

## Supplemental Online Content

Mupanomunda M, Fakih MG, Miller C, et al. Comparison of severe maternal morbidities associated with delivery during periods of circulation of specific SARS-CoV-2 variants. *JAMA Netw Open*. 2022;5(8):e2226436. doi:10.1001/jamanetworkopen.2022.26436

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This supplemental material has been provided by the authors to give readers additional information about their work.

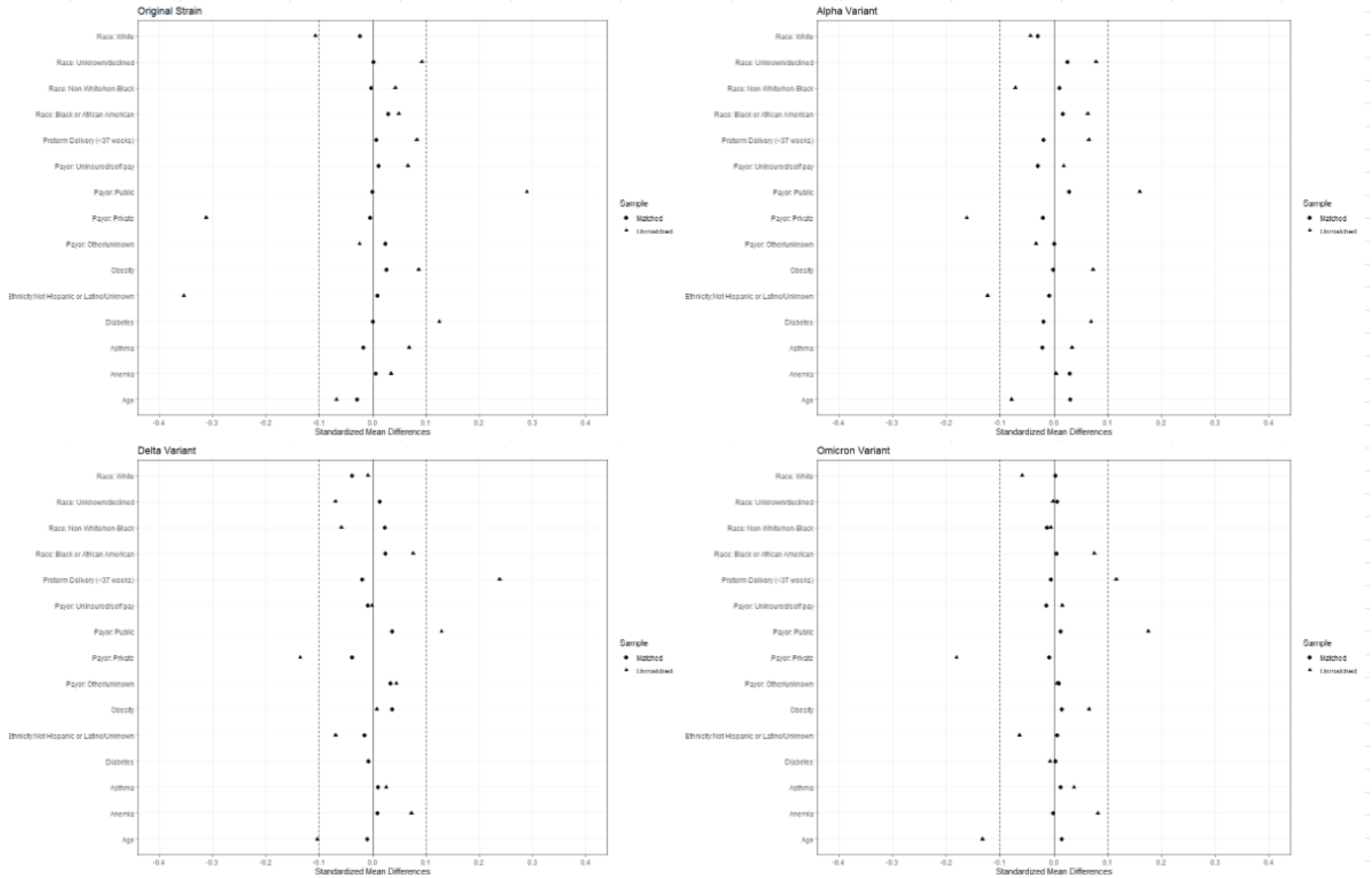
# eTable 1. Population Characteristics in the Unmatched Population

