## **Characteristics and treatment of hospitalized pregnant women with Coronavirus Disease 2019, COVID-19**

## **Supplemental Tables & Appendix**

**Table S1. Description of COVID-19 symptoms**

|  |  |
| --- | --- |
| Symptoms | * Respiratory: congested/runny nose, cough, hemoptysis/bloody sputum, shortness of breath/respiratory distress, sore throat, upper respiratory infection, influenza-like illness, wheezing * Non-respiratory: abdominal pain, altered mental status/confusion, anosmia/decreased smell, chest pain, conjunctivitis, diarrhea, dysgeusia/decreased taste, fatigue, fever/chills, headache, muscle aches/myalgias, nausea/vomiting, rash, seizures |

**Table S2. Categorization of underlying medical condition**

|  |  |
| --- | --- |
| Chronic Lung Disease (except asthma) | * Active tuberculosis * Asbestosis * Bronchiectasis * Bronchiolitis obliterans * Chronic bronchitis * Chronic respiratory failure * Cystic fibrosis * Emphysema/Chronic Obstructive Pulmonary Disease * Interstitial lung disease * Obstructive sleep apnea * Oxygen dependent * Pulmonary fibrosis * Restrictive lung disease * Sarcoidosis |
| Asthma | * Asthma/Reactive airway disease |
| Diabetes | * Type 1 or Type 2 Diabetes Mellitus |
| Thyroid Dysfunction | * Grave’s disease * Hashimoto’s Disease * Hyperthyroidism * Hypothyroidism |
| Other Chronic Metabolic Disease (except diabetes mellitus and Thyroid dysfunction) | * Adrenal Disorders (Addison’s, Adrenal Insufficiency, Cushing Syndrome, Congenital Adrenal Hyperplasia) * Glycogen or other storage diseases * Hyper/Hypo function of pituitary gland * Inborn errors of metabolism * Metabolic Syndrome * Parathyroid Dysfunction (Hyperparathyroidism, Hypoparathyroidism) |
| Cardiovascular Disease (except hypertension) | * Aortic aneurysm, history of * Aortic/Mitral/Tricuspid/Pulmonic valve replacement, history of * Aortic regurgitation * Aortic stenosis * Atherosclerotic cardiovascular disease * Atrial fibrillation * Atrioventricular blocks * Automated implantable devices/Pacemaker * Bundle branch block * Cardiomyopathy * Carotid stenosis * Cerebral vascular accident/Incident/Stroke, history of * Congenital heart disease * Coronary artery bypass grafting, history of * Coronary artery disease * Deep vein thrombosis, history of * Heart failure/congestive heart failure * Myocardial infarction, history of * Mitral regurgitation * Mitral stenosis * Peripheral artery disease * Peripheral vascular disease * Pulmonary embolism, history of * Pulmonary hypertension * Pulmonic regurgitation * Pulmonic stenosis * Transient ischemic attack, history of * Tricuspid regurgitation * Tricuspid stenosis * Ventricular fibrillation, history of * Ventricular tachycardia, history of |
| Hypertension | * Hypertension |
| Neurologic Disorder | * Amyotrophic lateral sclerosis * Cerebral palsy * Cognitive dysfunction * Dementia/Alzheimer’s disease * Developmental delay * Down syndrome/Trisomy 21 * Edward’s syndrome/Trisomy 18 * Epilepsy/seizure/seizure disorder * Mitochondrial disorder * Multiple sclerosis * Muscular dystrophy * Myasthenia gravis * Neural tube defects/Spina bifida * Neuropathy * Parkinson’s disease * Plegias/Paralysis/Quadriplegia * Scoliosis/Kyphoscoliosis * Traumatic brain injury, history of |
| Liver Disease | * Alcoholic hepatitis * Autoimmune hepatitis * Barrett’s esophagitis * Chronic liver disease * Chronic pancreatitis * Cirrhosis/End stage liver disease * Crohn’s disease * Esophageal varices * Esophageal strictures * Hepatitis B, chronic * Hepatitis C, chronic * Non-alcoholic fatty liver disease/Non-alcoholic steatohepatitis * Ulcerative colitis |

