Results of COVID-19 Vaccine Effectiveness Studies: An Ongoing Systematic Review

Weekly Summary Tables

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Prepared by:

International Vaccine Access Center,
Johns Hopkins Bloomberg School of Public Health

and

World Health Organization

For comments or questions, please contact: Anurima Baidya at abaidya1@jhmi.edu or Karoline Walter at kwalte21@jhmi.edu.

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1. Summary of Study Results for Post-Authorization COVID-19 Vaccine Effectiveness[#]

(Detailed methods available on VIEW-hub Resources page: https://view-hub.org/resources)

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose[±]	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
154	Buchan et al (January 1,2021)	Canada	Test negative case control	3,442 Omicron-positive cases, 9,201 Delta-positive cases, and 471,545 test-negative controls aged ≥18 years	**Omicron specifically^**	Excluded	Any mRNA vaccine	Documented infection	–	–	6 (-25–30)	7-59	~34 weeks
											-17 (-63-16)	240+	
							BNT162b2				-2 (-38-25)	7-59	
											-23 (-76- 13)	240+	
					Delta^		Any mRNA vaccine				84 (81-86)	7-59	
											70 (66-75)	240+	
							BNT162b2				82 (79-85)	7-59	
											66 (60-71)	240+	
153	Chung et al (January 1,2021)	USA	Test negative case control	3,384 individuals aged ≥12 years	Non-VOC, Alpha, Delta^	Included	BNT162b2	Symptomatic disease	–	–	66(56-73)	14+	~34 weeks
							mRNA-1273				81(73-86)		
152	Lutrick et al (December 31,2021)	USA	Prospective cohort	243 individuals aged 12-17 years	Delta^	Excluded	BNT162b2	Documented infection	–	–	92(79-97)	14+	~17 weeks
151	Collie et al* (December 29, 2021)	South Africa	Test negative case control	211,610 PCR tests of individuals In Gauteng Province	**Omicron specifically^**	Included	BNT162b2	Hospitalization	–	–	69 (48-81)	14+	~24 weeks
					Delta^						93 (90-94)		~19 weeks
150	Mendola et al* (23 December, 2021)	Italy	Retrospective cohort	2,478 HCWs 18+ years at a public hospital	Alpha††	Excluded	BNT162b2	Documented infection	–	–	89 (78-95)	8-98	~12 weeks
149	Alali et al* (December 7, 2021)	Kuwait	Retrospective cohort	3,246 HCWs 20+ years at a secondary hospital	Alpha††	Excluded	BNT162b2	Symptomatic disease	91.4 (65.1-97.9)	14+ (up to dose 2)	–	–	–
							AZD1222		75.4 (67.2-81.6))	28+ (up to dose 2)	94.5 (89.4 – 97.2)	14+	~20 weeks
148	Ostropolets et al (December 25, 2021)	USA	Retrospective cohort	179,666 patients of Columbia University Medical Center	Non-VOC, Alpha, Delta††	Excluded	BNT162b2	Documented infection	–		94 (91-95)	14+	52 weeks
								Hospitalization			95 (92-97)		
							mRNA-1273	Documented infection			97 (94-98)		
								Hospitalization			96 (92-99)		
							Ad26.COV2.S	Documented infection	81 (50-94)	14+	–	–	
								Hospitalization	92 (58-100)				

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
147	Amir et al (December 21, 2021)	Israel	Quasi-experimental	348,468 individuals aged 16-18 and 361,050 individuals aged 12-14	Delta^	Excluded	BNT162b2	Documented infection: 12-14 years	–	–	92 (91.1-92.8)	14-60	~6.5 weeks
								Documented infection: 16-18 years			89.8 (80-93.8)		
146	Katikireddi et al* (December 20, 2021)	Scotland	Retrospective cohort	2,534,527 adults (aged 18+)	Delta^	Excluded	AZD1222	Hospitalization or death	49.3 (43.3-54.6)	14+	83.7 (79.7-87.0)	14-27	~20 weeks
											53.6 (48.4-58.3)	140-153	
145	Kissling et al (December 23,2021)	Croatia, France, Ireland, Netherlands, Portugal, Romania, Spain, and the UK	Test negative case control	2,725 cases and 11,557 controls	Delta^	Included	BNT162b2	Documented infection [30-59 years]	–	–	87 (83–89)	14-29	~30 weeks
											65 (56–71)	90+	
							mRNA-1273				98 (93–100)	14-29	
											90 (76–96)	60-89	
							AZD1222				72 (52–83)	14-29	
											65 (48–76)	60-89	
							Ad26.COV2.S				50 (36–62)	30–59	
											52 (33–66)	60-89	
144	Hansen et al (December 23,2021)	Denmark	Retrospective cohort	41,684 Danish residents aged ≥12 years	**Omicron specifically^**	Excluded	BNT162b2	Documented infection	–	–	55.2 (23.5-73.7)	15-44	21 weeks
											-76.5 (-95.3, -59.5)	105-164	
							mRNA-1273				36.7 (-69.9-76.4)	15-44	
											-39.3 (-61.6, -20)	105-164	
					Delta specifically^		BNT162b2				86.7 (84.6-88.6)	15-44	
											53.8 (52.9-54.6)	105-164	
							mRNA-1273				88.2 (83.1–91.8)	15-44	
											65.0 (63.6- 66.3)	105-164	
143	Ioannou et al (December 21,2021)	USA	Target trial emulation study	4,199,742 individuals	Non-VOC and Alpha ††	Excluded	BNT162b2 & mRNA-1273	Documented infection (March 31st 2021)	31 (26-35)	14+	65 (63–68)	7+	~28 weeks
								Documented infection (June 30tht 2021)			69 (67–70)		
								Death (March 31st 2021)	55 (42–64)		89 (84–92)		
								Death (June 30tht 2021)			86 (82–89)		
142	Lewis et al (December 21,2021)	USA	Test negative case control	3,619 adults	Alpha and Delta††	Included	BNT162b2 & mRNA-1273	Hospitalization with no underlying conditions	–	–	96 (93-98)	14+	~30 weeks
								Hospitalization with one underlying conditions			93 (89-95)		

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
								Hospitalization with 2 underlying conditions			87 (92-91)		
								Hospitalization with 3+ underlying conditions			83 (72-88)		
141	Tartof et al (December 21,2021)	USA	Retrospective matched cohort	3,133,075 adults	Non-VOC, Alpha and Delta††	Included	BNT162b2	Documented infection	–	–	85 (83-86)	7-36	~48 weeks
											49 (46-51)	217+	
								Hospitalization			90 (86-92)	7-36	
											88 (85-90)	217+	
140	Bekker et al (December 20,2021)	South Africa	Retrospective matched cohort	477,234 HCWs	Beta, Delta, Kappa^	Included	Ad26.COV2.S	Hospitalization	67 (62-71)	28+	–	–	12 weeks
								ICU/CCU admission	75 (69-82)				
								Death	83 (75-89)				
					Beta specifically^			Hospitalization	62 (42-76)				
								ICU/CCU admission	49 (8-77)				
								Death	86 (57-100)				
					Delta specifically^			Hospitalization	67 (62-71)				
								ICU/CCU admission	78 (71-88)				
								Death	82 (74-89)				
139	Abu-Raddad et al (December 16,2021)	Qatar	Test negative case control	107,099 test-positive cases and 658,564 test-negative controls	Beta and Delta^	Excluded	mRNA-1273	Documented infection	60.3 (57-63.3)	14+	85.3 (83.5-86.9)	30+	~35 weeks
											-29.5 (-84-8.8)	240+	
								Symptomatic disease	78.3 (75.2-81.1)		94.4 (92.8-95.6)	30+	
											20 (-29-59.3)	240+	
								Asymptomatic disease	54.6 (47.7-60.6)		79.9 (75.5-83.4)	30+	
											-28.4 (-129.3-28.1)	240+	
								Hospitalization and death	82.1 (73.1-88.1)		97.2 (92.4-99)	30+	
											61 (-225.5-95.3)	180+	
138	McLean et al (December 16,2021)	USA	Prospective cohort	1,518 individuals aged ≥12 years	Non-VOC, Alpha and Delta††	Included	BNT162b2	Symptomatic and asymptomatic infections	–	–	50 (21-69)	14+	~52 weeks
							mRNA-1273				65 (37-81)		
							BNT162b2	Symptomatic infections			54 (26-71)		
							mRNA-1273				65 (38-81)		
						Excluded	BNT162b2	Symptomatic and asymptomatic infections			51 (22-70)		
							mRNA-1273				66 (38-82)		
					Delta specifically^	Excluded	BNT162b2	Symptomatic and asymptomatic infections			52 (20-71)		
							mRNA-1273				59 (24-78)		
137	Castillo-Arregoces et al (December 16,2021)	Colombia	Retrospective matched cohort	2,828,294 individuals aged 60+	Mu^	Excluded	BNT162b2	Hospitalization without death		14+	83 (78.4-86.6)	14+	32 weeks
								Post-hospitalization death			94.8 (93.3 – 96)		
								Death			88.3 (84.1-91.4)		

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
							AZD1222	Hospitalization without death			90.8 (85.5-94.2)		
								Post-hospitalization death			97.5 (95.8-98.5)		
								Death			93.9 (89.3-96.6)		
							Ad26.COV2.S	Hospitalization without death	60.9 (36.8-75.8)		–		
								Post-hospitalization death	85.8 (77.1-91.2)		–		
								Death	95.5 (82.0- 98.9)		–		
							CoronaVac	Hospitalization without death			47.3 (41.9-52.3)		
								Post-hospitalization death			72.1 (70.1-73.9)		
								Death			64.9 (61.2-68.9)		
136	Young-Xu et al* (December 15, 2021) *Updated analysis of reference #45*	USA	Test negative case control	71,190 male veterans aged 65+ in the Veterans Health Administration	Non-VOC and Alpha †† (pre-Delta)^	Excluded	BNT162b2 & mRNA-1273	Documented infection	–	–	94.5 (90.7-96.7)	14-43	4 weeks
											87.9 (85.9-89.5)	74-103	12 weeks
					Alpha, Delta†† (rising Delta)^						92.1 (87.2-95.1)	14-43	4 weeks
											67.3 (63.2-70.9)	134-163	20 weeks
					Delta^						62.0 (45.6-73.5)	14-43	4 weeks
											24.8 (18.8-30.4)	224-253	32 weeks
135	Florea et al (December 15, 2021) *Updated interim analysis of reference #86*	USA	Prospective cohort	927,004 matched pairs of adult (18+) Kaiser Permanente members in Southern California	Non-VOC, Alpha, Delta††	Included	mRNA-1273	Documented infection	-	-	82.8 (82.2-83.3)	14+	~35 weeks
											88.0 (86.8-89.1)	14-60	~6.5 weeks
											75.5 (70.4-79.7)	180-240	~35 weeks
								Hospitalization			96.1 (95.5-96.6)	14+	
											95.9 (93.5-97.4)	14-60	~6.5 weeks
											94.5 (90.9-96.7)	180-240	~35 weeks
								Death in hospital			97.2 (94.8-98.4)	14+	
					Delta^			Documented infection	-	-	86.5 (84.8-88.0)	14+	~15 weeks
134	Machado et al (December 14,2021)	Portugal	Retrospective cohort	1,884,932 adults aged 65+	Alpha and Delta^	Excluded	BNT162b2 and mRNA-1273	Symptomatic infection in 65-79 years old	–	–	79 (76-83)	14-41	~29 weeks
											39 (29-48)	98+	
								Symptomatic infection in 80+ years old			72 (61-79)	14-41	
											34 (29-48)	124+	
								Hospitalization in 65-79 years old			95 (90-97)	14-41	
											93 (86-96)	70+	

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
								Hospitalization in 80+ years old			83 (68-91)	14-41	
											63 (37-78)	124+	
								Death in 65-79 years old			95 (88-98)	14-41	
											93 (87-96)	70+	
								Death in 80+ years old			87 (71-93)	14-41	
											75 (64-82)	124+	
							AZD1222	Symptomatic infection in 65-79 years old			95 (90-97)	14-41	
											93 (86-96)	70+	
								Hospitalization in 65-79 years old			89 (52-94)	14+	
								Death in 65-79 years old			95 (90-97)		
133	Berec et al (December 12,2021)	Czech Republic	Retrospective cohort	6,287,356 individuals	Alpha and Delta^	Included	BNT162b2	Documented infection	–	–	87 (86-87)	0-2 mos.	~35 weeks
											53 (52-54)	7-8 mos.	
								Hospitalization			90 (89-91)	0-2 mos.	
											75 (73-76)	7-8 mos.	
								Death			92 (90-93)	0-2 mos.	
											83 (81-86)	7-8 mos.	
							mRNA-1273	Documented infection			90 (89-91)	0-2 mos.	
											65 (63-67)	7-8 mos.	
								Hospitalization			94 (92-96)	0-2 mos.	
											81 (78-84)	7-8 mos.	
								Death			96 (91-98)	0-2 mos.	
											88 (82-92)	7-8 mos.	
							AZD1222	Documented infection			83 (80-85)	0-2 mos.	
											55 (54-56)	5-6 mos.	
								Hospitalization			87 (81-91)	0-2 mos.	
											70 (68-72)	5-6 mos.	
								Death			93 (77-98)	0-2 mos.	
											82 (78-85)	5-6 mos.	
							Ad26.COV2.S	Documented infection			68 (66-70)	0-2 mos.	
											67 (65-69)	5-6 mos.	
								Hospitalization			68 (60-75)	2 months	
											67 (62-72)	5-6 mos.	
								Death			68 (42-82)	2 months	
											68 (53-78)	5-6 mos.	
132	Powell et al (December 11,2021)	England	Test-negative case control	543,017 children aged 12-17 years	Delta^	Excluded	BNT162b2 and mRNA-1273	Symptomatic infection in 12–15-year-old	75.4(73.9-76.9)	14+	–	14-84	~47 weeks
									46.8(14.9-66.7)	56-63			
								Symptomatic infection in 16–17-year-old	75.9(74.3-77.4)	14+	94.6 (92.8-95.9)		
									37.4(30.8-43.3)	84+			

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
								Symptomatic infection in 18–39-year-old	63(62.2-63.8)	14+	88.7 (88.5-88.8)		
									39.5(37.9-41)	84+			
								Symptomatic infection in 40–64-year-old	54.5(49.7-58.8)	14+	84.1 (83.6-84.5)		
									53(50.2-55.6)	84+			
								Hospitalization in 16–17-year-old	84.5(64.6-93.2)	14+	–		
131	Bajema et al* (December 10,2021) *Updated analysis of reference #94*	USA	Test-negative case control	755 cases and 1,141 controls	Non-VOC, Alpha, Delta††	Excluded	BNT162b2	Hospitalization	–	–	86 (77.6-91.3)	14-119	~36 weeks
											75.1 (64.6-82.4)	120+	
							mRNA-1273				89.6 (80.1-94.5)	14-119	
											86.1 (77.7-91.3)	120+	
130	Andrews et al (December 31,2021) *[Update to Dec 10, 2021 preprint]*	England	Test-negative case control	204,036 Omicron cases, 169,888 Delta cases, and test negative controls aged 18+	Omicron specifically^	Excluded	BNT162b2	Symptomatic Infection	—	28+	62.99 (58.83-66.73)	2-4 weeks	~28 weeks
											9.76 (6-.10-13.27)	25+ weeks	
							AZD1222		–		24.81 (1.17-42.79)	5-7 weeks	
											-4.43 (-7.53 to -1.42)	25+ weeks	
							mRNA-1273				68.33 (55.05-77.68)	2-4 weeks	
											6.74 (-47.57-41.07)	25+ weeks	
					Delta specifically^		BNT162b2		—		88.2 (86.7-89.5)	2-4 weeks	
											63.5 (61.4-65.5)	25+ weeks	
							AZD1222		—		76.2 (63.7-84.4)	2-4 weeks	
											41.8 (39.4-44.1)	25+ weeks	
							mRNA-1273				95.48 (90.35-97.88)	2-4 weeks	
											74.81 (39.44-89.52)	25+ weeks	
129		Canada	Retrospective cohort			Unknown	BNT162b2 & mRNA-1273	Documented infection	—	—	74.1 (62.5-82.1)	7+	~40.5 weeks

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
	Yassi et al (December 6, 2021)		Test-negative case control	21,242 HCWs in Vancouver, BC	Non-VOC, Alpha, Delta††				—	—	82.8 (74.0-88.6)		
128	Muhsen et al* (October 28, 2021)	Israel	Prospective cohort	9162 HCWs (aged 16-65 y) working in long-term care facilities	Alpha^	Excluded	BNT162b2	Documented infection	—	—	89 (83-93)	>14	~11 weeks
127	Wu et al* (December 2, 2021)	USA	Retrospective cohort	29,152 matched pairs of cancer patients in the Veterans Affairs health system	Non-VOC, Alpha††	Excluded	BNT162b2 & mRNA-1273	Documented infection	45 (8-66)	14+	58 (39-73)	14+	15 weeks
126	Vokó et al* (November 24, 2021)	Hungary	Retrospective cohort	3.7 million Hungarian residents aged 16+	Alpha^	Included	BNT162b2	Documented infection	41.0 (39.5-42.4)	0+ (up to <7 days post dose 2)	84.0 (83.3-84.7)	14+	~19 weeks
								Death	64.3 (61.8-66.6)		90.3 (88.9-91.5)		
							Sinopharm	Documented infection	34.0 (31.8-36.1)		72.8 (71.2-74.4)		~10.5 weeks
								Death	39.4 (34.1-44.3)		86.0 (83.7-87.9)		
							Sputnik V	Documented infection	48.7 (47.1-50.2)		88.1 (86.5-84.9)		~11 weeks
								Death	78.0 (74.3-81.2)		97.8 (95.5-98.9)		
							AZD1222	Documented infection	49.2 (47.7-50.6)		73.7 (71.1-76.0)		~11.5 weeks
								Death	71.3 (67.9-74.4)		85.8 (73.5-92.4)		
							mRNA-1273	Documented infection	60.8 (58.6-63.0)		88.2 (85.8-90.3)		~15 weeks
								Death	68.7 (62.5-73.8)		93.8 (90.3-96.1)		
125	Hall et al (December 1, 2021)	United Kingdom	Prospective cohort	35,768 HCWs (18+ years) undergoing routine asymptomatic testing	Non-VOC, Alpha, Delta^	Included	BNT162b2	Documented infection	57 (41-69)	21-27	Dose interval <6 weeks: 85 (71-92)	14-73	~8 weeks
											Dose interval <6 weeks: 58 (40-71)	>193	36 weeks
									58 (42-70)	>55	Dose interval 6+ weeks: 81 (68-89)	14-73	~8 weeks
											Dose interval 6+ weeks: 43 (17-61)	>193	33 weeks
							AZD1222	Documented infection	42 (-92-83)	21-27	49 (16-69)	14-73	~8 weeks
									29 (-43-65)	>55	51 (18-71)	>133	~23 weeks
124	Thiruvengadam et al	India	Test-negative case control	2766 cases and 2377 controls	Delta^	Excluded	AZD1222	Documented infection	46.2 (31.6-57.7)	21+	63.1 (51.5-72.1)	14+	~10 weeks