Characteristic	Original SARS-CoV-2 Strain (03/2020-12/2020)			Alpha SARS-CoV-2 Variant (01/2021-06/2021)			Delta SARS-CoV-2 Variant (07/2021- 11/2021)			Omicron SARS-CoV Variant (12/2021-01/2022)			Group Total			Total
	Unknown/Test-Negative N = 43,033	Test-Positive N = 978	p-value	Unknown/Test-Negative N = 25,168	Test-Positive N = 744	p-value	Unknown/Test-Negative N = 22,324	Test-Positive N = 681	p-value	Unknown/Test-Negative N = 7,800	Test-Positive N = 726	p-value	Unknown/Test-Negative N = 98,325	Test-Positive N = 3,129	p-value	N = 101,454
<b>Age</b>	29.6 (25.4, 33.6)	29.5 (24.8, 33.5)	0.072	29.7 (25.5, 33.6)	29.0 (24.4, 33.5)	0.015	29.9 (25.7, 33.8)	29.1 (25.0, 33.1)	0.006	29.8 (25.4, 33.8)	28.6 (24.5, 32.8)	<0.001	29.7 (25.5, 33.7)	29.1 (24.6, 33.2)	<0.001	29.7 (25.4, 33.6)
<b>Race</b>			<0.001			0.005			0.06			0.2			<0.001	
White	29,424 (68%)	618 (63%)		17,396 (69%)	499 (67%)		15,171 (68%)	460 (68%)		5,238 (67%)	467 (64%)		67,229 (68%)	2,044 (65%)		69,273 (68%)
Black or African American	8,330 (19%)	209 (21%)		4,601 (18%)	155 (21%)		3,964 (18%)	142 (21%)		1,416 (18%)	154 (21%)		18,311 (19%)	660 (21%)		18,971 (19%)
Other*	4,305 (10%)	111 (11%)		2,598 (10%)	62 (8.3%)		2,550 (11%)	66 (9.7%)		918 (12%)	84 (12%)		10,371 (11%)	323 (10%)		10,694 (11%)
Unknown/declined	974 (2.3%)	40 (4.1%)		573 (2.3%)	28 (3.8%)		639 (2.9%)	13 (1.9%)		228 (2.9%)	21 (2.9%)		2,414 (2.5%)	102 (3.3%)		2,516 (2.5%)
<b>Ethnicity</b>			<0.001			<0.001			0.068			0.1			<0.001	
Hispanic or Latino	7,051 (16%)	323 (33%)		4,015 (16%)	156 (21%)		3,966 (18%)	140 (21%)		1,513 (19%)	160 (22%)		16,545 (17%)	779 (25%)		17,324 (17%)
Not Hispanic or Latino/unknown	35,982 (84%)	655 (67%)		21,153 (84%)	588 (79%)		18,358 (82%)	541 (79%)		6,287 (81%)	566 (78%)		81,780 (83%)	2,350 (75%)		84,130 (83%)
