |              |            | 2 (3.4) |                      | 0                      |
| Zhao Z. (2020) | Severe/non-severe | Hospitalized patients who were diagnosed by positive RT-PCR for SARS-CoV-2 were included in this study. | Patients who were still hospitalized because their outcomes unknown at the time, thus risking grouping them incorrectly. Patients who were younger than 18 | 60 | 58 | Male | 136 (69.7%) | 222 (55.8%) | Diabetes | 58 (29.7) | 96 (49.2) |
|             |          |           |           |              |            |     |              |            | Hypertension | 16 (8.2) | 25 (6.3) |
|             |          |           |           |              |            |     |              |            | Asthma | 11 (5.6) | 25 (6.3) |
|             |          |           |           |              |            |     |              |            | COPD | 22 (11.3) | 46 (11.6) |
|             |          |           |           |              |            |     |              |            | Coronary artery disease |                      |              |
|             |          |           |           |              |            |     |              |            | Heart failure | 10 (5.1) | 10 (2.5) |
|             |          |           |           |              |            |     |              |            | Cancer | 9 (4.6) | 25 (6.3) |
|             |          |           |           |              |            |     |              |            | Immunosuppression |                      |              |
|             |          |           |           |              |            |     |              |            | Chronic Kidney disease | 16 (8.2) | 28 (7.1) |
|             |          |           |           |              |            |     |              |            | Dead/alive | 77 | 58 | Male | 53 (64.6%) | 222 (55.8%) | Diabetes | 25 (30.5) | 52 (63.4) |
|             |          |           |           |              |            |     |              |            | Hypertension | 3 (3.7) | 170 (42.7) |
|             |          |           |           |              |            |     |              |            | Asthma | 15 (18.3) | 25 (6.3) |
|             |          |           |           |              |            |     |              |            | COPD | 25 (30.5) | 46 (11.6) |
|             |          |           |           |              |            |     |              |            | Coronary artery disease |                      |              |
| Author, Year | Outcomes | Criteria | Age of participants (years old) | Sex of participants | Comorbidity of participants |
|----|----|----|----|----|----|
| Zheng Y. (2020) | Severe/non-severe | 73 patients diagnosed with COVID-19 in Taihe hospital were identified as the research subjects. Epidemiological history, clinical manifestation, imaging | years of age, and those with incomplete past medical history were also excluded. | 43 | Heart failure (22 (26.8)), Cancer (7 (8.5)), Immunosuppression (8 (9.8)), Chronic Kidney disease (14 (17.1)) |
| | | | | | Cardiovascular disease (12 (16.4)), Endocrine disease (4 (5.5)), Respiratory disease (4 (5.5)), Digestive system disease (3 (4.1)), Malignant tumor (1 (1.4)), Other (8 (11.0)) |
| Author, Year | Outcomes | Criteria | Age of participants (years old) | Sex of participants | Comorbidity of participants |
|-------------|----------|---------|---------------------------------|---------------------|-----------------------------|
|              |          | Inclusion | Exclusion | Interventions | Comparators | Sex | Interventions | Comparators | Diseases | Interventions (%) | Comparators (%) |
| Zhou F. (2020) | Dead/alive | detection and Q-PCR of the respiratory specimens as tools to confirm positive cases. | - | 69 | 52 | Male | 38 (70%) | 81 (59%) | Hypertension | 26 (48) | 2 (1) |
|              |          |          |          |              |              |     |              |              | Diabetes mellitus | 17 (31) | 19 (14) |
|              |          |          |          |              |              |     |              |              | Coronary heart disease | 13 (24) | 2 (1) |
|              |          |          |          |              |              |     |              |              | Chronic obstructive pulmonary disease | 4 (7) | 2 (1) |
|              |          |          |          |              |              |     |              |              | Carcinoma | 0 (0.0) | 2 (1) |
|              |          |          |          |              |              |     |              |              | Chronic kidney disease | 2 (4) | 0 (0.0) |
|              |          |          |          |              |              |     |              |              | Other | 11 (20) | 11 (8) |
| Zinellu (2020) | Dead/alive | All adult inpatients ≥ 18 years old with laboratory confirmed COVID-19 were enrolled in the study. | - | 79.5 | 68 | Male | 20 (71.4%) | 27 (54%) | Cardiovascular disease | 6 | 40 |
|              |          |          |          |              |              |     |              |              | }
| Author, Year | Outcomes | Criteria | Age of participants (years old) | Sex | Sex of participants | Sex of participants | Comorbidity of participants | Diseases | Interventions (%) | Comparators (%) |
|-------------|----------|----------|----------------------------------|-----|---------------------|---------------------|--------------------------|----------|-------------------|-----------------|
|             |          | Inclusion | Exclusion | Interventions | Comparators | Sex | Interventions | Comparators | Diseases | Interventions (%) | Comparators (%) |
| COVID-19 patients admitted to the Respiratory Disease and Infectious Disease Units of the University Hospital of Sassari and the Pneumology Unit of the Santissima Trinità Hospital of Cagliari, Sardinia, Italy, between 15 March and | | | | | | | | | Respiratory disease | 20 | 62 |
| | | | | | | | | | Kidney disease | 25 | 65 |
| | | | | | | | | | Diabetes | 21 | 62 |
| | | | | | | | | | Cancer | 24 | 65 |
| | | | | | | | | | Autoimmunity | 27 | 72 |
| Author, Year | Outcomes | Criteria | Age of participants (years old) | Sex of participants | Comorbidity of participants |
|-------------|----------|----------|-------------------------------|-------------------|----------------------------|
|             |          | Inclusion | Exclusion | Interventions | Comparators | Sex | Interventions | Comparators | Diseases | Interventions (%) | Comparators (%) |
|             |          | 15 May 2020. COVID-19 was confirmed by reverse transcription-polymerase chain reaction (RT-PCR) in all cases | | | | | |  | | | |
Table S5. Meta-regression analysis of the heterogeneous findings

