

SUPPLEMENT

Supplement to:

Adverse outcomes of SARS-CoV-2 infection with delta and omicron variants in vaccinated versus unvaccinated US veterans: retrospective cohort study

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Supplement 1. Description of covariates and how they were modeled in our multivariable logistic regression models

1. Calendar month of infection (July, August, September, October, November for Delta)
2. Age, modeled as restricted cubic splines with 5 knots corresponding to 5, 27.5, 50, 72.5 and 95 percentiles, as recommended¹⁹
 - a. Delta: corresponding to ages 31, 48, 61, 72, 83, respectively
 - b. Omicron: corresponding to ages 31, 47, 59, 70, 82, respectively
3. Sex (male, female)
4. Race (White, Black, Asian, American Indian/Alaska Native [AI/AN], Pacific Islander/Native Hawaiian [PI/NH], Other)
5. Ethnicity (Hispanic, non-Hispanic, Unknown)
6. Body mass index, Kg/m² (BMI), (BMI, modeled as restricted cubic splines with 5 knots corresponding to 5, 27.5, 50, 72.5 and 95 percentiles)
 - a. Delta: corresponding to BMI 21.6, 26.8, 30.0, 33.8, 42.0, respectively
 - b. Omicron: corresponding to BMI 21.6, 26.7, 29.9, 33.6, 42.0, respectively
7. Urban vs. Rural residence (based on zip codes)
8. Region, based on VISN, see map below (West Region: 19, 20, 21, 22; Midwest Region: 10, 12, 15, 23; Northeast Region: 1, 2, 4, 5; South Region: 6, 7, 8, 9, 16, 17)
9. Charlson Comorbidity Index- 2 year (continuous)
10. Care Assessment Need (CAN)-score 1-YEAR mortality score (continuous)
11. Immunosuppressant medications in the prior 90 days
12. Diabetes
13. Chronic kidney disease
14. Congestive heart failure
15. Hypertension
16. Obstructive sleep apnea
17. Depression
18. Post traumatic stress disorder (PTSD)
19. Chronic obstructive pulmonary disease (COPD)
20. Cancer
21. Cerebrovascular disease
22. Coronary atherosclerotic heart disease (CAHD)
23. Asthma
24. Alcohol Dependence
25. Drug Dependence
26. Hyperlipidemia
27. Dementia
28. Peripheral artery disease (PAD)
29. Venous thromboembolism (VTE)
30. Smoking (never, former, current, unknown)

Supplement 2. Immunosuppressive and cancer medications

Prescriptions filled within 90 days of test-positive date unless otherwise indicated

† Filled within one year of test-positive date

ABATACEPT, ABEMACICLIB, ABRAXANE, ACALABRUTINIB, ADALIMUMAB, AFATINIB, ALDESLEUKIN, ALECTINIB, ALEMTUZUMAB,† ALPELISIB, ANAKINRA, ANTI-THYMOCYTE GLOBULIN, † APREMILAST, APSPARAGINASE, ARSENIC TRIOXIDE, ASCIMINIB, ASPARAGINASE, ATEZOLIZUMAB, AVACOPAN, AVAPRITINIB, AVELUMAB, AXITINIB, AZACITIDINE, AZATHIOPRINE, BARICITINIB, BASILIXIMAB, BELANTAMAB, BELATACEPT, BELIMUMAB, BELINOSTAT, BELUMOSUDIL, BELZUTIFAN, BENDAMUSTINE, BENRALIZUMAB, BEVACIZUMAB, BEXAROTENE, BINIMETINIB, BINMETINIB, BLEOMYCIN, BLINATUMOMAB, BORTEZOMIB, BOSUTINIB, BRENTUXIMAB, BRIGATINIB, BRODALUMAB, BUDESONIDE, BUSULFAN, CABAZITAXEL, CABOZANTINIB, CANAKINUMAB, CAPECITABINE, CAPMATINIB, CARBOPLATIN, CARFILZOMIB, CARMUSTINE, CEMIPILIMAB, CERITINIB, CERTINIB, CERTOLIZUMAB, CETUXIMAB, CHLORAMBUCIL, CISPLATIN, CISPLATINUM, CLADRIBINE, CLOFARABINE, COBIMETINIB, COPANLISIB, COPAXONE, CRIZOTINIB, CYCLOPHOSPHAMIDE, CYCLOSPORINE, CYTARABINE, DABRAFENIB, DACARBAZINE, DACOMITINIB, DACTINOMYCIN, DARATUMUMAB, DASATINIB, DAUNORUBICIN, DENOSUMAB, DEXAMETHASONE, DIMETHYL FUMARATE, DOCETAXEL, DOXORUBICIN, DUPILUMAB, DURVALUMAB, DUVELISIB, ECULIZUMAB, ELOTUZUMAB, ENASIDENIB, ENCORAFENIB, ENFORTUMAB, ENTRECTINIB, ENZALUTAMIDE, EPIRUBICIN, ERDAFITINIB, ERIBULIN, ERLOTINIB, ESTRAMUSTINE, ETANERCEPT, ETOPOSIDE, EVEROLIMUS, FATUMUMAB, FINGOLIMOD, FLUDARABINE, FLUOROURACIL, FLUTAMIDE, GEFITINIB, GEMCITABINE, GEMTUZUMAB, GENGRAF, GILTERITINIB, GLASDEGIB, GLATIRAMER, GLATIRAMIR ACETATE, GOLIMUMAB, GUSELKUMAB, HERCEPTIN, HYDROCORTISONE, HYDROXYCHLOROQUINE, HYDROXYUREA, IBRUTINIB, IDARUBICIN, IDELALISIB, IFOSFAMIDE, IMATINIB, INFIGRATINIB, INFLECTRA, INFLIXIMAB, INOTUZUMAB, INTERFERON, INVIBRUTINIB, IPILIMUMAB, IRINOTECAN, ISATUXIMAB, IVOSIDENIB, IXAZOMIB, IXEKIZUMAB, LAPATINIB, LAROTRECTINIB, LEFLUNOMIDE, LENALIDOMIDE, LENVATINIB, LETROZOLE, LOMUSTINE, LONCASTUXIMAB, LURBINECTEDIN, MARGETUXIMAB, MECHLORETHAMINE, MELPHALAN, MEPOLIZUMAB, MERCAPTOPYRINE, METHOTREXATE, METHYLPREDNISOLONE, MIDOSTAURIN, MITOMYCIN, MITOXANTRONE, MOGAMULIZUMAB, MYCOPHENOLATE, MYCOPHENOLIC ACID, NATALIZUMAB, NELARABINE, NERATINIB, NILOTINIB, NILUTAMIDE, NIRAPARIB, NIVOLUMAB, OBINUTUZUMAB, OCRELIZUMAB,† OFATUMUMAB,† OLAPARIB, OSIMERTINIB, OXALIPLATIN, PACLITAXEL, PALBOCICLIB, PANITUMUMAB, PANOBINOSTAT, PAZOPANIB, PEGASPARGASE, PEGINTERFERON, PEMBROLIZUMAB, PEMETREXED, PEMIGATINIB, PENTOSTATIN, PERTUZUMAB, PEXIDARTINIB, PIMECROLIMUS, POLATUZUMAB, POMALIDOMIDE, PONATINIB, PRALATREXATE, PREDNISOLONE, PREDNISONE, PROCARBAZINE, RAMUCIRUMAB, RASBURICASE, RAVULIZUMAB, REGORAFENIB, RENFLEXIS, RESLIZUMAB, RIBOCICLIB, RILONACEPT, 10 RIPRETINIB, RISANKIZUMAB, RISKANIKIZUMAB, RITUXIMAB,† ROMIDEPSIN, ROPEGINTERFERON, RUCAPARIB, RUXOLITINIB, SACITUZUMAB, SARILUMAB, SATRALIZUMAB, SECUKINUMAB, SELINEXOR, SELPERCATINIB, SILTUXIMAB, SIPONIMOD, SIPULEUCEL, SIROLIMUS, SORAFENIB, SULFASALAZINE, SUNITINIB, SUTIMLIMAB, TACROLIMUS, TAFASITAMAB, TAGRAXOFUSP, TALAZOPARIB, TAZEMETOSTAT, TEMOZOLOMIDE, TEMSIROLIMUS, TERIFLUNOMIDE, THALIDOMIDE, THIIOGUANINE, THIOPHOSPHORAMIDE, THIOTEPA, TILDRAKIZUMAB, TIPIRACIL, TIVOZANIB, TOCILIZUMAB, TOFACITINIB, TRABECTEDIN, TRAMETINIB, TRASTUZUMAB, TRIFLURIDINE, TUCATINIB, UMBRALISIB, UPADACITINIB, USTEKINUMAB, VALRUBICIN, VANDETANIB, VEDOLIZUMAB, VENETOCLAX, VINBLASTINE, VINCISTINE, VINOELBINE, VORINOSTAT, ZANUBRUTINIB

Supplement 3. Receipt of antiviral and monoclonal antibody treatments for COVID-19, by vaccination status

For the Delta Period:

	All Patients N=95,336	No Vaccination n=49,928	Partial mRNA vaccination n=2,236	Two Doses mRNA n=35,994	Three Doses mRNA n=1,691	Complete Janssen n=5,064
Treatment Received, n (%)						
No Treatment	84,583 (88.7%)	45,092 (90.3%)	2,024 (90.5%)	31,154 (86.6%)	1,418 (83.9%)	4,526 (89.4%)
Casirivimab/imdevimab	9,113 (9.6%)	4,139 (8.3%)	181 (8.1%)	4,097 (11.4%)	199 (11.8%)	454 (9.0%)
Sotrovimab	70 (0.1%)	37 (0.1%)	2 (0.1%)	25 (0.1%)	3 (0.2%)	1 (0.0%)
Bamlanivimab/etesivimab	1,563 (1.6%)	659 (1.3%)	29 (1.3%)	713 (2.0%)	71 (4.2%)	83 (1.6%)
Tixagevimab/cilgavimab	7 (0.0%)	1 (0.0%)	0 (0.0%)	5 (0.0%)	0 (0.0%)	0 (0.0%)

For the Omicron Period:

	All Patients N=184,653	No Vaccination n=50,552	Partial mRNA vaccination n=4,278	Two Doses mRNA n=56,911	Three Doses mRNA n=56,115	Complete Janssen n=8,419
Treatment Received, n (%)						
No Treatment	159,169 (86.2%)	44,456 (87.9%)	3,788 (88.5%)	50,518 (88.8%)	46,422 (82.7%)	7,582 (90.1%)
Sotrovimab	2,694 (1.5%)	745 (1.5%)	52 (1.2%)	733 (1.3%)	965 (1.7%)	110 (1.3%)
Nirmatrelvir/ritonavir	9,305 (5.0%)	1,641 (3.2%)	166 (3.9%)	2,105 (3.7%)	4,153 (7.4%)	233 (2.8%)
Molnupiravir	2,998 (1.6%)	470 (0.9%)	49 (1.1%)	698 (1.2%)	1,373 (2.4%)	85 (1.0%)
Bamlanivimab/etesivimab	337 (0.2%)	108 (0.2%)	8 (0.2%)	109 (0.2%)	85 (0.2%)	15 (0.2%)
Bebtelovimab	1,052 (0.6%)	139 (0.3%)	16 (0.4%)	161 (0.3%)	559 (1.0%)	22 (0.3%)
Casirivimab/imdevimab	754 (0.4%)	243 (0.5%)	20 (0.5%)	260 (0.5%)	188 (0.3%)	31 (0.4%)
Remdesivir	8,791 (4.8%)	2,893 (5.7%)	186 (4.3%)	2,422 (4.3%)	2,532 (4.5%)	359 (4.3%)

Supplement 4. Patient characteristics of those excluded due to the requirement for recent care (at least one workload primary care encounter in the previous 18 months and at least one workload or inpatient admission in the past 12 months), during both study periods

CHARACTERISTICS	Delta Cohort N=95,336	Delta Exclusions N=6,624	Omicron Cohort N=184,653	Omicron Exclusions N=12,211
Vaccination, n (%)				
None	49,928 (52.4%)	5,335 (80.5%)	50,552 (27.4%)	7,627 (62.5%)
Partial mRNA	2,236 (2.3%)	121 (1.8%)	4,278 (2.3%)	479 (3.9%)
2 mRNA	35,994 (37.8%)	947 (14.3%)	56,911 (30.8%)	2,322 (19.0%)
3 mRNA	1,691 (1.8%)	42 (0.6%)	56,115 (30.4%)	1,271 (10.4%)
Complete Janssen	5,064 (5.3%)	162 (2.4%)	8,419 (4.6%)	297 (2.4%)
Other	423 (0.4%)	17 (0.3%)	8,378 (4.5%)	215 (1.8%)
Month of Infection, n (%)				
July 2021	9,928 (10.4%)	816 (12.3%)		
August 2021	29,849 (31.3%)	2,268 (34.2%)		
September 2021	23,897 (25.1%)	1,563 (23.6%)		
October 2021	15,478 (16.2%)	994 (15.0%)		
November 2021	16,184 (17.0%)	983 (14.8%)		
December 2021				
January 2022			107,596 (58.3%)	7,625 (62.4%)
February 2022			22,764 (12.3%)	1,359 (11.1%)
March 2022			6,542 (3.5%)	403 (3.3%)
April 2022			6,931 (3.8%)	439 (3.6%)
May 2022			17,377 (9.4%)	1,053 (8.6%)
June 2022			23,443 (12.7%)	1,332 (10.9%)
Age (years), mean (SD)	58.8 (16.4)	51.6 (16.8)	59.7 (16.2)	52.6 (17.2)
Age (years), n (%)				
under 50	28,432 (29.8%)	3,280 (49.5%)	50,905 (27.6%)	5,644 (46.2%)
50 to <65	26,489 (27.8%)	1,771 (26.7%)	53,560 (29.0%)	3,378 (27.7%)
65 to <80	32,918 (34.5%)	1,176 (17.8%)	64,595 (35.0%)	2,361 (19.3%)
80 and over	7,497 (7.9%)	397 (6.0%)	15,593 (8.4%)	828 (6.8%)
Male Sex, n (%)	83,982 (88.1%)	6,039 (91.2%)	160,158 (86.7%)	10,665 (87.3%)
Race, n (%)				
White	70,266 (73.7%)	4,343 (65.6%)	125,262 (67.8%)	7,140 (58.5%)
Black	15,582 (16.3%)	1,165 (17.6%)	37,810 (20.5%)	2,428 (19.9%)

Asian	786 (0.8%)	71 (1.1%)	2,925 (1.6%)	271 (2.2%)
American Indian/Alaska Native (AI/AN)	856 (0.9%)	72 (1.1%)	1,666 (0.9%)	118 (1.0%)
Pacific Islander/Native Hawaiian (PI/NH)	914 (1.0%)	76 (1.1%)	2,065 (1.1%)	120 (1.0%)
Unknown	6,932 (7.3%)	897 (13.5%)	14,925 (8.1%)	2,134 (17.5%)
Ethnicity, n (%)				
Non-Hispanic	83,420 (87.5%)	5,256 (79.3%)	155,261 (84.1%)	8,694 (71.2%)
Hispanic	7,455 (7.8%)	626 (9.5%)	18,159 (9.8%)	991 (8.1%)
Unknown	4,461 (4.7%)	742 (11.2%)	11,233 (6.1%)	2,526 (20.7%)
Urban, n (%)	71,335 (74.8%)	5,128 (77.4%)	143,315 (77.6%)	9,467 (77.5%)
Geographic region, n (%)				
West	22,363 (23.5%)	1,903 (28.7%)	47,019 (25.5%)	3,712 (30.4%)
Midwest	18,936 (19.9%)	1,166 (17.6%)	32,791 (17.8%)	1,996 (16.3%)
Northeast	12,027 (12.6%)	741 (11.2%)	28,739 (15.6%)	1,814 (14.9%)
South	42,010 (44.1%)	2,814 (42.2%)	76,104 (41.2%)	4,689 (38.4%)
BMI, mean (SD)	30.7 (6.5)	29.7 (6.2)	30.3 (6.4)	29.1 (6.1)
BMI, n (%)				
under 18.5	950 (1.0%)	93 (1.4%)	2,199 (1.2%)	177 (1.4%)
18.5 to <25	15,279 (16.0%)	1,217 (18.4%)	32,368 (17.5%)	2,407 (19.7%)
25 to <30	30,961 (32.5%)	2,116 (31.9%)	61,994 (33.6%)	3,576 (29.3%)
30 and over	47,382 (49.7%)	2,583 (39.0%)	86,780 (47.0%)	4,049 (33.2%)
Missing	764 (0.8%)	615 (9.3%)	1,312 (0.7%)	2,002 (16.4%)
Charlson Comorbidity Index, n (%)				
0	41,309 (43.3%)	5,665 (85.5%)	76,476 (41.4%)	10,301 (84.4%)
1	19,578 (20.5%)	481 (7.3%)	37,383 (20.2%)	836 (6.8%)
2	13,398 (14.1%)	218 (3.3%)	26,349 (14.3%)	402 (3.3%)
3	7,530 (7.9%)	88 (1.3%)	15,207 (8.2%)	214 (1.8%)
4	5,111 (5.4%)	46 (0.7%)	10,211 (5.5%)	160 (1.3%)
5-6	5,220 (5.5%)	84 (1.3%)	11,295 (6.1%)	184 (1.5%)
7-8	2,264 (2.4%)	25 (0.4%)	5,098 (2.8%)	81 (0.7%)
>=9	926 (1.0%)	17 (0.3%)	2,634 (1.4%)	33 (0.3%)
CAN Score Percentile, n (%)				
0-30	39,776 (41.7%)	1,265 (19.1%)	72,848 (39.5%)	1,897 (15.5%)
31-55	22,106 (23.2%)	549 (8.3%)	42,627 (23.1%)	758 (6.2%)
56-75	14,930 (15.7%)	329 (5.0%)	29,109 (15.8%)	496 (4.1%)
76-90	11,705 (12.3%)	172 (2.6%)	23,809 (12.9%)	311 (2.5%)
91-95	907 (1.0%)	4 (0.1%)	2,034 (1.1%)	20 (0.2%)