**Table S3. Characteristics of hospitalized SARS-CoV-2 positive pregnant patients by symptom status\***

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Overall**  **(n=905)** | | **Symptomatic† (n=336, 37.0%)** | | **Asymptomatic**  **(n=569, 63.0%)** | | |
| **Variable** | **n** | **Weighted %** | **n** | **Weighted %** | **n** | **Weighted %** | **p-value‡** |
| **Age group** |  |  |  |  |  |  |  |
| 15-24 years | 293 | 23.8 | 100 | 20.6 | 193 | 25.6 | 0.161 |
| 25-34 years | 476 | 57.9 | 179 | 61.9 | 297 | 55.6 | ref |
| 35-49 years | 136 | 18.3 | 57 | 17.5 | 79 | 18.8 | 0.430 |
| **Race/ethnicity** |  |  |  |  |  |  |  |
| American Indian/Alaska Native, non-Hispanic | 13 | 1.2 | 8 | 2.4 | 5 | 0.5 | <.001 |
| Asian/Pacific Islander, non-Hispanic | 56 | 6.9 | 26 | 5.2 | 30 | 7.9 | 0.792 |
| Black, non-Hispanic | 222 | 33.7 | 90 | 39.6 | 132 | 30.3 | 0.031 |
| Hispanic or Latino | 271 | 27.3 | 87 | 24.8 | 184 | 28.8 | 0.403 |
| White, non-Hispanic | 294 | 26.8 | 102 | 22.3 | 192 | 29.4 | ref |
| None of the above‡ | 49 | 4.1 | 23 | 5.6 | 26 | 3.1 | 0.053 |
| **Vaccine status**§ |  |  |  |  |  |  |  |
| Unvaccinated | 837 | 90.8 | 322 | 92.9 | 515 | 89.5 | ref |
| Partially vaccinated | 16 | 2.9 | 2 | 2.2 | 14 | 3.3 | 0.100 |
| Fully vaccinated | 34 | 6.3 | 9 | 4.9 | 25 | 7.2 | 0.155 |
| **Underlying medical conditions**|| |  |  |  |  |  |  |  |
| Any condition or conditions | 295 | 30.6 | 123 | 32.6 | 172 | 29.5 |  |
| Asthma | 95 | 11.6 | 38 | 12.5 | 57 | 11.1 | 0.812 |
| Hypertension | 53 | 5.7 | 30 | 8.9 | 23 | 3.8 | 0.119 |
| Chronic metabolic disease¶ | 50 | 5.2 | 21 | 4.7 | 29 | 5.5 | 0.802 |
| Cardiovascular disease¶ | 30 | 2.5 | 15 | 3.0 | 15 | 2.2 | 0.583 |
| Diabetes | 24 | 2.7 | 10 | 2.6 | 14 | 2.7 | 0.772 |
| Neurologic condition | 26 | 2.4 | 13 | 2.5 | 13 | 2.4 | 0.735 |
| Thyroid dysfunction | 29 | 2.7 | 13 | 2.1 | 16 | 2.9 | 0.851 |
| Other disease | 27 | 2.0 | 11 | 1.6 | 16 | 2.2 | 0.635 |
| Liver disease | 9 | 0.5 | 7 | 0.9 | 2 | 0.3 | 0.005 |
| Chronic lung disease¶ | 3 | 0.0 | 2 | 0.1 | 1 | 0.0 | 0.307 |
| **Smoking** |  |  |  |  |  |  |  |
| Current smoker | 47 | 5.3 | 19 | 7.7 | 28 | 4.0 | 0.257 |
| Former smoker | 86 | 8.5 | 43 | 8.9 | 43 | 8.2 | 0.609 |
| Not a smoker/Unknown smoking history | 772 | 86.2 | 274 | 83.4 | 498 | 87.8 | ref |
| **Pregnancy trimester at hospital admission** |  |  |  |  |  |  |  |
| First | 43 | 4.9 | 30 | 10.0 | 13 | 2.0 | .002 |
| Second | 72 | 7.6 | 65 | 19.3 | 7 | 0.7 | ref |
| Third | 790 | 87.4 | 241 | 70.7 | 549 | 97.3 | <.001 |
| **Current pregnancy plurality** |  |  |  |  |  |  |  |
| Singleton pregnancy | 861 | 94.4 | 309 | 90.7 | 552 | 96.5 | ref |
| Multiple pregnancy | 15 | 1.1 | 7 | 1.1 | 8 | 1.1 | 0.846 |
| Unknown | 29 | 4.5 | 20 | 8.2 | 9 | 2.4 | 0.251 |
| **Pregnancy-associated conditions**|| |  |  |  |  |  |  |  |
| Any condition or conditions | 188 | 19.6 | 70 | 19.0 | 118 | 19.9 | 0.942 |
| Hypertensive disorders of pregnancy | 105 | 10.7 | 44 | 10.3 | 61 | 11.0 | 0.848 |
| Unknown | 45 | 6.0 | 22 | 6.8 | 23 | 5.4 | 0.652 |
| Gestational diabetes | 70 | 6.3 | 25 | 5.9 | 45 | 6.5 | 0.887 |
| Intrauterine growth restriction | 27 | 3.7 | 9 | 4.5 | 18 | 3.2 | 0.395 |