| Moderator                  | Outcome: Severe          |         | Outcome: Dead          |         |
|----------------------------|--------------------------|---------|------------------------|---------|
|                            | OR  | 95% CI       | p-value | OR  | 95% CI       | p-value |
| Hypertension               | 1.31| 0.48-3.55    | 0.579   | 1.22| 0.67-2.20    | 0.492   |
| Diabetes Mellitus          | 0.55| 0.20-1.53    | 0.232   | 0.99| 0.62-1.60    | 0.973   |
| Age over 65 years          | NA | NA           | NA      | 1.00| 0.57-1.74    | 0.998   |

OR, Odds ratio; 95% CI, 95% confidence interval; NA, not available
*a reference was age less than 65 years
| Reference       | Reason for exclusion               | Reference       | Reason for exclusion               |
|-----------------|-----------------------------------|-----------------|-----------------------------------|
| Abate B.B.      | Other study design                | Münzel T.       | Other study design                |
| Aboham S.I.     | Other study design                | Nasrolahi A.     | Other study design                |
| Aboham S.I.     | Duplicates participants           | Naziroğlu T.    | Other study design                |
| Abrams E.M.     | Other study design                | Onisoyonivosekume D. | Other study design                |
| Acheampong D.O. | Other study design                | Pan J.          | Inappropriate outcomes            |
| Adris M.        | Inappropriate outcomes            | Patanavanich R. | Other study design                |
| Aksu K.         | Inappropriate comparison          | Patell U.       | Other study design                |
| Alguwaihes A.M. | Inappropriate comparison          | Patterson T.J.   | Other study design                |
| Almalki Z.S.    | Inappropriate outcomes            | Pettigrew S.    | Inappropriate outcomes            |
| Alomari S.O.    | Inappropriate outcomes            | Poherino F.     | Inappropriate outcomes            |
| Andrieu-Mondon M.| Other study design                | Popova L.       | Other study design                |
| Balaban Kocas B.| Inappropriate outcomes            | Purkayastha A.  | Inappropriate outcomes            |
| Baldock T.E.    | Other study design                | Radwan N.M.     | Other study design                |
| Barlow P.       | Other study design                | Risso D.        | Inappropriate outcomes            |
| Best J.H.       | Inappropriate comparison          | Rodriguez J.A.  | Other study design                |
| Brendish N.J.   | Inappropriate outcomes            | Rodriguez-Leor O.| Inappropriate comparison          |
| Castillo-López I.Y.| Other study design              | Salah H.M.      | Other study design                |
| Chene G.        | Other study design                | Scholz J.R.     | Other study design                |
| Colaneri M.     | Inappropriate comparison          | Schultze A.     | Inappropriate comparison          |
| Costantino F.   | Inappropriate outcomes            | Seiler N.K.     | Inappropriate comparison          |
| Crisan-Dabija R.| Other study design                | Shahzad Hasan S.| Other study design                |
| Di Lecce V.     | Inappropriate outcomes            | Sharma P.       | Inappropriate outcomes            |
| Di Vincenzo A.  | Other study design                | Shastri M.D.    | Other study design                |
| Dorjee K.       | Other study design                | Shatla M.M.     | Inappropriate outcomes            |
| Dratcu L.       | Other study design                | Shoar S.        | Other study design                |
| Feyaerts A.F.   | Other study design                | Shukla S.D.     | Inappropriate comparison          |
| Fillmore N.R.   | Inappropriate comparison          | Siddiqui K.     | Other study design                |
| Fisman D.N.     | Inappropriate comparison          | Sifat A.E.      | Other study design                |
| Gaiha S.M.      | Inappropriate outcomes            | Simons D.       | Other study design                |
| Reference          | Reason for exclusion       | Reference          | Reason for exclusion       |
|--------------------|----------------------------|--------------------|----------------------------|
| Gallo O.           | Other study design         | Sims O.T.         | Inappropriate outcomes    |
| Gandhi S.A.        | Other study design         | Sinclair R.G.      | Inappropriate comparison  |
| Ghinai I.          | Inappropriate outcomes    | Singh S.          | Other study design         |
| González-Rubio J.  | Other study design         | Soule E.K.        | Inappropriate outcomes    |
| Grover S.          | Other study design         | Streck J.M.       | Inappropriate comparison  |
| Gu T.              | Duplicates participants    | Takagi H.         | Other study design         |
| Gupta A.K.         | Other study design         | Talavera B.       | Inappropriate outcomes    |
| Hashmi S.K.        | Other study design         | Toussie D.        | Inappropriate comparison  |
| He S.              | Inappropriate comparison  | Tran T.V.         | Inappropriate comparison  |
| Holman N.          | Inappropriate comparison  | Tzu-Hsuan Chen D. | Inappropriate outcomes    |
| Horii T.           | Other study design         | Underner M.       | Other study design         |
| Hu J.              | Inappropriate outcomes    | Urigo C.          | Other study design         |
| Ieng S.M.          | Inappropriate comparison  | Uvâis N.A.        | Other study design         |
| Ioannidis J.       | Other study design         | Veldtman G.R.     | Inappropriate outcomes    |
| Islam M.Z.         | Inappropriate comparison  | Vila-Córcoles A.  | Inappropriate comparison  |
| Izquierdo J.L.     | Inappropriate comparison  | Volino-Souza M.   | Inappropriate comparison  |
| Jourdes A.         | Inappropriate comparison  | Vuolo M.          | Inappropriate outcomes    |
| Landoni G.         | Other study design         | Wang Z.           | Inappropriate comparison  |
| Lang A.E.          | Other study design         | Wenzl T.          | Other study design         |
| Lang A.E.          | Other study design         | Xiang J.          | Inappropriate comparison  |
| Li J.              | Other study design         | Xiong G.L.        | Inappropriate outcomes    |
| Liu J.             | Inappropriate outcomes    | Yue L.            | Other study design         |
| Lu J.              | Inappropriate outcomes    | Zajacova A.       | Other study design         |
| Marvisi M.         | Inappropriate comparison  | Zayet S.          | Other study design         |
| McRobbie H.        | Other study design         | Zeng L.           | Other study design         |
| Meini S.           | Inappropriate comparison  | Zhao Q.           | Other study design         |
| Mesas A.E.         | Other study design         | Zhou W.           | Inappropriate outcomes    |
Reference (excluded studies)