96-100	4,730 (5.0%)	23 (0.3%)	11,314 (6.1%)	59 (0.5%)
Missing	1,182 (1.2%)	4,282 (64.6%)	2,912 (1.6%)	8,670 (71.0%)
Immunosuppressants in prior 90 d, n (%)	5,693 (6.0%)	71 (1.1%)	13,032 (7.1%)	201 (1.6%)
Smoking, n (%)				
Never	36,996 (38.8%)	675 (10.2%)	74,423 (40.3%)	1,117 (9.1%)
Former	39,182 (41.1%)	593 (9.0%)	71,501 (38.7%)	796 (6.5%)
Current	14,971 (15.7%)	536 (8.1%)	30,432 (16.5%)	730 (6.0%)
Unknown	4,187 (4.4%)	4,820 (72.8%)	8,297 (4.5%)	9,568 (78.4%)
Comorbidities in the prior 2 yrs, n (%)				
Alcohol Dependence	19,786 (20.8%)	594 (9.0%)	39,679 (21.5%)	1,000 (8.2%)
Asthma	6,809 (7.1%)	86 (1.3%)	14,246 (7.7%)	162 (1.3%)
Cancer	16,146 (16.9%)	202 (3.0%)	26,399 (14.3%)	327 (2.7%)
Cerebrovascular Disease	1,517 (1.6%)	28 (0.4%)	3,671 (2.0%)	74 (0.6%)
Chronic Kidney Disease	11,656 (12.2%)	169 (2.6%)	23,926 (13.0%)	348 (2.8%)
Chronic Obstructive Pulmonary Disease	13,775 (14.4%)	232 (3.5%)	26,971 (14.6%)	438 (3.6%)
Congestive Heart Failure	6,338 (6.6%)	99 (1.5%)	13,775 (7.5%)	219 (1.8%)
Coronary Atherosclerotic Heart Disease	17,374 (18.2%)	247 (3.7%)	34,723 (18.8%)	481 (3.9%)
Dementia	3,326 (3.5%)	180 (2.7%)	7,775 (4.2%)	483 (4.0%)
Depression	33,226 (34.9%)	886 (13.4%)	68,150 (36.9%)	1,563 (12.8%)
Any Diabetes	29,043 (30.5%)	453 (6.8%)	56,451 (30.6%)	881 (7.2%)
Drug Dependence	4,326 (4.5%)	261 (3.9%)	9,603 (5.2%)	459 (3.8%)
Hyperlipidemia	55,713 (58.4%)	732 (11.1%)	108,281 (58.6%)	1,234 (10.1%)
Hypertension	54,735 (57.4%)	895 (13.5%)	108,802 (58.9%)	1,635 (13.4%)
Obstructive Sleep Apnea	31,482 (33.0%)	487 (7.4%)	62,478 (33.8%)	758 (6.2%)
Peripheral Artery Disease	8,681 (9.1%)	120 (1.8%)	18,112 (9.8%)	290 (2.4%)
Post-traumatic Stress Disorder	24,805 (26.0%)	752 (11.4%)	51,197 (27.7%)	1,279 (10.5%)
Venous Thromboembolism	2,221 (2.3%)	29 (0.4%)	4,775 (2.6%)	106 (0.9%)

Supplement 5. Patient characteristics of those receiving Pfizer versus Moderna, during both study periods

CHARACTERISTICS	Delta Pfizer N=18,877	Delta Moderna N=17,063	Omicron Pfizer N=56,423	Omicron Moderna N=53,687
Month of Infection, n (%)				
July 2021	1,875 (9.9%)	1,221 (7.2%)		
August 2021	6,094 (32.3%)	4,513 (26.4%)		
September 2021	4,958 (26.3%)	4,358 (25.5%)		
October 2021	3,107 (16.5%)	3,465 (20.3%)		
November 2021	2,843 (15.1%)	3,506 (20.5%)		
December 2021				
January 2022			32,894 (58.3%)	29,810 (55.5%)
February 2022			6,279 (11.1%)	6,872 (12.8%)
March 2022			1,916 (3.4%)	2,127 (4.0%)
April 2022			2,395 (4.2%)	2,285 (4.3%)
May 2022			5,803 (10.3%)	5,532 (10.3%)
June 2022			7,136 (12.6%)	7,061 (13.2%)
Age (years), mean (SD)	64.1 (14.8)	67.5 (14.0)	60.8 (15.8)	63.1 (15.4)
Age (years), n (%)				
under 50	3,341 (17.7%)	2,033 (11.9%)	14,025 (24.9%)	10,744 (20.0%)
50 to <65	4,950 (26.2%)	3,788 (22.2%)	16,370 (29.0%)	14,924 (27.8%)
65 to <80	8,480 (44.9%)	8,493 (49.8%)	21,115 (37.4%)	22,024 (41.0%)
80 and over	2,106 (11.2%)	2,749 (16.1%)	4,913 (8.7%)	5,995 (11.2%)
Male Sex, n (%)	16,883 (89.4%)	15,673 (91.9%)	48,285 (85.6%)	47,564 (88.6%)
Race, n (%)				
White	13,348 (70.7%)	13,628 (79.9%)	35,639 (63.2%)	38,034 (70.8%)
Black	3,603 (19.1%)	1,986 (11.6%)	13,911 (24.7%)	9,683 (18.0%)
Asian	205 (1.1%)	122 (0.7%)	1,127 (2.0%)	874 (1.6%)
American Indian/Alaska Native (AI/AN)	166 (0.9%)	144 (0.8%)	511 (0.9%)	456 (0.8%)
Pacific Islander/Native Hawaiian (PI/NH)	201 (1.1%)	137 (0.8%)	675 (1.2%)	596 (1.1%)
Unknown	1,354 (7.2%)	1,046 (6.1%)	4,560 (8.1%)	4,044 (7.5%)
Ethnicity, n (%)				
Non-Hispanic	16,484 (87.3%)	15,322 (89.8%)	47,379 (84.0%)	45,078 (84.0%)
Hispanic	1,598 (8.5%)	1,057 (6.2%)	5,621 (10.0%)	5,829 (10.9%)
Unknown	795 (4.2%)	684 (4.0%)	3,423 (6.1%)	2,780 (5.2%)

Urban, n (%)	15,607 (82.7%)	12,167 (71.3%)	47,185 (83.6%)	40,949 (76.3%)
Geographic region, n (%)				
West	4,458 (23.6%)	3,909 (22.9%)	15,016 (26.6%)	13,217 (24.6%)
Midwest	3,636 (19.3%)	3,960 (23.2%)	9,279 (16.4%)	9,526 (17.7%)
Northeast	2,430 (12.9%)	2,968 (17.4%)	9,078 (16.1%)	9,037 (16.8%)
South	8,353 (44.2%)	6,226 (36.5%)	23,050 (40.9%)	21,907 (40.8%)
BMI, mean (SD)	30.7 (6.5)	30.6 (6.4)	30.3 (6.2)	30.4 (6.4)
BMI, n (%)				
under 18.5	218 (1.2%)	173 (1.0%)	595 (1.1%)	587 (1.1%)
18.5 to <25	3,029 (16.0%)	2,819 (16.5%)	9,783 (17.3%)	9,178 (17.1%)
25 to <30	6,262 (33.2%)	5,564 (32.6%)	19,004 (33.7%)	18,259 (34.0%)
30 and over	9,244 (49.0%)	8,426 (49.4%)	26,681 (47.3%)	25,367 (47.2%)
Missing	124 (0.7%)	81 (0.5%)	360 (0.6%)	296 (0.6%)
Charlson Comorbidity Index, n (%)				
0	6,267 (33.2%)	4,778 (28.0%)	21,875 (38.8%)	19,020 (35.4%)
1	3,807 (20.2%)	3,494 (20.5%)	11,359 (20.1%)	10,935 (20.4%)
2	3,052 (16.2%)	2,948 (17.3%)	8,156 (14.5%)	8,551 (15.9%)
3	1,908 (10.1%)	1,919 (11.2%)	4,947 (8.8%)	5,092 (9.5%)
4	1,377 (7.3%)	1,432 (8.4%)	3,328 (5.9%)	3,535 (6.6%)
5-6	1,451 (7.7%)	1,571 (9.2%)	3,849 (6.8%)	3,916 (7.3%)
7-8	689 (3.6%)	650 (3.8%)	1,845 (3.3%)	1,745 (3.3%)
>=9	326 (1.7%)	271 (1.6%)	1,064 (1.9%)	893 (1.7%)
CAN Score Percentile, n (%)				
0-30	5,629 (29.8%)	3,829 (22.4%)	21,327 (37.8%)	17,469 (32.5%)
31-55	4,579 (24.3%)	3,974 (23.3%)	13,004 (23.0%)	12,809 (23.9%)
56-75	3,681 (19.5%)	3,700 (21.7%)	9,174 (16.3%)	9,649 (18.0%)
76-90	3,143 (16.6%)	3,456 (20.3%)	7,760 (13.8%)	8,166 (15.2%)
91-95	236 (1.3%)	291 (1.7%)	637 (1.1%)	746 (1.4%)
96-100	1,380 (7.3%)	1,610 (9.4%)	3,744 (6.6%)	4,093 (7.6%)
Missing	229 (1.2%)	203 (1.2%)	777 (1.4%)	755 (1.4%)
Immunosuppressants in prior 90 d, n (%)	1,432 (7.6%)	1,458 (8.5%)	4,458 (7.9%)	4,408 (8.2%)
Smoking, n (%)				
Never	7,244 (38.4%)	6,107 (35.8%)	23,903 (42.4%)	21,676 (40.4%)
Former	8,500 (45.0%)	8,207 (48.1%)	22,227 (39.4%)	22,320 (41.6%)
Current	2,395 (12.7%)	2,163 (12.7%)	7,973 (14.1%)	7,668 (14.3%)
Unknown	738 (3.9%)	586 (3.4%)	2,320 (4.1%)	2,023 (3.8%)

Comorbidities in the prior 2 yrs, n (%)				
Alcohol Dependence	3,852 (20.4%)	3,198 (18.7%)	11,986 (21.2%)	10,915 (20.3%)
Asthma	1,455 (7.7%)	1,303 (7.6%)	4,500 (8.0%)	4,284 (8.0%)
Cancer	4,324 (22.9%)	4,008 (23.5%)	9,109 (16.1%)	8,838 (16.5%)
Cerebrovascular Disease	381 (2.0%)	409 (2.4%)	1,259 (2.2%)	1,194 (2.2%)
Chronic Kidney Disease	3,022 (16.0%)	3,280 (19.2%)	7,790 (13.8%)	8,316 (15.5%)
Chronic Obstructive Pulmonary Disease	3,295 (17.5%)	3,819 (22.4%)	8,193 (14.5%)	9,363 (17.4%)
Congestive Heart Failure	1,719 (9.1%)	1,860 (10.9%)	4,566 (8.1%)	4,664 (8.7%)
Coronary Atherosclerotic Heart Disease	4,427 (23.5%)	4,820 (28.2%)	11,231 (19.9%)	12,078 (22.5%)
Dementia	895 (4.7%)	955 (5.6%)	2,570 (4.6%)	2,616 (4.9%)
Depression	6,467 (34.3%)	5,440 (31.9%)	20,879 (37.0%)	19,282 (35.9%)
Any Diabetes	7,044 (37.3%)	7,009 (41.1%)	18,429 (32.7%)	18,709 (34.8%)
Drug Dependence	796 (4.2%)	635 (3.7%)	2,745 (4.9%)	2,408 (4.5%)
Hyperlipidemia	12,006 (63.6%)	12,023 (70.5%)	33,220 (58.9%)	35,200 (65.6%)
Hypertension	12,702 (67.3%)	12,426 (72.8%)	34,564 (61.3%)	35,191 (65.5%)
Obstructive Sleep Apnea	6,783 (35.9%)	6,072 (35.6%)	20,167 (35.7%)	19,142 (35.7%)
Peripheral Artery Disease	2,367 (12.5%)	2,465 (14.4%)	6,041 (10.7%)	6,165 (11.5%)
Post-traumatic Stress Disorder	4,535 (24.0%)	3,821 (22.4%)	15,482 (27.4%)	14,054 (26.2%)
Venous Thromboembolism	550 (2.9%)	479 (2.8%)	1,559 (2.8%)	1,466 (2.7%)

Supplement 6. Median (IQR) days since last vaccine dose stratified by outcome, vaccination group, and study period

Delta Period:

Outcome	All Patients N=45,408	Partial mRNA vaccination n=2,236	Two Doses mRNA n=35,994	Three Doses mRNA n=1,691	Complete Janssen n=5,064
Hospitalization					
0	177 (136 to 213)	72 (25 to 184)	185 (151 to 218)	30 (12 to 93)	145 (99 to 184)
1	182 (141 to 217)	94 (25 to 192)	189 (159 to 222)	29 (13 to 75)	126 (83 to 169)
ICU Admission					
0	178 (137 to 214)	71 (25 to 185)	186 (152 to 219)	29 (12 to 90)	144 (97 to 183)
1	175 (134 to 210)	118 (28 to 186)	184 (153 to 216)	33 (14 to 84)	122 (88 to 161)
Ventilation					
0	178 (137 to 214)	72 (25 to 184)	186 (152 to 219)	29 (12 to 90)	144 (97 to 182)
1	174 (133 to 203)	133 (32 to 198)	180 (151 to 209)	50 (21 to 75)	124 (91 to 165)
Death					
0	177 (136 to 213)	70 (25 to 183)	185 (152 to 218)	29 (12 to 90)	144 (97 to 182)
1	191 (151 to 225)	153 (27 to 220)	199 (167 to 232)	30 (12 to 75)	141 (101 to 182)

Omicron Period:

Outcome	All Patients N=134,101	Partial mRNA vaccination n=4,278	Two Doses mRNA n=56,911	Three Doses mRNA n=56,115	Complete Janssen n=8,419
Hospitalization					
0	196 (95 to 288)	198 (102 to 312)	288 (246 to 335)	107 (68 to 173)	267 (195 to 304)
1	203 (106 to 305)	180 (84 to 303)	311 (266 to 349)	125 (80 to 186)	259 (202 to 307)
ICU Admission					
0	196 (96 to 289)	197 (100 to 312)	290 (248 to 336)	108 (68 to 174)	266 (195 to 304)
1	206 (107 to 309)	230 (86 to 297)	313 (267 to 346)	123 (80 to 181)	257 (198 to 308)
Ventilation					
0	196 (96 to 290)	197 (100 to 311)	290 (248 to 337)	109 (69 to 174)	266 (195 to 304)
1	205 (104 to 302)	184 (75 to 286)	305 (255 to 338)	118 (74 to 172)	250 (192 to 294)
Death					
0	196 (96 to 289)	198 (101 to 312)	290 (248 to 336)	108 (69 to 175)	266 (195 to 304)
1	231 (114 to 318)	137 (72 to 259)	314 (275 to 342)	115 (79 to 162)	278 (227 to 307)

Supplement 7. Chi-Square tests between each outcome and region as an assessment of whether regional variation is present.

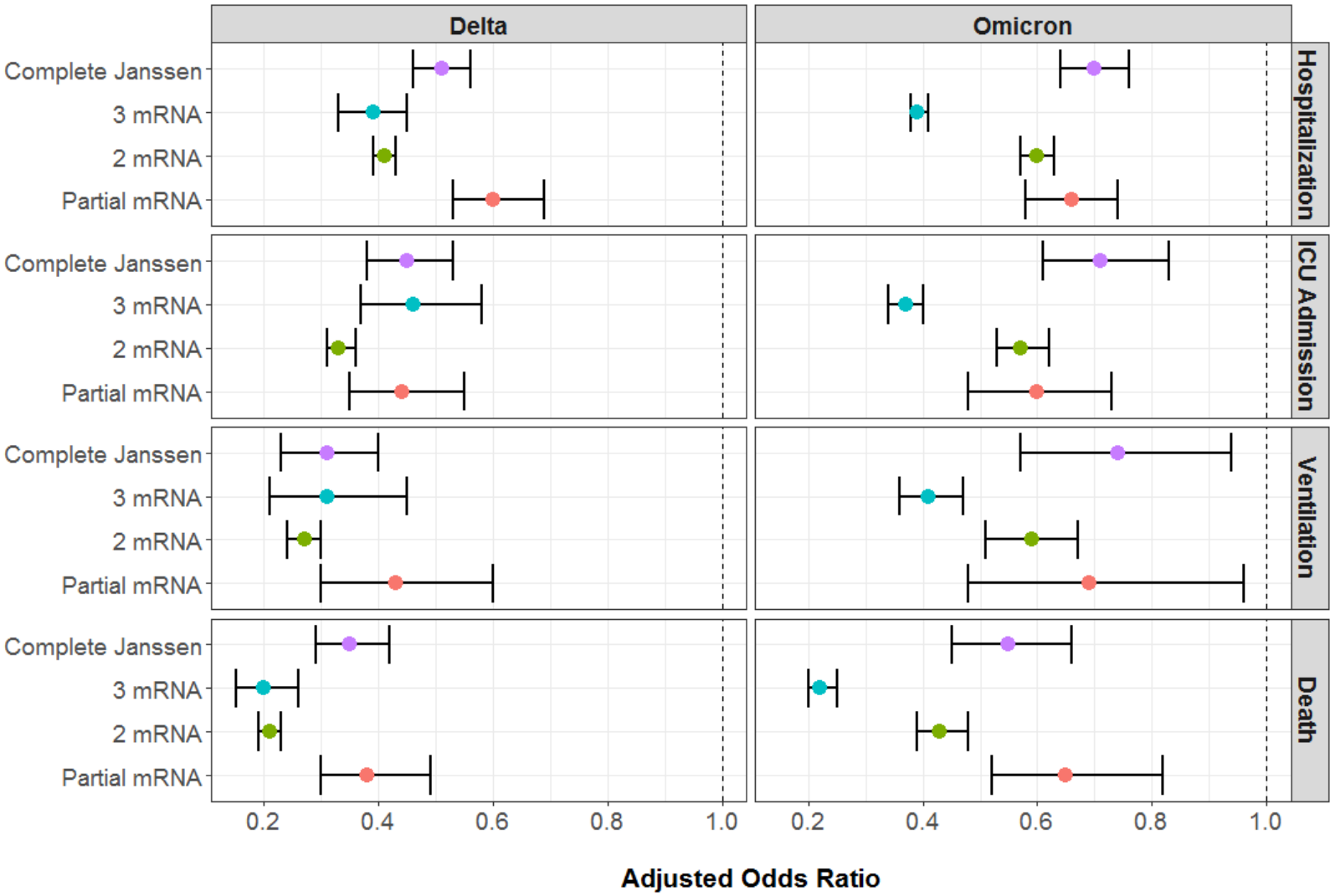
For the Delta Period:

Outcome	χ^2 Statistic	P-value
Hospitalization	15.363	0.002
ICU Admission	23.858	< 0.001
Ventilation	20.928	< 0.001
Death	8.141	0.043

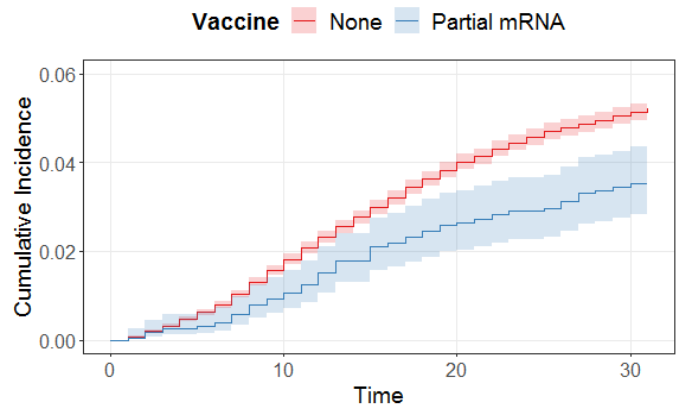
For the Omicron Period:

Outcome	χ^2 Statistic	P-value
Hospitalization	71.817	< 0.001
ICU Admission	63.665	< 0.001
Ventilation	7.336	0.062
Death	10.087	0.018

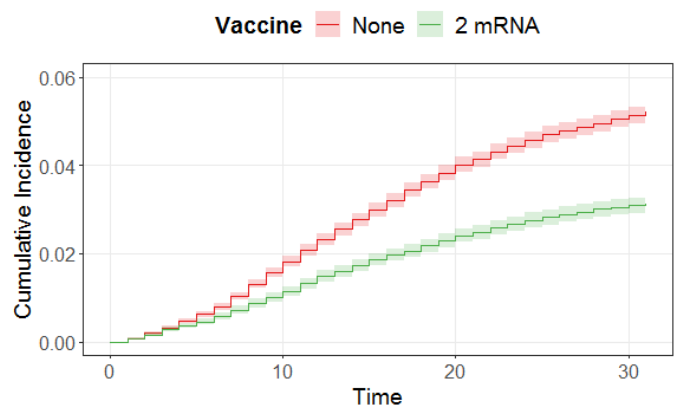
Supplement 8. Forest plot of primary analyses. No vaccination is the reference group.