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	(November 25,2021)												
123	Desai et al (November 23,2021)*	India	Test-negative case control	1068 matched case-control HCW pairs	Delta^	Included	BBV152	Symptomatic disease	−1 (−51 – 33)	21+	50 (33-62)	14+	~4 weeks
											46 (22-62)	28+	
											57 (21-76)	42+	
						Excluded					47 (29-61)	14+	
122	Paixao et al (November 12,2021)	Brazil	Test-negative case control	19,838 pregnant women	Gamma and Delta††	Excluded	CoronaVac	Symptomatic disease	5.0 (-18.2–23.7)	14+	41.0 (27.0-52.2)	14+	~28.5 weeks
121	Ng et al* (November 1, 2021)	Singapore	Retrospective cohort	1204 household contacts of 301 index cases	Delta index cases, specifically	Unknown	BNT162b2 & mRNA-1273	Documented infection	—	—	61.6 (37.5-80.4)	15+	~16.5 weeks
								Symptomatic infection			67.9 (41.3-87.8)		
								Severe disease			100 (CI omitted, no events among vaccinated)		
120	Al Hosani et al (October 27,2021)	United Arab Emirates	Retrospective cohort	176,640 individuals aged 15+	Non-VOC and Alpha^	Included	BBIBP-CorV	Hospitalization	-35 (-45– -26)	14+	74 (72-76)	14+	~34 weeks
								ICU admissions	0 (-17–15)		91 (88-93)		
								Deaths	12 (-95–61)		96 (69-99)		
119	Poukka et al (November 8, 2021)	Finland	Retrospective cohort	427,905 HCWs aged 16-69 years	Non-VOC, Alpha, Delta^	Excluded	BNT162b2	Documented infection	40 (33-46)	42+	83 (80-85)	14-90	~11 weeks
											55 (45-64)	181+	~29.5 weeks
								Hospitalization	82 (68-90)		99 (97-100)	14-90	~11 weeks
											98 (89-100)	181+	~38 weeks
							mRNA-1273	Documented infection	61 (45-72)		84 (68-92)	14-90	~11 weeks
											69 (-124-96)	91-180	~24 weeks
								Hospitalization	89 (22-98)		100 (-inf-100)	14-90	~11 weeks
											100 (-inf-100)	181+	~34 weeks
							Heterologous mRNA	Documented infection	—	—	100 (-inf-100)	14-90	~11 weeks
											100 (-inf-100)	181+	~29.5 weeks
								Hospitalization			100 (-inf-100)	14-90	~11 weeks
											100 (-inf-100)	181+	~38 weeks
							AZD1222	Documented infection	22 (-3-42)	42+	89 (73-95)	14-90	~11 weeks
											63 (-166-95)	91-180	~24 weeks
								Hospitalization	88 (10-98)	42+	100 (-inf-100)	14-90	~11 weeks
											100 (-inf-100)	181+	~25 weeks
							Heterologous AZD1222 + mRNA	Documented infection	—	—	80 (72-86)	14-90	~11 weeks
											62 (30-79)	91-180	~24 weeks
								Hospitalization			100 (-inf-100)	14-90	~11 weeks
											100 (-inf-100)	181+	~25 weeks
					Non-VOC, Alpha^		BNT162b2 & mRNA-1273 (homologous or heterologous)	Documented infection	38 (23-50)	42+	77 (71-82)	14-90	~11 weeks
											55 (34-69)	91-180	~24 weeks
								Hospitalization	90 (27-99)		95 (64-99)	14-90	~11 weeks
											100 (-inf-100)	91-180	~24 weeks

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
							AZD1222	Documented infection	15 (-15-37)	42+	100 (-inf-100)	14-90	~11 weeks
											100 (-inf-100)	91-180	~24 weeks
								Hospitalization	100 (-inf-100)	42+	100 (-inf-100)	14-90	~11 weeks
							Heterologous AZD1222 + mRNA	Documented infection	—	—	100 (-inf-100)	14-90	~11 weeks
											100 (-inf-100)	91-180	~24 weeks
								Hospitalization			100 (-inf-100)	14-90	~11 weeks
					Delta^		BNT162b2 & mRNA-1273 (homologous or heterologous)	Documented infection	45 (37-51)	42+	85 (81-88)	14-90	~11 weeks
											56 (46-65)	181+	~29.5 weeks
								Hospitalization	83 (68-91)		100 (97-100)	14-90	~11 weeks
											98 (88-100)	181+	~38 weeks
							AZD1222	Documented infection	49 (-16-77)		88 (71-95)	14-90	~11 weeks
											62 (-177-95)	91-180	~24 weeks
								Hospitalization	42 (-330-92)		100 (-inf-100)	14-90	~11 weeks
											100 (-inf-100)	181+	~25 weeks
							Heterologous AZD1222 + mRNA	Documented infection	—	—	80 (72-86)	14-90	~11 weeks
											63 (33-80)	91-180	~24 weeks
								Hospitalization			100 (-inf-100)	14-90	~11 weeks
											100 (-inf-100)	181+	~25 weeks
118	Embi et al*(December 30, 2021) *[Updated version of Embi et al November 5, 2021]*	USA	Test-negative case control	20,101 immunocompromised and 69,116 immunocompetent adults (18+) in nine states	Non-VOC, †† Alpha, †† Delta^	Included	BNT162b2	Hospitalization: immunocompromised	—	—	71 (65-76)	14+	~33 weeks
								Hospitalization: immunocompetent			88 (86-89)		
							mRNA-1273	Hospitalization: immunocompromised			81 (76-85)		
								Hospitalization: immunocompetent			93 (92-94)		
					Non-VOC, Alpha††		BNT162b2 & mRNA-1273	Hospitalization: immunocompromised			76 (69-81)		
								Hospitalization: immunocompetent			91 (90-93)		
					Delta^			Hospitalization: immunocompromised			79 (74-83)		
								Hospitalization: immunocompetent			90 (89-91)		
117	Sheikh et al* (October 20,2021)	Scotland	Retrospective cohort	1,563,818 adults	Alpha and Delta^	Unknown	BNT162b2	Death in 40-59 years	100 (CI omitted)	14+ up to 13 days post dose 2	95 (79-99)	14+	~25 weeks
								Death in ≥ 60 years	75 (26-91)		87 (77-93)		
							AZD1222	Death in 40-59 years	96 (85-99)		88 (76-93)		
								Death in ≥ 60 years	97 (86-99)		90 (84-94)		
					Delta specifically^		BNT162b2	Death	92 (66-98)		90 (83-94)		
							AZD1222		96 (89-99)		91 (86-94)		

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
116	Reis et al* (October 20,2021)	Israel	Retrospective cohort	94,354 vaccinated adolescents aged 12-18 matched with 94,354 controls	Delta^	Excluded	BNT162b2	Documented infection	59 (52-65)	14-20	90 (88-92)	7-21	~12 weeks
									66 (59-72)	21-27			
								Symptomatic disease	57 (39-71)	14-20	93 (88-97)		
									82 (73-91)	21-27			
115	Nordström et al* (October 18, 2021)	Sweden	Retrospective cohort	541,071 vaccinated individuals and 180,716 unvaccinated matched individuals	Delta^	Excluded	BNT162b2	Symptomatic disease	—	—	78 (78-79)	14+	~11 weeks
							mRNA-1273				87 (84-88)		
							AZD1222				50 (41-58)		
							AZD1222/ BNT162b2				67 (59-73)		
							AZD1222/ mRNA-1273				79 (62-88)		
114#	Skowronski et al (October 26,2021)	Canada	Test-negative case control	380,532 specimens in British Columbia including 27,439 cases (estimates also available for Quebec, but not included here)	Non-VOC, Alpha, Delta, Gamma^	Excluded	BNT162b2	Documented infection	—	—	90 (90-90)	14+	~37 weeks
											90 (89-90)	28-55	
											81 (78-83)	168+	
								Hospitalization			98 (97-98)	14+	
											98 (98-99)	28-55	
											98 (94-99)	168+	
							mRNA-1273	Documented infection			91 (90-91)	14+	
											94 (93- 94)	28-55	
											71 (65-75)	168+	
								Hospitalization			97 (96-98)	14+	
											99 (96-100)	28-55	
											96 (83-99)	168+	
							AZD1222	Documented infection			71 (69-74)	14+	
											74 (67-79)	28-55	
											69 (64-72)	84+	
								Hospitalization			94 (90-96)	14+	
											88 (62-96)	28-55	
											95 (89-98)	84+	
							Heterologous mRNA	Documented infection			91 (90- 92)	14+	
											93(91-94)	28-55	
											93(80-97)	112-139	
								Hospitalization			98 (96-99)	14+	
											97 (92-100)	28-55	
											97 (94-99)	84-111	

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
							Heterologous AZD1222 + mRNA	Documented infection			90 (89-91)	14+	
											91 (89-92)	28-55	
											92 (44-99)	112-139	
								Hospitalization			99 (98-100)	14+	
											99 (91-100)	28-55	
					Delta specifically^		BNT162b2	Documented infection			91 (91-92)	14+	
											92 (92-93)	28-55	
											80 (76, 84)	196+	
								Hospitalization			98 (97-98)	14+	
											99 (98-99)	28-55	
											98 (91-99)	168+	
							mRNA-1273	Documented infection			92 (91-93)	14+	
											94 (93- 95)	28-55	
											80 (73-85)	168+	
								Hospitalization			97 (96- 98)	14+	
											99 (96-100)	28-55	
											84 (63-93)	112-139	
							AZD1222	Documented infection			70 (66-73)	14+	
											68 (60-75)	28-55	
											65 (57-72)	84+	
								Hospitalization			92 (86-95)	14+	
											84 (51-95)	28-55	
											92 (81-97)	84+	
							Heterologous mRNA	Documented infection			98 (97-99)	14+	
											93 (91-94)	28-55	
											88 (82-91)	196+	
								Hospitalization			98 (97-99)	14+	
											96 (88-99)	28-55	
											98 (85-100)	168+	
							Heterologous AZD1222 + mRNA	Documented infection			91 (89-92)	14+	
											90 (88-92)	28-55	
											85 (77-90)	84-111	
								Hospitalization			99 (97-100)	14+	
											99 (90-100)		
					Alpha specifically^		BNT162b2	Documented infection			96 (93-98)	14+	
								Hospitalization			96 (83-99)		
							mRNA-1273	Documented infection			95 (85-98)		
								Hospitalization			—		
							AZD1222	Documented infection			74 (29-90)		
								Hospitalization			—		
								Documented infection			96 (93-98)		

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
							Heterologous mRNA	Hospitalization			97 (87-99)		
							Heterologous AZD1222 + mRNA	Documented infection			74 (29-90)		
								Hospitalization			—		
					Gamma specifically^		BNT162b2	Documented infection			93 (89-95)		
								Hospitalization			95 (83-99)		
							mRNA-1273	Documented infection			95 (85, 99)		
							AZD1222	Documented infection			90 (61, 98)		
							Heterologous mRNA	Documented infection			94 (75, 99)		
							Heterologous AZD1222 + mRNA	Documented infection			96 (70, 99)		
113	Lin et al (October 26,2021)	USA	Retrospective cohort	812,665 cases registered in North Carolina	Alpha and Delta^	Unknown	BNT162b2	Symptomatic disease	—	—	94.9 (94.5-95.2)	2 months	~33 weeks
											70.1 (68.9-71.2)	7 months	
								Hospitalization			96.4 (94.7-97.5)	2 months	
											87.7 (84.3-90.4)	7 months	
								Death			95.9 (92.9-97.6)	2 months	
											88.4 (83-92.1)	7 months	~32 weeks
							mRNA-1273	Symptomatic disease			96 (95.6-96.4)	2 months	
											81.9 (81-82.7)	7 months	
								Hospitalization			97.5 (96.3-98.3)	2 months	
											92.3 (89.7-94.3)	7 months	
								Death			96 (91.9-98)	3 months	
											93.7 (90.2-95.9)	7 months	~29 weeks
							Ad26.COV2.S	Symptomatic disease			79 (77.1-80.7)	1 month	
											64.3 (62.3-66.1)	5 months	
								Hospitalization			89.8 (78.8-95.1)	2 months	
								Death			89.4 (52.3-97.6)	3 months	
112	Nordstrom et al (October 25,2021)	Sweden	Retrospective cohort	842,974 pairs of vaccinated and unvaccinated Swedish individuals	Delta^	Excluded	BNT162b2	Symptomatic disease	—	—	92 (92-93)	15-30	~30 weeks
											23 (-2 – 41)	210+	
							mRNA-1273				96 (94-97)	15-30	
											59 (18-79)	210+	
							AZD1222				68 (52-79)	15-30	
											-19 (-97 – 28)	210+	
							AZD1222 and any mRNA vaccine				89 (79-94)	15-30	
											66 (41-80)	210+	
111		Brazil	Test-negative case control	7,434 individuals	Gamma and Delta^	Excluded	AZD1222	Symptomatic disease	45.2(16.2-64.1)	28-41 days	—	—	

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
	Ranzani et al (October 20,2021)			residing in a favela in Rio De Janeiro					58.6(28.0-76.2)	42-55 days			
									36.7(7.9-56.4)	>56 days			
								Asymptomatic disease	29.8(-44.2- 65.8)	>21 days			
110	Chin et al*(October 20, 2021)	USA	Retrospective cohort	827 propensity matched incarcerated men	Delta^	Included	mRNA-1273	Documented infection	—	—	56.6 (42.0-67.5)	14+	~27 weeks
								Symptomatic disease			84.2 (56.4-94.3)		
						Previously infected only		Documented infection			80.5 (52.8-92.0)		
						Excluded		Documented infection			49.5 (31.5-62.7)		
109	Irizarry et al(November 17, 2021) *[Updated version of Robles-Fontan et al (October 20,2021)]*	Puerto Rico	Retrospective cohort	87,704 PCR confirmed infections for individuals 12 years or older	Non-VOC, Alpha, Beta and Delta^^	Unknown	BNT162b2	Hospitalization (45-74y)	—	—	92 (90.8-93)	14+	~20 weeks
								Hospitalization (75-84y)			93.3 (91.3-95)		
								Hospitalization (85+y)			97.1 (95.8-98)		
								Death (45-74y)			86 (81-89)		
								Death (75-84y)			87 (80-92)		
								Death (85+y)			95.2 (91.5-97)		
							mRNA-1273	Hospitalization (45-74y)			82 (78-85)		
								Hospitalization (75-84y)			91.5 (89-94)		
								Hospitalization (85+y)			97.2 (96-98)		
								Death (45-74y)			69 (52-79)		
								Death (75-84y)			87 (79-92)		
								Death (85+y)			96.2 (93.9-98)		
							Ad26.COV2.S	Hospitalization (45-74y)			96.1 (95-97)		
								Hospitalization (75-84y)			98 (96.7-99)		
								Hospitalization (85+y)			99.2 (98.6-99.5)		
								Death (45-74y)			93.8 (90-96)		
								Death (75-84y)			96.6 (91.7-98)		
								Death (85+y)			99.3 (98.6-99.6)		
							BNT162b2	Documented infection[xx]			87 (85-89)	14+	
								Hospitalisation			57(53-60)	144+	
											92(85-95)	14+	
											80(73-85)	144+	
								Death			97(86-100)	14+	
											86(75-92)	144+	
							mRNA-1273				90(88-91)	14+	~18 weeks

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
								Documented infection[xx]			73(70-76)	144+	
								Hospitalisation			95(89-97)	14+	
											90(84-94)	144+	
								Death			99(89-100)	14+	
											93(81-97)	144+	
							Ad26.COV2.S	Documented infection[xx]			62(54-68)	14+	~22 weeks
											36(30-42)	144+	
								Hospitalisation			81(60-91)	14+	
											67(53-76)	144+	
								Death			78(16-94)	14+	
											72(49-85)	144+	
							BNT162b2	Documented infection[xx]			56 (53-59)	at day 137	~20 weeks
							mRNA-1273				71 (68-74)	at day 139	~18 weeks
							Ad26.COV2.S				27 (17-37)	at day 158	~22 weeks
108	Olson et al* (October 19, 2021)	USA	Test-negative case control	179 case patients and 285 controls aged 12-18 years	Delta^	Unknown	BNT162b2	Hospitalization (12-15y)	—	—	91 (74-97)	14+	~12 weeks
								Hospitalization (16-18y)			94 (78-99)		
107	Arregoces et al (October 19, 2021)	Colombia	Matched-pair cohort study	3,346,826 adults aged 60+ in Colombia	Mu^	Excluded	BNT162b2	Hospitalization	—	14+	90.3 (87.1-92.7)	14+	~9 weeks
								Post-hospitalization death			98.5 (97.8-98.9)		
								Death without prior hospitalization			89.2 (85.6-91.9)		
							CoronaVac	Hospitalization			67.2 (63.7-70.4)		~11 weeks
								Post-hospitalization death			77.1 (75.5-78.6)		
								Death without prior hospitalization			69.8 (66.7-72.6)		
							AZD1222	Hospitalization			75.4 (48.2-88.3)		~7 weeks
								Post-hospitalization death			96.3 (88.4-98.8)		
								Death without prior hospitalization			88.7 (64.8-96.4)		
							Ad26.COV2.S	Hospitalization	80(19.9-95.0)		—		~4 weeks
								Death without prior hospitalization	75(0.0-93.8)		—		

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
106	Ranzani et al (October 18, 2021)	Brazil	Test-negative case control	11,817 adults In Mato-Grosso do Sul	Gamma^	Excluded	Ad26.COV2.S	Symptomatic disease	50.9 (35.5-63.0)	28+	—	—	~10 weeks
								Hospitalization	72.9 (35.1-91.1)				
								ICU Admission	92.5 (54.9-99.6)				
								Death	90.5 (31.5-99.6)				
105	Liu et al (October 7, 2021)	USA	Test-negative case control	10,283 matched adult residents (18+) of New York City	Non-VOC, then Alpha, then Delta††	Excluded	BNT162b2 & mRNA-1273	Overall: Documented infection	—	—	58.9 (52-64.8)	14+	~35 weeks
								Immunocompromised: Documented infection	—	—	56.8 (44.7-66.2)		
104	Bruxvoort et al (October 1, 2021)	USA	Test-negative case control	8,153 cases and matched controls among Kaiser Permanente patients (aged 18+) in Southern California	Delta specifically^	Excluded	mRNA-1273	Documented infection	77.0 (60.7-86.5)	14+	86.7 (84.3-88.7)	14+	~25 weeks
									—	—	94.1 (90.5-96.3)	14-60	~6.5 weeks
											80.0 (70.2-86.6)	151-180	~23.5 weeks
								Hospitalization	—	—	97.6 (92.8-99.2)	14+	~25 weeks
					Non-Delta specifically^			Documented infection	—	—	98.6 (97.3-99.3)	14-60	~6.5 weeks
											88.7 (73.2-95.2)	121-150	~19.5 weeks
					Alpha specifically^			Documented infection	90.1 (82.9-94.2)	14+	98.4 (96.9-99.1)	14+	~25 weeks
					Gamma specifically^			Documented infection	74.2 (43.8-88.1)	14+	95.5 (90.9-97.8)	14+	
103	Martinez-Baz et al(September 30,2021)	Spain	Prospective cohort	30,240 close contacts of 12,263 index cases	Non-VOC, Alpha and Delta^	Excluded	BNT162b2	Documented infection	57 (52-61)	14+	69 (66-72)	14+	~31 weeks
									57 (51-61)	<90	70 (67-73)	<90	~11 weeks
									—	—	63 (58-68)	≥ 90	~18 weeks
								Symptomatic disease	66 (60-71)	14+	72 (69-75)	14+	~31 weeks
								Hospitalization	86 (69-94)		93 (88-96)		
							mRNA-1273	Documented infection	66 (56-73)	14+	82 (78-86)	14+	~28 weeks
									65 (56-73)	<90	—	—	~11 weeks
									—		67 (50-78)	≥ 90	~15 weeks
								Symptomatic disease	71 (61-79)	14+	85 (80-89)	14+	~28 weeks
								Hospitalization	73 (-10–93)		98 (82-100)		
							AZD1222	Documented infection	41 (34-48)	14+	54 (48-60)	14+	~16 weeks
									40 (31-47)	<90	54 (47-60)	<90	~11 weeks
									52 (37-64)	≥ 90	—	≥ 90	~3 weeks
								Symptomatic disease	46 (37-54)	14+	56 (48-63)	14+	16 weeks
								Hospitalization	78 (54-89)		95 (79-99)		
							Ad26.COV2.S	Documented infection	50 (42-57)	14+	—		~23 weeks
									52 (44-59)	<90			~11 weeks