1. Abate BB, Kassie AM, Kassaw MW, Aragie TG, Masresha SA. Sex difference in coronavirus disease (COVID-19): a systematic review and meta-analysis. BMJ Open. 2020;10(10):e040129. doi:10.1136/bmjopen-2020-040129

2. Münzel T, Kahad O, Kuntic M, Keaney JF, Deanfield JE, Daiber A. Effects of tobacco cigarettes, e-cigarettes, and waterpipe smoking on endothelial function and clinical outcomes. Eur Heart J. 2020;41(41):4057-4070. doi:10.1093/eurheartj/ehaa460

3. Abohamr SI, Abazid RM, Aldossari MA, et al. Clinical characteristics and in-hospital mortality of COVID-19 adult patients in Saudi Arabia. Saudi Med J. 2020;41(11):1217-1226. doi:10.15537/smj.2020.11.25495

4. Nasrolahi A, Haghani K, Gheyarzadeh A, Bakhtiyari S. Do genetic factors predispose people to COVID-19: A review article. Curr Mol Med. Published online November 2020. doi:10.2174/1566524020999201113102145

5. Abohamr SI, Aldossari MA, Alaklobi FA, et al. Clinical characteristics and in-hospital outcome of medical staff infected with COVID-19 in Saudi Arabia. A retrospective single-center study. Saudi Med J. 2020;41(12):1336-1343. doi:10.15537/smj.2020.12.25514

6. Naziroğlu T, Aksu K. Rare atopy in COVID-19 patients or COVID-19 famine in atopic patients? Dermatol Ther. Published online November 2020. doi:10.1111/dth.14581

7. Abrams EM, Sinha I, Fernandes RM, Hawcutt DB. Pediatric asthma and COVID-19: The known, the unknown, and the controversial. Pediatr Pulmonol. 2020;55(12):3573-3578. doi:10.1002/ppul.25117

8. Onisyonivosekume D, Mahrouseh N, Varga O. Introduction to Health Law. Stud Health Technol Inform. 2020;274:10-18. doi:10.3233/SHTI200660

9. Acheampong DO, Barffour IK, Boye A, Aninagyei E, Ocansey S, Morna MT. Male predisposition to severe COVID-19: Review of evidence and potential therapeutic prospects. Biomed Pharmacother. 2020;131:110748. doi:10.1016/j.biopha.2020.110748

10. Pan J, St Pierre JM, Pickering TA, et al. Coronavirus Disease 2019 (COVID-19): A Modeling Study of Factors Driving Variation in Case Fatality Rate by Country. Int J Environ Res Public Health. 2020;17(21). doi:10.3390/ijerph17218189

11. Adrish M, Chilmuri S, Mantri N, et al. Association of smoking status with outcomes in hospitalised patients with COVID-19. BMJ open Respir Res. 2020;7(1). doi:10.1136/bmjresp-2020-000716

12. Patanavanich R, Glantz SA. The Theoretical Problems Do Not Materially Affect the Results of Our Meta-analysis of Smoking and Covid-19 Disease Progression. Nicotine Tob Res Off J Soc Res Nicotine Tob. Published online November 2020. doi:10.1093/ntr/ntaa250

13. Aksu K, Naziroğlu T, Özkan P. Factors determining COVID-19 pneumonia severity in a country with routine BCG vaccination. Clin Exp Immunol. 2020;202(2):220-225.
14. Patel U, Malik P, Mehta D, et al. Early epidemiological indicators, outcomes, and interventions of COVID-19 pandemic: A systematic review. *J Glob Health*. 2020;10(2):20506. doi:10.7189/jogh.10.020506

15. Alguwaihes AM, Al-Sofiani ME, Megdad M, et al. Diabetes and Covid-19 among hospitalized patients in Saudi Arabia: a single-centre retrospective study. *Cardiovasc Diabetol*. 2020;19(1):205. doi:10.1186/s12933-020-01184-4

16. Patterson TJ, Currie PJ, Beck J, Spence RAJ, Spence GM. A systematic review of viral transmission risk to healthcare staff comparing laparoscopic and open surgery. *Surgeon*. 2020;18(6):e72-e77. doi:10.1016/j.surge.2020.06.016