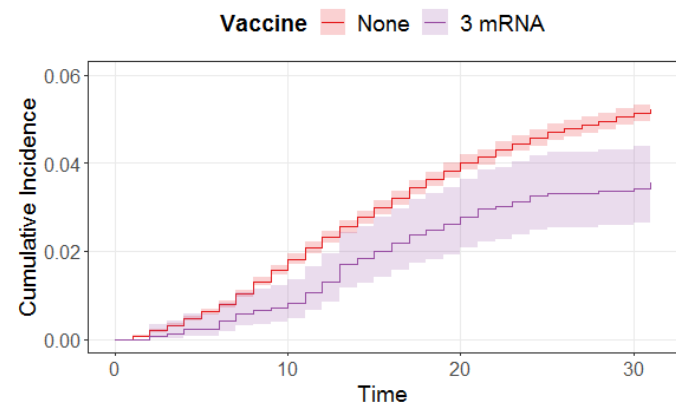
Delta Period – Outcome: Death



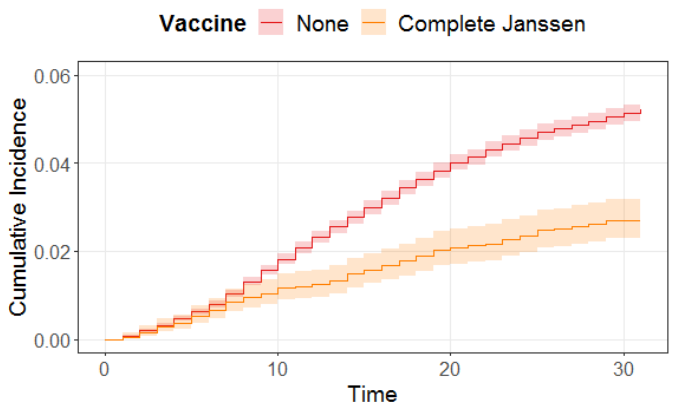
None			
At Risk	49928	49149	48018
Events	0	905	2001
Partial mRNA			
At Risk	2236	2215	2178
Events	0	24	59



None			
At Risk	49928	49149	48018
Events	0	905	2001
2 mRNA			
At Risk	35994	35633	35169
Events	0	413	868

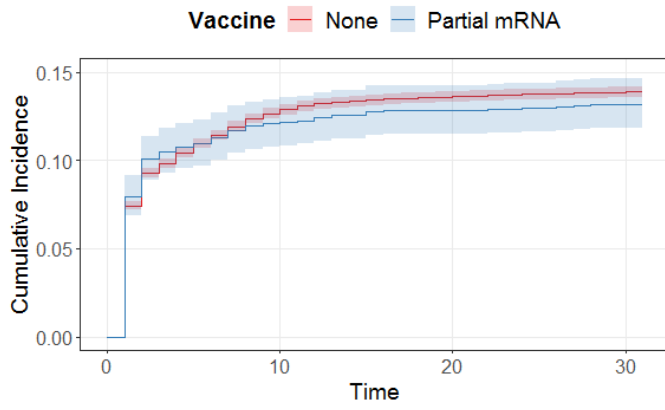


None			
At Risk	49928	49149	48018
Events	0	905	2001
3 mRNA			
At Risk	1691	1679	1647
Events	0	14	47



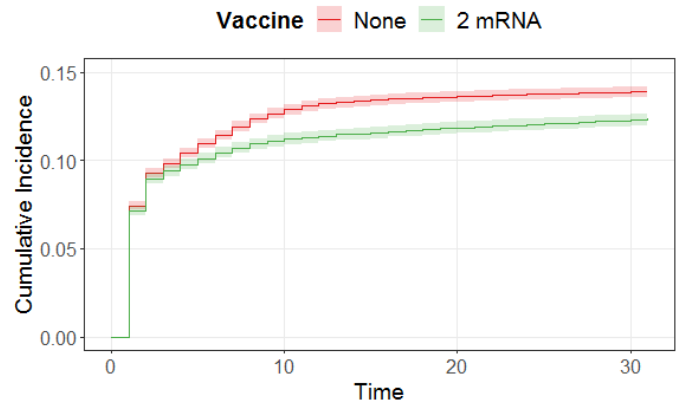
None			
At Risk	49928	49149	48018
Events	0	905	2001
Complete Janssen			
At Risk	5064	5011	4961
Events	0	59	105

Delta Period – Outcome: Hospitalization



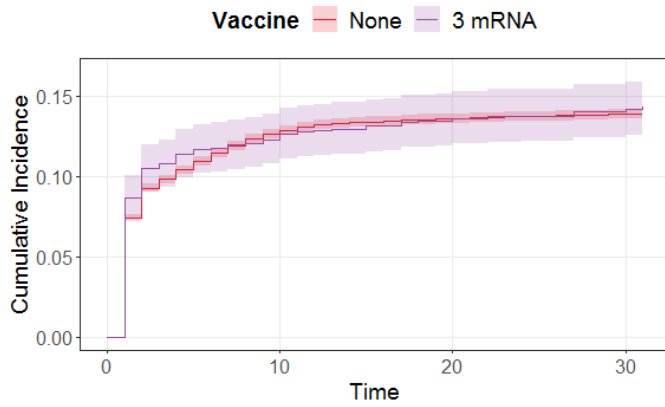
None				
At Risk	49928	43080	42005	41566
Events	0	6432	6799	6933

Partial mRNA				
At Risk	2236	1953	1914	1895
Events	0	272	287	295



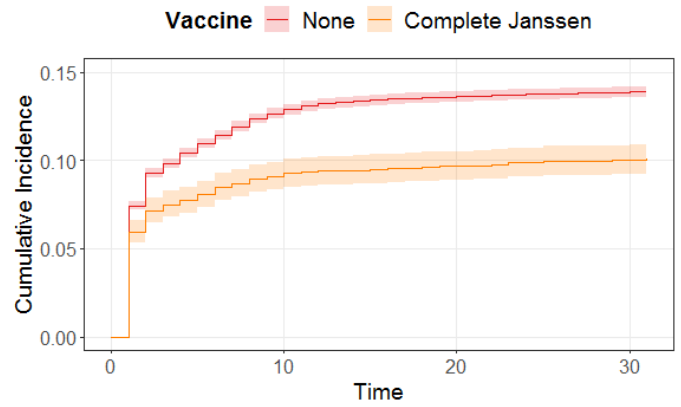
None				
At Risk	49928	43080	42005	41566
Events	0	6432	6799	6933

2 mRNA				
At Risk	35994	31779	31287	31000
Events	0	4034	4268	4425



None				
At Risk	49928	43080	42005	41566
Events	0	6432	6799	6933

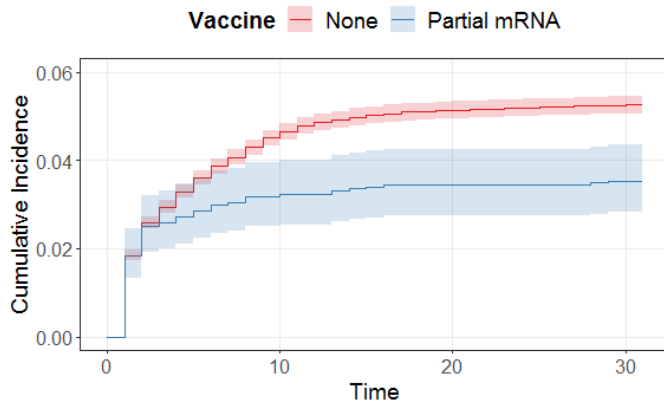
3 mRNA				
At Risk	1691	1478	1444	1428
Events	0	214	230	240



None				
At Risk	49928	43080	42005	41566
Events	0	6432	6799	6933

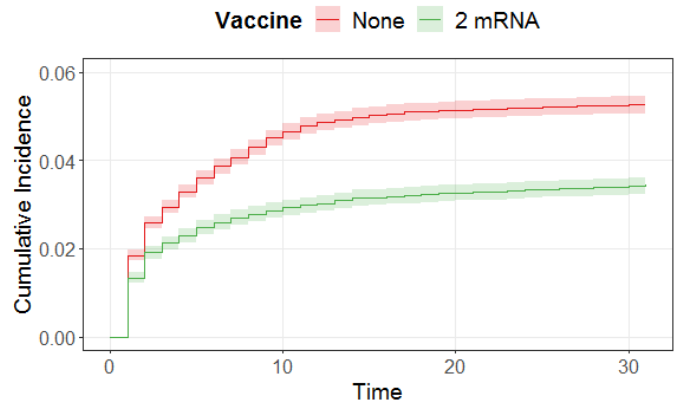
Complete Janssen				
At Risk	5064	4563	4514	4477
Events	0	469	490	508

Delta Period – Outcome: ICU Admission



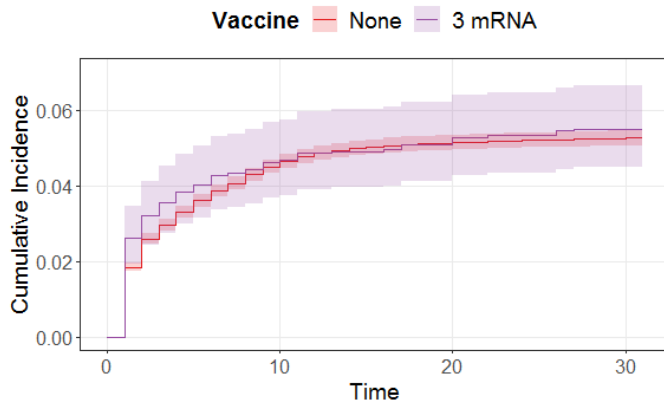
None				
At Risk	49928	47087	46015	45565
Events	0	2322	2566	2623

Partial mRNA				
At Risk	2236	2150	2116	2099
Events	0	72	77	79



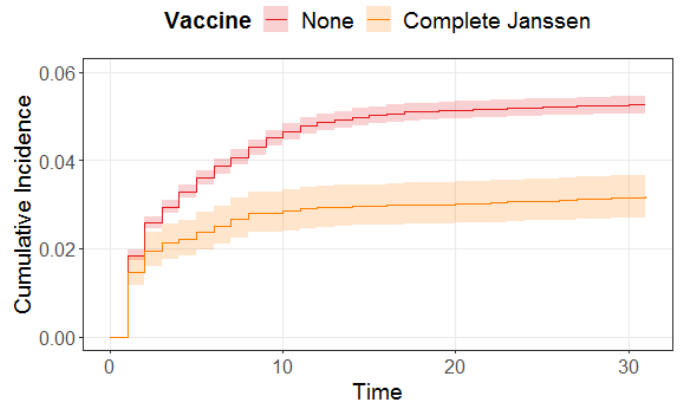
None				
At Risk	49928	47087	46015	45565
Events	0	2322	2566	2623

2 mRNA				
At Risk	35994	34675	34208	33973
Events	0	1054	1176	1228



None				
At Risk	49928	47087	46015	45565
Events	0	2322	2566	2623

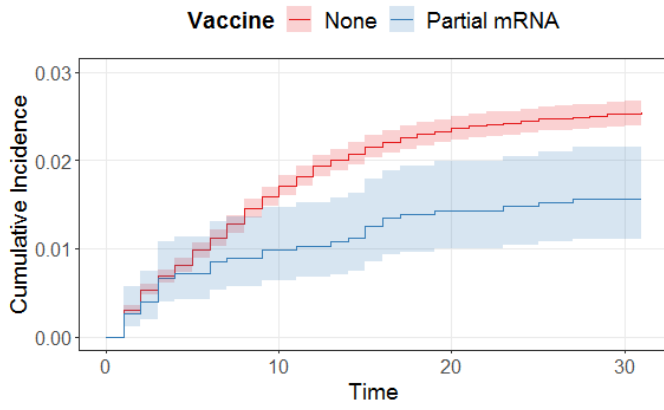
3 mRNA				
At Risk	1691	1605	1575	1558
Events	0	79	89	93



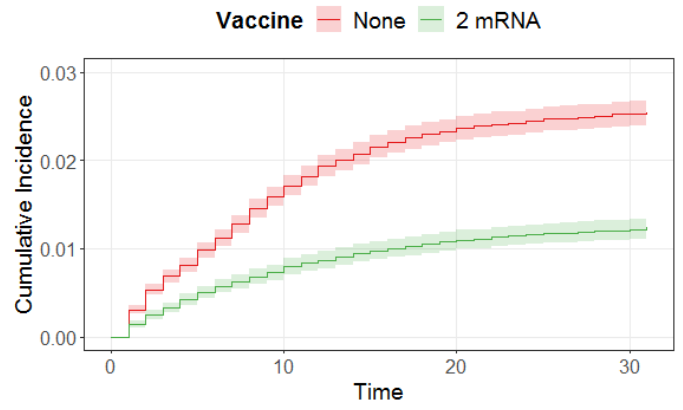
None				
At Risk	49928	47087	46015	45565
Events	0	2322	2566	2623

Complete Janssen				
At Risk	5064	4878	4835	4803
Events	0	144	153	160

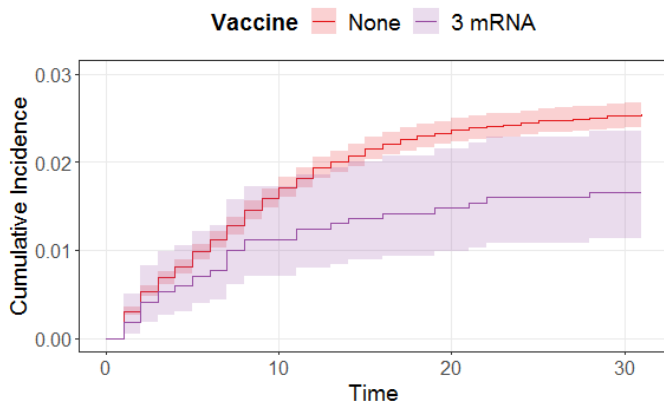
Delta Period – Outcome: Ventilation



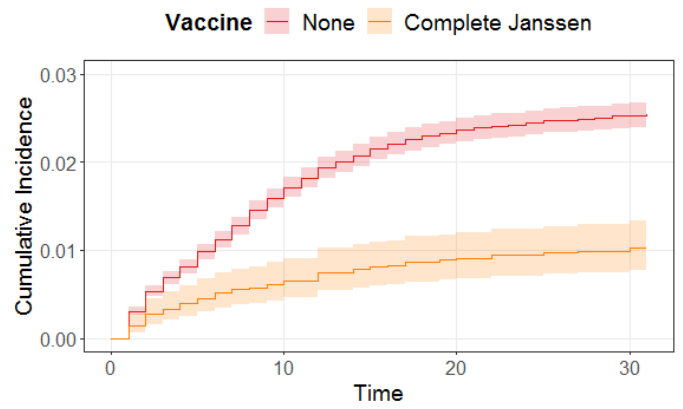
None				
At Risk	49928	48484	47287	46806
Events	0	852	1178	1263
Partial mRNA				
At Risk	2236	2196	2156	2140
Events	0	22	32	35



None				
At Risk	49928	48484	47287	46806
Events	0	852	1178	1263
2 mRNA				
At Risk	35994	35419	34916	34669
Events	0	286	395	437



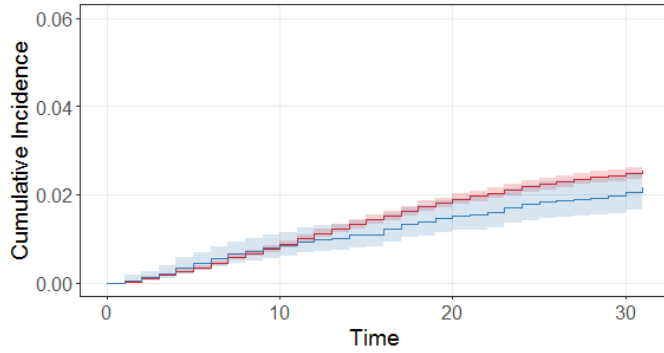
None				
At Risk	49928	48484	47287	46806
Events	0	852	1178	1263
3 mRNA				
At Risk	1691	1661	1632	1618
Events	0	19	25	28



None				
At Risk	49928	48484	47287	46806
Events	0	852	1178	1263
Complete Janssen				
At Risk	5064	4987	4936	4902
Events	0	33	46	52

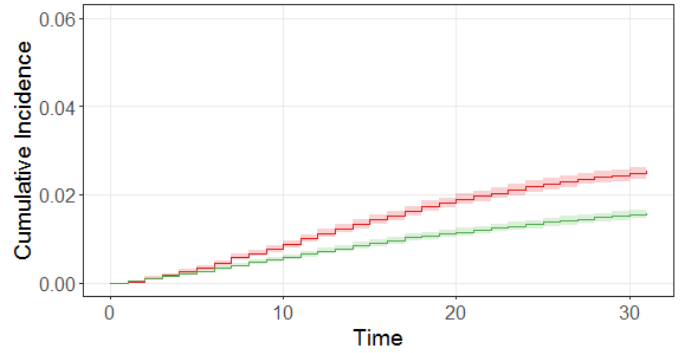
Omicron Period – Outcome: Death

Vaccine — None — Partial mRNA



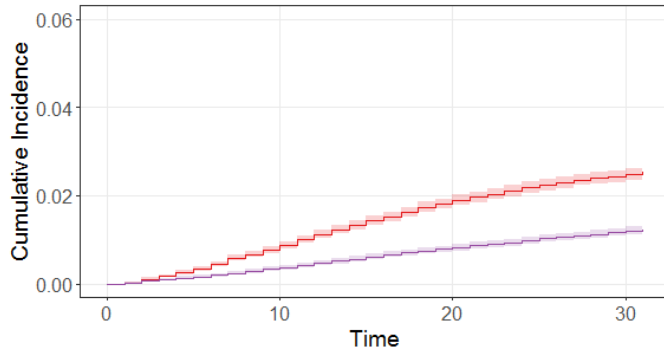
None				
At Risk	50552	50165	49638	49321
Events	0	446	958	1257
Partial mRNA				
At Risk	4278	4244	4215	4194
Events	0	36	65	88