<b>Payor</b>			<0.001			<0.001			0.001			<0.001				
Private	24,759 (58%)	412 (42%)		14,890 (59%)	380 (51%)		13,016 (58%)	351 (52%)		4,454 (57%)	349 (48%)		57,119 (58%)	1,492 (48%)	<0.001	58,611 (58%)
Public	17,512 (41%)	539 (55%)		9,934 (39%)	353 (47%)		8,914 (40%)	316 (46%)		3,193 (41%)	361 (50%)		39,553 (40%)	1,569 (50%)		41,122 (41%)
Uninsured/self pay	685 (1.6%)	26 (2.7%)		317 (1.3%)	11 (1.5%)		362 (1.6%)	11 (1.6%)		144 (1.8%)	15 (2.1%)		1,508 (1.5%)	63 (2.0%)		1,571 (1.5%)
Other/unknown	77 (0.2%)	1 (0.1%)		27 (0.1%)	0 (0%)		32 (0.1%)	3 (0.4%)		9 (0.1%)	1 (0.1%)		145 (0.1%)	5 (0.2%)		150 (0.1%)
<b>Obesity</b>	5,579 (13%)	158 (16%)	0.004	3,733 (15%)	131 (18%)	0.041	2,920 (13%)	91 (13%)	0.9	888 (11%)	99 (14%)	0.08	13,121 (13%)	479 (15%)	0.002	13,600 (13%)
<b>Asthma</b>	2,397 (5.6%)	72 (7.4%)	0.019	1,512 (6.0%)	51 (6.9%)	0.4	1,332 (6.0%)	45 (6.6%)	0.5	483 (6.2%)	52 (7.2%)	0.3	5,724 (5.8%)	220 (7.0%)	0.005	5,944 (5.9%)
<b>Diabetes</b>	4,388 (10%)	143 (15%)	<0.001	2,633 (10%)	95 (13%)	0.05	2,377 (11%)	71 (10%)	>0.9	823 (11%)	75 (10%)	>0.9	10,221 (10%)	384 (12%)	<0.001	10,605 (10%)
<b>Anemia</b>	3,777 (8.8%)	96 (9.8%)	0.3	2,306 (9.2%)	69 (9.3%)	>0.9	2,279 (10%)	86 (13%)	0.047	795 (10%)	94 (13%)	0.024	9,157 (9.3%)	345 (11%)	0.001	9,502 (9.4%)
<b>Preterm Delivery less than 37 weeks gestation</b>	4,790 (11%)	137 (14%)	0.006	3,016 (12%)	106 (14%)	0.07	2,384 (11%)	138 (20%)	<0.001	848 (11%)	109 (15%)	<0.001	11,038 (11%)	490 (16%)	<0.001	11,528 (11%)
<b>Patients with Severe Maternal Morbidities</b>	690 (1.6%)	44 (4.5%)	<0.001	431 (1.7%)	35 (4.7%)	<0.001	343 (1.5%)	70 (10%)	<0.001	109 (1.4%)	21 (2.9%)	0.003	1,573 (1.6%)	170 (5.4%)	<0.001	1,743 (1.7%)