17. Almalki ZS, Khan MF, Almazrou S, et al. Clinical Characteristics and Outcomes Among COVID-19 Hospitalized Patients with Chronic Conditions: A Retrospective Single-Center Study. *J Multidiscip Healthc*. 2020;13:1089-1097. doi:10.2147/JMDH.S273918

18. Pettigrew S, Jun M, Roberts I, Bullen C, Nallaiah K, Rodgers A. Preferences for Tobacco Cessation Information and Support During Covid-19. *J Addict Med*. 2020;14(6):e362-e365. doi:10.1097/ADM.0000000000000743

19. Alomari SO, Abou-Mrad Z, Bydon A. COVID-19 and the central nervous system. *Clin Neurol Neurosurg*. 2020;198:106116. doi:10.1016/j.clineuro.2020.106116

20. Polverino F, Stern DA, Ruocco G, et al. Comorbidities, Cardiovascular Therapies, and COVID-19 Mortality: A Nationwide, Italian Observational Study (ItaliCO). *Front Cardiovasc Med*. 2020;7:585866. doi:10.3389/fcvm.2020.585866

21. Andreu-Mondon M, Barrio-Gimenez P, Mondon-Vehils S. COVID-19 and restrictions on tobacco use. *Med Clin (Barc)*. Published online November 2020. doi:10.1016/j.medcli.2020.10.008

22. Popova L. Carpe covid: using COVID-19 to communicate about harms of tobacco products. *Tob Control*. Published online November 2020. doi:10.1136/tobaccocontrol-2020-056276

23. Balaban Kocas B, Cetinkal G, Ser OS, et al. The relation between left ventricular global longitudinal strain and troponin levels in patients hospitalized with COVID-19 pneumonia. *Int J Cardiovasc Imaging*. Published online November 2020:1-9. doi:10.1007/s10554-020-02102-1

24. Purkayastha A, Sen C, Garcia GJ, et al. Direct Exposure to SARS-CoV-2 and Cigarette Smoke Increases Infection Severity and Alters the Stem Cell-Derived Airway Repair Response. *Cell Stem Cell*. 2020;27(6):869-875.e4. doi:10.1016/j.stem.2020.11.010

25. Baldock TE, Bolam SM, Gao R, et al. Infection prevention measures for orthopaedic departments during the COVID-2019 pandemic: a review of current evidence. *Bone Jt open*. 2020;1(4):74-79. doi:10.1302/2633-1462.14.BJO-2020-0018.R1

26. Radwan NM, Mahmoud NE, Alfaifi AH, Alabulkareem KI. Comorbidities and severity of coronavirus disease 2019 patients. *Saudi Med J*. 2020;41(11):1165-1174.
27. Barlow P. COVID-19, Trade, and Health: This Changes Everything? Comment on “What Generates Attention to Health in Trade Policy-Making? Lessons From Success in Tobacco Control and Access to Medicines: A Qualitative Study of Australia and the (Comprehensive and Prog. Int J Heal policy Manag. Published online November 2020. doi:10.34172/ijhpm.2020.220

28. Risso D, Drayna D, Morini G. Alteration, Reduction and Taste Loss: Main Causes and Potential Implications on Dietary Habits. Nutrients. 2020;12(11). doi:10.3390/nu12113284

29. Best JH, Mohan S V, Kong AM, et al. Baseline Demographics and Clinical Characteristics Among 3471 US Patients Hospitalized with COVID-19 and Pulmonary Involvement: A Retrospective Study. Adv Ther. 2020;37(12):4981-4995. doi:10.1007/s12325-020-01510-y

30. Rodriguez JA, Roa AA, Lemos-Ramirez JC. E-Cigarette or Vaping Product Use-Associated Lung Injury (EVALI) Mimicking COVID-19 Disease. Case Rep Pulmonol. 2020;2020:8821289. doi:10.1155/2020/8821289

31. Brendish NJ, Poole S, Naidu V V, et al. Clinical characteristics, symptoms and outcomes of 1054 adults presenting to hospital with suspected COVID-19: A comparison of patients with and without SARS-CoV-2 infection. J Infect. 2020;81(6):937-943. doi:10.1016/j.jinf.2020.09.033

32. Rodriguez-Leor O, Cid Alvarez AB, de Prado AP, et al. In-hospital outcomes of patients with ST-segment elevation myocardial infarction and COVID-19. EuroIntervention. J Eur Collab with Work Gr Interv Cardiol Eur Soc Cardiol. Published online November 2020. doi:10.4244/EIJ-D-20-00935

33. Castillo-López IY, Govea-Camacho LH, Rodríguez-Torres IA, Recio-Macías DA, Alobid I, Mullol J. Olfactory Dysfunction in a Mexican Population Outside of COVID-19 Pandemic: Prevalence and Associated Factors (the OLFAMEX Study). Curr Allergy Asthma Rep. 2020;20(12):78. doi:10.1007/s11882-020-00975-9

34. Salah HM, Sharma T, Mehta J. Smoking Doubles the Mortality Risk in COVID-19: A Meta-Analysis of Recent Reports and Potential Mechanisms. Cureus. 2020;12(10):e10837. doi:10.7759/cureus.10837

35. Chene G, Bouvet L, Cerruto E, Nohuz E. How can we minimize the potential risk of viral contamination during laparoscopic procedures for suspected or infected COVID-19 patients? Eur J Obstet Gynecol Reprod Biol. 2020;255:63-66. doi:10.1016/j.ejogrb.2020.10.011