Vaccine — None — 2 mRNA



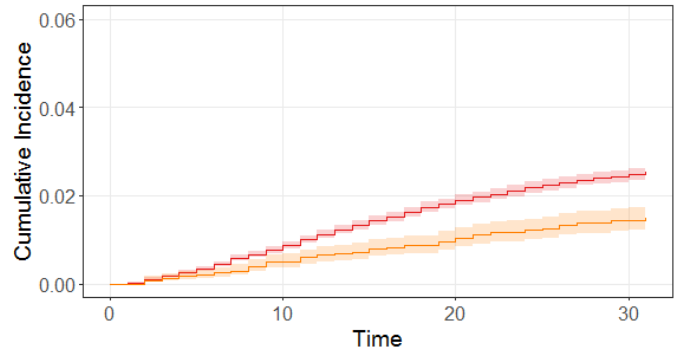
None				
At Risk	50552	50165	49638	49321
Events	0	446	958	1257
2 mRNA				
At Risk	56911	56614	56278	56048
Events	0	328	655	882

Vaccine — None — 3 mRNA



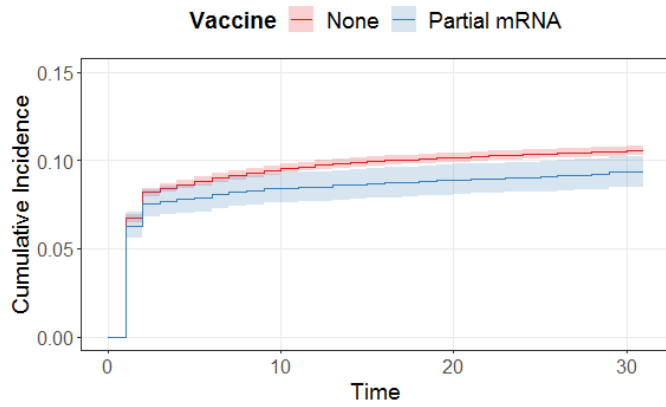
None				
At Risk	50552	50165	49638	49321
Events	0	446	958	1257
3 mRNA				
At Risk	56115	55928	55675	55462
Events	0	207	463	676

Vaccine — None — Complete Janssen



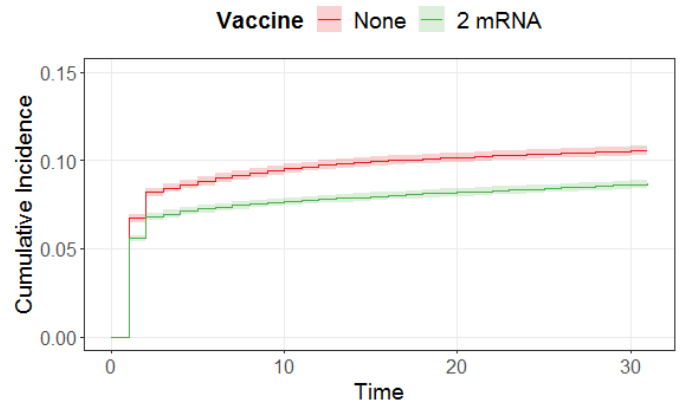
None				
At Risk	50552	50165	49638	49321
Events	0	446	958	1257
Complete Janssen				
At Risk	8419	8378	8338	8299
Events	0	43	88	122

Omicron Period – Outcome: Hospitalization



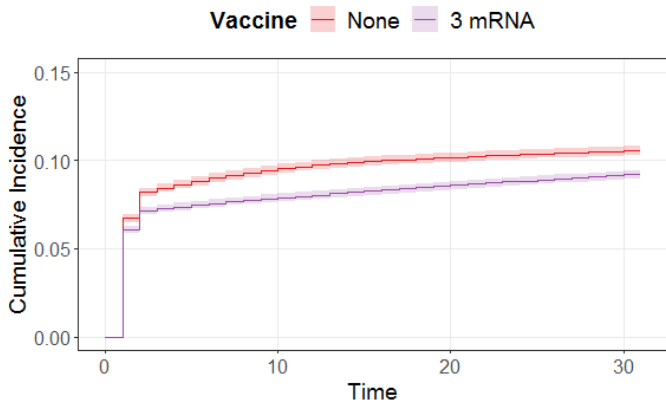
None				
At Risk	50552	45520	44874	44539
Events	0	4826	5145	5328

Partial mRNA				
At Risk	4278	3899	3861	3829
Events	0	361	381	400



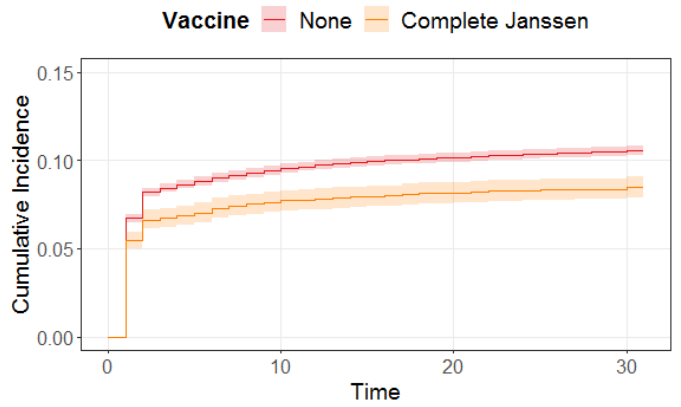
None				
At Risk	50552	45520	44874	44539
Events	0	4826	5145	5328

2 mRNA				
At Risk	56911	52379	51902	51559
Events	0	4370	4663	4908



None				
At Risk	50552	45520	44874	44539
Events	0	4826	5145	5328

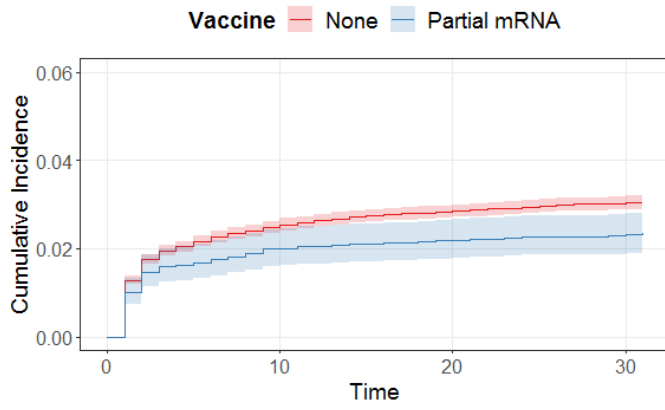
3 mRNA				
At Risk	56115	51604	51092	50663
Events	0	4428	4821	5157



None				
At Risk	50552	45520	44874	44539
Events	0	4826	5145	5328

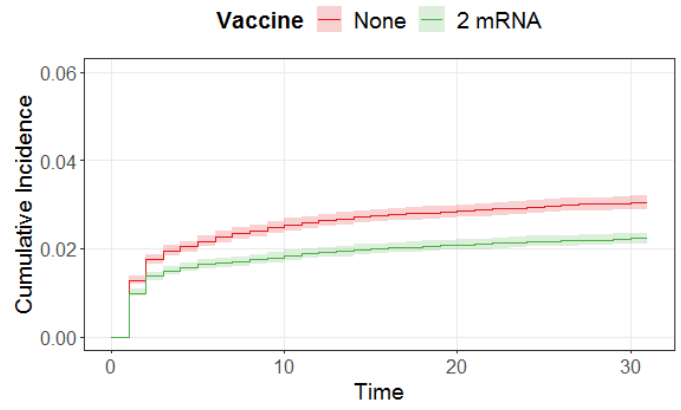
Complete Janssen				
At Risk	8419	7743	7677	7642
Events	0	649	688	711

Omicron Period – Outcome: ICU Admission



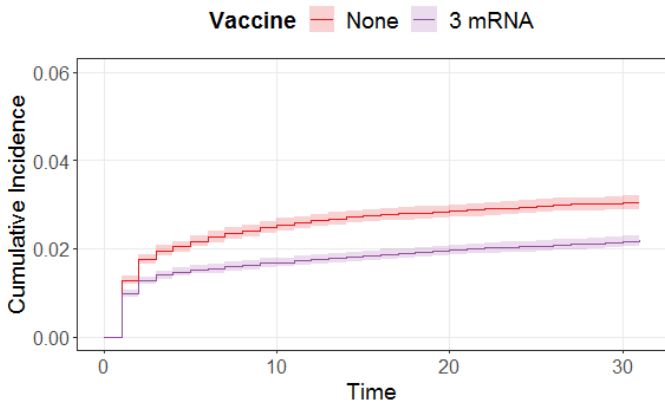
None				
At Risk	50552	49007	48450	48121
Events	0	1287	1441	1536

Partial mRNA				
At Risk	4278	4168	4136	4115
Events	0	86	94	99



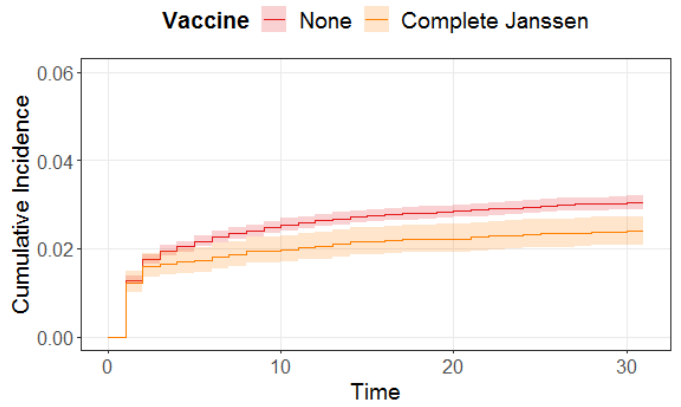
None				
At Risk	50552	49007	48450	48121
Events	0	1287	1441	1536

2 mRNA				
At Risk	56911	55668	55258	55004
Events	0	1052	1188	1267



None				
At Risk	50552	49007	48450	48121
Events	0	1287	1441	1536

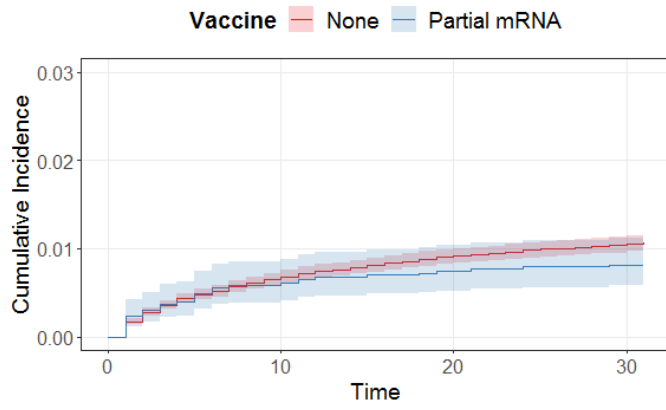
3 mRNA				
At Risk	56115	55031	54682	54423
Events	0	947	1104	1211



None				
At Risk	50552	49007	48450	48121
Events	0	1287	1441	1536

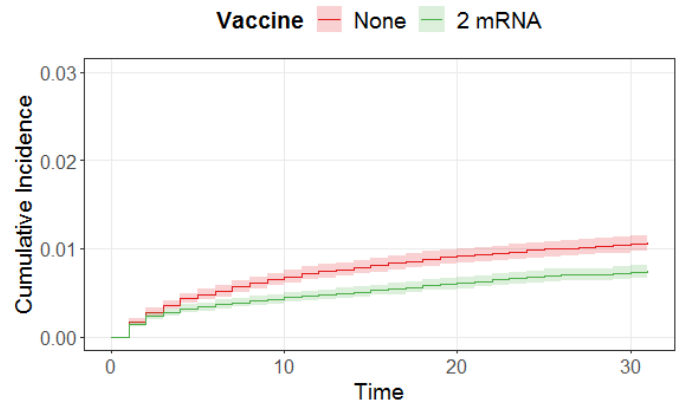
Complete Janssen				
At Risk	8419	8219	8165	8127
Events	0	167	187	201

Omicron Period – Outcome: Ventilation



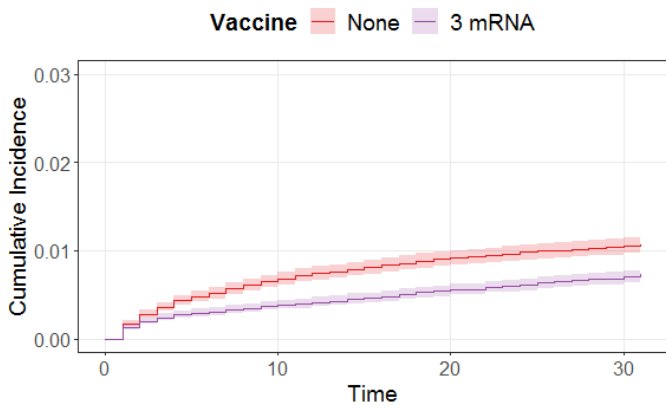
None				
At Risk	50552	49895	49329	49008
Events	0	345	464	533

Partial mRNA				
At Risk	4278	4224	4193	4173
Events	0	26	32	35



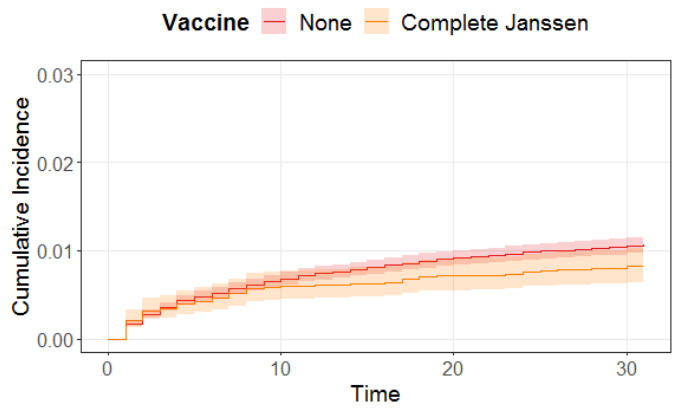
None				
At Risk	50552	49895	49329	49008
Events	0	345	464	533

2 mRNA				
At Risk	56911	56406	56020	55746
Events	0	257	347	418



None				
At Risk	50552	49895	49329	49008
Events	0	345	464	533

3 mRNA				
At Risk	56115	55737	55417	55157
Events	0	218	312	396



None				
At Risk	50552	49895	49329	49008
Events	0	345	464	533

Complete Janssen				
At Risk	8419	8334	8291	8253
Events	0	50	60	69

Supplement 10. Cox regression model results

For the Delta Period:

	HOSPITALIZATION		ICU ADMISSION		VENTILATION		DEATH	
	Crude Hazard Ratio (95% CI)	Adjusted* Hazard Ratio (95% CI)	Crude Hazard Ratio (95% CI)	Adjusted* Hazard Ratio (95% CI)	Crude Hazard Ratio (95% CI)	Adjusted* Hazard Ratio (95% CI)	Crude Hazard Ratio (95% CI)	Adjusted* Hazard Ratio (95% CI)
No Vaccination (49,928)	1	1	1	1	1	1	1	1
Partial (2,236)	0.95 0.84-1.07	0.65 0.58-0.74	0.67 0.53-0.83	0.47 0.37-0.58	0.61 0.44-0.86	0.44 0.31-0.61	0.67 0.54-0.84	0.42 0.34-0.53
Two Doses mRNA (35,994)	0.88 0.85-0.92	0.47 0.46-0.49	0.65 0.60-0.69	0.35 0.33-0.38	0.48 0.44-0.54	0.27 0.24-0.30	0.59 0.55-0.64	0.24 0.22-0.26
Three Doses mRNA (1,691)	1.03 0.91-1.17	0.45 0.40-0.51	1.05 0.85-1.29	0.49 0.40-0.60	0.65 0.45-0.94	0.31 0.21-0.46	0.67 0.52-0.87	0.23 0.18-0.30
Complete Janssen (5,064)	0.71 0.65-0.78	0.56 0.51-0.61	0.60 0.51-0.70	0.47 0.40-0.55	0.40 0.30-0.53	0.31 0.24-0.41	0.51 0.43-0.61	0.39 0.33-0.46

For the Omicron Period:

	HOSPITALIZATION		ICU ADMISSION		VENTILATION		DEATH	
	Crude Hazard Ratio (95% CI)	Adjusted* Hazard Ratio (95% CI)	Crude Hazard Ratio (95% CI)	Adjusted* Hazard Ratio (95% CI)	Crude Hazard Ratio (95% CI)	Adjusted* Hazard Ratio (95% CI)	Crude Hazard Ratio (95% CI)	Adjusted* Hazard Ratio (95% CI)
No Vaccination (50,552)	1	1	1	1	1	1	1	1
Partial (4,278)	0.88 0.80-0.98	0.72 0.65-0.79	0.76 0.62-0.93	0.62 0.50-0.75	0.77 0.54-1.08	0.69 0.49-0.98	0.85 0.69-1.05	0.68 0.55-0.84
Two Doses mRNA (56,911)	0.81 0.78-0.84	0.65 0.63-0.68	0.73 0.68-0.79	0.59 0.54-0.63	0.69 0.61-0.79	0.59 0.52-0.67	0.62 0.57-0.68	0.46 0.42-0.50
Three Doses mRNA (56,115)	0.87 0.84-0.90	0.45 0.44-0.47	0.71 0.66-0.76	0.39 0.36-0.42	0.68 0.60-0.77	0.41 0.36-0.47	0.48 0.44-0.53	0.24 0.22-0.27
Complete Janssen (8,419)	0.80 0.74-0.86	0.74 0.68-0.80	0.79 0.68-0.91	0.73 0.63-0.84	0.78 0.61-1.00	0.74 0.57-0.95	0.58 0.49-0.70	0.57 0.47-0.68

* Adjusted by multivariable Cox regression for 30 baseline characteristics listed in Table 1. The characteristics were modeled for adjustment as shown in Supplementary Table 1

Supplement 11. Sensitivity analysis that compares those who received 2 mRNA doses to those who received 3 mRNA doses in the Omicron period, with the added restriction that those in the 2 mRNA group must have received their last dose at least 180 days prior to infection (i.e., would have met a minimum threshold to be eligible for a 3rd mRNA dose).