Statistics presented: n (%); Median (IQR)

\*American Indian or Alaska Native, Asian, Hispanic

# eFigure. Standardized Mean Differences Between Groups With and Without SARS-CoV-2 Infection Before and After Propensity Matching



eTable 2. Distribution of Individual SMM, by Variant

Complication (as defined by US CDC)	Original Strain		Alpha Variant		Delta Variant		Omicron Variant	
	Unknown/Test-Negative N = 3,906	Test-Positive N = 978	Unknown/Test-Negative N = 2,974	Test-Positive N = 744	Unknown/Test-Negative N = 2,724	Test-Positive N = 681	Unknown/Test-Negative N = 2,900	Test-Positive N = 726
Acute myocardial infarction	0 (0%)	0 (0%)	1 (<0.1%)	1 (0.1%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aneurysm	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Acute renal failure	1 (<0.1%)	9 (0.9%)	5 (0.2%)	6 (0.8%)	2 (<0.1%)	8 (1.2%)	5 (0.2%)	1 (0.1%)
Acute respiratory distress syndrome	3 (<0.1%)	18 (1.8%)	4 (0.1%)	19 (2.6%)	4 (0.1%)	44 (6.5%)	2 (<0.1%)	7 (1.0%)
Amniotic fluid embolism	0 (0%)	0 (0%)	0 (0%)	1 (0.1%)	0 (0%)	0 (0%)	1 (<0.1%)	0 (0%)
Cardiac arrest/ventricular fibrillation	0 (0%)	0 (0%)	0 (0%)	1 (0.1%)	0 (0%)	2 (0.3%)	0 (0%)	0 (0%)
Conversion of cardiac rhythm	0 (0%)	0 (0%)	0 (0%)	1 (0.1%)	0 (0%)	0 (0%)	1 (<0.1%)	0 (0%)
Disseminated intravascular coagulation	4 (0.1%)	2 (0.2%)	3 (0.1%)	1 (0.1%)	4 (0.1%)	9 (1.3%)	6 (0.2%)	3 (0.4%)
Eclampsia	5 (0.1%)	2 (0.2%)	5 (0.2%)	0 (0%)	2 (<0.1%)	0 (0%)	1 (<0.1%)	2 (0.3%)
Heart failure/arrest during surgery or procedure	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Purpurful cerebrovascular disorders	1 (<0.1%)	3 (0.3%)	2 (<0.1%)	0 (0%)	0 (0%)	4 (0.6%)	1 (<0.1%)	0 (0%)
Pulmonary edema or acute heart failure	2 (<0.1%)	1 (0.1%)	5 (0.2%)	3 (0.4%)	1 (<0.1%)	1 (0.1%)	3 (0.1%)	0 (0%)
Severe anesthesia complications	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sepsis	5 (0.1%)	11 (1.1%)	1 (<0.1%)	6 (0.8%)	4 (0.1%)	7 (1.0%)	2 (<0.1%)	2 (0.3%)
Shock	5 (0.1%)	3 (0.3%)	2 (<0.1%)	2 (0.3%)	1 (<0.1%)	6 (0.9%)	0 (0%)	1 (0.1%)
Sickle cell disease with crisis	2 (<0.1%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Air and thrombotic embolism	0 (0%)	1 (0.1%)	0 (0%)	0 (0%)	0 (0%)	1 (0.1%)	0 (0%)	0 (0%)
Blood products transfusion	40 (1.0%)	15 (1.5%)	36 (1.2%)	12 (1.6%)	29 (1.1%)	25 (3.7%)	36 (1.2%)	12 (1.7%)
Hysterectomy	8 (0.2%)	1 (0.1%)	2 (<0.1%)	3 (0.4%)	2 (<0.1%)	0 (0%)	2 (<0.1%)	0 (0%)
Temporary tracheostomy	0 (0%)	1 (0.1%)	0 (0%)	0 (0%)	0 (0%)	2 (0.3%)	0 (0%)	1 (0.1%)
Ventilation	4 (0.1%)	7 (0.7%)	3 (0.1%)	4 (0.5%)	2 (<0.1%)	15 (2.2%)	3 (0.1%)	3 (0.4%)
Any severe maternal morbidity event	66 (1.7%)	44 (4.5%)	55 (1.8%)	35 (4.7%)	40 (1.5%)	70 (10%)	53 (1.8%)	21 (2.9%)
Any respiratory maternal morbidity event	6 (0.2%)	18 (1.8%)	5 (0.2%)	19 (2.6%)	5 (0.2%)	46 (6.8%)	4 (0.1%)	7 (1.0%)
Any non-respiratory material morbidity event	64 (1.6%)	34 (3.5%)	54 (1.8%)	26 (3.5%)	38 (1.4%)	42 (6.2%)	53 (1.8%)	16 (2.2%)
Any non-transfusion maternal morbidity event	32 (0.8%)	33 (3.4%)	22 (0.7%)	28 (3.8%)	17 (0.6%)	58 (8.5%)	18 (0.6%)	13 (1.8%)

**eTable 3.** Baseline Characteristics Comparing Populations With Documented SARS-CoV-2 Testing After Propensity Matching