36. Scholz JR, Lopes MACQ, Saraiva JFK, Colombo FC. COVID-19, Renin-Angiotensin System, Angiotensin-Converting Enzyme 2, and Nicotine: What is the Interrelation? Arq Bras Cardiol. 2020;115(4):708-711. doi:10.36660/abc.20200653

37. Colaneri M, Novelli V, Cutti S, et al. The experience of the health care workers of a severely hit SARS-CoV-2 referral Hospital in Italy: incidence, clinical course and modifiable risk factors for COVID-19 infection. J Public Health (Oxf). Published online November 2020. doi:10.1093/pubmed/fdaa195
38. Schultze A, Walker AJ, MacKenna B, et al. Risk of COVID-19-related death among patients with chronic obstructive pulmonary disease or asthma prescribed inhaled corticosteroids: an observational cohort study using the OpenSAFELY platform. *Lancet Respir Med*. 2020;8(11):1106-1120. doi:10.1016/S2213-2600(20)30415-X

39. Costantino F, Bahier L, Tarancón LC, et al. COVID-19 in French patients with chronic inflammatory rheumatic diseases: clinical features, risk factors and treatment adherence. *Jt bone spine*. Published online November 2020;105095. doi:10.1016/j.jbspin.2020.105095

40. Seiler NK, Swamy R, Xiao J, Yun Y. Tobacco smoking cessation in mental health services during the COVID-19 pandemic. *J Addict Dis*. 2020;38(4):582-584. doi:10.1080/10550887.2020.1791379

41. Crisan-Dabija R, Pavel CA, Popa IV, Taras U, Burlacu A. “A Chain Only as Strong as Its Weakest Link”: An Up-to-Date Literature Review on the Bidirectional Interaction of Pulmonary Fibrosis and COVID-19. *J Proteome Res*. 2020;19(11):4327-4338. doi:10.1021/acs.jproteome.0c00387

42. Shahzad Hasan S, Kow CS, Ahmadi K. Smoking Cessation Amid the Coronavirus 2019 Pandemic: Making Every Contact Count. *Chronic Obstr Pulm Dis (Miami, Fla)*. 2020;7(4):300-302. doi:10.15326/jcopdf.7.4.2020.0171

43. Di Lecce V, Carpagnano GE, Pierucci P, et al. Baseline characteristics and outcomes of COVID-19 patients admitted to a Respiratory Intensive Care Unit (RICU) in Southern Italy. *Multidiscip Respir Med*. 2020;15(1):704. doi:10.4081/mrm.2020.704

44. Sharma P, Ebbert JO, Rosedahl JK, Philpot LM. Changes in substance use among young adults during a respiratory disease pandemic. *SAGE open Med*. 2020;8:2050312120965321. doi:10.1177/2050312120965321

45. Di Vincenzo A, Vettor R, Rossato M. COVID-19 and smoking habits: a smoky situation! *Monaldi Arch chest Dis = Arch Monaldi per le Mal del torace*. 2020;90(4). doi:10.4081/monaldi.2020.1539

46. Shastrī MD, Shukla SD, Chong WC, et al. Smoking and COVID-19: What we know so far. *Respir Med*. 2020;176:106237. doi:10.1016/j.rmed.2020.106237

47. Dorjee K, Kim H, Bonomo E, Dolma R. Prevalence and predictors of death and severe disease in patients hospitalized due to COVID-19: A comprehensive systematic review and meta-analysis of 77 studies and 38,000 patients. *PLoS One*. 2020;15(12):e0243191. doi:10.1371/journal.pone.0243191

48. Shatla MM, Khafagy AA, Bulkhi AA, Aljahdali IA. Public Concerns and Mental Health Changes Related to the COVID-19 Pandemic Lockdown in Saudi Arabia. *Clin Lab*. 2020;66(10). doi:10.7754/Clin.Lab.2020.200614

49. Dratcu L, Boland X. Does Nicotine Prevent Cytokine Storms in COVID-19? *Cureus*. 2020;12(10):e11220. doi:10.7759/cureus.11220

50. Shoar S, Hosseini F, Naderan M, Mehta JL. Meta-analysis of Cardiovascular Events and Related Biomarkers Comparing Survivors Versus Non-survivors in Patients With COVID-19. *Am J Cardiol*. 2020;135:50-61. doi:10.1016/j.amjcard.2020.08.044
51. Feyaerts AF, Luyten W. Vitamin C as prophylaxis and adjunctive medical treatment for COVID-19? *Nutrition*. 2020;79-80:110948. doi:10.1016/j.nut.2020.110948

52. Shukla SD, O’Toole RF. Exposure to bushfire and biomass smoke and the risk of bacterial and viral lung infection. *Respirology*. 2020;25(11):1121-1122. doi:10.1111/resp.13908

53. Fillmore NR, La J, Szalat RE, et al. Prevalence and outcome of COVID-19 infection in cancer patients: a national Veterans Affairs study. *J Natl Cancer Inst*. Published online October 2020. doi:10.1093/jnci/djaa159

54. Siddiqi K, Siddiqui F, Khan A, et al. The impact of COVID-19 on smoking patterns in Pakistan: findings from a longitudinal survey of smokers. *Nicotine Tob Res Off J Soc Res Nicotine Tob*. Published online October 2020. doi:10.1093/ntr/ntaa207