Abbreviation: ref=reference group

\*Data are from the COVID-19-Associated Hospitalization Surveillance Network (COVID-NET), 14 states, January–November 2021.

†Symptomatic was defined as respiratory or non-respiratory COVID-19 symptoms at admission or developed symptoms during hospitalization as indicated by a discharge diagnosis of pneumonia, acute respiratory failure, or acute respiratory distress syndrome.

‡P-values are from generalized estimating equation models that adjust for sampling variables age and month and account for clustering by site and complex sampling weights.

§The none of the above category includes multiracial, non-Hispanic and unknown race/ethnicity categories to generate p-values due to small cell sizes due to PSM.

§Three symptomatic and 15 asymptomatic patients are missing vaccination status because one state did not collect that information.

||Underlying medical conditions and pregnancy-associated conditions percent columns do not add up to 100% since multiple options could be chosen per patient.

¶Chronic metabolic disease does not include diabetes or thyroid dysfunction, cardiovascular disease does not include hypertension, and chronic lung disease does not include asthma.

**Table S4. Distribution of variables by pregnancy status prior to and after propensity score matching, n (weighted %)**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Prior to PSM (n=996)** | | | | | **Post PSM (n=234)** | | | | |
|  | **Pregnant (n=123)** | | **Not pregnant (n=873)** | | | **Pregnant (n=116)** | | **Not pregnant**  **(n=116)** | | |
| **Variable** | **n** | **(%)** | **n** | **(%)** | **p-value†** | **n** | **(%)** | **n** | **(%)** | **p-value†** |
| **Age group** |  |  |  |  |  |  |  |  |  |  |
| 15-24 year | 28 | (17.4) | 182 | (8.4) | <.001 | 28 | (17.8) | 28 | (8.0) | 0.021 |
| 25-34 year | 71 | (64.3) | 166 | (21.8) | ref | 64 | (63.5) | 64 | (64.7) | ref |
| 35-49 year | 24 | (18.2) | 525 | (69.7) | <.001 | 24 | (18.6) | 24 | (27.3) | 0.332 |
| **Race/ethnicity** |  |  |  |  |  |  |  |  |  |  |
| American Indian/Alaska Native, non-Hispanic | 3 | (5.2) | 27 | (2.0) | 0.212 | 3 | (5.3) | 4 | (3.3) | 0.495 |
| Asian/Pacific Islander, non-Hispanic | 18 | (12.2) | 63 | (8.4) | 0.690 | 17 | (12.3) | 14 | (13.0) | 0.999 |
| Black, non-Hispanic | 25 | (26.0) | 227 | (32.5) | 0.958 | 25 | (26.6) | 19 | (20.1) | 0.143 |
| Hispanic or Latino | 24 | (23.0) | 169 | (19.2) | 0.959 | 22 | (22.8) | 31 | (26.3) | 0.999 |
| White, non-Hispanic | 44 | (26.1) | 355 | (34.2) | ref | 41 | (25.4) | 41 | (30.4) | ref |
| None of the above‡ | 9 | (7.4) | 32 | (3.6) | 0.114 | 8 | (7.5) | 7 | (6.9) | 0.332 |
| **Underlying medical conditions** |  |  |  |  |  |  |  |  |  |  |
| Cardiovascular disease§ | 5 | (2.9) | 121 | (16.4) | 0.033 | 5 | (2.9) | 3 | (2.0) | 0.818 |
| Chronic lung disease§ | 1 | (0.1) | 57 | (5.8) | 0.002 | 1 | (0.1) | 2 | (0.5) | 0.440 |
| Asthma | 12 | (7.9) | 189 | (20.9) | 0.019 | 12 | (8.1) | 14 | (16.3) | 0.367 |
| Chronic metabolic disease§ | 9 | (2.4) | 258 | (32.0) | <.001 | 9 | (2.4) | 11 | (11.3) | 0.051 |
| Diabetes | 4 | (1.0) | 188 | (23.8) | <.001 | 4 | (1.0) | 6 | (5.7) | 0.127 |
| Thyroid Dysfunction | 6 | (1.5) | 85 | (11.5) | 0.016 | 6 | (1.5) | 5 | (5.6) | 0.155 |
| Hypertension | 10 | (8.6) | 206 | (29.6) | 0.252 | 10 | (8.8) | 6 | (6.5) | 0.586 |
| Liver disease | 5 | (2.0) | 36 | (4.3) | 0.585 | 5 | (2.1) | 10 | (7.4) | 0.223 |
| Neurologic condition | 5 | (2.1) | 96 | (9.4) | 0.103 | 5 | (2.1) | 2 | (1.3) | 0.463 |