	HOSPITALIZATION		ICU ADMISSION		VENTILATION		DEATH	
	Crude Odds Ratio (95% CI)	Adjusted* Odds Ratio (95% CI)	Crude Odds Ratio (95% CI)	Adjusted* Odds Ratio (95% CI)	Crude Odds Ratio (95% CI)	Adjusted* Odds Ratio (95% CI)	Crude Odds Ratio (95% CI)	Adjusted* Odds Ratio (95% CI)
Two Doses mRNA with 180+ Days Since Last Dose (49,396)	1	1	1	1	1	1	1	1
Three Doses mRNA (56,115)	1.04 1.00-1.08	0.67 0.64-0.71	0.94 0.87-1.02	0.66 0.61-0.72	0.96 0.84-1.11	0.72 0.62-0.83	0.75 0.67-0.83	0.53 0.47-0.59

* Adjusted by multivariable logistic regression for 30 baseline characteristics listed in Table 1. The characteristics were modeled for adjustment as shown in Supplementary Table 1

Supplement 12. Adjusted risk differences

DELTA PERIOD	HOSPITALIZATION		ICU ADMISSION		VENTILATION		DEATH	
	Adjusted Risk Difference (95% CI)*	Adjusted Odds Ratio (95% CI)	Adjusted Risk Difference (95% CI)*	Adjusted Odds Ratio (95% CI)	Adjusted Risk Difference (95% CI)*	Adjusted Odds Ratio (95% CI)	Adjusted Risk Difference (95% CI)*	Adjusted Odds Ratio (95% CI)
Reference category: No Vaccination								
No Vaccination (49,928)	Ref.		Ref.		Ref.		Ref.	
Partial (2,236)	-5.7% -7.0 to -4.5	0.60 0.53 to 0.69	-3.7% -4.4 to -3.0	0.44 0.35 to 0.55	-1.9% -2.3 to -1.2	0.43 0.30 to 0.60	-4.4% -5.2 to -3.6	0.38 0.30 to 0.49
Two Doses mRNA (35,994)	-8.9% -9.4 to -8.5	0.41 0.39 to 0.43	-4.4% -4.8 to -4.1	0.33 0.31 to 0.36	-2.4% -2.6 to -2.2	0.27 0.24 to 0.30	-5.9% -6.2 to -5.6	0.21 0.19 to 0.23
Three Doses mRNA (1,691)	-9.4% -10.4 to 8.3	0.39 0.33 to 0.45	-3.5% -4.3 to -2.7	0.46 0.37 to 0.58	-2.3% -2.6 to -1.9	0.31 0.21 to 0.45	-6.0% -6.5 to -5.5	0.20 0.15 to 0.26
Complete Janssen (5,064)	-7.3% -7.9 to -6.4	0.51 0.46 to 0.56	-3.6% -4.2 to -3.0	0.45 0.38 to 0.53	-2.3% -2.6 to -1.9	0.31 0.23 to 0.40	-4.7% -5.2 to -4.2	0.35 0.29 to 0.42
Reference category: Two doses mRNA								
No Vaccination (49,928)	+8.9% 8.5 to 9.4	2.42 2.31 to 2.54	+4.4% 4.1 to 4.8	3.00 2.78 to 3.23	+2.4% 2.2 to 2.6	3.77 3.36 to 4.23	+5.9% 5.6 to 6.2	4.78 4.41 to 5.19
Partial (2,236)	+3.3% 2.0 to 4.4	1.46 1.27 to 1.67	+0.8% 0.1 to 1.4	1.32 1.04 to 1.67	+0.6% 0.2 to 1.1	1.63 1.13 to 2.28	+1.5% 0.7 to 2.3	1.84 1.43 to 2.33
Two Doses mRNA (35,994)	Ref.		Ref.		Ref.		Ref.	
Three Doses mRNA (1,691)	-0.4% -1.5 to 0.6	0.94 0.81 to 1.09	+0.9% 0.1 to 1.8	1.39 1.11 to 1.73	+0.2% -0.2 to 0.6	1.17 0.78 to 1.70	-0.1% -0.6 to 0.4	0.95 0.72 to 1.24
Complete Janssen (5,064)	+1.7% 0.9 to 2.5	1.23 1.11 to 1.36	+0.8% 0.3 to 1.4	1.35 1.13 to 1.60	+0.1% -0.1 to 0.4	1.15 0.85 to 1.53	+1.3% 0.7 to 1.7	1.69 1.40 to 2.03
Comparison of Pfizer vs. Moderna vaccines								
Two Doses-Moderna (17,063)	Ref.		Ref.		Ref.		Ref.	
Two Doses-Pfizer (18,877)	+1.7% 1.1 to 2.2	1.25 1.17 to 1.34	+0.4% 0.1 to 0.7	1.19 1.06 to 1.34	+0.3% 0.2 to 0.5	1.42 1.17 to 1.73	+0.1% -0.1 to 0.4	1.07 0.95 to 1.21
Comparison of different intervals since last vaccination								
Two Doses mRNA 7-90 days ago (1,368)	Ref.		Ref.		Ref.		Ref.	
Two Doses mRNA 91-150 days ago (7,289)	-1.3% -2.8 to 0.1	0.84 0.69 to 1.03	+0.8% -0.1 to 1.4	1.41 0.97 to 2.14	+0.1% -0.3 to 0.5	1.14 0.66 to 2.15	-0.3% -1.2 to 0.4	0.86 0.56 to 1.38
Two Doses mRNA 151-270 days ago (26,157)	-0.2% -1.6 to 1.1	0.97 0.80 to 1.18	+0.6% -0.2 to 1.3	1.35 0.94 to 2.01	0.0% -0.4 to 0.4	1.05 0.62 to 1.94	+0.1% -0.9 to 0.8	1.05 0.71 to 1.65

OMICRON PERIOD	HOSPITALIZATION		ICU ADMISSION		VENTILATION		DEATH	
	Adjusted Risk Difference (95% CI)*	Adjusted Odds Ratio (95% CI)	Adjusted Risk Difference (95% CI)*	Adjusted Odds Ratio (95% CI)	Adjusted Risk Difference (95% CI)*	Adjusted Odds Ratio (95% CI)	Adjusted Risk Difference (95% CI)*	Adjusted Odds Ratio (95% CI)
Reference category: No Vaccination								
No Vaccination (50,552)	Ref.		Ref.		Ref.		Ref.	
Partial (4,278)	-3.7% -4.6 to -2.8	0.66 0.58 to 0.74	-1.5% -2.1 to -1.0	0.60 0.48 to 0.73	-0.4% -0.7 to -0.1	0.69 0.48 to 0.96	-1.1% -1.5 to -0.6	0.65 0.52 to 0.82
Two Doses mRNA (56,911)	-4.3% -4.7 to -3.9	0.60 0.57 to 0.63	-1.7% -1.9 to -1.5	0.57 0.53 to 0.62	-0.6% -0.7 to -0.4	0.59 0.51 to 0.67	-1.8% -2.0 to -1.6	0.43 0.39 to 0.48
Three Doses mRNA (56,115)	-7.0% -7.4 to -6.7	0.39 0.38 to 0.41	-2.5% -2.7 to -2.3	0.37 0.34 to 0.40	-0.8% -0.9 to -0.7	0.41 0.36 to 0.47	-2.6% -2.8 to -2.4	0.22 0.20 to 0.25
Complete Janssen (8,419)	-3.1% -3.9 to -2.5	0.70 0.64 to 0.76	-1.1% -1.5 to -0.6	0.71 0.61 to 0.83	-0.3% -0.6 to -0.1	0.74 0.57 to 0.94	-1.4% -1.8 to -1.0	0.55 0.45 to 0.66
Reference category: Two doses mRNA								
No Vaccination (50,552)	+4.3% 3.9 to 4.7	1.66 1.59 to 1.74	+1.7% 1.5 to 1.9	1.76 1.62 to 1.90	+0.6% 0.4 to 0.7	1.71 1.50 to 1.95	+1.8% 1.6 to 2.0	2.31 2.10 to 2.53
Partial (4,278)	+0.6% -0.3 to 1.3	1.09 0.97 to 1.23	+0.1% -0.4 to 0.6	1.05 0.84 to 1.29	+0.1% -0.1 to 0.5	1.17 0.81 to 1.64	+0.7% 0.3 to 1.2	1.51 1.19 to 1.89
Two Doses mRNA (56,911)	Ref.		Ref.		Ref.		Ref.	
Three Doses mRNA (56,115)	-2.7% -3.1 to -2.4	0.65 0.63 to 0.69	-0.8% -1.0 to -0.7	0.65 0.59 to 0.70	-0.2% -0.3 to -0.2	0.70 0.61 to 0.80	-0.8% -0.9 to -0.7	0.51 0.46 to 0.57
Complete Janssen (8,419)	+1.2% 0.4 to 1.8	1.16 1.06 to 1.27	+0.6% 0.2 to 1.0	1.25 1.07 to 1.46	+0.2% 0.0 to 0.4	1.26 0.97 to 1.62	+0.4% 0.1 to 0.7	1.26 1.03 to 1.53
Comparison of Pfizer vs. Moderna vaccines								
Two Doses-Moderna (28,230)	Ref.		Ref.		Ref.		Ref.	
Two Doses-Pfizer (28,548)	+2.2% 1.7 to 2.6	1.34 1.26 to 1.43	+0.6% 0.4 to 0.9	1.32 1.17 to 1.48	+0.3% 0.1 to 0.4	1.39 1.15 to 1.70	+0.2% 0.0 to 0.4	1.16 1.01 to 1.33
Three Doses-Moderna (25,457)	Ref.		Ref.		Ref.		Ref.	
Three Doses-Pfizer (27,875)	+1.6% 1.3 to 2.0	1.33 1.25 to 1.42	+0.3% 0.1 to 0.5	1.21 1.07 to 1.36	+0.1% 0.0 to 0.2	1.22 0.99 to 1.49	0.0% -0.2 to 0.1	0.97 0.83 to 1.14

<i>Comparison of different intervals since last vaccination</i>								
Two Doses mRNA 7-150 days ago (5,721)	Ref.		Ref.		Ref.		Ref.	
Two Doses mRNA 151-270 days ago (14,948)	+0.1% -0.7 to 1.1	1.02 0.89 to 1.17	+0.1% -0.3 to 0.5	1.06 0.83 to 1.35	+0.1% -0.2 to 0.3	1.08 0.73 to 1.62	+0.2% -0.3 to 0.6	1.14 0.84 to 1.57
Two Doses mRNA 271-365 days ago (27,260)	+0.3% -0.4 to 1.2	1.04 0.92 to 1.17	+0.2% -0.1 to 0.7	1.11 0.89 to 1.38	0.0% -0.3 to 0.3	1.05 0.74 to 1.53	+0.2% -0.2 to 0.5	1.15 0.87 to 1.53
Three doses mRNA 7-90 days ago (22,127)	Ref.		Ref.		Ref.		Ref.	
Three doses mRNA 91-150 days ago (15,161)	+0.8% 0.3 to 1.1	1.16 1.07 to 1.25	+0.2% 0.0 to 0.4	1.17 1.01 to 1.35	+0.1% 0.0 to 0.2	1.18 0.93 to 1.51	+0.2% 0.1 to 0.3	1.31 1.09 to 1.58

*95% confidence intervals from bootstrapping with 100 replications.

Supplement 13. Percent difference in beta estimates after sequentially adding adjustment variables

The following analysis is an exploration of which covariates in our models may be driving changes between the unadjusted and adjusted analysis. We focus on the OR for a patient with 3 doses of an mRNA vaccine being hospitalized within 30 days compared to a patient with 2 doses of an mRNA vaccine, during the Omicron period. We selected this model as our focus because of the substantial shift from the unadjusted OR estimate (1.07; 95% CI 1.03 – 1.12) to the adjusted OR estimate (0.65; 95% CI 0.63 – 0.69). Starting with the unadjusted model (Model 0), we then fit 30 adjusted models (Model 1) for each of the 30 adjustment variables listed in Supplement 1. We calculated the percent difference in β_1 after the addition of each adjustment variable and selected the one with the largest absolute difference to sequentially add to the next base model. We repeated this process of adding each remaining adjustment variable to the base model until the largest percent difference in β_1 from a single adjustment variable was less than 5%, which occurred in the 7th iteration. The table below shows results from the first 6 iterations. The 6 adjustment variables that provided the largest percent differences in β_1 were **age, number of comorbidities (Charlson Index), calendar month, CAN score, immunosuppressant meds, and BMI**.

$$\text{Percent Difference} = \frac{\beta_1^{\text{new}} - \beta_1^{\text{old}}}{\beta_1^{\text{old}}} \times 100\%$$

Model 0: $\beta_0 + \beta_1\text{vaccine}$

Model 1: $\beta_0 + \beta_1\text{vaccine} + \beta_2\text{variable}$

Model 2: $\beta_0 + \beta_1\text{vaccine} + \beta_2\text{age} + \beta_3\text{variable}$

Model 3: $\beta_0 + \beta_1\text{vaccine} + \beta_2\text{age} + \beta_3\text{CCI} + \beta_4\text{variable}$

Model 4: $\beta_0 + \beta_1\text{vaccine} + \beta_2\text{age} + \beta_3\text{CCI} + \beta_4\text{month} + \beta_5\text{variable}$

Model 5: $\beta_0 + \beta_1\text{vaccine} + \beta_2\text{age} + \beta_3\text{CCI} + \beta_4\text{month} + \beta_5\text{CAN} + \beta_6\text{variable}$

Model 6: $\beta_0 + \beta_1\text{vaccine} + \beta_2\text{age} + \beta_3\text{CCI} + \beta_4\text{month} + \beta_5\text{CAN} + \beta_6\text{immuno} + \beta_7\text{variable}$

Adjustment Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Age (restricted cubic splines)	-623%					
Charlson Comorbidity Index	-470%	20%				
Calendar Month of Infection	-97%	11%	11%			
CAN Score	-575%	-4%	-9%	-8%		
Immunosuppressant meds	-110%	14%	7%	6%	6%	
BMI (restricted cubic splines)	-14%	-10%	-8%	-7%	-5%	-5%
Smoking	3%	-7%	-5%	-4%	-3%	-3%
Cancer	-142%	6%	-1%	-1%	-2%	-2%
Dementia	-31%	-6%	-3%	-3%	-2%	-2%
Congestive Heart Failure	-109%	-1%	-3%	-2%	-1%	-1%
Drug Dependence	13%	-2%	-2%	-1%	-1%	-1%
Obstructive Sleep Apnea	4%	1%	-1%	-1%	-1%	-1%
Race	-2%	2%	0%	1%	1%	1%
Hypertension	-209%	2%	0%	0%	0%	0%
Chronic Kidney Disease	-159%	3%	0%	0%	0%	0%
CAHD	-156%	1%	0%	0%	0%	0%
Diabetes	-129%	2%	0%	0%	0%	0%
PAD	-107%	1%	0%	0%	0%	0%
COPD	-93%	-3%	-2%	-2%	0%	0%
Hyperlipidemia	-88%	1%	0%	0%	0%	0%
Sex	-59%	0%	0%	0%	0%	0%
VTE	-21%	1%	0%	0%	0%	0%
PTSD	-19%	0%	0%	0%	0%	0%
Cerebrovascular Disease	-19%	0%	0%	0%	0%	0%
Urban vs Rural	9%	-1%	-1%	-1%	0%	0%
Ethnicity	-8%	0%	0%	0%	0%	0%
Region	-8%	0%	0%	0%	0%	0%
Depression	-7%	1%	0%	0%	0%	0%
Alcohol Dependence	-3%	1%	0%	0%	0%	0%
Asthma	1%	0%	-1%	0%	0%	0%

Supplement 14. Analysis of time since last dose, stratified by baseline Care Assessment Need (CAN) score

	HOSPITALIZATION			ICU ADMISSION			VENTILATION			DEATH		
	Rate ¹	Crude Odds Ratio (95% CI)	Adjusted Odds Ratio ² (95% CI)	Rate ¹	Crude Odds Ratio (95% CI)	Adjusted Odds Ratio ² (95% CI)	Rate ¹	Crude Odds Ratio (95% CI)	Adjusted Odds Ratio ² (95% CI)	Rate ¹	Crude Odds Ratio (95% CI)	Adjusted Odds Ratio ² (95% CI)
Comparison of different intervals since last vaccination – DELTA – CAN Score At/Below Median: 0-40												
Two Doses mRNA 7-90 days ago (754)	37	1	1	5	1	1	3	1	1	1	1	1
Two Doses mRNA 91-150 days ago (3,590)	29	0.78 0.51-1.22	0.65 0.43-1.03	9	1.63 0.64-5.50	1.39 0.55-4.70	2	0.84 0.21-5.57	0.67 0.17-4.42	2	1.68 0.31-31.2	1.13 0.21-21.0
Two Doses mRNA 151-270 days ago (8,143)	32	0.86 0.58-1.32	0.71 0.48-1.10	7	1.32 0.54-4.37	1.14 0.46-3.79	5	1.72 0.52-10.6	1.27 0.38-7.83	2	1.58 0.32-28.4	0.86 0.17-15.6
Comparison of different intervals since last vaccination – DELTA – CAN Score Above Median: 41-100												
Two Doses mRNA 7-90 days ago (595)	223	1	1	42	1	1	19	1	1	39	1	1
Two Doses mRNA 91-150 days ago (3,604)	208	0.94 0.75-1.18	0.88 0.70-1.12	67	1.58 1.05-2.50	1.47 0.97-2.32	25	1.33 0.74-2.65	1.20 0.66-2.39	38	0.97 0.63-1.56	0.86 0.55-1.42
Two Doses mRNA 151-270 days ago (17,721)	208	0.94 0.76-1.16	0.95 0.76-1.19	51	1.19 0.80-1.85	1.32 0.89-2.07	17	0.87 0.50-1.70	0.97 0.55-1.90	49	1.25 0.84-1.96	1.01 0.66-1.61

¹ Rate is calculated per 1,000 patient at-risk months (up to 1 month per patient)

² Adjusted by multivariable logistic regression for 30 baseline characteristics listed in Table 1. The characteristics were modeled for adjustment as shown in Supplementary Table 1