55. Fisman DN, Greer AL, Hillmer M, Tuite R. Derivation and Validation of Clinical Prediction Rules for COVID-19 Mortality in Ontario, Canada. *Open forum Infect Dis*. 2020;7(11):ofaa463. doi:10.1093/ofid/ofaa463

56. Sifat AE, Nozohouri S, Villalba H, Vaidya B, Abbruscato TJ. The Role of Smoking and Nicotine in the Transmission and Pathogenesis of COVID-19. *J Pharmacol Exp Ther*. 2020;375(3):498-509. doi:10.1124/jpet.120.000170

57. Gaiha SM, Cheng J, Halpern-Felsher B. Association Between Youth Smoking, Electronic Cigarette Use, and COVID-19. *J Adolesc Heal Off Publ Soc Adolesc Med*. 2020;67(4):519-523. doi:10.1016/j.jadohealth.2020.07.002

58. Simons D, Shahab L, Brown J, Perski O. The association of smoking status with SARS-CoV-2 infection, hospitalization and mortality from COVID-19: a living rapid evidence review with Bayesian meta-analyses (version 7). *Addiction*. Published online October 2020. doi:10.1111/add.15276

59. Gallo O. Risk for COVID-19 infection in patients with tobacco smoke-associated cancers of the upper and lower airway. *Eur Arch oto-rhino-laryngology Off J Eur Fed Oto-Rhino-Laryngological Soc Affil with Ger Soc Oto-Rhino-Laryngology - Head Neck Surg*. Published online November 2020:1-8. doi:10.1007/s00405-020-06456-z

60. Sims OT, Jackson A, Guo Y, Truong DN, Odame EA, Mamudu HM. A Cross-Sectional Analysis of Tobacco Use and Concurrent Alcohol and Substance Use Among Patients Living with HIV/HCV Co-infection: Findings from a Large Urban Tertiary Center. *J Clin Psychol Med Settings*. Published online October 2020:1-9. doi:10.1007/s10880-020-09744-2

61. Gandhi SA. Letter from California, USA. *Respirology*. Published online November 2020. doi:10.1111/resp.13980

62. Sinclair RG, Somsamouth K, Sahar D, Englert R, Singh P. Microbial contamination in the communal-use Lao tobacco waterpipe. *Int Health*. Published online October 2020. doi:10.1093/inthealth/ihaa078

63. Ghinai I, Davis ES, Mayer S, et al. Risk Factors for Severe Acute Respiratory Syndrome Coronavirus 2 Infection in Homeless Shelters in Chicago, Illinois-March-May, 2020. *Open forum Infect Dis*. 2020;7(11):ofaa477. doi:10.1093/ofid/ofaa477
64. Singh S, Zuwasti U, Haas C. Coronavirus-Associated Coagulopathy: Lessons From SARS-CoV1 and MERS-CoV for the Current SARS-CoV2 Pandemic. *Cureus*. 2020;12(11):e11310. doi:10.7759/cureus.11310

65. González-Rubio J, Navarro-López C, López-Nájera E, et al. A Systematic Review and Meta-Analysis of Hospitalised Current Smokers and COVID-19. *Int J Environ Res Public Health*. 2020;17(20). doi:10.3390/ijerph17207394

66. Soule EK, Kheradmand F, Eissenberg T. Health practitioners should caution about misinformation and association of adverse effects of electronic cigarette use and COVID-19. *Prev Med reports*. 2020;20:101255. doi:10.1016/j.pmedr.2020.101255

67. Grover S, Mohanty V, Jain S, Anand T, Aghi MB. “YES it’s the Perfect Time to Quit”: Fueling Tobacco Cessation in India during COVID-19 Pandemic. *Tob use insights*. 2020;13:1179173X20960447. doi:10.1177/1179173X20960447

68. Streck JM, Kalkhoran S, Bearnott B, et al. Perceived risk, attitudes, and behavior of cigarette smokers and nicotine vapers receiving buprenorphine treatment for opioid use disorder during the COVID-19 pandemic. *Drug Alcohol Depend*. 2020;218:108438. doi:10.1016/j.drugalcdep.2020.108438

69. Gu T, Mack JA, Salvatore M, et al. Characteristics Associated With Racial/Ethnic Disparities in COVID-19 Outcomes in an Academic Health Care System. *JAMA Netw open*. 2020;3(10):e2025197. doi:10.1001/jamanetworkopen.2020.25197

70. Takagi H. Systematic review of the prevalence of current smoking among hospitalized COVID-19 patients in China: could nicotine be a therapeutic option? *Intern Emerg Med*. 2020;15(8):1601-1603. doi:10.1007/s11739-020-02473-2

71. Gupta AK, Seth S, Mehrotra R. Tobacco use as a well-recognized cause of severe COVID-19 manifestations. *Respir Med*. 2020;176:106233. doi:10.1016/j.rmed.2020.106233

72. Talavera B, Garcia-Azorín D, Martínez-Pías E, et al. Anosmia is associated with lower in-hospital mortality in COVID-19. *J Neurol Sci*. 2020;419:117163. doi:10.1016/j.jns.2020.117163

73. Hashmi SK, Hussain F, Hays JT. Thank You for Not Smoking. *Mayo Clin Proc*. 2020;95(10):2062-2064. doi:10.1016/j.mayocp.2020.08.012

74. Toussie D, Voutsinas N, Finkelstein M, et al. Clinical and Chest Radiography Features Determine Patient Outcomes in Young and Middle-aged Adults with COVID-19. *Radiology*. 2020;297(1):E197-E206. doi:10.1148/radiol.2020201754