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
									28 (-8–53)	≥ 90			~10 weeks
								Symptomatic disease	54 (45-62)	14+			~23 weeks
								Hospitalization	74 (43-88)				
							1 dose of AZD1222+ 1 dose of BNT162b2	Documented infection	—		86 (70-93)	14+	~21 weeks
											85 (69-93)	<90	~11 weeks
								Symptomatic disease			91 (71-97)	14+	~21 weeks
								Hospitalization			95 (79-99)		
					Alpha^ specifically		BNT162b2	Documented infection	54 (37-67)	14+	71 (61-78)	14+	~31 weeks
							mRNA-1273		60 (14-81)		86 (56-95)		~28 weeks
							AZD1222		37 (21-50)		38 (-42–73)		16 weeks
							Ad26.COV2.S		77 (27-93)		—		~23 weeks
					Delta^ specifically		BNT162b2	Documented infection	63 (51-73)	14+	67 (59-74)	14+	~31 weeks
							mRNA-1273		72 (51-84)		77 (64-85)		~28 weeks
							AZD1222		53 (26-70)		55 (39-67)		16 weeks
							Ad26.COV2.S		42 (18-59)		—		~23 weeks
							1 dose of AZD1222+ 1 dose of BNT162b2		—		86 (45-97)		~21 weeks
102#	Eyre et al (September 29, 2021)	England	Retrospective cohort	139,164 contacts who sought testing exposed to 99,597 index cases of all ages Household close contacts	Alpha^ specifically	Included	BNT162b2	Documented infection	31 (25-36)	0+ up to 13 days post dose 2	94 (90-96)	14+	~20.5 weeks
							AZD1222		11 (3-18)		71 (51-83)		~8 weeks
					Delta^ specifically	Included	BNT162b2	Documented infection	42 (39-45)		90 (87-92)		~29 weeks
							AZD1222		46 (42-50)		72 (68-75)		~16 weeks
101	Glatman-Freedman et al (September 27, 2021)	Israel	Retrospective cohort	Adolescents aged 12-15 y	Delta^	Excluded	BNT162b2	Documented infection	—	—	91.5 (88.2-93.9)	8-28	2 weeks
100	Meyer et al (September 23,2021)	Germany	Retrospective cohort	252 residents and staff of a nursing home Non-household close contacts	Alpha^	Unknown	BNT162b2	Documented infection	—	—	45 (0-69)	7+	~11 weeks
								Symptomatic disease			68 (36-84)		
								Hospitalization			88 (37-98)		
99	Pilishvili et al* (September 22,2021)	USA	Test-negative case control	1482 HCPs as cases and 3449	Alpha††	Excluded	BNT162b2 & mRNA-1273	Symptomatic disease	—	—	88.9 (84.7-92.0)	14+	~14 weeks
											96.3 (92.5-98.2)	15-28	
											80.7 (61.0-90.4)	85-98	

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
				HCPs as control				Symptomatic disease - immunocompromising condition	39.1 (−45.0-74.4)	14+ through Dose 2 or later (at least 1 dose)	—	—	
								Symptomatic disease - pregnancy	77.1 (32.2- 92.2)		—	—	
							BNT162b2	Symptomatic disease	77.6 (70.9-82.7)	14+ up to <7 post 2nd dose	88.8 (84.6-91.8)	7+	
							mRNA-1273		88.9 (78.7-94.2)		96.3 (91.3-98.4)		
98#	Skowronski et al (September 22,2021)	Canada	Test-negative case control	7116 test-positive cases and 60,958 test-negative controls among adults 50-69 years	Alpha and Gamma^	Excluded	BNT162b2	Documented infection	75 (72-78)	21+	—	—	—
								Hospitalization	83 (75-89)				
							mRNA-1273	Documented infection	82 (76-87)				
								Hospitalization	85 (63-94)				
							AZD1222	Documented infection	61 (54-66)				
								Hospitalization	96 (86-99)				
					Alpha specifically^		BNT162b2	Documented infection	77 (71-81)				
								Hospitalization	79 (58-90)				
							mRNA-1273	Documented infection	85 (74-92)				
								Hospitalization	80 (17-95)				
							AZD1222	Documented infection	66 (57-74)				
					Gamma specifically^		BNT162b2	Documented infection	79 (73-84)				
								Hospitalization	88 (74-95)				
							mRNA-1273	Documented infection	85 (71-92)				
								Hospitalization	91 (36-99)				
							AZD1222	Documented infection	60 (48-69)				
								Hospitalization	90 (67-97)				
					Delta specifically^		BNT162b2	Documented infection	74 (45-88)				
							mRNA-1273		73 (-14–94)				
							AZD1222		73 (35-88)				
					Non-VOC specifically^		BNT162b2	Documented infection	86 (71-93)				
							mRNA-1273		81 (39-94)				
							AZD1222		92 (66-98)				
97	Self et al* (September 17,2021)	USA	Test-negative case control	1,682 case-patients and 2,007 control-patients ≥18 years without immunocompr	Alpha and Delta††	Excluded	BNT162b2	Hospitalization	—	—	88 (85-91)	14+	~20 weeks
											91 (88–93)	14-120	
											77 (67–84)	>120	
							mRNA-1273				93 (91-95)	14+	
											93 (90–95)	14-120	
											92 (87–96)	>120	
							Ad26.COV2.S		71 (56–81)	14+	—	—	

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
				omising conditions					68 (49–80)	>28			
96	Glatman-Freedman et al* (September 16, 2021)	Israel	Retrospective longitudinal cohort	All Israeli residents aged 16+	Alpha^	Excluded	BNT162b2	Documented infection	54.3 (50.6-57.8)	14-20	97.3 (96.7-97.8)	22-28	2 weeks
								Symptomatic disease	58.3 (54.7-61.6)		97.9 (97.4-98.3)		
								Hospitalization	74.5 (69.1-79.0)		99.0 (98.4-99.3)		
								Severe/critical disease	77.3 (71.2-82.1)		99.2 (98.6-99.5)		
								Death	71.7 (64.1-77.7)		98.6 (97.0-99.3)		
95#	Andrews et al (September 14, 2021)	England	Test-negative case control	1,475,391 symptomatic cases and 3,299,344 test-negative control patients among adults (16+)	Alpha specifically^	Excluded	BNT162b2	Symptomatic disease	45.7 (44-47.3)	28+	95 (93.8-95.9)	14+	~33.5 weeks
									—		95 (93.8-96)	14-69	~8 weeks
									—		94.8 (88.4-97.7)	70+	~33.5 weeks
								Hospitalization	85.2 (81.6-88.1)	28+	97.9 (91.4-99.5)	14+	~33.5 weeks
								Death	73.1 (65-79.3)	28+	96.3 (89.9-98.6)	14+	~33.5 weeks
							AZD1222	Symptomatic disease	44.5 (42.9-46.1)	28+	81.7 (79-84)	14+	~20.5 weeks
									—		81.9 (79.2-84.3)	14-69	~8 weeks
									—		76.2 (49.8-88.7)	70+	~20.5 weeks
								Hospitalization	82.5 (78.7-85.7)	28+	93.9 (84.9-97.5)	14+	~20.5 weeks
									—		93.8 (84.7-97.5)	70+	~20.5 weeks
								Death	79.1 (68.8-86)	28+	100 (CI omitted, no deaths among vaccinated)	14+	~20.5 weeks
							mRNA-1273	Symptomatic disease	54.5 (8.5-77.3)	28+	—	—	—
					Delta specifically^		BNT162b2	Symptomatic disease	51.9 (51.4-52.4)	28+	83.5 (83.3-83.6)	14+	~33.5 weeks
									—		89.8 (89.6-90)	14-69	~8 weeks
									—		69.7 (68.7-70.5)	140+	~33.5 weeks
								Hospitalization	91.8 (90.4-93)	28+	96.7 (96.3-97)	14+	~33.5 weeks
									—		98.4 (97.9-98.8)	14-69	~8 weeks
									—		92.7 (90.3-94.6)	140+	~33.5 weeks
								Death	88.6 (77.3-94.3)	28+	95.2 (93.7-96.4)	14+	~33.5 weeks
									—		98.2 (95.9-99.2)	14-69	~8 weeks
									—		90.4 (85.1-93.8)	140+	~33.5 weeks
							AZD1222	Symptomatic disease	43.3 (42.3-44.2)	28+	65.2 (64.9-65.6)	14+	~20.5 weeks
									—		66.7 (66.3-67)	14-69	~8 weeks
									—		47.3 (45-49.6)	140+	~20.5 weeks
								Hospitalization	81.4 (78.7-83.7)	28+	93 (92.4-93.5)	14+	~20.5 weeks
									—		95.2 (94.6-95.6)	14-69	~8 weeks
									—		77 (70.3-82.3)	140+	~20.5 weeks

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
								Death	88.4 (78.2-93.8)	28+	92.7 (90.7-94.3)	14+	~20.5 weeks
									—		94.1 (91.8-95.8)	14-69	~8 weeks
									—		78.7 (52.7-90.4)	140+	~20.5 weeks
							mRNA-1273	Symptomatic disease	65.9 (65-66.7)	28+	94.8 (94.4-95.2)	14+	~7 weeks
									—		94.5 (94.1-95)	14-69	
									—		90.3 (67.2-97.1)	70-104	
								Hospitalization	95.2 (91.8-97.1)	28+	100 (CI omitted, no events among vaccinated)	14-69	~7 weeks
94	Bajema et al(September 10,2021)	USA	Test-negative case control	388 case-patients and 787 controls from 5 Veterans Affair Medicals Centers	Alpha, Delta, Non-VOC††	Excluded	BNT162b2 & mRNA-1273	Hospitalization	—	—	86.1 (76.5-91.8)	<104 days	~13 weeks
								Hospitalization			87.2 (78.2-92.5)	≥104 days	~28.5 weeks
							BNT162b2	Hospitalization			83.4 (74.0-89.4)	14+	~28.5 weeks
							mRNA-1273	Hospitalization			91.6 (83.5-95.7)		~26.5 weeks
					Alpha^		BNT162b2 & mRNA-1273	February-June: Hospitalization			84.1 (74.1-90.2)		~23 weeks
					Delta^			July-August: Hospitalization			89.3 (80.1-94.3)		~28.5 weeks
93	Polinski et al (September 12, 2021)	USA	Retrospective Cohort	501,947 individuals ≥18 years	Alpha††	Excluded	Ad26.COV2.S	Documented infection	79 (77-80)	14+	—	—	~14 weeks
								Hospitalization	81 (79-84)				
								Immunocompromised: Documented infection	64 (57-70)				
								Immunocompromised: Hospitalization	68 (54-77)				
					Delta^			June-July: Documented infection	78 (73-82)				
								June-July: Hospitalization	85 (73-91)				
92	Grannis et al (September 10,2021)	USA	Test-negative	32,867 events from 187 hospitals and 221 emergency departments/urgent care visits	Delta^	Included	BNT162b2	Hospitalization	—	—	80 (73-85)	14+	4 weeks
								Emergency/Urgent care visit			77 (74–80)		
							mRNA-1273	Hospitalization			95 (92-97)		
								Emergency/Urgent care visit			92 (89-93)		
							Ad26.COV2.S	Hospitalization	60 (31-77)	14+	—	—	
								Emergency/Urgent care visit	65 (56-72)				
91		Israel			Alpha^	Excluded		Documented infection	71 (33-94)	21-27	96 (89-100)	7-56	~11 weeks

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
	Dagan et al* (September 7,2021)		Prospective Cohort	10,861 vaccinated pregnant females matched with 10,861 controls			BNT162b2 & mRNA-1273	Symptomatic infection	76 (30-100)		97 (91-100)		
								Hospitalization	—		89 (43-100)		
90	Thompson et al* (September 8, 2021)	USA	Test-negative case control	58,904 adults aged 50+ with Covid-like illness who were hospitalized or visited emergency/ urgent care facilities	Non-VOC, Alpha^††	Excluded	BNT162b2	Hospitalization	33 (18-46)	14+	87 (85-90)	14+	~22 weeks
								Emergency department or urgent care visit	58 (46-68)		89 (85-91)		
							mRNA-1273	Hospitalization	68 (59-75)		91 (89-93)		20 weeks
								Emergency department or urgent care visit	73 (64-79)		92 (89-94)		
							Ad26.COV2.S	Hospitalization	68 (50-79)		—		14 weeks
								Emergency department or urgent care visit	73 (59-82)				
							BNT162b2 & mRNA-1273	Hospitalization, patients with ≥ 1 chronic respiratory condition	56 (47-64)	14+	90 (88-92)	14+	~22 weeks
								Hospitalization, patients with ≥ 1 chronic non-respiratory condition	54 (45-61)		88 (86-90)		
								Hospitalization, overall	—		88 (84-92)	14-27	~2 weeks
											86 (74-93)	112+	~22 weeks
								Emergency department or urgent care visit	—		92 (88-95)	14-27	~2 weeks
											86 (74-93)	112+	~22 weeks
89	Iliaki et al* (October 18, 2021) *[Update to September 6 preprint]*	USA	Retrospective Cohort	4,317 HCWs	Alpha††	Excluded	BNT162b2 & mRNA-1273	Documented infection	80.2(57.5-90.8)	14+	95.2(80.0-98.8)	14+	~10 weeks
88	Tande et al* (September 6,2021)	USA – Mayo Clinic, Minnesota	Retrospective Cohort	Asymptomatic screening of 46,008 patients: pre-	Non-VOC^††	Included	BNT162b2 & mRNA-1273	Asymptomatic infection (January-March)	44 (-6-71)	20+ up to <14 post 2nd dose	91 (72-98)	14+	~10 weeks

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
				surgical, pre-op PCR tests	Alpha^††			Asymptomatic infection (April-May)	46 (53-83)		71 (53-83)		~19 weeks
					Delta^††			Asymptomatic infection (June-August)	63 (44-76)		63 (44-76)		~32 weeks
87	Barlow et al (September 3,2021)	USA	Test-negative case control	500 matched pairs aged 15 years and above	Delta^	Excluded	BNT162b2 and mRNA-1273	Documented infection	—	14+	74(65-82)	14+	~4 weeks
							Ad26.COV2.S		51(-2 – 76)		—		
86	Bruxvoort et al* (November 24, 2021) *[Update to September 2,2021 Preprint]*	USA	Matched prospective cohort	352,878 vaccinated 352,878 unvaccinated individuals	Delta and Alpha^	Included	mRNA-1273	Documented infection	—	—	87.4 (85.6-89.1)	14+	~20 weeks
								Asymptomatic infection			72.7 (57.6-82.4)		
								Symptomatic infection			88.3 (86.5-89.9)		
								Hospitalization			95.8 (92.5-97.6)		
								Death			97.9 (84.5-99.7)		
85	Giansante et al* (September 2, 2021)	Italy	Retrospective cohort	9839 staff and HCWs	Delta and Alpha^	Excluded	BNT162b2 and mRNA-1273	Documented infection	85.5(75.9-91.3)	14+ up to <7 post 2nd dose	84.8 (73.2-91.4)	14+	~16 weeks
								Symptomatic infection	81.7(62.7-91)		87.1 (69.3-94.6)		
				Only 7190 HCWs				Documented infection	87.8 (76.5-93.7)		84.4 (69.7-92.0)		
								Symptomatic infection	83.1 (60.0-92.9)		86.5 (62.9-95.1)		
84	Katz et al* (December 10,2021) *[Published version of September 2 pre-print]*	Israel	Prospective cohort	1,250 HCWs from six Israeli hospitals	Alpha^	Included	BNT162b2	Documented infection	—	—	94.5(82.5-98.2)	14+	~18 weeks
								Symptomatic infection			97 (72-99.7)	7+	
83	Nunes et al* (September 23, 2021)	Portugal	Retrospective cohort	1,880,351 older adults (65+) in Portugal	Alpha^ (Feb-Mar) then Delta^ (May-onward)	Excluded	BNT162b2 and mRNA-1273	Hospitalization, 65-79 y	78 (61-87)	14+ up to <14 post 2nd dose	94 (88-97)	14+	~14.5 weeks
								Death, 65-79 y	77 (56-88)		96 (92-98)		
								Hospitalization, 80+ y	55 (36-69)		82 (72-89)	14+	~22.5 weeks
								Death, 80+ y	56 (35-70)		81 (74-87)	14+	
82#	Chemaitelly et al* (October 6, 2021)	Qatar	Test-negative case control	142,300 cases and 848,240 controls among	Alpha^ then Beta^ (Jan-Jun), then	Included	BNT162b2	Documented infection	36.8 (33.2-40.2)	14+	73.2 (71.3-75.0)	28-63	7 weeks
											22.3 (-1.7-40.7)	175+	~32 weeks
								Symptomatic infection	47.9 (43.6-51.9)		72.5 (69.6-75.1)	28-63	7 weeks
											27.8 (-1.4-48.7)	175+	~32 weeks