Characteristic	Original Strain		Alpha Variant		Delta Variant		Omicron Variant	
	Test-Positive N = 978	Test-Negative N = 3,912	Test-Positive N = 744	Test-Negative N = 2,976	Test-Positive N = 678	Test-Negative N = 2,712	Test-Positive N = 724	Test-Negative N = 2,434
<b>Age</b>	29.5 (24.8, 33.5)	29.2 (24.7, 33.4)	29.0 (24.4, 33.5)	29.1 (24.6, 33.5)	29.1 (25.0, 33.1)	29.2 (24.9, 33.1)	28.6 (24.6, 32.8)	29.8 (25.2, 33.9)
<b>Race</b>								
White	618 (63%)	2,517 (64%)	499 (67%)	2,018 (68%)	458 (68%)	1,834 (68%)	466 (64%)	1,586 (65%)
Black or African American	209 (21%)	800 (20%)	155 (21%)	621 (21%)	142 (21%)	564 (21%)	153 (21%)	490 (20%)
Other*	111 (11%)	445 (11%)	62 (8.3%)	230 (7.7%)	66 (9.7%)	253 (9.3%)	84 (12%)	292 (12%)
Unknown/declined	40 (4.1%)	150 (3.8%)	28 (3.8%)	107 (3.6%)	12 (1.8%)	61 (2.2%)	21 (2.9%)	66 (2.7%)
<b>Ethnicity</b>								
Hispanic or Latino	323 (33%)	1,320 (34%)	156 (21%)	625 (21%)	139 (21%)	553 (20%)	160 (22%)	648 (27%)
Not Hispanic or Latino/unknown	655 (67%)	2,592 (66%)	588 (79%)	2,351 (79%)	539 (79%)	2,159 (80%)	564 (78%)	1,786 (73%)
<b>Payor</b>								
Private	412 (42%)	1,651 (42%)	380 (51%)	1,521 (51%)	351 (52%)	1,398 (52%)	349 (48%)	1,241 (51%)
Public	539 (55%)	2,150 (55%)	353 (47%)	1,408 (47%)	316 (47%)	1,274 (47%)	361 (50%)	1,161 (48%)
Uninsured/self pay	26 (2.7%)	106 (2.7%)	11 (1.5%)	47 (1.6%)	11 (1.6%)	40 (1.5%)	14 (1.9%)	32 (1.3%)
Other/unknown	1 (0.1%)	5 (0.1%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
<b>Obesity</b>	158 (16%)	639 (16%)	131 (18%)	498 (17%)	90 (13%)	357 (13%)	98 (14%)	319 (13%)
<b>Asthma</b>	72 (7.4%)	269 (6.9%)	51 (6.9%)	210 (7.1%)	45 (6.6%)	174 (6.4%)	51 (7.0%)	184 (7.6%)
<b>Diabetes</b>	143 (15%)	524 (13%)	95 (13%)	397 (13%)	71 (10%)	285 (11%)	74 (10%)	258 (11%)
<b>Anemia</b>	96 (9.8%)	398 (10%)	69 (9.3%)	289 (9.7%)	86 (13%)	343 (13%)	94 (13%)	288 (12%)
<b>Preterm Delivery less than 37 weeks gestation</b>	137 (14%)	553 (14%)	106 (14%)	450 (15%)	138 (20%)	547 (20%)	107 (15%)	291 (12%)
<b>Patients with Severe Maternal Morbidities</b>	44 (4.5%)	81 (2.1%)	35 (4.7%)	59 (2.0%)	70 (10%)	61 (2.2%)	21 (2.9%)	41 (1.7%)

Statistics presented: n (%); Median (IQR)

\*American Indian or Alaska Native, Asian, Hispanic

**eTable 4.** Association of SARS-CoV-2 Infection With Any SMM, Nonrespiratory SMM, Respiratory SMM, and Nontransfusion SMM

	Original Strain			Alpha Variant			Delta Variant			Omicron Variant		
	Test-Positive	Test-Negative	Odds Ratio (95% CI)	Test-Positive	Test-Negative	Odds Ratio (95% CI)	Test-Positive	Test-Negative	Odds Ratio (95% CI)	Test-Positive	Test-Negative	Odds Ratio (95% CI)
<b>Any SMM</b>												
SMM	44	81	2.23 (1.52, 3.22)	35	59	2.44 (1.58,3.72)	70	61	5.0 (3.51, 7.15)	21	41	1.74 (1.01, 2.94)
No SMM	934	3831		709	2917		608	2651		703	2393	
<b>Non-Respiratory SMM</b>												
SMM	34	80	1.73 (1.13, 2.57)	26	57	1.85 (1.14, 2.94)	42	61	2.87 (1.91, 4.28)	16	41	1.31 (0.72, 2.32)
No SMM	944	3832		718	2919		636	2651		708	2393	
<b>Respiratory SMM</b>												
SMM	18	9	8.13 (3.73, 19.03)	19	9	8.64 (4.0, 20.13)	46	9	21.86 (11.17, 47.95)	7	6	3.95 (1.31, 12.31)
No SMM	960	3903		725	2967		632	2703		717	2428	
<b>Non-Transfusion SMM</b>												
SMM	33	43	3.14 (1.97, 4.96)	28	33	3.49 (2.08, 5.80)	58	34	21.86 (11.17, 47.95)	13	22	2.00 (0.97, 3.95)
No SMM	945	3869		716	2943		620	2678		711	2412	