75. He S, Tian J, Li X, et al. Positive RT-PCR Test Results in 420 Patients Recovered From COVID-19 in Wuhan: An Observational Study. *Front Pharmacol*. 2020;11:549117. doi:10.3389/fphar.2020.549117

76. Tran T V, Nguyen HC, Pham L V, et al. Impacts and interactions of COVID-19 response involvement, health-related behaviours, health literacy on anxiety, depression and health-related quality of life among healthcare workers: a cross-sectional study. *BMJ Open*. 2020;10(12):e041394. doi:10.1136/bmjopen-2020-041394

77. Holman N, Knighton P, Kar P, et al. Risk factors for COVID-19-related mortality in
people with type 1 and type 2 diabetes in England: a population-based cohort study. *Lancet Diabetes Endocrinol.* 2020;8(10):823-833. doi:10.1016/S2213-8587(20)30271-0

78. Tzu-Hsuan Chen D. The psychosocial impact of the COVID-19 pandemic on changes in smoking behavior: Evidence from a nationwide survey in the UK. *Tob Prev Cessat.* 2020;6:59. doi:10.18332/tpc/126976

79. Horii T, Fujioka T, Takahashi M, et al. Late-onset pneumothorax in a COVID-19 patient treated with ventilation and ECMO: A case report and literature review. *Radiol case reports.* 2020;15(12):2560-2564. doi:10.1016/j.radcr.2020.09.036

80. Underner M, Perriot J, Peiffer G, Jaafari N. [COVID-19 and changes in smoking behavior]. *Rev Mal Respir.* 2020;37(8):684-686. doi:10.1016/j.rmr.2020.08.004

81. Hu J, Zhou J, Dong F, et al. Combination of serum lactate dehydrogenase and sex is predictive of severe disease in patients with COVID-19. *Medicine (Baltimore).* 2020;99(42):e22774. doi:10.1097/MD.0000000000022774

82. Urigo C, Soin S, Sahu A. Spontaneous pneumomediastinum as a complication of a COVID-19 related pneumonia: case report and review of literature. *Radiol case reports.* 2020;15(12):2577-2581. doi:10.1016/j.radcr.2020.09.052

83. Ieng SM, Cheong IH. An Overview of Epidemiology of COVID-19 in Macau S.A.R. *Front public Heal.* 2020;8:550057. doi:10.3389/fpubh.2020.550057

84. Uvais NA. Interests in quitting smoking and alcohol during COVID-19 pandemic in India: A Google Trends study. *Psychiatry Clin Neurosci.* 2020;74(10):550-551. doi:10.1111/pcn.13118

85. Ioannidis JPA, Jha P. Does the COVID-19 pandemic provide an opportunity to eliminate the tobacco industry? *Lancet Glob Heal.* Published online October 2020. doi:10.1016/S2214-109X(20)30466-6

86. Veldtman GR, Pirisi M, Storti E, et al. Management principles in patients with COVID-19: perspectives from a growing global experience with emphasis on cardiovascular surveillance. *Open Hear.* 2020;7(2). doi:10.1136/openhrt-2020-001357

87. Islam MZ, Riaz BK, Islam ANMS, et al. Risk factors associated with morbidity and mortality outcomes of COVID-19 patients on the 28th day of the disease course: a retrospective cohort study in Bangladesh. *Epidemiol Infect.* 2020;148:e263. doi:10.1017/S0950268820002630

88. Vila-Córcoles A, Ochoa-Gondar O, Satué-Gracia EM, et al. Influence of prior comorbidities and chronic medications use on the risk of COVID-19 in adults: a population-based cohort study in Tarragona, Spain. *BMJ Open.* 2020;10(12):e041577. doi:10.1136/bmjopen-2020-041577

89. Izquierdo JL, Almonacid C, González Y, et al. The Impact of COVID-19 on Patients with Asthma. *Eur Respir J.* Published online November 2020. doi:10.1183/13993003.03142-2020

90. Volino-Souza M, de Oliveira GV, Conte-Junior CA, Alvares TS. Covid-19 Quarantine: Impact of Lifestyle Behaviors Changes on Endothelial Function and
Possible Protective Effect of Beetroot Juice. *Front Nutr.* 2020;7:582210. doi:10.3389/fnut.2020.582210

91. Jourdes A, Lafaurie M, Martin-Blondel G, et al. Clinical characteristics and outcome of hospitalized patients with SARS-CoV-2 infection at Toulouse University hospital (France). Results from the Covid-clinic-Toul cohort. *La Rev Med interne.* 2020;41(11):732-740. doi:10.1016/j.revmed.2020.08.006

92. Vuolo M, Kelly BC, Roscigno VJ. COVID-19 Mask Requirements as a Workers’ Rights Issue: Parallels to Smoking Bans. *Am J Prev Med.* 2020;59(5):764-767. doi:10.1016/j.amepre.2020.07.001

93. Landoni G, Maimeri N, Fedrizzi M, et al. Why are Asian countries outperforming the Western world in controlling COVID-19 pandemic? *Pathog Glob Health.* Published online November 2020:1-3. doi:10.1080/20477724.2020.1850982

94. Wang Z, Zheutlin A, Kao Y-H, et al. Hospitalised COVID-19 patients of the Mount Sinai Health System: a retrospective observational study using the electronic medical records. *BMJ Open.* 2020;10(10):e040441. doi:10.1136/bmjopen-2020-040441