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
	[Update to Aug 27 preprint] *Note: See Duration of Protection Table for further context*			residents of Qatar (12+)	Delta^ (Jul-Sep)			Asymptomatic infection	22.2 (12.1-31.2)		66.9 (61.9-71.3)	28-63	7 weeks
											-33.3 (-181.8-36.9)	175+	~32 weeks
								Severe, critical, or fatal disease	66.1 (56.8-73.5)		96.8 (93.9-98.3)	28-63	7 weeks
											55.6 (-44.3-86.3)	175+	~32 weeks
					Alpha specifically^		BNT162b2	Documented infection	47.9 (15.5-67.9)	14+	88.6 (79.2-93.7)	28-63	7 weeks
											80.0 (-71.2-97.7)	147+	~32 weeks
					Beta specifically^		BNT162b2	Documented infection	25.8 (-2.0-46.1)		63.9 (52.6-72.5)	28-63	7 weeks
											40.0 (-151.1-85.7)	147+	~32 weeks
					Delta specifically^		BNT162b2	Documented infection	63.4 (42.6-76.6)		73.3 (63.6-80.4)	28-63	7 weeks
											17.9 (-12.9-40.3)	147+	~32 weeks
81	Goldberg et al (October 27, 2021) *[Update to Aug 25 preprint]* *Note: See Duration of Protection Table for further context*	Israel	Retrospective cohort	9,395,923 adults (16+) in Israel	Delta^	Excluded	BNT162b2	Documented infection, 16-39 y fully vaccinated May 2021 (~2 mos prior)	—	—	73 (67-78)	55-98	13 weeks
								Documented infection, 16-39 y fully vaccinated Jan 2021 (~6 mos prior)			50 (45-55)	168-203	28 weeks
								Documented infection, 40-59 y fully vaccinated May 2021 (~2 mos prior)			80 (71-86)	55-98	13 weeks
								Documented infection, 40-59 y fully vaccinated Jan 2021 (~6 mos prior)			58 (54-62)	168-203	28 weeks
								Documented infection, 60+ y fully vaccinated May 2021 (~2 mos prior)			75 (58-85)	55-98	13 weeks
								Documented infection, 60+ y fully vaccinated Jan 2021 (~6 mos prior)			57 (52-62)	168-203	28 weeks
								Severe disease, 40-59 y fully vaccinated Mar 2021 (~4 mos prior)			98 (94-99)	109-159	22 weeks
								Severe disease, 40-59 y fully vaccinated Jan 2021 (~6 mos prior)			94 (87-97)	168-203	28 weeks
								Severe disease,			91 (85-95)	109-159	22 weeks

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
								60+ y fully vaccinated Mar 2021 (~4 mos prior)					
								Severe disease, 60+ y fully vaccinated Jan 2021 (~6 mos prior)			86 (82-90)	168-203	28 weeks
80#	Tartof et al* (October 16, 2021) *[Update to Aug 23 preprint]*	USA	Retrospective cohort	3,436,957 members (12+) of Kaiser Permanente Southern California healthcare system	Epsilon (Jan-Mar), Alpha (Apr-May), Delta (Jun-Jul)^	Included	BNT162b2	Documented infection	58 (54-61)	14+	73 (72-74)	7+	~29 weeks
											88 (86-89)	7-36	~3 weeks
											47 (43-51)	157+	~29 weeks
								Hospitalization	54 (43-63)		90 (89-92)	7+	~29 weeks
											87 (82-91)	7-36	~3 weeks
											88 (82-92)	157+	~29 weeks
					Delta specifically^			Documented infection	74 (55-85)		75 (71-78)	7+	~29 weeks
											93 (85-97)	7-36	~3 weeks
											53 (39-65)	127+	~29 weeks
								Hospitalization	79 (-49-97)		93 (84-96)	7+	~29 weeks
					Non-Delta variants specifically^			Documented infection	74 (64-81)		91 (88-92)	7+	~29 weeks
											97 (95-99)	7-36	~3 weeks
											67 (45-80)	127+	~29 weeks
								Hospitalization	75 (21-92)		95 (90-98)		~29 weeks
79	Prasad et al (August 19,2021)	USA	Retrospective cohort	3,104 surgery patients and 7,438 propensity-matched controls	Non-VOC††	Included	BNT162b2 or mRNA-1273	Post-operative documented infection	—	—	91 (56-99)	14+	~8 weeks
78	Pouwels et al* (October 14, 2021) *[Update to Aug 18 preprint]*	UK	Prospective cohort	384,543 individuals aged 18 years or older	Alpha^ (December - May)	Included	BNT162b2	Documented infection	59 (52-65)	21+	78 (68-84)	14+	~28 weeks
								Ct<30	70 (65-74)		94 (91-96)		
							AZD1222	Documented infection	63 (55-69)		79 (56-90)		
								Ct<30	74 (69-79)		86 (71-93)		
				358,983 individuals	Delta^ (May - August)		BNT162b2	Documented infection	57 (50-63)		80 (77-83)		
								Ct<30	62(56-68)		84 (82-86)		
							AZD1222	Documented infection	46(35-55)		67 (62-71)		
								Ct<30	50(41-59)		70 (65-73)		

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
77	Tenforde et al* (November 4, 2021) [*Update to Aug 18 MMWR*)	USA	Test-negative case control	4513 hospitalized adults (18+)	Alpha and Delta^	Included	BNT162b2	Hospitalization, all	—	—	81 (77-84)	14+	~30 weeks
											85 (82-88)	14-120	~15 weeks
											64 (51-73)	120+	~30 weeks
							mRNA-1273	Hospitalization, all			89 (86-92)	14+	~28 weeks
											91 (87-93)	14-120	~15 weeks
											85 (77-91)	120+	~28 weeks
							BNT162b2 or mRNA-1273	Hospitalization, Immunocompetent			90 (87-91)	14+	~30 weeks
								Hospitalization, Immunocompromised			51 (31-65)		
					Alpha specifically^		BNT162b2 or mRNA-1273	Hospitalization, all			90 (84-94)		
					Delta specifically^			Hospitalization, all			86 (79-90)		
76	Chin et al (August 18, 2021)	USA	Retrospective cohort	60,707 incarcerated people in California prisons	Non-VOC^	Excluded	BNT162b2 or mRNA-1273	Documented infection, all	74 (64-82)	14+	97 (88-99)	14+	~5 weeks
								Documented infection, cohort at moderate/high risk for severe COVID-19	74 (62-82)		92 (74-98)		
							mRNA-1273	Documented infection, all	71 (58-80)		96 (67-99)		
75	Nanduri et al (August 18,2021)	USA	Retrospective cohort	10,428,783 residents of skilled nursing facilities	Non-VOC and Alpha†† (Pre-Delta circulation) ^	Unknown	BNT162b2	Documented infection	—	—	74.2 (69–78.7)	14+	~16 weeks
							mRNA-1273				74.7(66.2-81.1)		
					Alpha†† (Delta circulating but not dominant) ^		BNT162b2	Documented infection			66.5 (58.3-73.1)		~22 weeks
							mRNA-1273				70.4 (60.1-78.0)		
					Delta^		BNT162b2	Documented infection			52.4 (48–56.4)		~28 weeks
							mRNA-1273				50.6 (45–55.7)		
74#	Tang et al*	Qatar	Test-negative case control	Cases with confirmed	Delta specifically^	Included	BNT162b2	Documented infection	42.8 (18.2-60.1)	14+	50.6 (45.4-55.3)	14+	~25 weeks

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
	(November 2, 2021) *[Update to Aug 11 preprint]*			Delta (~2800 per analysis) or Beta infection and matched controls (~11,200) among residents of Qatar of all ages			mRNA-1273		73.2 (57.3-83.2)		72.0 (66.1-76.9)		
							BNT162b2	Severe, critical, or fatal disease	84.5 (-25.2-98.1)		94.1 (85.9-97.6)		
							mRNA-1273		87.5 (23.4-95.8)		96.1 (71.4-99.5)		
							BNT162b2	Symptomatic COVID-19	56.2 (30.6-72.4)		44.4 (37.0-50.9)		
							mRNA-1273		82.5 (65.2-91.2)		73.9 (65.9-79.9)		
							BNT162b2	Asymptomatic COVID-19	46.7 (-56.2-81.8)		46.0 (32.3-56.9)		
							mRNA-1273		61.8 (-9.6-86.7)		53.6 (33.4-67.6)		
					Beta specifically^		BNT162b2	Documented infection	18.9 (-1.8-35.4)		74.3 (70.3-77.7)		
							mRNA-1273		66.3 (55.8-74.2)		80.8 (69.0-88.2)		
							BNT162b2	Severe, critical, or fatal disease	74.8 (-7.6-94.1)		92.7 (81.5-97.1)		
							mRNA-1273		72.5 (7.7-91.8)		100.0 (CI omitted due to zero events among vaccinated)		
73	Chemaitelly et al (August 9, 2021)	Qatar	Retrospective cohort	782 kidney transplant recipients	Alpha and Beta^	Excluded	BNT162b2 and mRNA-1273	Documented infection	—	—	46.6 (0.0-73.7)	14+	~17 weeks
											66.0 (21.3-85.3)	42+	
											73.9 (33-89.9)	56+	
								Severe infection			72.3 (0.0-90.9)	14+	
											85.0 (35.7-96.5)	42+	
											83.8 (31.3-96.2)	56+	
72	Puranik et al (August 9, 2021)	USA	Retrospective cohort	77,607 adults	Alpha and Delta ^	Excluded	BNT162b2	Documented infection	16 (-20-42)	1-7	76 (69-81)	14+	~ 26 weeks
								Hospitalization	75 (-30-97.4)		85 (73-93)		
								ICU admission	100 (-430-100)		87 (46-98.6)		
							mRNA-1273	Documented infection	-10 (-50-24)		86 (81-90.6)		
								Hospitalization	25 (-150-79)		91.6 (81-97)		
								ICU admission	100 (-430-100)		93.3 (57-99.8)		
71	de Gier et al* (August 5, 2021)	Netherlands	Retrospective cohort	184,672 household and other close	Alpha^	Unknown	AZD1222	Documented infection among household contacts (adj. for	2 (-11-14)	14+	87 (77-93)	7+	~15 weeks
							BNT162b2		-18 (-43-2)		65 (60-70)		

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
				contacts (aged 18+) of 113,582 index cases (aged 18+)			mRNA-1273	vaccination status of index case)	33 (-27-64)		91 (79-97)		
							Ad26.COV2.S		12 (-71-54)		—		
70	Lefèvre et al (July 31,2021)	France	Retrospective cohort	378 LTCF residents	Beta specifically^	Included	BNT162b2	Documented infection	55 (13-76)	14+ up to 6 days after 2nd dose	49 (14-69)	7+	~16 weeks
								Hospitalization and death	86 (32-97)		86 (67-94)		
69	Alali et al (July 29,2021)	Kuwait	Retrospective cohort	3,246 HCWs	Alpha^	Excluded	BNT162b2	Documented infection	91.4 (65.1-97.9)	14+	94.5(89.4-97.2)	7+	~18 weeks
							AZD1222	Documented infection	75.4 (67.2-81.6)	28+	—		
68	Gram et al (July 28, 2021)	Denmark	Retrospective cohort	5,542,079 adults	Alpha^	Excluded	Heterologous: AZD1222 (1st dose) BNT162b2 or mRNA-1273(2nd dose)	Documented infection	31 (14-44)	77-83	88 (83-92)	14+	~7.5 weeks
								Hospitalization	93 (80-98)	14+	not calculated due to no events in vaccinated group		
67	Amirthalingam et al (December 10,2021) *[Published version of July 28 pre-print]*	UK	Test-negative case control	750 participants aged 50-89 years	Alpha^	Excluded	BNT162b2	Documented infection, 80 y+	42 (31-52)	28+	77 (56-88)	14+, dose interval 19-29 days	~16 weeks
											90 (83-94)	14+, dose interval 65-84 days	
								Documented infection, 65-79 y	53 (48-58)		77 (66-85)	14+, dose interval 19-29 days	
											89 (86-92)	14+, dose interval 65-84 days	
								Documented infection, 50-64 y	51 (47-55)		88 (67-96)	14+, dose interval 19-29 days	
											92 (91-94)	14+, dose interval 65-84 days	

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
							AZD1222	Documented infection, 80 y+	42 (29-53)		96(68-99)	14+, dose interval 45-64 days	
											82 (68-89)	14+, dose interval 65-84 days	
								Documented infection, 65-79 y	52 (46-56)		73 (25-90)	14+, dose interval 30-44 days	
											74 (69-79)	14+, dose interval 65-84 days:	
								Documented infection, 50-64 y	42 (39-46)		55 (34-69)	14+, dose interval 30-44 days	
											77 (74-79)	14+, dose interval 65-84 days	
66	Kissling et al (July 22,2021)	UK, France, Ireland, Netherlands, Portugal, Scotland, Spain, Sweden	Test-negative	592 cases and 4,372 controls aged 65+	Alpha^	Excluded	BNT162b2	Symptomatic COVID-19	61(39-75)	14+	87(74-93)	14+	~16 weeks
							AZD1222	Symptomatic COVID-19	68(39-83)		—		
65#	Carazo et al* (August 30, 2021) *[Update to July 22 preprint]*	Canada	Test-negative case control	5316 cases and 53,160 test negative controls among HCWs	Non-VOC and Alpha^	Excluded	BNT162b2	Documented infection	70.3 (68.1-72.4)	14+	85.5 (80.4-89.3)	7+	~20 weeks
								Symptomatic COVID-19	72.8 (70.5-74.9)		92.2 (87.8-95.1)		
							mRNA-1273	Documented infection	68.7 (59.5-75.9)	14+	84.1 (34.9-96.1)	7+	
								Symptomatic COVID-19	80.9 (74.3-85.8)		—		
							BNT162b2 and mRNA-1273	Hospitalization	97.2 (92.3-99.0)	14+	—	7+	
					Alpha specifically^	Excluded	BNT162b2 and mRNA-1273	Documented infection	60.0 (53.6-65.5)	14+	92.6 (87.1-95.8)	7+	

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
					Non-VOC specifically^	Excluded	BNT162b2 and mRNA-1273	Documented infection	77.0 (72.6-80.7)		86.5 (56.8-95.8)		
64	Hitchings et al (October 28, 2021) *[Update to July 22 preprint]*	Brazil	Test-negative case control	30,680 matched pairs of adults aged 60+ in Sao Paolo, Brazil	Gamma^	Included (except in previous 90 days)	AZD1222	Symptomatic COVID-19	33.4 (26.4-39.7)	28+	77.9 (69.2-84.2)	14+	~9.5 weeks
								Hospitalization	55.1 (46.6-62.2)		87.6 (78.2-92.9)		
								Death	61.8 (48.9-71.4)		93.6 (81.9-97.7)		
63	Kim et al* (September 8, 2021) *[Update to July 22 preprint]*	USA	Test-negative case control	812 US adults aged 16+ with COVID-19-like illness	Non-VOC and Alpha††	Unknown	BNT162b2 and mRNA-1273	Symptomatic COVID-19	75 (55-87)	14+ up to 14 days post 2nd dose	91 (83-95)	14+	~18.5 weeks
62#	Lopez Bernal et al* (July 21, 2021)	UK	Test-negative case control	19,109 cases and 171,834 test negative controls aged 16+	Alpha specifically^	Excluded	BNT162b2	Symptomatic COVID-19	47.5 (41.6–52.8)	21+	93.7 (91.6–95.3)	14+	~17 weeks
							AZD1222	Symptomatic COVID-19	48.7 (45.2–51.9)		74.5 (68.4–79.4)		
					Delta specifically^		BNT162b2	Symptomatic COVID-19	35.6 (22.7–46.4)		88.0 (85.3–90.1)		
							AZD1222	Symptomatic COVID-19	30.0 (24.3–35.3)		67.0 (61.3–71.8)		
61	Butt et al* (July 20, 2021)	USA	Test-negative case control	54,360 propensity-matched pairs of veterans	Original and Alpha ††	Excluded	BNT162b2 and mRNA-1273	Documented infection	85.0 (84.2-85.8)	0+	97.1 (96.6-97.5)	7+	~6.5 weeks
							BNT162b2	Documented infection	84.0 (82.7-85.1)		96.2 (95.5-96.9)		
							mRNA-1273	Documented infection	85.7 (84.6-86.8)		98.2 (97.5-98.6)		
60	Layan, Maylis et al (July 16,2021)	Israel	Prospective cohort	687 household contacts (HHCs) of 215 index cases from 210 households	Original and Alpha¶	Included	BNT162b2	Documented infection among HHCs vaccinated and not isolated (relative to HHCs not vaccinated and not isolated)	—	—	81 (60-93)	7+	~12 weeks
59	Balicer et al* (September 7,2021) *[Update to July 12 preprint]*	Israel	Prospective Cohort	21722 pregnant women	Original and Alpha^	Excluded	BNT162b2	Documented infection	67 (40-84)	14-20	96 (89-100)	7-56	~18 weeks
									71 (33-94)	21-27‡			
								Symptomatic COVID-19	66 (32-86)	14-20	97 (91-100)		
									76 (30-100)	21-27‡			
								Hospitalization	—	—	89 (43-100)		
58	Butt et al*	Qatar	Retrospective cohort	814pregnant women	Alpha and Beta^	Excluded	BNT162b2	Documented infection	—	—	87.7 (43.5-97.3)	14+	~17 weeks

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
	(October 7, 2021) *[Update to June 22 preprint]*						mRNA-1273				100.0 (0-100.0)		
57	Prunas et al (July 16, 2021)	Israel	Retrospective cohort	253,564 Israeli individuals from 65,264 households with at least 1 infected individual and at least 2 members	Original and Alpha¶	Unknown	BNT162b2	Documented infection among household contacts	—	—	80.5 (78.9-82.1)	10+	~8.5 weeks
56	Whitaker et al (July 9,2021)	UK	Prospective cohort	5,642,687 patients reporting to 718 English general practices	Original and Alpha$^{\psi}$	Included	BNT162b2	Symptomatic COVID-19	48.6 (27.9-63.3)	28-90‡	93.3 (85.8-96.8)	14+	~20 weeks
							AZD1222		50.2 (40.8-58.2)		78.0 (69.7-84.0)		
55	John et al (July 13,2021)	USA	Retrospective cohort	40,074 patients with cirrhosis within Veterans Health Administration , propensity matched	Original and Alpha ††	Excluded	BNT162b2 and mRNA-1273	Documented infection	64.8 (10.9-86.1)	28+ (including some with dose 2)	78.6 (25.5-93.8)	7+	~10 weeks
								Hospitalization	100.0 (99.3-100.0)		100.0 (99-100)		
								COVID-19 related death	100.0 (99.3-100.0)		100.0 (99-100)		
54	Bertollini et al (July 13, 2021)	Qatar	Prospective cohort	10,092 matched pairs of Qatari adults arriving at an international airport.	Original, Alpha and Beta^	Included	BNT162b2 and mRNA-1273	Documented infection	—		78 (72-83)	14+	~4 weeks
53	Goldshtein et al* (July 12,2021)	Israel	Retrospective cohort	15060 pregnant Israeli women	Original and Alpha¶	Excluded	BNT162b2	Documented infection	54 (33-69)	11-27, including some with dose 2	—		~5 weeks
									78 (57-89)	28+, includes			