Abbreviation: PSM = propensity score matching, ref=reference group

\*Data are from the COVID-19-Associated Hospitalization Surveillance Network (COVID-NET), 14 states, January–November 2021.

†P-values are from generalized estimating equation models that adjust for sampling variables age and month and account for clustering by site and complex sampling weights.

‡None of the above category includes multiracial, non-Hispanic and unknown race/ethnicity categories to generate p-values due to small cell sizes due to PSM.

§Cardiovascular disease does not include hypertension, chronic lung disease does not include asthma and chronic metabolic disease does not include diabetes or thyroid dysfunction.

**Table S5. Multivariable regression and inverse probability treatment weighting for estimating the prevalence ratio of treatment by pregnancy status\***

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Method** | **Propensity logistic model** | **Outcome GEE Model** | | | | | |
|  | **Sample weighting** | **Outcome** | **Doubly Robust** | **Weight used** | **PR** | **95% CI** | **P-value** |
| 1. Multivariable regression† | | | | | | | |
| a | NA | Remdesivir | NA | sample weight | 0.77 | (0.65-0.91) | 0.002 |
| 2. Inverse Probability Treatment Weighting‡ | | | | | | | |
| a | No | Remdesivir | Yes | final weight | 0.80 | (0.68-0.94) | 0.007 |
| b | Yes | Remdesivir | No | final weight | 0.98 | (0.86-1.11) | 0.768 |
| c | Yes | Remdesivir | Yes | final weight | 0.87 | (0.78-0.98) | 0.020 |
| 1. Multivariable regression† | | | | | | | |
| a | NA | Systemic steroids | NA | sample weight | 0.68 | (0.55-0.85) | <.001 |
| 2. Inverse Probability Treatment Weighting‡ | | | | | | | |
| a | No | Systemic steroids | Yes | final weight | 0.80 | (0.75-0.85) | <.001 |
| b | Yes | Systemic steroids | No | final weight | 0.91 | (0.83-0.99) | 0.029 |
| c | Yes | Systemic steroids | Yes | final weight | 0.87 | (0.82-0.93) | <.001 |

Abbreviations: GEE=generalized estimating equations, NA=not applicable

\*Data are from the COVID-19-Associated Hospitalization Surveillance Network. COVID-NET, 14 states, January–November 2021 and included hospitalized, symptomatic COVID-19 positive women who were eligible for treatment. All models included a total n=996 (123 pregnant and 873 non-pregnant women).

†Multivariable models used Poisson generalized estimating equation (GEE) models to account for clustering by site and adjusted for month, age, race and ethnic group, and underlying medical conditions, and accounted for complex sample weights.

‡Inverse probability treatment weights (IPTW) are the inverse of the propensity score. First, we calculated propensity scores for each patient using multivariable logistic regression to estimate the probability of pregnancy based on baseline covariates, among all women regardless of pregnancy status. The propensity logistic model included the following covariates: age group, site, race and Hispanic ethnicity group, and underlying medical conditions. The propensity models were weighted to account for the complex sampling weights. Additionally, in propensity logistic models 2b and 2c complex sample weights were included as a predictor. Second, we calculated the inverse probability treatment weights (IPTW) by taking the inverse of the propensity score. We then multiplied the IPTW by the complex sample weights to create a final weight. Finally, to model our outcome (remdesivir or systemic steroid receipt) we used generalized estimating equation models to account for clustering by site and adjusted for age and month. Models 2a and 2c were doubly robust additionally adjusting for race and ethnic group and underlying medical conditions. All outcome models were weighted by final weights.

**Appendix**

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