	HOSPITALIZATION			ICU ADMISSION			VENTILATION			DEATH		
	Rate ¹	Crude Odds Ratio (95% CI)	Adjusted Odds Ratio ² (95% CI)	Rate ¹	Crude Odds Ratio (95% CI)	Adjusted Odds Ratio ² (95% CI)	Rate ¹	Crude Odds Ratio (95% CI)	Adjusted Odds Ratio ² (95% CI)	Rate ¹	Crude Odds Ratio (95% CI)	Adjusted Odds Ratio ² (95% CI)
Comparison of different intervals since last vaccination – OMICRON – CAN Score At/Below Median: 0-40												
Two Doses mRNA 7-150 days ago (3,722)	19	1	1	4	1	1	2	1	1	1	1	1
Two Doses mRNA 151-270 days ago (10,102)	16	0.85 0.64-1.14	0.88 0.66-1.18	4	0.90 0.51-1.65	0.92 0.52-1.70	2	1.00 0.44-2.56	0.98 0.43-2.52	0	0.37 0.04-3.07	0.39 0.05-3.30
Two Doses mRNA 271-365 days ago (13,018)	18	0.95 0.72-1.25	0.82 0.63-1.09	4	0.91 0.53-1.65	0.76 0.44-1.38	2	0.94 0.42-2.37	0.78 0.35-1.97	0	0.86 0.20-5.86	0.50 0.11-3.46
Three doses mRNA 7-90 days ago (8,888)	18	1	1	4	1	1	3	1	1	1	1	1
Three doses mRNA 91-150 days ago (4,465)	23	1.24 0.96-1.60	0.95 0.73-1.23	6	1.57 0.93-2.62	1.30 0.77-2.19	3	0.85 0.42-1.64	0.64 0.31-1.25	0	0 0.00-0.00	0 0.00-0.00
Comparison of different intervals since last vaccination – OMICRON – CAN Score Above Median: 41-100												
Two Doses mRNA 7-150 days ago (1,879)	197	1	1	46	1	1	14	1	1	30	1	1
Two Doses mRNA 151-270 days ago (4,556)	195	0.99 0.86-1.14	1.10 0.95-1.29	45	0.97 0.75-1.28	1.08 0.83-1.42	16	1.11 0.72-1.78	1.22 0.78-1.96	31	1.06 0.78-1.46	1.22 0.88-1.70
Two Doses mRNA 271-365 days ago (13,854)	207	1.05 0.92-1.19	1.06 0.93-1.22	49	1.06 0.85-1.35	1.13 0.89-1.44	15	1.07 0.72-1.64	1.10 0.74-1.71	41	1.40 1.06-1.87	1.17 0.89-1.59
Three doses mRNA 7-90 days ago (12,941)	121	1	1	28	1	1	8	1	1	17	1	1
Three doses mRNA 91-150 days ago (10,491)	156	1.30 1.20-1.40	1.18 1.09-1.29	36	1.29 1.11-1.49	1.16 1.00-1.36	12	1.39 1.07-1.81	1.27 0.97-1.65	23	1.36 1.13-1.64	1.35 1.12-1.64

¹ Rate is calculated per 1,000 patient at-risk months (up to 1 month per patient)

² Adjusted by multivariable logistic regression for 30 baseline characteristics listed in Table 1. The characteristics were modeled for adjustment as shown in Supplementary Table 1

Supplement 15. Full regression output from R for the 8 primary models

Delta Period - Death

Call:

```
glm(formula = Death30d ~ vaccine + IndexMonth + rcs(Age, c(31, 48, 61, 72, 83)) + Sex + Race + Ethnicity + rcs(BMI, c(21.6, 26.8, 30, 33.8, 42)) + Urban_Rural + Region + CCI + CAN + immuno + DiabetesAny2yrs + CKD2yrs + CHF2yrs + HTN2yrs + OSA2yrs + MDD2yrs + PTSD2yrs + COPD2yrs + Cancer2yrs + Cerebrovasc2yrs + CAHD2yrs + Asthma2yrs + AlcDep2yrs + DrugDep2yrs + Hyperlipidemia2yrs + Dementia2yrs + PAD2yrs + VTE2yrs + Smoke2yrs, family = binomial(), data = .)
```

Deviance Residuals:

Min	1Q	Median	3Q	Max
-1.7537	-0.2959	-0.1766	-0.0889	3.8824

Coefficients:

	Estimate	Std. Error	z value	Pr(> z)	
(Intercept)	-11.02762	0.90357	-12.204	< 2e-16	***
vaccine2 mRNA	-1.56489	0.04111	-38.062	< 2e-16	***
vaccine3 mRNA	-1.61413	0.13862	-11.644	< 2e-16	***
vaccineComplete Janssen	-1.04029	0.09255	-11.240	< 2e-16	***
vaccineOther	-1.48806	0.33139	-4.490	7.11e-06	***
vaccinePartial mRNA	-0.95650	0.12240	-7.814	5.53e-15	***
IndexMonthAugust	-0.04144	0.06158	-0.673	0.500916	
IndexMonthSeptember	-0.04827	0.06326	-0.763	0.445478	
IndexMonthOctober	-0.14335	0.06917	-2.072	0.038226	*
IndexMonthNovember	-0.14604	0.06975	-2.094	0.036272	*
rcs(Age, c(31, 48, 61, 72, 83))Age	0.15230	0.02063	7.382	1.56e-13	***
rcs(Age, c(31, 48, 61, 72, 83))Age'	-0.25282	0.06008	-4.208	2.57e-05	***
rcs(Age, c(31, 48, 61, 72, 83))Age''	0.78474	0.20015	3.921	8.82e-05	***
rcs(Age, c(31, 48, 61, 72, 83))Age'''	-0.88485	0.25666	-3.448	0.000566	***
SexM	0.54326	0.10049	5.406	6.44e-08	***
RaceBlack	-0.06935	0.05643	-1.229	0.219085	
RaceAsian	0.32971	0.24690	1.335	0.181759	
RaceAmerican Indian/Alaska Native	0.14354	0.17725	0.810	0.418039	
RacePacific Islander/Native Hawaiian	0.19756	0.17301	1.142	0.253505	
RaceUnknown	-0.06667	0.07919	-0.842	0.399886	
EthnicityHispanic	0.17698	0.07647	2.314	0.020642	*
EthnicityUnknown	0.03706	0.09715	0.381	0.702857	
rcs(BMI, c(21.6, 26.8, 30, 33.8, 42))BMI	-0.04343	0.01217	-3.570	0.000357	***
rcs(BMI, c(21.6, 26.8, 30, 33.8, 42))BMI'	0.35797	0.09838	3.639	0.000274	***
rcs(BMI, c(21.6, 26.8, 30, 33.8, 42))BMI''	-0.93593	0.46358	-2.019	0.043494	*
rcs(BMI, c(21.6, 26.8, 30, 33.8, 42))BMI'''	0.44126	0.60049	0.735	0.462445	
Urban_RuralUrban	0.06455	0.03885	1.661	0.096666	.
RegionNortheast	-0.05751	0.06337	-0.907	0.364146	
RegionSouth	0.14676	0.04869	3.014	0.002576	**
RegionWest	0.16759	0.05279	3.175	0.001499	**
CCI1	0.21973	0.06323	3.475	0.000511	***
CCI2	0.28060	0.06849	4.097	4.19e-05	***
CCI3	0.32119	0.08067	3.982	6.84e-05	***
CCI4	0.34228	0.09137	3.746	0.000180	***
CCI5-6	0.36318	0.09997	3.633	0.000280	***
CCI7-8	0.53502	0.12096	4.423	9.72e-06	***
CCI9+	0.52558	0.15220	3.453	0.000554	***
CAN31-55	0.41810	0.08556	4.887	1.03e-06	***
CAN56-75	0.62067	0.09285	6.685	2.31e-11	***
CAN76-90	0.86289	0.09859	8.752	< 2e-16	***
CAN91-95	1.01146	0.14467	6.991	2.72e-12	***
CAN96-100	1.26595	0.11490	11.018	< 2e-16	***
CANMissing	1.14865	0.16015	7.172	7.38e-13	***
immuno1	0.52484	0.05698	9.211	< 2e-16	***
DiabetesAny2yrs1	0.10211	0.04436	2.302	0.021337	*
CKD2yrs1	0.27872	0.04905	5.682	1.33e-08	***

CHF2yrs1	0.11973	0.05400	2.217	0.026602	*
HTN2yrs1	0.14977	0.04891	3.062	0.002198	**
OSA2yrs1	-0.20400	0.04160	-4.904	9.37e-07	***
MDD2yrs1	-0.04201	0.04326	-0.971	0.331475	
PTSD2yrs1	0.03241	0.04917	0.659	0.509833	
COPD2yrs1	0.03127	0.04533	0.690	0.490327	
Cancer2yrs1	-0.08550	0.04580	-1.867	0.061939	.
Cerebrovasc2yrs1	-0.12116	0.10114	-1.198	0.230912	
CAHD2yrs1	0.13869	0.04084	3.396	0.000684	***
Asthma2yrs1	-0.33721	0.08076	-4.176	2.97e-05	***
AlcDep2yrs1	-0.28836	0.05466	-5.275	1.33e-07	***
DrugDep2yrs1	0.01920	0.10332	0.186	0.852616	
Hyperlipidemia2yrs1	-0.09883	0.04130	-2.393	0.016709	*
Dementia2yrs1	0.42403	0.06124	6.924	4.39e-12	***
PAD2yrs1	0.10877	0.04830	2.252	0.024330	*
VTE2yrs1	0.03416	0.08799	0.388	0.697822	
Smoke2yrsFormer	0.10273	0.03932	2.613	0.008977	**
Smoke2yrsCurrent	0.02395	0.06073	0.394	0.693344	
Smoke2yrsUnknown	-0.01086	0.09283	-0.117	0.906874	

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family taken to be 1)

Null deviance: 33114 on 94571 degrees of freedom

Residual deviance: 26443 on 94507 degrees of freedom

(764 observations deleted due to missingness)

AIC: 26573

Number of Fisher Scoring iterations: 9

Delta Period - Hospitalization

Call:

```
glm(formula = Hosp30d ~ vaccine + IndexMonth + rcs(Age, c(31,
  48, 61, 72, 83)) + Sex + Race + Ethnicity + rcs(BMI, c(21.6,
  26.8, 30, 33.8, 42)) + Urban_Rural + Region + CCI + CAN +
  immuno + DiabetesAny2yrs + CKD2yrs + CHF2yrs + HTN2yrs +
  OSA2yrs + MDD2yrs + PTSD2yrs + COPD2yrs + Cancer2yrs + Cerebrovasc2yrs +
  CAHD2yrs + Asthma2yrs + AlcDep2yrs + DrugDep2yrs + Hyperlipidemia2yrs +
  Dementia2yrs + PAD2yrs + VTE2yrs + Smoke2yrs, family = binomial(),
  data = .)
```

Deviance Residuals:

Min	1Q	Median	3Q	Max
-1.8508	-0.5487	-0.3865	-0.2647	3.0699

Coefficients:

	Estimate	Std. Error	z value	Pr(> z)	
(Intercept)	-3.203555	0.281165	-11.394	< 2e-16	***
vaccine2 mRNA	-0.884474	0.024011	-36.837	< 2e-16	***
vaccine3 mRNA	-0.943024	0.076044	-12.401	< 2e-16	***
vaccineComplete Janssen	-0.679519	0.051280	-13.251	< 2e-16	***
vaccineOther	-0.573320	0.156549	-3.662	0.000250	***
vaccinePartial mRNA	-0.504242	0.068831	-7.326	2.37e-13	***
IndexMonthAugust	-0.177415	0.035082	-5.057	4.25e-07	***
IndexMonthSeptember	-0.290323	0.036696	-7.912	2.54e-15	***
IndexMonthOctober	-0.305086	0.040249	-7.580	3.46e-14	***
IndexMonthNovember	-0.286640	0.040587	-7.062	1.64e-12	***
rcs(Age, c(31, 48, 61, 72, 83))Age	0.048336	0.005500	8.788	< 2e-16	***
rcs(Age, c(31, 48, 61, 72, 83))Age'	-0.074649	0.020106	-3.713	0.000205	***
rcs(Age, c(31, 48, 61, 72, 83))Age''	0.258841	0.075479	3.429	0.000605	***
rcs(Age, c(31, 48, 61, 72, 83))Age'''	-0.369388	0.115191	-3.207	0.001342	**
SexM	0.231317	0.042673	5.421	5.94e-08	***
RaceBlack	0.383085	0.028850	13.278	< 2e-16	***
RaceAsian	0.123527	0.134761	0.917	0.359330	

RaceAmerican Indian/Alaska Native	-0.027703	0.112996	-0.245	0.806327	
RacePacific Islander/Native Hawaiian	-0.088997	0.113927	-0.781	0.434699	
RaceUnknown	-0.031656	0.046264	-0.684	0.493815	
EthnicityHispanic	0.339167	0.041318	8.209	2.24e-16	***
EthnicityUnknown	0.045070	0.057324	0.786	0.431727	
rcs(BMI, c(21.6, 26.8, 30, 33.8, 42))BMI	-0.073438	0.007681	-9.561	< 2e-16	***
rcs(BMI, c(21.6, 26.8, 30, 33.8, 42))BMI'	0.208831	0.060180	3.470	0.000520	***
rcs(BMI, c(21.6, 26.8, 30, 33.8, 42))BMI''	-0.365246	0.282804	-1.292	0.196525	
rcs(BMI, c(21.6, 26.8, 30, 33.8, 42))BMI'''	-0.029341	0.368108	-0.080	0.936469	
Urban_RuralUrban	0.121018	0.024080	5.026	5.02e-07	***
RegionNortheast	-0.107970	0.037493	-2.880	0.003980	**
RegionSouth	-0.036382	0.028895	-1.259	0.208000	
RegionWest	0.025081	0.031646	0.793	0.428052	
CCI1	0.261792	0.034830	7.516	5.63e-14	***
CCI2	0.307825	0.039818	7.731	1.07e-14	***
CCI3	0.458184	0.047903	9.565	< 2e-16	***
CCI4	0.523719	0.055425	9.449	< 2e-16	***
CCI5-6	0.633873	0.060019	10.561	< 2e-16	***
CCI7-8	0.842047	0.073624	11.437	< 2e-16	***
CCI9+	1.002330	0.095918	10.450	< 2e-16	***
CAN31-55	0.317673	0.039950	7.952	1.84e-15	***
CAN56-75	0.522185	0.046601	11.205	< 2e-16	***
CAN76-90	0.778929	0.051803	15.036	< 2e-16	***
CAN91-95	0.974637	0.090543	10.764	< 2e-16	***
CAN96-100	1.088218	0.066417	16.385	< 2e-16	***
CANMissing	0.730008	0.095047	7.681	1.58e-14	***
immunol	0.446401	0.036346	12.282	< 2e-16	***
DiabetesAny2yrs1	0.089462	0.027307	3.276	0.001052	**
CKD2yrs1	0.069163	0.032050	2.158	0.030932	*
CHF2yrs1	0.150426	0.036359	4.137	3.51e-05	***
HTN2yrs1	0.185529	0.027547	6.735	1.64e-11	***
OSA2yrs1	0.025283	0.024056	1.051	0.293267	
MDD2yrs1	0.025804	0.024711	1.044	0.296380	
PTSD2yrs1	0.007303	0.027350	0.267	0.789443	
COPD2yrs1	-0.004521	0.028883	-0.157	0.875609	
Cancer2yrs1	-0.139363	0.028516	-4.887	1.02e-06	***
Cerebrovasc2yrs1	0.109856	0.064102	1.714	0.086569	.
CAHD2yrs1	0.026617	0.026571	1.002	0.316482	
Asthma2yrs1	-0.050730	0.041483	-1.223	0.221368	
AlcDep2yrs1	-0.028871	0.028070	-1.029	0.303694	
DrugDep2yrs1	0.350839	0.048217	7.276	3.43e-13	***
Hyperlipidemia2yrs1	-0.008183	0.024358	-0.336	0.736925	
Dementia2yrs1	0.103986	0.045424	2.289	0.022066	*
PAD2yrs1	0.137971	0.031387	4.396	1.10e-05	***
VTE2yrs1	0.219787	0.054914	4.002	6.27e-05	***
Smoke2yrsFormer	-0.025077	0.023625	-1.061	0.288482	
Smoke2yrsCurrent	-0.055988	0.033603	-1.666	0.095680	.
Smoke2yrsUnknown	0.086751	0.053288	1.628	0.103534	

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family taken to be 1)

Null deviance: 73699 on 94547 degrees of freedom
Residual deviance: 64472 on 94483 degrees of freedom
(764 observations deleted due to missingness)
AIC: 64602

Number of Fisher Scoring iterations: 6

Delta Period - ICU Admission

Call:

```
glm(formula = ICU30d ~ vaccine + IndexMonth + rcs(Age, c(31,
  48, 61, 72, 83)) + Sex + Race + Ethnicity + rcs(BMI, c(21.6,
  26.8, 30, 33.8, 42)) + Urban_Rural + Region + CCI + CAN +
```



```
immuno + DiabetesAny2yrs + CKD2yrs + CHF2yrs + HTN2yrs +
OSA2yrs + MDD2yrs + PTSD2yrs + COPD2yrs + Cancer2yrs + Cerebrovasc2yrs +
CAHD2yrs + Asthma2yrs + AlcDep2yrs + DrugDep2yrs + Hyperlipidemia2yrs +
Dementia2yrs + PAD2yrs + VTE2yrs + Smoke2yrs, family = binomial(),
data = .)
```

Deviance Residuals:

Min	1Q	Median	3Q	Max
-1.2387	-0.3289	-0.2356	-0.1625	3.5220

Coefficients:

	Estimate	Std. Error	z value	Pr(> z)	
(Intercept)	-6.262712	0.500152	-12.522	< 2e-16	***
vaccine2 mRNA	-1.097453	0.038513	-28.496	< 2e-16	***
vaccine3 mRNA	-0.766423	0.113537	-6.750	1.47e-11	***
vaccineComplete Janssen	-0.796659	0.084334	-9.446	< 2e-16	***
vaccineOther	-0.623672	0.247232	-2.523	0.011648	*
vaccinePartial mRNA	-0.817088	0.119267	-6.851	7.34e-12	***
IndexMonthAugust	-0.310908	0.051894	-5.991	2.08e-09	***
IndexMonthSeptember	-0.445118	0.055087	-8.080	6.46e-16	***
IndexMonthOctober	-0.502596	0.061954	-8.112	4.96e-16	***
IndexMonthNovember	-0.457759	0.062108	-7.370	1.70e-13	***
rcs(Age, c(31, 48, 61, 72, 83))Age	0.082435	0.010397	7.929	2.21e-15	***
rcs(Age, c(31, 48, 61, 72, 83))Age'	-0.164645	0.035426	-4.648	3.36e-06	***
rcs(Age, c(31, 48, 61, 72, 83))Age''	0.530823	0.129106	4.112	3.93e-05	***
rcs(Age, c(31, 48, 61, 72, 83))Age'''	-0.722003	0.190532	-3.789	0.000151	***
SexM	0.187432	0.070339	2.665	0.007706	**
RaceBlack	0.366289	0.044612	8.211	< 2e-16	***
RaceAsian	0.225511	0.213744	1.055	0.291402	
RaceAmerican Indian/Alaska Native	-0.163299	0.191479	-0.853	0.393752	
RacePacific Islander/Native Hawaiian	-0.067841	0.180606	-0.376	0.707192	
RaceUnknown	-0.089249	0.075744	-1.178	0.238676	
EthnicityHispanic	0.346965	0.064826	5.352	8.69e-08	***
EthnicityUnknown	0.039802	0.093355	0.426	0.669847	
rcs(BMI, c(21.6, 26.8, 30, 33.8, 42))BMI	-0.045219	0.011792	-3.835	0.000126	***
rcs(BMI, c(21.6, 26.8, 30, 33.8, 42))BMI'	0.095387	0.094223	1.012	0.311367	
rcs(BMI, c(21.6, 26.8, 30, 33.8, 42))BMI''	0.050162	0.445562	0.113	0.910362	
rcs(BMI, c(21.6, 26.8, 30, 33.8, 42))BMI'''	-0.478565	0.581742	-0.823	0.410712	
Urban_RuralUrban	0.054616	0.037884	1.442	0.149394	
RegionNortheast	-0.076978	0.061575	-1.250	0.211245	
RegionSouth	0.060071	0.046043	1.305	0.192008	
RegionWest	0.051281	0.051060	1.004	0.315226	
CCI1	0.296379	0.057564	5.149	2.62e-07	***
CCI2	0.372740	0.064470	5.782	7.40e-09	***
CCI3	0.484272	0.076621	6.320	2.61e-10	***
CCI4	0.557853	0.087361	6.386	1.71e-10	***
CCI5-6	0.678479	0.093618	7.247	4.25e-13	***
CCI7-8	0.751083	0.113610	6.611	3.82e-11	***
CCI9+	1.057456	0.138542	7.633	2.30e-14	***
CAN31-55	0.305427	0.065378	4.672	2.99e-06	***
CAN56-75	0.478504	0.075520	6.336	2.36e-10	***
CAN76-90	0.682175	0.083294	8.190	2.61e-16	***
CAN91-95	0.850103	0.138685	6.130	8.80e-10	***
CAN96-100	0.926263	0.104292	8.881	< 2e-16	***
CANMissing	0.573004	0.162446	3.527	0.000420	***
immuno1	0.425778	0.053733	7.924	2.30e-15	***
DiabetesAny2yrs1	0.114335	0.042609	2.683	0.007289	**
CKD2yrs1	0.144857	0.048550	2.984	0.002848	**
CHF2yrs1	0.147462	0.054023	2.730	0.006341	**
HTN2yrs1	0.225178	0.045369	4.963	6.93e-07	***
OSA2yrs1	0.091617	0.037635	2.434	0.014918	*
MDD2yrs1	-0.046118	0.039320	-1.173	0.240833	
PTSD2yrs1	0.010148	0.043451	0.234	0.815338	
COPD2yrs1	0.025470	0.044402	0.574	0.566228	
Cancer2yrs1	-0.138313	0.044476	-3.110	0.001872	**
Cerebrovasc2yrs1	-0.044585	0.099451	-0.448	0.653934	
CAHD2yrs1	0.047650	0.041129	1.159	0.246641	

Asthma2yrs1	-0.103560	0.066116	-1.566	0.117266	
AlcDep2yrs1	-0.056338	0.045615	-1.235	0.216800	
DrugDep2yrs1	0.261592	0.076394	3.424	0.000616	***
Hyperlipidemia2yrs1	-0.017936	0.039096	-0.459	0.646400	
Dementia2yrs1	-0.134972	0.072658	-1.858	0.063222	.
PAD2yrs1	0.097238	0.047686	2.039	0.041436	*
VTE2yrs1	0.130727	0.082227	1.590	0.111874	
Smoke2yrsFormer	-0.009583	0.037350	-0.257	0.797502	
Smoke2yrsCurrent	-0.073970	0.053687	-1.378	0.168265	
Smoke2yrsUnknown	0.051495	0.085391	0.603	0.546473	

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family taken to be 1)

Null deviance: 34432 on 94571 degrees of freedom

Residual deviance: 30901 on 94507 degrees of freedom

(764 observations deleted due to missingness)

AIC: 31031

Number of Fisher Scoring iterations: 7

Delta Period - Ventilation

Call:

```
glm(formula = Vent30d ~ vaccine + IndexMonth + rcs(Age, c(31,
  48, 61, 72, 83)) + Sex + Race + Ethnicity + rcs(BMI, c(21.6,
  26.8, 30, 33.8, 42)) + Urban_Rural + Region + CCI + CAN +
  immuno + DiabetesAny2yrs + CKD2yrs + CHF2yrs + HTN2yrs +
  OSA2yrs + MDD2yrs + PTSD2yrs + COPD2yrs + Cancer2yrs + Cerebrovasc2yrs +
  CAHD2yrs + Asthma2yrs + AlcDep2yrs + DrugDep2yrs + Hyperlipidemia2yrs +
  Dementia2yrs + PAD2yrs + VTE2yrs + Smoke2yrs, family = binomial(),
  data = .)
```

Deviance Residuals:

Min	1Q	Median	3Q	Max
-1.3107	-0.2167	-0.1532	-0.1043	3.8043

Coefficients:

	Estimate	Std. Error	z value	Pr(> z)	
(Intercept)	-8.443361	0.804508	-10.495	< 2e-16	***
vaccine2 mRNA	-1.325762	0.059121	-22.424	< 2e-16	***
vaccine3 mRNA	-1.165834	0.197872	-5.892	3.82e-09	***
vaccineComplete Janssen	-1.182654	0.143512	-8.241	< 2e-16	***
vaccineOther	-0.646495	0.361888	-1.786	0.074026	.
vaccinePartial mRNA	-0.837021	0.175050	-4.782	1.74e-06	***
IndexMonthAugust	-0.196391	0.077124	-2.546	0.010883	*
IndexMonthSeptember	-0.218179	0.080538	-2.709	0.006748	**
IndexMonthOctober	-0.476361	0.094292	-5.052	4.37e-07	***
IndexMonthNovember	-0.477098	0.095195	-5.012	5.39e-07	***
rcs(Age, c(31, 48, 61, 72, 83))Age	0.097639	0.016388	5.958	2.55e-09	***
rcs(Age, c(31, 48, 61, 72, 83))Age'	-0.194473	0.054260	-3.584	0.000338	***
rcs(Age, c(31, 48, 61, 72, 83))Age''	0.679237	0.196130	3.463	0.000534	***
rcs(Age, c(31, 48, 61, 72, 83))Age'''	-1.195209	0.291622	-4.098	4.16e-05	***
SexM	0.462472	0.115401	4.008	6.14e-05	***
RaceBlack	0.106454	0.069717	1.527	0.126778	
RaceAsian	0.509291	0.286853	1.775	0.075825	.
RaceAmerican Indian/Alaska Native	0.038256	0.257882	0.148	0.882069	
RacePacific Islander/Native Hawaiian	0.041696	0.250564	0.166	0.867834	
RaceUnknown	-0.168446	0.115097	-1.464	0.143328	
EthnicityHispanic	0.269186	0.096933	2.777	0.005486	**
EthnicityUnknown	0.022756	0.139939	0.163	0.870824	
rcs(BMI, c(21.6, 26.8, 30, 33.8, 42))BMI	-0.035885	0.019326	-1.857	0.063332	.
rcs(BMI, c(21.6, 26.8, 30, 33.8, 42))BMI'	0.335924	0.146163	2.298	0.021546	*
rcs(BMI, c(21.6, 26.8, 30, 33.8, 42))BMI''	-1.180530	0.665200	-1.775	0.075948	.
rcs(BMI, c(21.6, 26.8, 30, 33.8, 42))BMI'''	1.096131	0.836306	1.311	0.189965	

Urban_RuralUrban	0.052970	0.055563	0.953	0.340424	
RegionNortheast	0.056142	0.092784	0.605	0.545127	
RegionSouth	0.200467	0.069411	2.888	0.003876	**
RegionWest	0.124636	0.077506	1.608	0.107819	
CCI1	0.178955	0.086628	2.066	0.038849	*
CCI2	0.441722	0.093556	4.721	2.34e-06	***
CCI3	0.370217	0.114397	3.236	0.001211	**
CCI4	0.432135	0.130483	3.312	0.000927	***
CCI5-6	0.438697	0.141722	3.095	0.001965	**
CCI7-8	0.539577	0.171088	3.154	0.001612	**
CCI9+	0.441821	0.220079	2.008	0.044691	*
CAN31-55	0.170187	0.094675	1.798	0.072240	.
CAN56-75	0.303749	0.109015	2.786	0.005331	**
CAN76-90	0.489801	0.121014	4.047	5.18e-05	***
CAN91-95	0.767054	0.201056	3.815	0.000136	***
CAN96-100	0.591271	0.156684	3.774	0.000161	***
CANMissing	0.670194	0.235144	2.850	0.004370	**
immuno1	0.626397	0.075003	8.352	< 2e-16	***
DiabetesAny2yrs1	0.171735	0.063559	2.702	0.006893	**
CKD2yrs1	0.219315	0.072072	3.043	0.002342	**
CHF2yrs1	0.265803	0.079552	3.341	0.000834	***
HTN2yrs1	0.157125	0.066728	2.355	0.018538	*
OSA2yrs1	0.101251	0.054627	1.853	0.063813	.
MDD2yrs1	-0.139052	0.058934	-2.359	0.018302	*
PTSD2yrs1	-0.006003	0.064407	-0.093	0.925743	
COPD2yrs1	0.062839	0.065941	0.953	0.340614	
Cancer2yrs1	0.034432	0.064265	0.536	0.592104	
Cerebrovasc2yrs1	0.145916	0.147028	0.992	0.320983	
CAHD2yrs1	0.071261	0.060677	1.174	0.240223	
Asthma2yrs1	-0.138250	0.099270	-1.393	0.163722	
AlcDep2yrs1	-0.100389	0.069080	-1.453	0.146157	
DrugDep2yrs1	0.253048	0.116849	2.166	0.030341	*
Hyperlipidemia2yrs1	-0.097008	0.057608	-1.684	0.092193	.
Dementia2yrs1	-0.242582	0.123374	-1.966	0.049271	*
PAD2yrs1	0.082210	0.071238	1.154	0.248492	
VTE2yrs1	0.087575	0.122867	0.713	0.475991	
Smoke2yrsFormer	0.056802	0.055123	1.030	0.302800	
Smoke2yrsCurrent	0.011007	0.078891	0.140	0.889037	
Smoke2yrsUnknown	-0.153891	0.139664	-1.102	0.270518	

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family taken to be 1)

Null deviance: 18087 on 94571 degrees of freedom
 Residual deviance: 16316 on 94507 degrees of freedom
 (764 observations deleted due to missingness)
 AIC: 16446

Number of Fisher Scoring iterations: 8

Omicron Period - Death

Call:

```
glm(formula = Death30d ~ vaccine + IndexMonth + rcs(Age, c(31,
  48, 61, 72, 83)) + Sex + Race + Ethnicity + rcs(BMI, c(21.6,
  26.8, 30, 33.8, 42)) + Urban_Rural + Region + CCI + CAN +
  immuno + DiabetesAny2yrs + CKD2yrs + CHF2yrs + HTN2yrs +
  OSA2yrs + MDD2yrs + PTSD2yrs + COPD2yrs + Cancer2yrs + Cerebrovasc2yrs +
  CAHD2yrs + Asthma2yrs + AlcDep2yrs + DrugDep2yrs + Hyperlipidemia2yrs +
  Dementia2yrs + PAD2yrs + VTE2yrs + Smoke2yrs, family = binomial(),
  data = .)
```

Deviance Residuals:

Min	1Q	Median	3Q	Max
-1.5536	-0.1631	-0.0768	-0.0351	4.0138

Coefficients:

	Estimate	Std. Error	z value	Pr(> z)	
(Intercept)	-8.37075	1.43870	-5.818	5.95e-09	***
vaccine2 mRNA	-0.83651	0.04730	-17.683	< 2e-16	***
vaccine3 mRNA	-1.50455	0.05215	-28.852	< 2e-16	***
vaccineComplete Janssen	-0.60552	0.09931	-6.097	1.08e-09	***
vaccineOther	-1.56276	0.12419	-12.584	< 2e-16	***
vaccinePartial mRNA	-0.42505	0.11640	-3.652	0.000261	***
IndexMonthFebruary	0.04939	0.04917	1.005	0.315136	
IndexMonthMarch	-0.13132	0.09064	-1.449	0.147381	
IndexMonthApril	-0.47208	0.11153	-4.233	2.31e-05	***
IndexMonthMay	-0.84825	0.09159	-9.262	< 2e-16	***
IndexMonthJune	-0.85501	0.07940	-10.769	< 2e-16	***
rcs(Age, c(31, 48, 61, 72, 83))Age	0.09319	0.03432	2.715	0.006627	**
rcs(Age, c(31, 48, 61, 72, 83))Age'	-0.03714	0.09823	-0.378	0.705345	
rcs(Age, c(31, 48, 61, 72, 83))Age''	0.02821	0.31789	0.089	0.929288	
rcs(Age, c(31, 48, 61, 72, 83))Age'''	0.05116	0.37895	0.135	0.892606	
SexM	0.33248	0.12816	2.594	0.009480	**
RaceBlack	-0.28994	0.05810	-4.990	6.03e-07	***
RaceAsian	-0.20940	0.25732	-0.814	0.415773	
RaceAmerican Indian/Alaska Native	0.19714	0.19476	1.012	0.311423	
RacePacific Islander/Native Hawaiian	0.14271	0.18949	0.753	0.451383	
RaceUnknown	-0.02635	0.08226	-0.320	0.748737	
EthnicityHispanic	-0.05459	0.07989	-0.683	0.494381	
EthnicityUnknown	-0.02153	0.09766	-0.220	0.825491	
rcs(BMI, c(21.6, 26.8, 30, 33.8, 42))BMI	-0.11640	0.00995	-11.699	< 2e-16	***
rcs(BMI, c(21.6, 26.8, 30, 33.8, 42))BMI'	0.56243	0.09779	5.751	8.85e-09	***
rcs(BMI, c(21.6, 26.8, 30, 33.8, 42))BMI''	-1.93949	0.49925	-3.885	0.000102	***
rcs(BMI, c(21.6, 26.8, 30, 33.8, 42))BMI'''	1.89958	0.68584	2.770	0.005610	**
Urban_RuralUrban	0.19654	0.04483	4.384	1.16e-05	***
RegionNortheast	-0.11804	0.06495	-1.818	0.069129	.
RegionSouth	-0.05510	0.05331	-1.034	0.301307	
RegionWest	0.00280	0.05789	0.048	0.961415	
CCI1	0.20509	0.08185	2.506	0.012226	*
CCI2	0.19603	0.08565	2.289	0.022103	*
CCI3	0.35507	0.09341	3.801	0.000144	***
CCI4	0.35477	0.10250	3.461	0.000538	***
CCI5-6	0.41840	0.10825	3.865	0.000111	***
CCI7-8	0.49798	0.12513	3.980	6.90e-05	***
CCI9+	0.71064	0.14394	4.937	7.93e-07	***
CAN31-55	0.75129	0.15853	4.739	2.15e-06	***
CAN56-75	1.23436	0.16129	7.653	1.96e-14	***
CAN76-90	1.89693	0.16229	11.689	< 2e-16	***
CAN91-95	2.11956	0.18670	11.353	< 2e-16	***
CAN96-100	2.42762	0.17030	14.255	< 2e-16	***
CANMissing	2.10732	0.19468	10.825	< 2e-16	***
immunol	0.54036	0.05409	9.991	< 2e-16	***
DiabetesAny2yrs1	0.07789	0.04691	1.660	0.096868	.
CKD2yrs1	0.17124	0.04941	3.466	0.000529	***
CHF2yrs1	0.10204	0.05233	1.950	0.051163	.
HTN2yrs1	0.05120	0.05626	0.910	0.362746	
OSA2yrs1	-0.07952	0.04815	-1.651	0.098645	.
MDD2yrs1	-0.10577	0.04744	-2.230	0.025762	*
PTSD2yrs1	0.03425	0.05559	0.616	0.537819	
COPD2yrs1	-0.12233	0.04683	-2.612	0.008997	**
Cancer2yrs1	-0.04393	0.05094	-0.862	0.388487	
Cerebrovasc2yrs1	-0.12516	0.09100	-1.375	0.169000	
CAHD2yrs1	0.00325	0.04400	0.074	0.941120	
Asthma2yrs1	-0.30279	0.09169	-3.302	0.000959	***
AlcDep2yrs1	-0.26732	0.05892	-4.537	5.70e-06	***
DrugDep2yrs1	0.01364	0.10603	0.129	0.897635	
Hyperlipidemia2yrs1	-0.06092	0.04569	-1.334	0.182352	
Dementia2yrs1	0.28994	0.05458	5.312	1.09e-07	***
PAD2yrs1	0.12593	0.04786	2.631	0.008503	**
VTE2yrs1	0.19026	0.07830	2.430	0.015101	*
Smoke2yrsFormer	0.19127	0.04487	4.263	2.02e-05	***

Smoke2yrsCurrent	0.15302	0.06534	2.342	0.019194	*
Smoke2yrsUnknown	0.20512	0.09080	2.259	0.023874	*

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family taken to be 1)

Null deviance: 31759 on 183340 degrees of freedom
 Residual deviance: 23637 on 183275 degrees of freedom
 (1312 observations deleted due to missingness)
 AIC: 23769

Number of Fisher Scoring iterations: 10

Omicron Period - Hospitalization

Call:

```
glm(formula = Hosp30d ~ vaccine + IndexMonth + rcs(Age, c(31,
  48, 61, 72, 83)) + Sex + Race + Ethnicity + rcs(BMI, c(21.6,
  26.8, 30, 33.8, 42)) + Urban_Rural + Region + CCI + CAN +
  immuno + DiabetesAny2yrs + CKD2yrs + CHF2yrs + HTN2yrs +
  OSA2yrs + MDD2yrs + PTSD2yrs + COPD2yrs + Cancer2yrs + Cerebrovasc2yrs +
  CAHD2yrs + Asthma2yrs + AlcDep2yrs + DrugDep2yrs + Hyperlipidemia2yrs +
  Dementia2yrs + PAD2yrs + VTE2yrs + Smoke2yrs, family = binomial(),
  data = .)
```

Deviance Residuals:

Min	1Q	Median	3Q	Max
-1.9980	-0.4302	-0.2631	-0.1712	3.2984

Coefficients:

	Estimate	Std. Error	z value	Pr(> z)	
(Intercept)	-3.1140188	0.2601155	-11.972	< 2e-16	***
vaccine2 mRNA	-0.5079601	0.0233171	-21.785	< 2e-16	***
vaccine3 mRNA	-0.9317389	0.0241654	-38.557	< 2e-16	***
vaccineComplete Janssen	-0.3573818	0.0459603	-7.776	7.49e-15	***
vaccineOther	-0.9521739	0.0446579	-21.322	< 2e-16	***
vaccinePartial mRNA	-0.4225408	0.0606347	-6.969	3.20e-12	***
IndexMonthFebruary	0.2936679	0.0251401	11.681	< 2e-16	***
IndexMonthMarch	0.5189328	0.0404466	12.830	< 2e-16	***
IndexMonthApril	0.4711791	0.0423669	11.121	< 2e-16	***
IndexMonthMay	0.2223877	0.0313193	7.101	1.24e-12	***
IndexMonthJune	0.2403648	0.0276110	8.705	< 2e-16	***
rcs(Age, c(31, 48, 61, 72, 83))Age	0.0361874	0.0057644	6.278	3.44e-10	***
rcs(Age, c(31, 48, 61, 72, 83))Age'	-0.0769658	0.0202868	-3.794	0.000148	***
rcs(Age, c(31, 48, 61, 72, 83))Age''	0.2662860	0.0738824	3.604	0.000313	***
rcs(Age, c(31, 48, 61, 72, 83))Age'''	-0.3317492	0.1063686	-3.119	0.001815	**
SexM	0.1280112	0.0393584	3.252	0.001144	**
RaceBlack	0.1754787	0.0234637	7.479	7.50e-14	***
RaceAsian	-0.2705241	0.1057681	-2.558	0.010536	*
RaceAmerican Indian/Alaska Native	0.1699365	0.0935657	1.816	0.069336	.
RacePacific Islander/Native Hawaiian	-0.3158967	0.1017345	-3.105	0.001902	**
RaceUnknown	-0.0293838	0.0381462	-0.770	0.441126	
EthnicityHispanic	0.1270250	0.0340256	3.733	0.000189	***
EthnicityUnknown	0.0696535	0.0447751	1.556	0.119796	
rcs(BMI, c(21.6, 26.8, 30, 33.8, 42))BMI	-0.0940692	0.0055979	-16.804	< 2e-16	***
rcs(BMI, c(21.6, 26.8, 30, 33.8, 42))BMI'	0.2709178	0.0482077	5.620	1.91e-08	***
rcs(BMI, c(21.6, 26.8, 30, 33.8, 42))BMI''	-0.8142597	0.2373677	-3.430	0.000603	***
rcs(BMI, c(21.6, 26.8, 30, 33.8, 42))BMI'''	0.7909459	0.3209623	2.464	0.013728	*
Urban_RuralUrban	-0.0381204	0.0205623	-1.854	0.063754	.
RegionNortheast	-0.0773029	0.0296237	-2.609	0.009068	**
RegionSouth	-0.0388784	0.0246370	-1.578	0.114555	
RegionWest	-0.0987544	0.0273652	-3.609	0.000308	***
CCI1	0.3651424	0.0329627	11.077	< 2e-16	***
CCI2	0.4655773	0.0359111	12.965	< 2e-16	***
CCI3	0.5530976	0.0412976	13.393	< 2e-16	***

CCI4	0.6436220	0.0462732	13.909	< 2e-16	***
CCI5-6	0.7927737	0.0486613	16.292	< 2e-16	***
CCI7-8	0.9417973	0.0579179	16.261	< 2e-16	***
CCI9+	1.1057947	0.0695844	15.891	< 2e-16	***
CAN31-55	0.7269403	0.0416604	17.449	< 2e-16	***
CAN56-75	1.1268945	0.0461014	24.444	< 2e-16	***
CAN76-90	1.5844659	0.0488766	32.418	< 2e-16	***
CAN91-95	1.8585260	0.0703927	26.402	< 2e-16	***
CAN96-100	1.9404925	0.0568681	34.123	< 2e-16	***
CANMissing	1.3516336	0.0734672	18.398	< 2e-16	***
immuno1	0.5586861	0.0267574	20.880	< 2e-16	***
DiabetesAny2yrs1	0.0137365	0.0222722	0.617	0.537396	
CKD2yrs1	0.1055584	0.0245820	4.294	1.75e-05	***
CHF2yrs1	0.3699752	0.0264735	13.975	< 2e-16	***
HTN2yrs1	0.2090638	0.0250444	8.348	< 2e-16	***
OSA2yrs1	-0.0316099	0.0210092	-1.505	0.132435	
MDD2yrs1	0.0777288	0.0207345	3.749	0.000178	***
PTSD2yrs1	-0.0247389	0.0232849	-1.062	0.288033	
COPD2yrs1	-0.0302183	0.0227623	-1.328	0.184324	
Cancer2yrs1	-0.2163026	0.0251914	-8.586	< 2e-16	***
Cerebrovasc2yrs1	0.1368759	0.0441307	3.102	0.001925	**
CAHD2yrs1	0.0006774	0.0215227	0.031	0.974892	
Asthma2yrs1	-0.1770222	0.0356062	-4.972	6.64e-07	***
AlcDep2yrs1	0.0340812	0.0233706	1.458	0.144759	
DrugDep2yrs1	0.4050421	0.0368639	10.987	< 2e-16	***
Hyperlipidemia2yrs1	0.0003331	0.0210928	0.016	0.987400	
Dementia2yrs1	0.2170227	0.0313249	6.928	4.26e-12	***
PAD2yrs1	0.1308156	0.0239111	5.471	4.48e-08	***
VTE2yrs1	0.2662712	0.0401551	6.631	3.33e-11	***
Smoke2yrsFormer	-0.0012871	0.0207086	-0.062	0.950441	
Smoke2yrsCurrent	0.1496049	0.0276045	5.420	5.97e-08	***
Smoke2yrsUnknown	0.2940177	0.0430473	6.830	8.49e-12	***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family taken to be 1)

Null deviance: 114846 on 183230 degrees of freedom
Residual deviance: 91722 on 183165 degrees of freedom
(1312 observations deleted due to missingness)
AIC: 91854

Number of Fisher Scoring iterations: 6

Omicron Period - ICU Admission

Call:

```
glm(formula = ICU30d ~ vaccine + IndexMonth + rcs(Age, c(31,
  48, 61, 72, 83)) + Sex + Race + Ethnicity + rcs(BMI, c(21.6,
  26.8, 30, 33.8, 42)) + Urban_Rural + Region + CCI + CAN +
  immuno + DiabetesAny2yrs + CKD2yrs + CHF2yrs + HTN2yrs +
  OSA2yrs + MDD2yrs + PTSD2yrs + COPD2yrs + Cancer2yrs + Cerebrovasc2yrs +
  CAHD2yrs + Asthma2yrs + AlcDep2yrs + DrugDep2yrs + Hyperlipidemia2yrs +
  Dementia2yrs + PAD2yrs + VTE2yrs + Smoke2yrs, family = binomial(),
  data = .)
```

Deviance Residuals:

Min	1Q	Median	3Q	Max
-1.2179	-0.2329	-0.1444	-0.0929	3.6783

Coefficients:

	Estimate	Std. Error	z value	Pr(> z)	
(Intercept)	-5.0550030	0.4935690	-10.242	< 2e-16	***
vaccine2 mRNA	-0.5629668	0.0401561	-14.019	< 2e-16	***
vaccine3 mRNA	-0.9998816	0.0423618	-23.603	< 2e-16	***
vaccineComplete Janssen	-0.3374439	0.0784184	-4.303	1.68e-05	***

vaccineOther	-1.0020655	0.0833989	-12.015	< 2e-16	***
vaccinePartial mRNA	-0.5162776	0.1079685	-4.782	1.74e-06	***
IndexMonthFebruary	0.2196383	0.0436850	5.028	4.96e-07	***
IndexMonthMarch	0.4077673	0.0692529	5.888	3.91e-09	***
IndexMonthApril	0.4638964	0.0718847	6.453	1.09e-10	***
IndexMonthMay	0.0785137	0.0582509	1.348	0.17771	
IndexMonthJune	0.0243080	0.0516597	0.471	0.63797	
rcs(Age, c(31, 48, 61, 72, 83))Age	0.0330433	0.0113243	2.918	0.00352	**
rcs(Age, c(31, 48, 61, 72, 83))Age'	-0.0709988	0.0386949	-1.835	0.06653	.
rcs(Age, c(31, 48, 61, 72, 83))Age''	0.2007692	0.1389674	1.445	0.14854	
rcs(Age, c(31, 48, 61, 72, 83))Age'''	-0.2173470	0.1962841	-1.107	0.26816	
SexM	0.1337551	0.0740164	1.807	0.07075	.
RaceBlack	0.2488670	0.0402138	6.189	6.07e-10	***
RaceAsian	-0.2591721	0.2105201	-1.231	0.21828	
RaceAmerican Indian/Alaska Native	0.0791341	0.1727969	0.458	0.64698	
RacePacific Islander/Native Hawaiian	-0.0295058	0.1692911	-0.174	0.86164	
RaceUnknown	-0.0266711	0.0695302	-0.384	0.70128	
EthnicityHispanic	0.1619734	0.0603780	2.683	0.00730	**
EthnicityUnknown	-0.0022408	0.0826000	-0.027	0.97836	
rcs(BMI, c(21.6, 26.8, 30, 33.8, 42))BMI	-0.0704644	0.0090695	-7.769	7.89e-15	***
rcs(BMI, c(21.6, 26.8, 30, 33.8, 42))BMI'	0.2082918	0.0821739	2.535	0.01125	*
rcs(BMI, c(21.6, 26.8, 30, 33.8, 42))BMI''	-0.7381443	0.4089223	-1.805	0.07106	.
rcs(BMI, c(21.6, 26.8, 30, 33.8, 42))BMI'''	0.8681665	0.5531418	1.570	0.11653	
Urban_RuralUrban	0.0008955	0.0365182	0.025	0.98044	
RegionNortheast	-0.0411204	0.0535988	-0.767	0.44297	
RegionSouth	0.1025161	0.0435839	2.352	0.01866	*
RegionWest	-0.1464481	0.0504246	-2.904	0.00368	**
CCI1	0.4333696	0.0645397	6.715	1.88e-11	***
CCI2	0.4678272	0.0694963	6.732	1.68e-11	***
CCI3	0.5579342	0.0776461	7.186	6.69e-13	***
CCI4	0.6669841	0.0844296	7.900	2.79e-15	***
CCI5-6	0.7754385	0.0877605	8.836	< 2e-16	***
CCI7-8	0.9561182	0.1005460	9.509	< 2e-16	***
CCI9+	0.9604269	0.1173748	8.183	2.78e-16	***
CAN31-55	0.8053244	0.0810755	9.933	< 2e-16	***
CAN56-75	1.2526911	0.0881004	14.219	< 2e-16	***
CAN76-90	1.6703090	0.0924095	18.075	< 2e-16	***
CAN91-95	1.9318216	0.1245016	15.516	< 2e-16	***
CAN96-100	2.0116689	0.1041651	19.312	< 2e-16	***
CANMissing	1.6958802	0.1289830	13.148	< 2e-16	***
immunol	0.5424181	0.0432881	12.530	< 2e-16	***
DiabetesAny2yrs1	0.0683514	0.0388670	1.759	0.07865	.
CKD2yrs1	0.1319715	0.0418589	3.153	0.00162	**
CHF2yrs1	0.3777170	0.0435075	8.682	< 2e-16	***
HTN2yrs1	0.2489348	0.0479356	5.193	2.07e-07	***
OSA2yrs1	-0.0268788	0.0371898	-0.723	0.46984	
MDD2yrs1	-0.0302113	0.0367815	-0.821	0.41144	
PTSD2yrs1	-0.0058477	0.0415927	-0.141	0.88819	
COPD2yrs1	0.0265236	0.0388973	0.682	0.49531	
Cancer2yrs1	-0.1689771	0.0433039	-3.902	9.54e-05	***
Cerebrovasc2yrs1	0.0363589	0.0736630	0.494	0.62160	
CAHD2yrs1	0.0234185	0.0375812	0.623	0.53319	
Asthma2yrs1	-0.1339519	0.0627826	-2.134	0.03288	*
AlcDep2yrs1	0.0069849	0.0418531	0.167	0.86746	
DrugDep2yrs1	0.1069726	0.0664041	1.611	0.10719	
Hyperlipidemia2yrs1	0.0845675	0.0387281	2.184	0.02899	*
Dementia2yrs1	-0.0389787	0.0544860	-0.715	0.47437	
PAD2yrs1	0.0964510	0.0402275	2.398	0.01650	*
VTE2yrs1	0.2378152	0.0637323	3.731	0.00019	***
Smoke2yrsFormer	-0.0168590	0.0370493	-0.455	0.64908	
Smoke2yrsCurrent	0.0802952	0.0487186	1.648	0.09932	.
Smoke2yrsUnknown	0.2138219	0.0749375	2.853	0.00433	**

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family taken to be 1)

Null deviance: 42409 on 183340 degrees of freedom
 Residual deviance: 36103 on 183275 degrees of freedom
 (1312 observations deleted due to missingness)
 AIC: 36235

Number of Fisher Scoring iterations: 8

Omicron Period - Ventilation

Call:

```
glm(formula = Vent30d ~ vaccine + IndexMonth + rcs(Age, c(31,
  48, 61, 72, 83)) + Sex + Race + Ethnicity + rcs(BMI, c(21.6,
  26.8, 30, 33.8, 42)) + Urban_Rural + Region + CCI + CAN +
  immuno + DiabetesAny2yrs + CKD2yrs + CHF2yrs + HTN2yrs +
  OSA2yrs + MDD2yrs + PTSD2yrs + COPD2yrs + Cancer2yrs + Cerebrovasc2yrs +
  CAHD2yrs + Asthma2yrs + AlcDep2yrs + DrugDep2yrs + Hyperlipidemia2yrs +
  Dementia2yrs + PAD2yrs + VTE2yrs + Smoke2yrs, family = binomial(),
  data = .)
```

Deviance Residuals:

Min	1Q	Median	3Q	Max
-0.7041	-0.1397	-0.0960	-0.0694	3.7903

Coefficients:

	Estimate	Std. Error	z value	Pr(> z)	
(Intercept)	-6.45541	0.76371	-8.453	< 2e-16	***
vaccine2 mRNA	-0.53444	0.06661	-8.024	1.02e-15	***
vaccine3 mRNA	-0.89446	0.07034	-12.717	< 2e-16	***
vaccineComplete Janssen	-0.30324	0.12881	-2.354	0.018561	*
vaccineOther	-1.07655	0.15499	-6.946	3.76e-12	***
vaccinePartial mRNA	-0.37657	0.17679	-2.130	0.033173	*
IndexMonthFebruary	0.21013	0.07159	2.935	0.003336	**
IndexMonthMarch	0.37707	0.11395	3.309	0.000936	***
IndexMonthApril	0.26912	0.12747	2.111	0.034752	*
IndexMonthMay	-0.10000	0.10330	-0.968	0.333013	
IndexMonthJune	-0.14699	0.09069	-1.621	0.105048	
rcs(Age, c(31, 48, 61, 72, 83))Age	0.05421	0.01703	3.183	0.001459	**
rcs(Age, c(31, 48, 61, 72, 83))Age'	-0.16976	0.05923	-2.866	0.004158	**
rcs(Age, c(31, 48, 61, 72, 83))Age''	0.66860	0.21638	3.090	0.002002	**
rcs(Age, c(31, 48, 61, 72, 83))Age'''	-1.21232	0.31825	-3.809	0.000139	***
SexM	0.07243	0.11474	0.631	0.527903	
RaceBlack	0.02882	0.07065	0.408	0.683307	
RaceAsian	-0.21044	0.30790	-0.683	0.494311	
RaceAmerican Indian/Alaska Native	0.07059	0.27295	0.259	0.795921	
RacePacific Islander/Native Hawaiian	-0.01311	0.26367	-0.050	0.960340	
RaceUnknown	0.02029	0.11169	0.182	0.855841	
EthnicityHispanic	0.16548	0.09703	1.705	0.088131	.
EthnicityUnknown	-0.18498	0.14505	-1.275	0.202200	
rcs(BMI, c(21.6, 26.8, 30, 33.8, 42))BMI	-0.06922	0.01560	-4.437	9.14e-06	***
rcs(BMI, c(21.6, 26.8, 30, 33.8, 42))BMI'	0.26622	0.13768	1.934	0.053163	.
rcs(BMI, c(21.6, 26.8, 30, 33.8, 42))BMI''	-1.04170	0.67380	-1.546	0.122103	
rcs(BMI, c(21.6, 26.8, 30, 33.8, 42))BMI'''	1.26532	0.89695	1.411	0.158338	
Urban_RuralUrban	0.09013	0.06247	1.443	0.149131	
RegionNortheast	-0.06475	0.09532	-0.679	0.496966	
RegionSouth	0.15862	0.07543	2.103	0.035483	*
RegionWest	0.17541	0.08252	2.126	0.033529	*
CCI1	0.24636	0.10262	2.401	0.016360	*
CCI2	0.39238	0.10984	3.572	0.000354	***
CCI3	0.50180	0.12549	3.999	6.37e-05	***
CCI4	0.64068	0.13773	4.652	3.29e-06	***
CCI5-6	0.63363	0.14525	4.362	1.29e-05	***
CCI7-8	0.77164	0.16811	4.590	4.43e-06	***
CCI9+	0.79926	0.19765	4.044	5.26e-05	***
CAN31-55	0.60506	0.12128	4.989	6.07e-07	***
CAN56-75	0.91101	0.13581	6.708	1.97e-11	***
CAN76-90	1.21346	0.14522	8.356	< 2e-16	***

CAN91-95	1.35124	0.21215	6.369	1.90e-10	***
CAN96-100	1.48056	0.16865	8.779	< 2e-16	***
CANMissing	1.07827	0.22731	4.744	2.10e-06	***
immuno1	0.44038	0.07387	5.961	2.50e-09	***
DiabetesAny2yrs1	-0.01515	0.06628	-0.229	0.819246	.
CKD2yrs1	0.12252	0.07228	1.695	0.090066	.
CHF2yrs1	0.19256	0.07755	2.483	0.013030	*
HTN2yrs1	0.13313	0.07561	1.761	0.078253	.
OSA2yrs1	0.10903	0.06078	1.794	0.072850	.
MDD2yrs1	0.01807	0.06106	0.296	0.767337	.
PTSD2yrs1	-0.08025	0.06878	-1.167	0.243273	.
COPD2yrs1	0.01506	0.06702	0.225	0.822216	.
Cancer2yrs1	0.04023	0.07259	0.554	0.579407	.
Cerebrovasc2yrs1	-0.01226	0.13486	-0.091	0.927561	.
CAHD2yrs1	0.04832	0.06436	0.751	0.452792	.
Asthma2yrs1	-0.27115	0.11086	-2.446	0.014452	*
AlcDep2yrs1	-0.13318	0.07148	-1.863	0.062447	.
DrugDep2yrs1	0.14807	0.11216	1.320	0.186753	.
Hyperlipidemia2yrs1	-0.04406	0.06308	-0.699	0.484827	.
Dementia2yrs1	-0.37740	0.11072	-3.409	0.000653	***
PAD2yrs1	0.26956	0.06793	3.968	7.24e-05	***
VTE2yrs1	0.12242	0.11377	1.076	0.281906	.
Smoke2yrsFormer	0.12195	0.06225	1.959	0.050115	.
Smoke2yrsCurrent	0.08657	0.08252	1.049	0.294169	.
Smoke2yrsUnknown	0.22910	0.12758	1.796	0.072545	.

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family taken to be 1)

Null deviance: 17607 on 183340 degrees of freedom
 Residual deviance: 16070 on 183275 degrees of freedom
 (1312 observations deleted due to missingness)
 AIC: 16202

Number of Fisher Scoring iterations: 9