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
										some with dose 2			
52#	Chemaitelly et al* (July 9, 2021)	Qatar	Test-negative case-control	25,034 matched pairs of adults	Alpha specifically^	Unknown	mRNA-1273	Documented infection	88.2 (83.8-91.4)	14+ days	100.0 (CI omitted since there were no events among vaccinated persons)	14+	13 weeks
				52,442 matched pairs of adults	Beta specifically^	Unknown	mRNA-1273	Documented infection	68.2(64.3-71.7)		96.0 (90.9-98.2)		
				4,497 matched pairs of adults	Alpha and Beta^	Unknown	mRNA-1273	Severe, critical or fatal disease	83.7(74.1-89.7)		89.5 (18.8-98.7)		
								Symptomatic infection	66.0(60.6-70.7)		98.6 (92.0-100)		
								Asymptomatic infection	47.3(37.6-55.5)		92.5 (84.8-96.9)		
			Retrospective cohort	2520 vaccinated and 73,853 unvaccinated, antibody-negative controls	Alpha specifically^	Excluded	mRNA-1273	Documented infection	—		100.0 (82.5-100.)	14+	13 weeks
					Beta specifically ^	Excluded	mRNA-1273	Documented infection	—		87.8 (73.4-95.5)		
51#	Tenforde et al* (August 6, 2021) *[Update to July 8 preprint]*	USA	Test-negative case-control	1212 hospitalized adults from 18 hospitals	Original and Alpha^	Included	BNT162b2/ mRNA-1273	Hospitalization	75.4(60.4-84.7)	14+ up to 14 days post 2nd dose	86.6 (79.0-91.4)	14+	~2 weeks
							BNT162b2		—		84.7 (74.1-91.0)		
							mRNA-1273		—		88.9 (78.7-94.)		
					Alpha^	Included	BNT162b2/ mRNA-1273		—		92.1 (82.3-96.5)		
50	Jara et al (July 7,2021)	Chile	Prospective cohort	10,187,720 adults	Alpha and Gamma^	Excluded	CoronaVac	Documented infection	15.5 (14.2-16.8)	14+ days	65.9 (65.2-66.6)	14+	8 weeks
								Hospitalization	37.4 (34.9-39.9)		87.5 (86.7-88.2)		
								ICU admission	44.7 (40.8-48.3)		90.3 (89.1-91.4)		
								Death	45.7 (40.9-50.2)		86.3 (84.5-87.9)		
49#		Canada				Excluded	BNT162b2	Symptomatic infection	63 (56-68)	14+	92 (87-95)	14+	~28 weeks

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
	Nasreen et al (September 30, 2021) *[Update to July 16 preprint]*		Test-negative Case Control	682,071 symptomatic community-dwelling individuals (age 16+) in Ontario	Non-VOC specifically^	Unknown		Hospitalization or death	77 (67-84)		97 (88-99)		
							mRNA-1273	Symptomatic infection	63 (47-74)		98 (83-100)		~25 weeks
								Hospitalization or death	66 (43-80)		100 (no CI provided)		
							AZD1222	Symptomatic infection	67 (44-81)		100 (no CI provided)		~3 weeks
								Hospitalization or death	92 (45-99)		100 (no CI provided)		
					Alpha specifically^		BNT162b2	Symptomatic infection	67 (65-68)		88 (86-90)		~28 weeks
								Hospitalization or death	82 (81-84)		96 (94-97)		
							mRNA-1273	Symptomatic infection	82 (80-84)		92 (87-95)		~25 weeks
								Hospitalization or death	80 (76-84)		95 (92-97)		
							AZD1222	Symptomatic infection	63 (59-66)		87 (47-97)		~3 weeks
								Hospitalization or death	87 (83-90)		92 (41-99)		
					Beta specifically^		BNT162b2	Symptomatic infection	50 (15-70))		86 (0-98)		~28 weeks
								Hospitalization or death	64 (31-82)		92 (39-99)		
							mRNA-1273	Symptomatic infection	—		100 (no CI provided)		~25 weeks
								Hospitalization or death	59 (-77-90)		100 (no CI provided)		
							AZD1222	Symptomatic infection	84 (-13-98)		100 (no CI provided)		~3 weeks
								Hospitalization or death	61 (-64-91)		—		
					Gamma specifically^		BNT162b2	Symptomatic infection	63 (54-70)		90 (76-96)		~28 weeks
								Hospitalization or death	80 (70-87)		94 (59-99)		
							mRNA-1273	Symptomatic infection	89 (76-95)		100 (no CI provided)		~25 weeks
								Hospitalization or death	88 (63-96)		100 (no CI provided)		
							AZD1222	Symptomatic infection	41 (12-60)		100 (no CI provided)		~3 weeks
								Hospitalization or death	76 (40-90)		100 (no CI provided)		
							BNT162b2	Symptomatic infection	57 (53-61)		92 (89-94))		~28 weeks

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
					Delta specifically^			Hospitalization or death	81 (76-85)		98 (96-99)		
							mRNA-1273	Symptomatic infection	70 (64-76)		94 (90-97)		~25 weeks
								Hospitalization or death	90 (82-94)		98 (93-100)		
							AZD1222	Symptomatic infection	68 (57-76)		88 (68-96)		~3 weeks
								Hospitalization or death	91 (82-96)		90 (67-97)		
48	Baum et al* (June 28,2021) *[Update to June 28 preprint]*	Finland	Prospective cohort	Two study cohorts: 901,092 Finnish elderly aged 70 years and 774,526 chronically ill aged 16-69 years	Original and Alpha^	Excluded	BNT162b2 & mRNA-1273 (elderly cohort)	Documented infection	45 (36-53)	21+ days	75 (65-82)	7+	16 weeks
								Hospitalization	63 (49-74)		93 (70-98)		
							BNT162b2 & mRNA-1273 (Chronically ill cohort)	Documented infection	40 (26-51)		77 (65-85)		
								Hospitalization	82 (56-93)		90 (29-99)		
							AZD1222 (chronically ill cohort)	Documented infection	42 (32-50)		—		
								Hospitalization	62 (42-75)		—		
47	Saciuk et al*(December 30,2021) *[Update to June 27, 2021 preprint]*	Israel	Retrospective cohort	1.6 million members of Maccabi HealthCare HMO ≥16	Original and Alpha¶	Excluded	BNT162b2	Documented infection	—		93.0 (92.6-93.4)	7+	14 weeks
								Hospitalization	—		93.4 (91.9-94.7)	7+	
								Death	—		91.1 (86.5-94.1)	7+	
46	Pawlowski et al.* (Jun 17, 2021) *[Update to Feb. 18, 2021 preprint]*	USA – Mayo Clinic	Retrospective Cohort	68,266 – propensity matched on, zip, # of PCRs, demographics	Original & Alpha ¥	Excluded	BNT162b2	Documented Infection	61.0 (50.8-69.2)	≥14	88.0 (84.2-91.0)	≥14	~17 weeks (120 days)
								Hospitalization	—		88.3 (72.6-95.9)	≥14	
								ICU Admission	—		100.0 (18.7-100)	≥14	
							mRNA-1273	Documented Infection	66.6 (51.9-77.3)	≥14	92.3 (82.4-97.3)	≥14	
								Hospitalization	—		90.6 (76.5-97.1)	≥14	
								ICU Admission	—		100.0 (17.9-100)	≥14	
45	Young-Xu et al (October 6,2021)*	USA	Test negative case control	77014 veterans aged 65+ within Veterans	Original and Alpha ††	Excluded	BNT162b2 & mRNA-1273	Documented infection	58 (54-62)	7+	94 (92-95)	7+	~8 weeks
								Hospitalization	40 (27-50)		89 (81-93)		
								Death	55 (21- 74)		98.5 (86.6-99.8)		

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
	[Update to Jul 14 preprint]			Health Administration				Asymptomatic infection	58.0 (41.7-69.7)		69.7 (47.7-82.5)		
								Hospitalization	53.0 (25.7-70.3)		88.4 (74.9-94.7)		
								Deaths	55.6 (26.6-73.2)		97.0 (91.7-98.9)		
44	Azamgarhi et al (June 17, 2021)* [*Update to Azamgarhi et al below*]	UK-London	Retrospective cohort	2235 HCWs working at one hospital	Original and Alpha£	Excluded	BNT162b2	Documented infection	70.0 (6.0-91.0)	>14	—		
43#	Stowe et al (June 14, 2021)	UK	TND Case-control	Patients seeking emergency care services with subsequent hospitalization	Alpha specifically^	Included	BNT162b2	Hospitalization	83 (62-93)	21+ to <13 days post dose 2	95 (78-99)	14+	~20 weeks (but most much less)
							AZD1222		76 (61-85)		86 (53-96)		
					Delta specifically^		BNT162b2		94 (46-99)		96 (86-99)		
							AZD1222		71 (51-83)		92 (75-97)		
42#	Sheikh et al (June 14, 2021)	Scotland	TND	Scottish population	Alpha^	Unknown	BNT162b2	Documented infection	38 (29-45)	28+	92 (90–93)	14+	~20 weeks (but most much less)
						Unknown	AZD1222	Documented infection	37 (32-42)	28+	73 (66–78)	14+	
					Delta^	Unknown	BNT162b2	Documented infection	30 (17-41)	28+	79 (75–82)	14+	
						Unknown	AZD1222	Documented infection	18 (9-25)	28+	60 (53–66)	14+	
41	Flacco, Maria et al* (June 10, 2021)	Italy	Retrospective cohort	245,226 individuals	Original and Alpha††	Excluded	BNT162b2	Documented infection	55 (40-66)	14+	98 (97-99)	14+	~14 weeks
								Hospitalization	—		99 (96-100)	14+	
								Death	—		98 (87-100)	14+	
							mRNA-1273	Documented infection	93 (74-98)	14+	—		
							AZD1222	Documented infection	95 (92-97)	21+	—		
40	Skowronski et al* (July 9, 2021) [Update to June 9 preprint]	Canada	TND	≥70-year olds living in community	Alpha specifically^	Included	BNT162b2 & mRNA-1273	Documented infection	67 (57-75)	21+	—		~6 weeks
					Gamma specifically^				61 (45- 72)	21+			
					Non-VOC specifically^				72 (58-81)	21+			
					Original, Alpha, Gamma and Non-VOC^		BNT162b2		64(57-71)	21+			
							mRNA-1273		71(56-81)	21+			
39	Emborg et al. (June 2, 2021) [Update of Houston-Melms below]	Denmark	Cohort	46,101 long-term care facility (LTCF) residents, 61,805 individuals 65	original & Alpha¶¶	Excluded	BNT162b2	Documented infection	7 (-1-15)	>14	82 (79-84)	>7	10 weeks
								COVID-Hospitalization	35 (18-49)	>14	93 (89-96)	>7	
								COVID-Mortality	7 (-15-25)	>14	94 (90-96)	>7	

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
				years and older living at home but requiring practical help and personal care (65PHC), 98,533 individuals ≥85 years of age (+85), 425,799 health-care workers (HCWs), and 231,858 individuals with comorbidities that predispose for severe COVID-19 disease (SCD)									
38	Thompson et al* [updated on June 30,2021]	USA	Cohort	3975 health care personnel, first responders, and other essential and frontline workers in 8 locations in US	Original	Excluded	BNT162b2	Documented infection	80 (60-90)	≥14 days post dose 1 to 13 days post dose 2	93 (78-98)	≥14	13 weeks
							mRNA-1273	Documented infection	83 (40-95)	≥14 days post dose 1 to 13 days post dose 2	82 (20-96)	≥14	
37	Salo et al (July 10, 2021) *[Update to May 30 preprint]*	Finland	Retrospective cohort	HCW and their unvaccinated spouses	Alpha††	Excluded	BNT162b2 & mRNA-1273	Documented infection in HCW	26.8 (7.5-42.1)	2 weeks	—		*10 weeks since dose 1
								Documented infection in HCW	69 (59.2-76.3)	10 weeks (includes 2 dose recipients)	—		
36	Khan et al (May 31, 2021)	USA	Retrospective cohort		Unknown	Included	BNT162b2 & mRNA-1273	Documented infection	-1 (-50-32)	14+ up to 7 days	69 (44-83)	7+	14 weeks

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
				14,697 IBD patients in VA hospitals				Hospitalization/death	9 (-114-61)	post dose 2	49 (-36-81)	7+	
35	Martinez-Bas et al* (May 27, 2021)	Spain	Prospective Cohort	20,961 close contacts of confirmed cases	Alpha	Excluded	BNT162b2	Documented infection	21 (3-36%)	14+	65 (56-73)	14+	12 weeks
								Symptomatic infection	30 (10-45)	14+	82 (73-88)	14+	
								Hospitalization	65 (25-83)	14+	94 (60-99)	14+	
							AZD1222	Documented infection	44 (31-54)	14+	—		n/a
								Symptomatic infection	50 (37-61)	14+	—		
								Hospitalization	92 (46-99)	14+	—		
34#	Chung et al* (Aug 20, 2021) *[Update to July 26 preprint]*	Canada	Test negative design case control	Adults (16+) in Ontario: 53,270 cases 270,763 controls	Non-VOC^	Excluded	BNT162b2	Symptomatic infection	59 (55-62)	14+	91 (88-93)	7+	15 weeks
								Hospitalization and Death	69 (59-77)		96 (82-99)	0+	
							mRNA-1273	Symptomatic infection	72 (63-80)		94 (86-97)	7+	
								Hospitalization and Death	73 (42-87)		96 (74-100)	0+	
					Alpha specifically^		BNT162b2 & mRNA-1273	Symptomatic infection	61 (56-66)		90 (85-94)	7+	
								Hospitalization and Death	59 (39-73)		94 (59-99)	0+	
					Beta or Gamma specifically^		BNT162b2 & mRNA-1273	Symptomatic infection	43 (22-59)		88 (61-96)	7+	
							BNT162b2 & mRNA-1273	Hospitalization and Death	56(-9-82)		100	0+	
33	PHE (May 20, 2021)	UK	Test-negative case control	≥65 years	Alpha	Excluded	BNT162b2	Symptomatic infection	54 (50-58)	28+	90 (82-95)	≥14	
							AZD1222	Symptomatic infection	53 (49-57)	28+	89 (78-94)	≥14	
32#	Ranzani et al.* (Aug 20, 2021) *[update to Jul 21 preprint]*	Brazil	Test-negative case control	22,177 70+ year olds in Sao Paulo	Gamma^	Included	Coronavac	Symptomatic infection	12.5 (3.7-20.6)	≥14	46.8 (38.7-53.8)	≥14	~10.5 weeks
								Hospitalization	16.9 (5.7-26.8)		55.5 (46.5-62.9)		
								Death	31.2 (17.6-42.5)		61.2 (48.9-70.5)		
31	Ismail et al. (May 12, 2021)	UK	Screening method	13,907 ≥70	Alpha	Included	AZD1222	Hospitalization in 70-79	84 (74-89)	28+	—		
								Hospitalization I n 80+	73 (60-81)	28+	—		
							BNT162b2	Hospitalization in 70-79	81 (73-87)	28+	—		
								Hospitalization I n 80+	81 (76-85)	28+	93 (89-95)	≥14	

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
30	Pilishvili et al.* (May 14, 2021)	US	Test-negative case control	HCP at 33 U.S. sites across 25 U.S. states	Unknown	Excluded	BNT162b2 & mRNA-1273	Symptomatic infection	82 (74-87)	≥14 days post dose 1 to 6 days post dose 2	94 (87-97)	≥7	
29	Lopez-Bernal et al.* (May 13, 2021) *[Update to Mar 1 preprint]*	UK	Test-negative case control	156,930 UK population over age 70	Alpha^	Included	BNT162b2	Over 80 years: Symptomatic infection	—		79 (68-86)	≥7	
								Over 70 years: Symptomatic infection	61 (51-69)	28-34 days post dose 1 including some with dose 2	—		
							AZD1222	Over 70 years: Symptomatic infection	60 (41-73)	28-34 days post dose 1 including some with dose 2	—		
28	Angel et al.* (May 6, 2021)	Israel	Retrospective cohort	6710 HCWs at a single tertiary care center in	Alpha¶	Excluded	BNT162b2	Symptomatic	89 (83-94)	>7 days post dose 1 to 7 days post dose 2	97 (94-99)	>7 days	
								Asymptomatic	36 (-51-69)		86 (69-97)		
27#	Abu-Raddad et al.* (July 8, 2021)	Qatar	Test-negative case-control	Qatari adults	Alpha specifically^	Unknown	BNT162b2	CC Alpha documented infection	65.5 (58.2-71.5)	15-21 days	90 (86-92)	≥14	
								CC Alpha severe/fatal infection	72 (32-90)		100 (82-100)		
					Beta specifically^			CC Beta documented infection	46.5 (38.7-53.3)		75 (71-79)		
								CC Beta severe/fatal infection	56.5 (0-82.8)		100 (74-100)		
			Retrospective cohort	Qatari adults	Alpha specifically^	Unknown	BNT162b2	Cohort documented infection Alpha	—		87 (82-91)		
					Beta specifically^			Cohort documented infection Beta	—		72 (66-77)		
26	Haas et al. * (May 5, 2021)	Israel	Retrospective cohort	Israeli population ≥16 years	Alpha^	Excluded	BNT162b2	Documented infection	—		95.3 (94.9-95.7)	≥7 days	
								Asymptomatic infection			91.5 (90.7-92.2)		

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
	[Update to Mar 24 preprint]							Symptomatic infection			97.0 (96.7-97.2)		
								Hospitalization			97.2 (96.8-97.5)		
								Severe/ critical hospitalization			97.5 (97.1-97.8)		
								Death			96.7 (96.0-97.3)		
25	Corchado-Garcia et al.* (November 2, 2021) *[Update to April 30 preprint]*	USA	Retrospective cohort	97,787 adults in the Mayo Clinic Network	Alpha and Delta^	Excluded	Ad26.COV2.S	Documented infection	74.2 (64.9-81.6)	≥15	—		
24	Fabiani et al.* (Apr 29, 2021)	Italy	Retrospective cohort	9,878 HCWs	Unknown	Excluded	BNT162b2	Documented infection	84 (40-96)	14-21	95 (62-99)	≥7 days	
								Symptomatic infection	83 (15-97)		94 (51-99)		
23	Gras-Valenti et al.*(Apr 29, 2021)	Spain	Case-control	268 HCWs	Original & Alpha¥¥	Included	BNT162b2	Documented infection	53 (1-77)	>12	—		
22	Tenforde et al.* (Apr 28, 2021)	USA	Test-negative case-control	Hospitalized adults ≥65 years	Original and Alpha¥	Unknown	BNT162b2 & mRNA-1273	Hospitalization	64 (28-82)	≥14 days post dose 1 to 14 days post dose 2	94 (49-99)	≥14 days	
21	Goldberg et al. (Apr 24, 2021)	Israel	Prospective cohort	5,600,000+ individuals ≥16 years	Original and Alpha^	Included	BNT162b2	Documented infection	58 (57-59)	>14 days post dose 1 to <7 days post dose 2	93 (93-93)	≥7 days	
								Hospitalization	69 (68-71)		94 (94-95)		
								Severe disease	66 (63-69)		94 (94-95)		
								Death	63 (58-67)		94 (93-95)		
20	Pritchard et al.* (Jun 9, 2021) *[Update to Apr 23 preprint]*	UK	Prospective cohort	373,402 individuals ≥16 years	Alpha & Original^	Excluded	BNT162b2	Documented infection	66 (60-71)	≥21	80 (74-85)	≥0 days	
								Symptomatic disease	78 (72-83)		95 (91-98)		
							AZD1222	Documented infection	61 (54-68)		79 (65-88)		
								Symptomatic disease	71 (62-78)		92 (78-97)		
19	Vasileiou et al.* (Apr 23, 2021) *[Update to Feb 21 preprint]*	UK – Scotland	Prospective Cohort (Person-time)	Scotland population: 5.4 million	Original & Alpha£	Excluded	BNT162b2	Hospitalization	91 (85-94)	28-34	—		