95. Lang AE, Yakhkind A. Coronavirus Disease 2019 and Smoking: How and Why We Implemented a Tobacco Treatment Campaign. *Chest.* 2020;158(4):1770-1776. doi:10.1016/j.chest.2020.06.013

96. Wenzl T. Smoking and COVID-19: Did we overlook representativeness? *Tob Induc Dis.* 2020;18:89. doi:10.18332/tid/129584

97. Lang AE, Yakhkind A. More Than Meets the Eye: The Similarities Between Coronavirus Disease 2019 and Smoking. *Mayo Clin Proc.* 2020;95(10):2282-2283. doi:10.1016/j.mayocp.2020.08.008

98. Xiang J, Chen Z, Zhou J, et al. Comparative analysis of the main haematological indexes and RNA detection for the diagnosis of SARS-CoV-2 infection. *BMC Infect Dis.* 2020;20(1):779. doi:10.1186/s12879-020-05489-3

99. Li J, Long X, Zhang Q, et al. Tobacco smoking confers risk for severe COVID-19 unexplainable by pulmonary imaging. *J Intern Med.* Published online December 2020. doi:10.1111/jiom.13190

100. Xiong GL, Atkin A, Moquin K, et al. COVID-19 Transmission in a Psychiatric Long-Term Care Rehabilitation Facility: An Observational Study. *Prim care companion CNS Disord.* 2020;22(6). doi:10.4088/PCC.20m02765

101. Liu J, Chen T, Yang H, et al. Clinical and radiological changes of hospitalised patients with COVID-19 pneumonia from disease onset to acute exacerbation: a multicentre paired cohort study. *Eur Radiol.* 2020;30(10):5702-5708. doi:10.1007/s00330-020-06916-4

102. Yue L, Zhang R, Duan G. The relationship between smoking and COVID-19 progression. *Nicotine Tob Res Off J Soc Res Nicotine Tob.* Published online November 2020. doi:10.1093/ntr/nta245

103. Lu J, Yin Q, Li Q, et al. Clinical characteristics and factors affecting the duration of positive nucleic acid test for patients of COVID-19 in XinYu, China. *J Clin Lab Anal.*
2020;34(10):e23534. doi:10.1002/jcla.23534

104. Zajacova A, Jehn A, Stackhouse M, Denice P, Ramos H. Changes in health behaviours during early COVID-19 and socio-demographic disparities: a cross-sectional analysis. *Can J Public Health*. 2020;111(6):953-962. doi:10.17269/s41997-020-00434-4

105. Marvisi M, Ferrozzi F, Balzarini L, Mancini C, Ramponi S, Uccelli M. First report on clinical and radiological features of COVID-19 pneumonitis in a Caucasian population: Factors predicting fibrotic evolution. *Int J Infect Dis IJID Off Publ Int Soc Infect Dis*. 2020;99:485-488. doi:10.1016/j.ijid.2020.08.054

106. Zayet S, Klopfenstein T, Mezher C, Gendrin V, Conrozier T, Ben Abdallah Y. Coronavirus disease 2019 with spontaneous pneumothorax, pneumomediastinum and subcutaneous emphysema, France. *New microbes new Infect*. 2020;38:100785. doi:10.1016/j.nmni.2020.100785

107. McRobbie H, Kwan B. Tobacco use disorder and the lungs. *Addiction*. Published online November 2020. doi:10.1111/add.15309

108. Zeng L, Wang S, Cai J, et al. Clinical characteristics of COVID-19 with cardiac injury: a systematic review and meta-analysis. *Epidemiol Infect*. 2020;148:e266. doi:10.1017/S0950268820002587

109. Meini S, Fortini A, Andreini R, Sechi LA, Tascini C. The Paradox of the Low Prevalence of Current Smokers Among Covid-19 Patients Hospitalized in Non-Intensive Care Wards: Results From an Italian Multicenter Case-Control Study. *Nicotine Tob Res Off J Soc Res Nicotine Tob*. Published online September 2020. doi:10.1093/ntr/ntaa188

110. Zhao Q, Meng M, Kumar R, et al. The impact of COPD and smoking history on the severity of COVID-19: A systemic review and meta-analysis. *J Med Virol*. 2020;92(10):1915-1921. doi:10.1002/jmv.25889

111. Mesas AE, Cavero-Redondo I, Álvarez-Bueno C, et al. Predictors of in-hospital COVID-19 mortality: A comprehensive systematic review and meta-analysis exploring differences by age, sex and health conditions. *PLoS One*. 2020;15(11):e0241742. doi:10.1371/journal.pone.0241742

112. Zhou W, Song L, Wang X, et al. Cardiac injury prediction and lymphocyte immunity and inflammation analysis in hospitalized patients with coronavirus disease 2019 (COVID-19). *Int J Cardiol*. Published online October 2020. doi:10.1016/j.ijcard.2020.10.049
Figures
Figure S1. Funnel plot of included studies (Severity; all age group, and ≤ 65 years old)
Figure S2. The graph from Egger’s test of included studies in the meta-analysis (Severity; all age group, and ≤ 65 years old)
Figure S3. Funnel plot of included studies (Dead; all age group)
Figure S4. The graph from Egger’s test of included studies in the meta-analysis (Dead; all age group)
**Figure S5.** Funnel plot of included studies (Dead; ≤65 years old)
Figure S6. The graph from Egger’s test of included studies in the meta-analysis (Dead; ≤65 years old)