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
							AZD1222	Hospitalization	88 (75-94)	28-34			
18	Hall et al.* (Apr 23, 2021) *[Update to Feb 21 preprint]*	UK – SIREN study	Prospective Cohort (Person-time)	23,324 healthcare workers	Alpha^	Excluded	BNT162b2	Documented infection	72 (58-86)	≥21	86 (76-97)	≥7	
17	Mason et al.* (October 18, 2021) *[Update to Apr 22 preprint]*	UK - England	Case-control	170,226 80-83-year-olds	Alpha^	Excluded	BNT162b2	Documented infection	55 (40-66)	21-27	70 (55- 80)	35-41	
								Hospitalization	50 (19-69)	21-27	75 (52-87)	35-41	
								Emergency visit	58 (31–74)		79(60-90)		
16	Bjork et al.* (September 29, 2021) *[Update to Apr 21 preprint]*	Sweden	Retrospective cohort	805,741 Swedish adults aged 18-64 years	Original & Alpha^	Unknown	BNT162b2	Documented infection	42 (14-63)	≥14	86 (72-94)	≥7	4 weeks
15	Glampson et al.* (Sep 17, 2021) *[Update to Jul 15 preprint]*	UK	Retrospective cohort	2,183,939 adults ≥16 in Northwest London	Alpha^	Included	BNT162b2	Documented infection	78 (73-82)	22-28	—		
							AZD1222	Documented infection	74 (65-81)	22-28			
14	Andrejko et al.* (Jul 20, 2021) [update to May 25 preprint]	USA	Test-negative case control	1023 California adults ≥18 years	B.1.427/ B.1.429 & Alpha^	Excluded	BNT162b2 & mRNA-1273	Documented infection	66.9 (28.7--84.6)	≥15	87.4 (77.2-93.1)	≥15	~14 weeks
								Asymptomatic infection	—		68.3 (27.9-85.7)	≥15	
								Symptomatic infection	—		91.3 (79.3-96.3)	≥15	
								Hospitalization	—		100	≥15	
							BNT162b2	Documented infection	—		87.0 (68.6-94.6)	≥15	
							mRNA-1273	Documented infection	—		86.2 (68.4-93.9)	≥15	
13	Regev-Yochay et al.* (July 7,2021) [*Update to April 9 preprint]*	Israel	Prospective cohort	3578 HCWs in one Israeli health system	Alpha¶	Included	BNT162b2	Asymptomatic infection	—		65 (45-79)	≥11	
								Asymptomatic infection presumed infectious (Ct< 30)			70 (43-84)	≥11	

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
								Symptomatic infection			90 (84-94)	≥11	
								Symptomatic infection presumed infectious (CT<30)			88 (80-94)	≥11	
12	Bouton et al. (Mar 30, 2021)	USA – MA	Prospective Cohort	10,950 healthcare workers in Boston	Original^	included	BNT162b2 & mRNA-1273	Documented infection	82 (68-90) >14 days post dose 1 including some with dose 2 starting day 0				
11	Thompson et al.* (Mar 29, 2021)	USA	Prospective cohort	3,950 healthcare workers in eight US sites	Original¥	Excluded	BNT162b2 & mRNA1273	Documented infection	80 (59-90)	≥14	90 (68-97)	≥14	
10	Shrotri et al.* (Jun 23, 2021) *[Update to Mar 26 preprint]*	UK	Prospective cohort	10,412 care home residents aged ≥65 years from 310 LTCFs in England	Original and Alpha^	Stratified	BNT162b2	Documented infection	65 (29-83)	35-48	—		
							AZD1222	Documented infection	68 (34-85)	35-48			
9	Public Health England – March (Mar 17, 2021)	UK - England	Test Negative Case-Control	Adults in England over 70 years	Alpha^	Unknown	BNT162b2	Symptomatic infection	58 (49-65)	≥28	—		
							AZD1222	Symptomatic infection	58 (38-72)	≥35			
			Retrospective Cohort	Adults in England over 80 years		Included	BNT162b2	Hospitalization[1]	42 (32-51)	≥14	—		
								Death[1]	54 (41-64)	≥14			
							AZD1222	Hospitalization[1]	35 (4-56)	14-21			
8	Yelin et al. (Mar 17, 2021)	Israel – Maccabi System	Retrospective Cohort	1.79 million enrollees, adults <90 years	Alpha^	Excluded	BNT162b2	Documented infection	91 (89-93) ≥35 days post dose 1 most with dose 2				
								Symptomatic infection	99 (95-99) ≥35 days post dose 1 most with dose 2				
7	Britton et al.* (Mar 15, 2021)	USA – CT	Retrospective Cohort	463 residents of two skilled nursing facilities experiencing outbreaks	Original¥	Stratified	BNT162b2	Include Hx of COVID: Documented infection	63 (33-79) ≥14 days post dose 1 including some with dose 2 through day 7				
								Exclude Hx of COVID: Documented infection	60 (30-77) ≥14 days post dose 1 including some with dose 2 through day 7				
6	Tande et al.* (Mar 10, 2021)	USA – Mayo Clinic	Retrospective Cohort	Asymptomatic screening of 39,156 patients: pre-surgical, pre-op PCR tests	original¥	Included	BNT162b2 & mRNA-1273	Asymptomatic infection	79 (63-88) >10 days post dose 1, including some with dose 2		80 (56-91)	>0	
							BNT162b2	Asymptomatic infection	79 (62-89)	>10	80 (56-91)	>0	

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
5	Mousten-Helms et al. (Mar 9, 2021)	Denmark	Retrospective Cohort	Long term care facilities in Denmark - 39,040 residents, 331,039 staff	original & Alpha¶¶	Excluded	BNT162b2	LTCF Resident: Documented Infection	21 (-11-44)	>14	64 (14-84)	>7	
								LTCF Staff: Documented Infection	17 (4-28)	>14	90 (82-95)	>7	
4	Hyams et al.* (November 1, 2021) *[Update to Mar 3 preprint]*	UK – University of Bristol	Test Negative Case-Control	466 tests: ≥80 years hospitalized with respiratory symptoms	Alpha£	Included	BNT162b2	Hospitalization	79 (47-93)	>14	—		
							AZD1222	Hospitalization	80 (36-95)	>14			
3	Dagan et al.* (Feb. 24, 2021)	Israel – Clalit Health System	Retrospective Cohort	596,618 – matched on demographics, residence, clinical characteristics	original & Alpha^	Excluded	BNT162b2	Documented infection	46 (40-51)	14-21	92 (88-95)	>7	
								Symptomatic infection	57 (50-63)	14-21	94 (87-98)	>7	
								Hospitalization	74 (56-86)	14-21	87 (55-100)	>7	
								Severe disease	62 (39-80)	14-21	92 (75-100)	>7	
2	Public Health England – Feb. (Feb. 22, 2021)	UK - England	Screening Method	43,294 cases, with England as source population	Alpha^	Included	BNT162b2	Over 80 years: Symptomatic infection	57 (48-63)	>28	88 (84-90)	7	
1	Amit et al.* (Feb 18, 2021)	Israel	Prospective Cohort	9,109 healthcare workers	original & Alpha¶	Excluded	BNT162b2	Documented infection	75 (72-84) ≥15 days post dose 1 including some with dose 2 through day 7				
								Symptomatic infection	85 (71-92) ≥15 days post dose 1 including some with dose 2 through day 7				

Purple text indicates new or updated study.
Product Manufacturers: BNT162b2 (Pfizer), mRNA-1273 (Moderna), AZD1222 (Astra-Zeneca), Ad26.COV2.S (Janssen), Coronavac
±Unless noted otherwise, days post 1st dose are prior to receiving dose 2.
‡Unclear if 1st dose VE estimates includes any individuals who received a second dose.
*Manuscripts with an asterisk (*) are peer-reviewed publications.
^Indicates predominant variant identified by study authors. If no ^ then variants identified through secondary source when possible. Please see additional footnotes.
¶The rise of SARS-CoV-2 variant Alpha in Israel intensifies the role of surveillance and vaccination in elderly | medRxiv
¥CDC Says More Virulent British Strain Of Coronavirus Now Dominant In U.S. : Coronavirus Updates : NPR
£Coronavirus (COVID-19) Infection Survey, UK - Office for National Statistics
¶¶Denmark logs more contagious COVID variant in 45% of positive tests | Reuters
¥¥COVID variant first detected in UK now dominant strain in Spain
££Reporte-circulacion-variantes-al-9.04.21-PUBLICADO-FINAL.pdf (minsal.cl)
††Based on https://outbreak.info/location-reports
ψhttps://www.gov.uk/government/publications/covid-19-variants-genomically-confirmed-case-numbers/variants-distribution-of-cases-data

[#] Manuscripts that are cited in the WHO COVID-19 Weekly Epidemiological Updates (see Special Focus Update on SARS-CoV-2 Variants of Interest and Variants of Concern, Table 3, included in every other Weekly Epidemiological Update): https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports.
[xx] VE estimate presented with 99% CIs.

1.1 Inclusion criteria for VE studies

Note: All VE studies now must meet these criteria to be in the VE table:

- Published or preprint studies (not press release, presentations, media)
- Must have confidence intervals around VE, except in instances where it is not possible to calculate
- Needs to include persons with & without infection or disease and with and without vaccination (ie a proper comparison group). This excludes case only studies (e.g., impact studies, risk of progression to severe disease (i.e. PHE)).
- No modeled comparison group nor comparison to historical cohort
- The study design should account for confounding and/or VE estimate should be adjusted or state adjustment made no difference
- Outcomes must be lab confirmed, not syndromic
- At least 90% of participants must have documented vaccination status rather than relying on recall
- VE must be for one vaccine, not for >1 vaccine combined (with exception for studies accessing Pfizer + Moderna vaccines and studies of heterologous schedules, but all participants included in a VE estimate should receive same brands of vaccines in the same order
- No significant bias that likely affects results
- Cannot include day 0-12 in unvaccinated definition
- Cannot compare to early post vaccination to calculate VE (e.g. day 0-12 vs day 12-21)

1.2 VE Studies that do not meet criteria are listed below in case of interest:

1. Hunter P and Brainard J. Estimating the effectiveness of the Pfizer COVID-19 BNT162b2 vaccine after a single dose. A reanalysis of a study of 'real-world' vaccination outcomes from Israel. *medRxiv*. Published online 2021:2021.02.01.21250957. doi: 10.1101/2021.02.01.21250957
2. Institut National de Santé Publique du Québec. Preliminary Data on Vaccine Effectiveness and Supplementary Opinion on the Strategy for Vaccination Against COVID-19 in Quebec in a Context of Shortage. Gouvernement du Québec. 2021:Publication No 3111. Available at: https://www.inspq.qc.ca/sites/default/files/publications/3111-vaccine-effectiveness-strategy-vaccination-shortage-covid19.pdf.
3. Weekes M, Jones NK, Rivett L, et al. Single-dose BNT162b2 vaccine protects against asymptomatic SARS-CoV-2 infection. *Authorea*. Published online Feb 24, 2021. doi: 10.22541/au.161420511.12987747/v1
4. Aran D. Estimating real-world COVID-19 vaccine effectiveness in Israel using aggregated counts. Published online Mar 4, 2021. Available at: https://github.com/dviraran/covid_analyses/blob/master/Aran_letter.pdf.
5. Shah ASV, Gribben C, Bishop J, et al. Effect of vaccination on transmission of COVID-19: an observational study in healthcare workers and their households. *medRxiv*. Published online 2021:2021.03.11.21253275. doi: 10.1101/2021.03.11.21253275
6. Monge S, Olmedo C, Alejos B, et al. Direct and indirect effectiveness of mRNA vaccination against SARS-CoV-2 infection in long-term care facilities in Spain. *Emerg Infect Dis*. 2021;27(10):2595-2603. doi: https://doi.org/10.3201/eid2710.211184

7. Jameson AP, Sebastian T, Jacques LR. Coronavirus disease 2019 (COVID-19) vaccination in healthcare workers: An early real-world experience. *Infect Control Hosp Epidemiol*.:1-2. doi:10.1017/ice.2021.171
8. Vahidy FS, Pischel L, Tano ME, et al. Real World Effectiveness of COVID-19 mRNA Vaccines against Hospitalizations and Deaths in the United States. *medRxiv*. Published online 2021:2021.04.21.21255873 doi: 10.1101/2021.04.21.21255873
9. Swift MD, Breeher LE, Tande AJ, et al. Effectiveness of Messenger RNA Coronavirus Disease 2019 (COVID-19) Vaccines Against Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) Infection in a Cohort of Healthcare Personnel. *Clin Inf Dis.* Published online Apr 26, 2021:2021;ciab361. doi: 10.1093/cid/ciab361
10. Zaqout A, Daghfal J, Alaqad I, et al. The initial impact of a national BNT162b2 mRNA COVID-19 vaccine rollout. *medRxiv*. Published online 2021:2021.04.26.21256087 doi: 10.1101/2021.04.26.21256087
11. Cavanaugh AM, Fortier S, Lewis P, et al. COVID-19 Outbreak Associated with a SARS-CoV-2 R.1 Lineage Variant in a Skilled Nursing Facility After Vaccination Program – Kentucky, March 2021. *MMWR Morb Mortal Wkly Rep.* 2021;70:639-643. doi: 10.15585/mmwr.mm7017e2
12. Menni C, Klaser K, May A, et al. Vaccine side-effects and SARS-CoV-2 infection after vaccination in users of the COVID Symptom Study app in the UK: a prospective observational study. *Lancet Infect Dis.* 2021; 21; 939-49. Published online April 27, 2021. doi: 10.1016/S1473-3099(21)00224-3.
13. Tang L, Hijano DR, Gaur AH, et al. Asymptomatic and Symptomatic SARS-CoV-2 Infections After BNT162b2 Vaccination in a Routinely Screened Workforce. *JAMA.* Published online May 6, 2021:2021;325(24):2500-2502. doi: 10.1001/jama.2021.6564
14. Chodick G, Tene L, Rotem Ran S, et al. The Effectiveness of the Two-Dose BNT162b2 Vaccine: Analysis of Real-World Data. *Clin Infect Dis.* Published online May 17, 2021:2021;ciab438. doi: 10.1093/cid/ciab438
15. Lopez Bernal J, Andrews N, Gower C, et al. Effectiveness of BNT162b2 mRNA vaccine and ChAdOx1 adenovirus vector vaccine on mortality following COVID-19. *medRxiv*. Published online 2021:2021.05.14.21257600 doi: 10.1101/2021.05.14.21257218
16. Bianchi FB, Germinario CA, Migliore G, et al. BNT162b2 mRNA COVID-19 Vaccine Effectiveness in the Prevention of SARS-CoV-2 Infection: A Preliminary Report. *J Infect Dis.* Published online May 19, 2021:2021;jiab262. doi: 10.1093/infdis/jiab262
17. Walsh J, Skally M, Traynor L, et al. Impact of first dose of BNT162b2 vaccine on COVID-19 infection among healthcare workers in an Irish hospital. *Ir J Med Sci*. Published online May 2021:1-2. doi:10.1007/s11845-021-02658-4
18. Yassi A, Grant JM, Lockhart K, et al. Infection control, occupational and public health measures including mRNA-based vaccination against SARS-CoV-2 infections to protect healthcare workers from variants of concern: a 14-month observational study using surveillance data. *PLoS ONE*. 2021;16(7):e0254920. doi:10.1371/journal.pone.0254920
19. Kumar S, Saxena S, Atri M, Chamola SK. Effectiveness of the Covid-19 vaccine in preventing infection in dental practitioners: results of a cross-sectional questionnaire-based survey. *medRxiv*. Published online 2021:2021.05.28.21257967. doi:10.1101/2021.05.28.21257967
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2. Summary of Study Results for Post-Authorization COVID-19 Booster Dose Vaccine Effectiveness

#	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	Reference group	Booster Dose VE relative to Dose 2* % (95%CI)	Days post Booster dose	Max Duration of follow up after fully vaccinated
20	Tan et al (January 5,2021)	Singapore	Retrospective cohort	703,209 individuals aged 60 years and above	Delta††	Excluded	BNT162b2 primary series + BNT162b2 booster	Documented infection	Complete vaccination with two doses of BNT162b2 primary series	73 (71-74)	12+	~6 weeks
								Symptomatic disease		72 (71-74)		
								Severe disease		95 (92-97)		
							BNT162b2 primary series+ mRNA-1273 booster	Documented infection		82 (77-86)		
								Symptomatic disease		82 (76-87)		
								Severe disease		92 (44-99)		
							mRNA-1273 primary series + mRNA-1273 booster	Documented infection		86 (81-90)		
								Symptomatic disease		85 (79-89)		
							mRNA-1273 primary series+ BNT162b2 booster	Documented infection		90 (73-96)		
								Symptomatic disease		90 (69-97)		
19	Buchan et al (January 1,2021)	Canada	Test negative case control	164 Omicron-positive cases, 209 Delta-positive cases, and 46,708 test-negative controls aged ≥18 years	**Omicron specifically^**	Excluded	BNT162b2	Documented infection	Complete vaccination with two doses of primary series at least 5 months prior	34 (16-49)	7+	~8 weeks
							mRNA-1273			59 (16-80)		
					Delta specifically^		BNT162b2			93 (91-94)		
							mRNA-1273			93 (90-96)		
18	Gray et al (December 29,2021)	South Africa	Test-negative case control		**Omicron^**	Excluded	Ad26.COV.2	Hospitalization	Complete vaccination with one dose of primary series at least 6-9 months prior	63 (31-81)	0-13	~13 weeks
										84 (67-92)	14-27	
										85 (54-95)	1-2 months	
17	Lustig et al (December 21, 2021)	Israel	Prospective cohort	12,413 HCW in a large tertiary care center	Delta^	Excluded	BNT162b2	Documented infection	Complete vaccination with two doses of primary series at least	85.6 (79.2-90.1)	10+	~7 weeks

#	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	Reference group	Booster Dose VE relative to Dose 2* % (95%CI)	Days post Booster dose	Max Duration of follow up after fully vaccinated
									5 months prior			
16	Amir et al (December 21, 2021)	Israel	Quasi-experimental	348,468 individuals aged 16-18 (booster group) and 361,050 individuals aged 12-14 recently fully vaccinated	Delta^	Excluded	BNT162b2	Documented infection	Individuals aged 12-14 recently vaccinated (<60 days) with 2 doses	73.4 (67.1-78.9)	14+	~4 weeks
									Unvaccinated individuals aged 16-18	96.2 (94.8-97.2)		
15	Hansen et al (December 23,2021)	Denmark	Retrospective cohort	41,684 Danish residents aged ≥12 years	**Omicron specifically^**	Excluded	BNT162b2	Documented infection	Complete vaccination with two doses of primary series	54.6 (30.4-70.4)	1-30	~4 weeks
					Delta specifically^		BNT162b2			81.2 (79.2-82.9)		
							mRNA-1273			82.8 (58.8-92.9)		
14	Sheikh et al (December 22,2021)	Scotland	Test-negative case control	162,946 RT-PCR positive tests in Scotland	**Omicron specifically^**	Included	BNT162b2, mRNA-1273, AZD1222 primary series+ BNT162b2 and mRNA-1273 booster	Symptomatic disease (16-49)	Complete vaccination with two doses of primary series more than 25 weeks before testing positive	62 (54-68)	7+	~7 weeks
								Symptomatic disease (50+)		56 (51-60)	14+	
					Delta specifically^			Symptomatic disease (16-49)		54 (46-62)	7+	
								Symptomatic disease (50+)		57 (52-62)	14+	
										84 (80-87)	7+	
										83 (81-84)	14+	
										77 (74-80)	7+	
										88 (86-89)	14+	
13	Tartof et al (December 21,2021)	USA	Retrospective matched cohort	3,133,075 individuals	Delta specifically^	Included	BNT162b2	Documented infection	Unvaccinated	88 (86-89)	14+	~12 weeks
								Hospitalization		97 (95-98)		
								Documented infection	Complete vaccination with two doses of primary series at least 6 months prior	75 (71-78)		
								Hospitalization		70 (48-83)		
12	Berec et al (December 12,2021)	Czech Republic	Retrospective cohort	6,287,356 individuals	Delta^	Included	BNT162b2 primary series + BNT162b2 booster	Documented infection	Complete vaccination with two	92 (91-92)	7+	~8 weeks

#	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	Reference group	Booster Dose VE relative to Dose 2* % (95%CI)	Days post Booster dose	Max Duration of follow up after fully vaccinated
							mRNA-1273 primary series+ BNT162b2 booster		doses of primary series at least 6-8 months prior	94 (91-96)		
							AZD1222 primary series + BNT162b2 booster			82 (68-90)		
							BNT162b2 primary series+ mRNA-1273 booster			92 (88-95)		
							mRNA-1273 primary series + mRNA-1273 booster			94 (91-95)		
							AZD1222 primary series+ mRNA-1273 booster			91 (63-98)		
11	Andrews et al (December 31,2021) *[Update to Dec 10, 2021 preprint]*	England	Test-negative case control	204,036 Omicron cases, 169,888 Delta cases, and test negative controls aged 18+	Omicron specifically^	Included	BNT162b2 primary series + BNT162b2 booster	Symptomatic disease	Complete vaccination with two doses of primary series at least 140 days prior	68.6 (66.8-70.2)	14-34	~12 weeks
										48.8 (46.1-51.3)	70+	
							BNT162b2 primary series + mRNA-1273 booster			72.1 (68.9-74.9)	14-34	
										70.6 (63.1-76.6)	35-69	
							AZD1222 primary series + BNT162b2 booster			64.4 (62.9-65.8)	14-34	
										42.7 (37.2-47.7)	70+	
							AZD1222 primary series + mRNA-1273 booster			69.7 (68.0-71.4)	14-34	
										61.9 (55.3-67.5)	35-69	
					Delta specifically^		BNT162b2 primary series + BNT162b2 booster			95.1 (94.7-95.4)	14-34	
										90.9 (90.1-91.7)	70+	
							BNT162b2 primary series + mRNA-1273 booster			97.0 (96.2-97.7)	14-34	
										92.0 (87.4-94.9)	35-69	
							AZD1222 primary series + BNT162b2 booster			95.4 (95.1-95.7)	14-34	
										86.8 (84.4-88.9)	70+	
							AZD1222 primary series + mRNA-1273 booster			97.0 (96.6-97.4)	14-34	
										96.4 (94.1-97.8)	35-69	
10		Israel			Delta^	Excluded		Death		33 (26-40)	14+	~8 weeks

	Arbel et al (December 8,2021)*		Prospective cohort	843,208 individuals			BNT162b2 primary series + BNT162b2 booster	Documented infection	Receipt of 2 doses at least 5 months prior	91 (87-93) 83 (82-94)	54+	
9	Goldberg et al (December 5, 2021)	Israel	Retrospective cohort	5.7 million Israeli individuals	Delta^	Excluded	BNT162b2 primary series + BNT162b2 booster	16-39:Documented infection 40-59:Documented infection 60+:Documented infection	Receipt of 2 doses at least 5 months prior	91 (90.1-91,3) 89 (88.3-89.3) 82.2 (81.5-82.8)	12+	~8 weeks
8	Sharma et al (November 30, 2021)	USA	Matched retrospective cohort	129,130 matched pairs of veterans who received a second dose at least 6 months prior	Delta††	Included	BNT162b2 primary series + BNT162b2 booster mRNA-1273 primary series + mRNA-1273 booster	Documented infection Hospitalization Documented infection Hospitalization	Receipt of 2 doses at least 180 days prior	45.7 (37.9-52.5) 44.8 (26.6-58.4) 46.6 (36.4-55.3) 50.0 (26.2-66.1)	0+	~7 weeks
7	Andrews et al (December 17, 2021) *[Update to November 15, 2021 Preprint]*	England	Test-negative case control	462,591 adults aged 50+ years in England	Delta††	Included (if >90 days prior)	BNT162b2 primary series + BNT162b2 booster AZD1222 primary series + BNT162b2 booster BNT162b2 primary series + BNT162b2 booster AZD1222 primary series + BNT162b2 booster	Symptomatic disease	Complete vaccination with two doses of primary series at least 140 days prior Unvaccinated individuals	84.5 (83.7-85.3) 89.1 (88.3-89.9) 94.3 (93.9-94.6) 93.8 (93.3-94.3)	14+	~7.5 weeks
6	Barda et al*(October 29, 2021)	Israel	Retrospective cohort	1158269 Israeli individuals	Delta^	Excluded	BNT162b2 primary series + BNT162b2 booster	Documented infection Symptomatic disease Hospitalization Severe disease Death	Complete vaccination with two doses at least 5 months ago	88 (87-90) 91 (89-92) 93 (88-97) 92 (82-97) 81 (59-97)	7+	~7 weeks
5	Saciuk et al* (November 2, 2021)	Israel	Retrospective cohort	947,131 persons fully vaccinated at least 6 months prior (Jan-Feb 2021) among active members of the Maccabi HMO	Delta^	Excluded	BNT162b2 primary series + BNT162b2 booster	Documented infection	Complete vaccination with two doses	89.1 (87.5-90.5)	7+	10 weeks

4	ENSEMBLE 2 (October 14,2021)	North and South America, Africa, Asia and Europe	Randomized-placebo control trial	31,300 participants	Non-VOC, Alpha, Delta	Unknown	Ad26.COV2.S primary series + Ad26.COV2.S booster dose	Documented infection	Complete vaccination one dose	51.1 (29.5-66.4)	71+	~24 weeks
								Asymptomatic infection		34.2 (-6.4–59.8)		
								Moderate Symptomatic infection		70.7 (45.4-85.1)		
								Moderate and severe/critical infection		75.2 (54.5-87.3)		
					Alpha^			Documented infection		94.2 (62.9-99.9)		
					Mu^					63.1 (-27.9–91.6)		
3	Bar-On et al * (December 8, 2021) *[Published version of October 7 pre-print]*	Israel	Retrospective cohort	4,629,865 Israeli residents (16+) who had been fully vaccinated at least 5 months prior	Delta^	Excluded	BNT162b2 primary series + BNT162b2 booster	16-29 y: Documented infection	Complete vaccination with two doses	94.2 (93.6-94.9)	12+	~3.5 weeks
								30-39 y: Documented infection		88.6 (87.8-89.5)		~4.5 weeks
								40-49 y: Documented infection		89.7 (89.1-90.4)		5 weeks
								50-59 y: Documented infection		91.8 (91.2-92.4)		6 weeks
								60+ y: Documented infection		91.9 (91.6-92.2)		8 weeks
								40-59: Severe disease		95.4 (90.6-97.8)		6 weeks
								60+: Severe disease		94.5 (93.4-95.3)		8 weeks
								60+: Death		93.2 (89.4-95.7)		
2	Patalon et al* (November 30, 2021) *[Update to August 31 preprint]*	Israel	Test-negative case control	306,710 Israeli adults ≥ 40 years with either 2 or 3 doses	Delta^	Excluded	BNT162b2 primary series + BNT162b2 booster	Documented infection	Complete vaccination with two doses	85 (83-86)	14-20	~7 weeks
										86 (85-87)	28-65	
			Matched case-control					Documented infection		87 (85-88)	14-20	
										83 (82-85)	28-65	
								Hospitalization		92 (87-95)	14-20	
										97 (95-98)	28-65	
1	Bar-On et al* (October 7,2021)	Israel	Retrospective cohort	1,144,690	Delta^	Excluded	BNT162b2 primary series + BNT162b2 booster	Documented infection	Complete vaccination with two doses	92 (90- 93)	12+	~3 weeks
								Severe disease		94 (91-96)		

	[Update to August 31 Preprint]											

2.1 Booster studies that do not meet criteria are listed below in case of interest

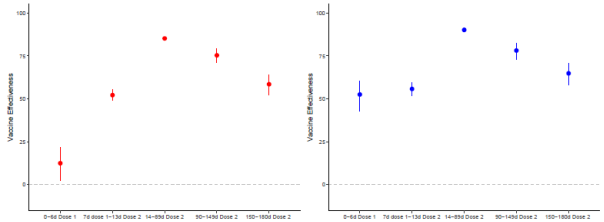
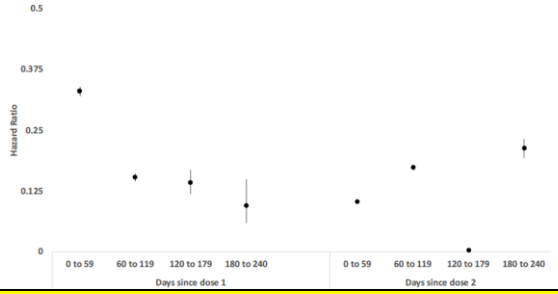
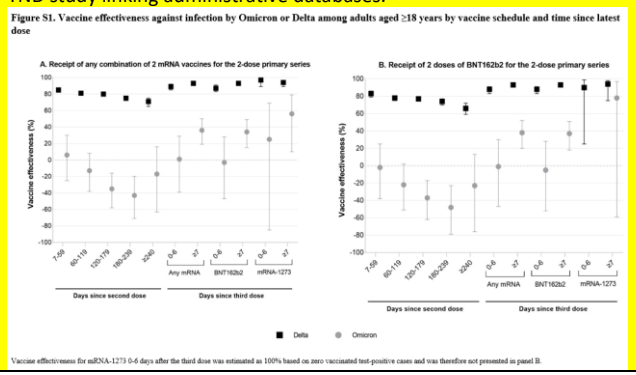
1. Bomze D, Sprecher E, Gamzu R. Effect of a nationwide booster vaccine rollout in Israel on SARS-CoV-2 infection and severe illness in young adults. *Travel Med Infect Dis*. Published online 2021 October 30. doi: https://doi.org/10.1016/j.tmaid.2021.102195
2. Lippi G & Mattiuzzi C. Primary COVID-19 vaccine cycle and booster doses efficacy: analysis of Italian nationwide vaccination campaign. *Research Square*. Published online November 30, 2021. doi: 10.21203/rs.3.rs-1116534/v1
3. Mattiuzzi, C., & Lippi, G. Efficacy of COVID-19 vaccine booster doses in older people. *ResearchSquare*. Published online 2021 December 20. doi: https://doi.org/10.21203/rs.3.rs-1185254/v1
4. Robles-Fontán, M. M., & Irizarry, R. A. (2021). Effectiveness of different booster regimens for preventing infection and adverse outcomes in Puerto Rico. *MedRxiv*, Published online 2021 December 21. https://doi.org/10.1101/2021.12.19.21268070
5. Chadeau-Hyam M, Eales O, Bodinier B, et al. REACT-1 round 15 final report: Increased breakthrough SARS-CoV-2 infections among adults who had received two doses of vaccine, but booster doses and first doses in children are providing important protection. *MedRxiv*, Published online 2021 December 16. https://www.medrxiv.org/content/10.1101/2021.12.14.21267806v1.

3. Duration of Protection Studies

These are studies that assess duration of protection criteria as outlined above along with those studies that do not meet aforementioned criteria that are relevant to evaluating duration of protection. Some of these studies are also in the above table but duplicated here for ease.

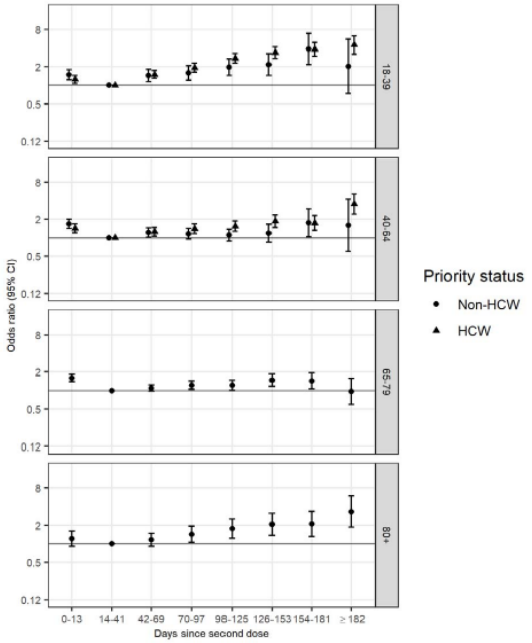
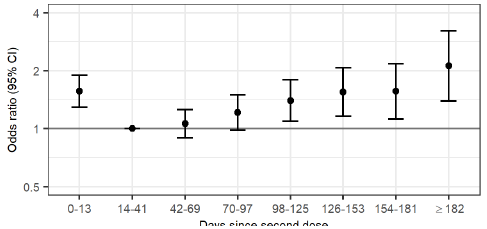
We would like to highlight

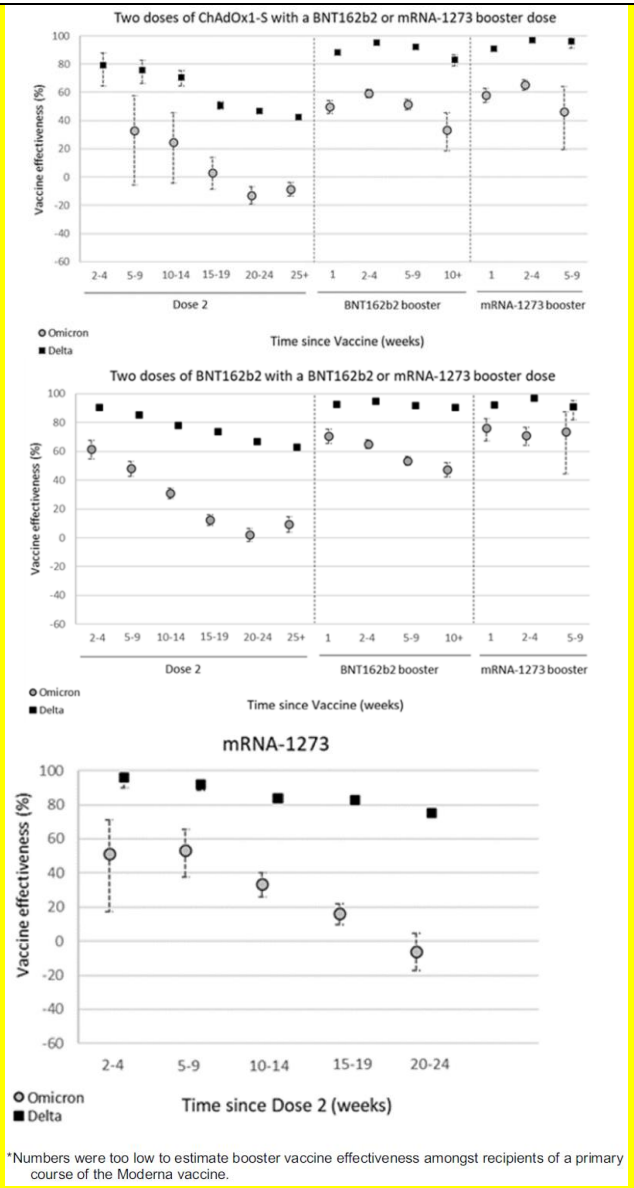
- It is currently challenging to disentangle any apparent reduction in VE over time due to waning immunity from reduction due to immune escape by the Delta variant.
- Countries have implemented different dose intervals and vaccination strategies that can make comparisons across studies challenging.
- Persons who are vaccinated early in a program are different than those who are vaccinated later. For example, many who were vaccinated early were those at highest risk, and this could confound the results. Some of the older individuals also might have some degree of immunosenescence.

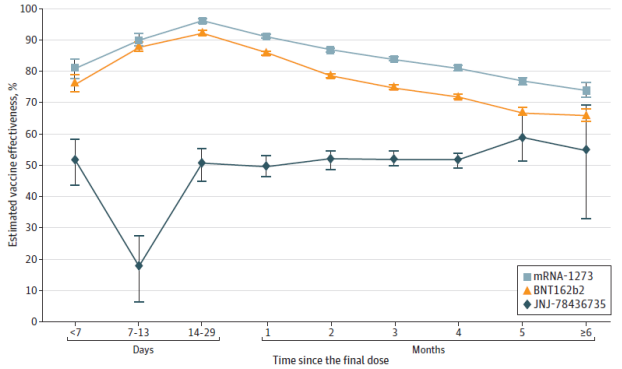
#	Reference (date)	Country	Population	Dominant Variants	Vaccine product	Study Period	Descriptive Findings
88	Prunas et al (January 5, 2022)	Israel	12-16 year olds enrolled in Maccabi health services	Delta	Comirnaty	June 15-December 8, 2021	Matched case control evaluating association between time since vaccination and infection (red) and disease (blue). 
87	Fisman et al (January 5, 2022)	Canada	5+ year olds	Alpha, Beta, Gamma, Delta, nonVOCs	Comirnaty ChAdOx1 mRNA-1273 (homologous and heterologous)	December 2020-October 2021	Case-Cohort study looking at VE against infection combined across the different platforms over time since vaccination as well as evaluated impact of dosing intervals. 
86	Buchan et al (January 1, 2022)	Canada	18+ year olds	Delta, **Omicron**	Comirnaty ChAdOx1 mRNA-1273 (vaccinated persons had at least 1 dose of an mrna vaccine)	November 22-December 19, 2021	TND study linking administrative databases. 

<table>
<tr>
<td>85</td>
<td>Cerqueria-Silva et al (December 27, 2021)</td>
<td>Brazil</td>
<td>18+ year olds with prior infection 90+ days prior to testing in study period</td>
<td>Gamma, Delta</td>
<td>Coronavac, Comirnaty ChAdOx1 Ad26.COV2.S</td>
<td>January 18, 2021, - November 11, 2021.</td>
<td>Matched TND study linking adminsitrative databases.
VE against symptomatic disease on top; severe disease on bottom.
<table>
<tr><th></th><th>14-90 days</th><th>>90 days</th><th>p-value</th></tr>
<tr><td>BNT162b2</td><td>64.2% (54.2-72.0)</td><td>100% (*)</td><td>0.277</td></tr>
<tr><td>ChAdOx1</td><td>55.5% (50.5-60.1)</td><td>56.8% (46.6-65.1)</td><td>0.544</td></tr>
<tr><td>CoronaVac</td><td>40.5% (36.4-44.3)</td><td>38.0% (33.1-42.5)</td><td>0.760</td></tr>
<tr><td>Ad26.COV2.S</td><td>46.1% (32.7-56.7)</td><td>30.6% (-12.4-57.1)</td><td>0.420</td></tr>
</table>

Table A4. Vaccine effectiveness ≥14 days after series comp
<table>
<tr><th></th><th colspan="3">Vaccine waning (time after series completion)</th></tr>
<tr><th></th><th>14-90 days</th><th>>90 days</th><th>p-value</th></tr>
<tr><td>BNT162b2</td><td>88.8% (50.0-97.5)</td><td>100% (*)</td><td>0.765</td></tr>
<tr><td>ChAdOx1</td><td>86.6% (77.6-92.0)</td><td>95.1% (84.8-98.4)</td><td>0.007</td></tr>
<tr><td>CoronaVac</td><td>86.6% (79.8-90.3)</td><td>74.4% (63.3-82.2)</td><td>0.012</td></tr>
<tr><td>Ad26.COV2.S</td><td>60.2% (-10.8-85.7)</td><td>41.0% (-240.9-89.9)</td><td>0.978</td></tr>
</table>
</td>
</tr>
</table>

83	Hitchings et al (December 24, 2021)	Brazil	18+ year olds living in Sao Paulo	Gamma, Delta	Coronavac	January 17-September 30, 2021	TND based on linking adminsitrative databases among persons with 2 doses of coronavac (ref period day 14-41 post dose 2). OR for symptomatic disease.  OR against hospitalization or death 

82	UK HSA (December 24, 2021) (update of Andrews et al publication)	UK	General population	Delta, **Omicron**	Comirnaty ChAdOx1 mRNA-1273	November 27-December 17, 2021	 *Numbers were too low to estimate booster vaccine effectiveness amongst recipients of a primary course of the Moderna vaccine.

81	Tabak et al (December 22, 2021)	USA	18+ year olds	NonVOC, Alpha, Delta	Comirnaty mRNA-1273 Ad26.COV2.S	May 1-August 7, 2021	TND study on patients presenting to CVS with symptoms for testing. (final dose in primary series) Figure 2. Multivariable Adjusted Estimated Vaccine Effectiveness Against SARS-CoV-2 Infection and 95% CIs 

<table>
<tr>
<td>80</td>
<td>Kissling et al (December 22, 2021)</td>
<td>8 European countries</td>
<td>30+ years</td>
<td>Delta</td>
<td>Comirnaty
mRNA-1273
ChAdOx1
Ad26.COV2.S</td>
<td>July-August 2021</td>
<td>TND study in primary care sites evaluating VE against symptomatic disease

Table 3: Effectiveness of complete COVID-19 vaccination among participants in the primary care and community I-MOVE-COVID-19 and ECDC VE study, by time since vaccination and vaccine product, Europe, July–August 2021

<table>
<tr><th colspan="4">Analysis by time since vaccination</th></tr>
<tr><th>Brand, age group and time since vaccination</th><th>Cases / controls</th><th>Crude VE (95% CI)[a]</th><th>Adjusted VE (95% CI)[b]</th></tr>
<tr><td colspan="4">Comirnaty, age 30–59 years[c]</td></tr>
<tr><td>Unvaccinated</td><td>1045/1684</td><td></td><td></td></tr>
<tr><td>Vaccinated 14–29 days</td><td>123/1287</td><td>87 (84–89)</td><td>87 (83–89)</td></tr>
<tr><td>Vaccinated 30–59 days</td><td>261/1584</td><td>75 (71–79)</td><td>76 (72–81)</td></tr>
<tr><td>Vaccinated 60–89 days</td><td>60/335</td><td>70 (59–78)</td><td>72 (61–80)</td></tr>
<tr><td>Vaccinated ≥90 days</td><td>151/647</td><td>66 (58–72)</td><td>65 (56–71)</td></tr>
<tr><td colspan="4">Comirnaty, age 60+ years[c]</td></tr>
<tr><td>Unvaccinated</td><td>74/161</td><td></td><td></td></tr>
<tr><td>Vaccinated 14–29 days</td><td>2/30</td><td>-</td><td>-</td></tr>
<tr><td>Vaccinated 30–59 days</td><td>32/425</td><td>67 (42–81)</td><td>65 (37–80)</td></tr>
<tr><td>Vaccinated 60–89 days</td><td>146/951</td><td>65 (49–76)</td><td>66 (48–78)</td></tr>
<tr><td>Vaccinated ≥90 days</td><td>192/1159</td><td>66 (51–76)</td><td>64 (44–77)</td></tr>
<tr><td colspan="4">Vaxzevria, age 30–59 years[d]</td></tr>
<tr><td>Unvaccinated</td><td>990/1655</td><td></td><td></td></tr>
<tr><td>Vaccinated 14–29 days</td><td>21/107</td><td>71 (52–83)</td><td>72 (52–83)</td></tr>
<tr><td>Vaccinated 30–59 days</td><td>79/320</td><td>67 (56–75)</td><td>67 (57–75)</td></tr>
<tr><td>Vaccinated 60–89 days</td><td>42/162</td><td>64 (47–76)</td><td>65 (48–76)</td></tr>
<tr><td>Vaccinated ≥90 days</td><td>9/50</td><td>-</td><td>-</td></tr>
<tr><td colspan="4">Spikevax, age 30–59 years[e]</td></tr>
<tr><td>Unvaccinated</td><td>1033/1672</td><td></td><td></td></tr>
<tr><td>Vaccinated 14–29 days</td><td>2/180</td><td>98 (92–100)</td><td>98 (93–100)</td></tr>
<tr><td>Vaccinated 30–59 days</td><td>19/285</td><td>91 (85–94)</td><td>91 (85–95)</td></tr>
<tr><td>Vaccinated 60–89 days</td><td>6/98</td><td>89 (75–96)</td><td>90 (76–96)</td></tr>
<tr><td>Vaccinated ≥90 days</td><td>11/33</td><td>-</td><td>-</td></tr>
<tr><td colspan="4">Janssen, age 30–59 years[f]</td></tr>
<tr><td>Unvaccinated</td><td>919/1578</td><td></td><td></td></tr>
<tr><td>Vaccinated 14–29 days</td><td>19/61</td><td>-</td><td>-</td></tr>
<tr><td>Vaccinated 30–59 days</td><td>123/338</td><td>46 (32–57)</td><td>50 (36–62)</td></tr>
<tr><td>Vaccinated 60–89 days</td><td>70/205</td><td>45 (26–60)</td><td>52 (33–66)</td></tr>
<tr><td>Vaccinated ≥90 days</td><td>5/17</td><td>-</td><td>-</td></tr>
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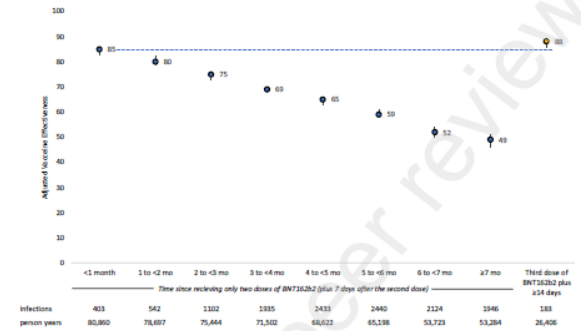
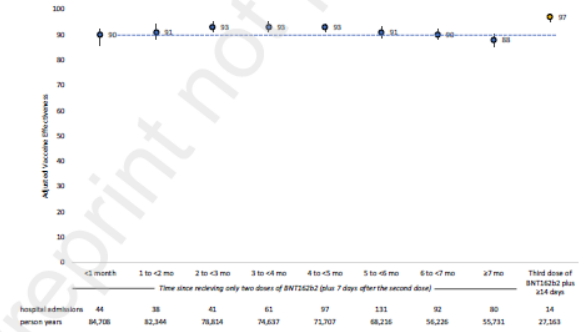
79	Tartof et al (December 21, 2021)	USA	3 million 18+ Kaiser permanente members	NonVOC, alpha, Delta,	Comirnaty	December 14, 2020-December 5, 2021	Cohort study looking at booster dose VE and duration of protection of 2 doses. Manuscript has stratification by age group and immunocompromised status, with similar patterns as seen below though immunocompromised has a trend towards more waning against hospitalization but not significant. **Figure 1. BNT162b2 effectiveness against SARS-CoV-2 infections and COVID-19 hospital admissions** **A Infections**  **B Hospital admissions** 

78	Katikireddi et al (December 20, 2021)	Scotland and Brazil	≥18 year old general population	Scotland: Delta Brazil: Gamma/Delta	ChAdOx1	Scotland: May 19-October 25, 2021 Brazil: January 18-October 25, 2021	Scotland: administrative database linkage study Brazil: evaluated VE by comparing fully vaccinated persons at day 0-13 and persons 14+ days post dose 2.

	Scotland			Brazil		
	Person-years	Number of events	Vaccine effectiveness* (95% CI)	Person-years	Number of events	Vaccine effectiveness* (95% CI)
Unvaccinated	336 942	2245	0% (ref)	..	..	..
0–2 weeks after first dose	6860	39	−15·4% (−60·6 to 17·0)	1 849 099	21 736	0% (ref)
Partially vaccinated†	94 761	420	49·3% (43·3 to 54·6)	11 701 310	37 802	57·9% (56·9 to 58·9)
0–1 week after second dose	47 252	78	77·7% (71·9 to 82·3)	1 601 585	2688	73·2% (71·9 to 74·5)
2–3 weeks after second dose	55 318	85	83·7% (79·7 to 87·0)	1 492 259	1095	86·4% (85·4 to 87·3)
4–5 weeks after second dose	65 698	106	86·6% (83·6 to 89·0)	1 338 063	1019	83·5% (82·3 to 84·7)
6–7 weeks after second dose	71 120	134	86·8% (84·2 to 88·9)	1 117 983	1019	77·9% (76·1 to 79·5)
8–9 weeks after second dose	73 540	245	79·0% (75·9 to 81·7)	862 976	863	75·6% (73·4 to 77·6)
10–11 weeks after second dose	73 212	280	79·6% (76·8 to 82·1)	651 213	751	69·3% (66·3 to 72·1)
12–13 weeks after second dose	71 773	337	77·4% (74·6 to 80·0)	445 924	646	60·8% (56·6 to 64·6)
14–15 weeks after second dose	68 114	356	75·9% (72·9 to 78·6)	264 128	472	59·7% (54·6 to 64·2)
16–17 weeks after second dose	63 974	402	70·5% (67·0 to 73·7)	169 692	397	50·5% (43·4 to 56·6)
18–19 weeks after second dose	58 608	508	63·7% (59·6 to 67·4)	132 459	275	42·2% (32·4 to 50·6)
20–21 weeks after second dose	45 716	598	53·6% (48·4 to 58·3)	..	..	..

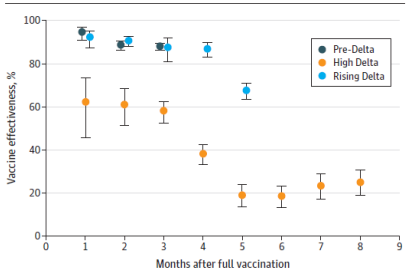
Scotland reference group: unvaccinated, Brazil reference group: 0–13 days after first dose vaccination. *In Scotland, vaccine effectiveness was adjusted for age, sex, deprivation, comorbidities, number of previous tests, interval between doses, and temporal trend; individuals positive for SARS-CoV-2 before Dec 8, 2020, were excluded from the analysis. In Brazil, vaccine effectiveness was adjusted for age, sex, deprivation, macroregion of residence, primary reason for vaccination, interval between doses, and temporal trend. †Partially vaccinated: ≥2 weeks after the first dose and before the second dose.

Table 2: Vaccine effectiveness estimates for ChAdOx1 nCoV-19 against COVID-19 hospital admissions or death by length of time since two-dose vaccination in Scotland and Brazil

	Scotland			Brazil		
	Total samples	Positive samples	Vaccine effectiveness* (95% CI)	Total samples	Positive samples	Vaccine effectiveness* (95% CI)
Unvaccinated	26 130	13 698	0% (ref)	9 852 053	4 920 001	0% (ref)
0–1 week after first dose	911	374	20·9% (8·2 to 31·9)	286 322	151 328	−9·6% (−10·5 to −8·8)
Partially vaccinated†	15 714	7176	37·6% (34·6 to 40·5)	1 143 423	398 717	37·6% (37·3 to 37·9)
0–1 week after second dose	5027	2025	50·2% (46·7 to 53·5)	112 391	30 550	51·3% (50·6 to 52·0)
2–3 weeks after second dose	7141	2429	67·9% (65·9 to 69·8)	95 671	7963	69·8% (69·3 to 70·4)
4–5 weeks after second dose	8947	3387	67·3% (65·3 to 69·1)	79 298	15 568	68·4% (67·8 to 68·9)
6–7 weeks after second dose	10 622	4346	63·8% (61·7 to 65·7)	60 301	12 401	66·8% (66·1 to 67·5)
8–9 weeks after second dose	11 258	4633	63·3% (61·3 to 65·3)	44 351	9424	65·4% (64·6 to 66·2)
10–11 weeks after second dose	14 043	6319	59·3% (57·2 to 61·4)	32 832	7103	63·2% (62·2 to 64·2)
12–13 weeks after second dose	17 300	7966	55·3% (53·0 to 57·5)	22 454	5177	58·8% (57·4 to 60·1)
14–15 weeks after second dose	17 421	7670	52·9% (50·4 to 55·2)	15 305	3435	59·8% (58·2 to 61·4)
16–17 weeks after second dose	15 442	6554	48·7% (45·9 to 51·4)	10 822	2529	58·7% (56·7 to 60·5)
18–19 weeks after second dose	14 403	6248	44·6% (41·5 to 47·6)	7458	1852	57·7% (55·4 to 60·0)
20–21 weeks after second dose	10 596	4718	39·1% (35·4 to 42·6)	..	..	..

*In Scotland, vaccine effectiveness was adjusted for age, sex, deprivation, comorbidities, number of at-risk groups, smoking status, blood pressure, body-mass index, health board, interval between doses, and temporal trend. In Brazil, vaccine effectiveness was adjusted for age, sex, deprivation, macroregion of residence, diabetes, obesity, immunosuppression, cardiac disease, pregnancy, puerperal period, chronic kidney disease, and temporal trend. Descriptive characteristics for the sample are available in appendix 2 (pp 11–15). †Partially vaccinated: ≥2 weeks after the first dose and before the second dose.

Table 3: Vaccine effectiveness estimates for ChAdOx1 nCoV-19 against confirmed SARS-CoV-2 symptomatic infection by length of time since two-dose vaccination in Scotland and Brazil using a test-negative design case-control study

77	Abu-Raddad et al (December 16, 2021)	Qatar	General population	Alpha→Beta →Delta	mRNA-1273	January 1 - December 5, 2021	TND study linking adminsitrative databases. **Table 5. Effectiveness of the mRNA-1273 vaccine against any SARS-CoV-2 infection and against any severe, critical, or fatal COVID-19, after adjusting for prior infection and healthcare worker status.** Effectiveness against infection: Cases[1] (PCR-positive) Vaccinated / Unvaccinated; Controls[1] (PCR-negative) Vaccinated / Unvaccinated; Effectiveness in % (95% CI)[2]. Effectiveness against hospitalization and death: Cases[1] (Severe, critical, or fatal disease)[3] Vaccinated / Unvaccinated; Controls[1] (PCR-negative) Vaccinated / Unvaccinated; Effectiveness in % (95% CI)[2]. 0-13 days after first dose: 2,931 / 86,836 / 4,360 / 146,643 / -12.2 (-18.3 to -6.4) / 172 / 3,073 / 727 / 11,375 / 23.1 (6.1 to 35.3) ≥14 days after first dose and no second dose: 962 / 87,230 / 3,891 / 145,195 / 60.3 (57.0 to 63.3) / 28 / 3,066 / 464 / 11,379 / 82.1 (73.1 to 88.1) 1st month after the second dose: 416 / 87,093 / 4,701 / 143,648 / 85.3 (83.5 to 86.9) / 4 / 3,068 / 414 / 11,339 / 97.2 (92.4 to 99.0) 2nd month after the second dose: 148 / 86,809 / 2,136 / 144,929 / 84.7 (81.5 to 87.3) / 1 / 3,046 / 132 / 11,492 / 97.4 (81.4 to 99.6) 3rd month after the second dose: 146 / 86,757 / 1,493 / 145,387 / 75.7 (70.5 to 80.1) / 0 / 3,049 / 68 / 11,553 / 100.0 (55.0 to 100.0)[4] 4th month after the second dose: 186 / 86,790 / 1,221 / 145,738 / 69.1 (62.5 to 74.5) / 2 / 3,043 / 52 / 11,556 / 89.5 (31.9 to 97.8) 5th month after the second dose: 192 / 86,770 / 902 / 145,968 / 53.6 (42.9 to 62.3) / 1 / 3,046 / 44 / 11,566 / 94.2 (55.0 to 99.2) 6th month after the second dose: 105 / 86,709 / 494 / 146,082 / 50.6 (34.5 to 62.8) / 1 / 3,042 / 10 / 11,583 / 61.0 (-225.5 to 95.3) 7th month after the second dose: 168 / 86,675 / 376 / 146,252 / -3.5 (-32.3 to 19.1) / 0 / 3,041 / 13 / 11,571 / 100.0 (-146.7 to 100.0)[4] 8th month or greater after the second dose: 83 / 86,671 / 137 / 146,298 / 29.1 (-84.0 to 8.8) / 0 / 3,043 / 11 / 11,581 / 100.0 (-194.4 to 100.0)[4] **Table 7. Effectiveness of the mRNA-1273 vaccine against symptomatic and asymptomatic SARS-CoV-2 infection.** Effectiveness against symptomatic infection[1]: Cases[1] (PCR-positive) Vaccinated / Unvaccinated; Controls[1] (PCR-negative) Vaccinated / Unvaccinated; Effectiveness in % (95% CI)[2]. Effectiveness against asymptomatic infection[1]: Cases[1] (PCR-positive) Vaccinated / Unvaccinated; Controls[1] (PCR-negative) Vaccinated / Unvaccinated; Effectiveness in % (95% CI)[2]. 0-13 days after first dose: 1,170 / 30,068 / 1,562 / 41,914 / 11.0 (-3.4 to 18.0) / 788 / 20,888 / 1,379 / 39,879 / -9.9 (-21.3 to 0.5) ≥14 days after first dose and no second dose: 303 / 30,433 / 1,572 / 41,593 / 78.3 (75.2 to 81.1) / 299 / 20,896 / 1,078 / 39,322 / 54.6 (47.7 to 60.6) 1st month after the second dose: 79 / 30,302 / 1,720 / 41,253 / 94.4 (92.8 to 95.6) / 139 / 20,887 / 1,022 / 39,114 / 79.9 (75.3 to 83.4) 2nd month after the second dose: 44 / 30,080 / 1,033 / 41,388 / 94.0 (91.8 to 95.6) / 59 / 20,868 / 432 / 39,462 / 81.8 (75.2 to 86.6) 3rd month after the second dose: 52 / 30,052 / 814 / 41,496 / 91.2 (88.1 to 93.4) / 56 / 20,865 / 241 / 39,626 / 86.1 (52.7 to 75.7) 4th month after the second dose: 87 / 30,067 / 676 / 41,697 / 82.9 (78.1 to 86.7) / 64 / 20,868 / 231 / 39,661 / 63.6 (48.8 to 74.2) 5th month after the second dose: 94 / 30,059 / 552 / 41,784 / 76.7 (70.4 to 81.7) / 63 / 20,864 / 148 / 39,717 / 33.7 (3.7 to 54.4) 6th month after the second dose: 55 / 30,029 / 301 / 41,877 / 74.8 (65.3 to 81.7) / 30 / 20,854 / 73 / 39,717 / 30.8 (-13.0 to 57.6) 7th month after the second dose: 82 / 30,000 / 225 / 41,950 / 68.7 (30.3 to 62.2) / 62 / 20,857 / 86 / 39,767 / -40.6 (-115.6 to 0.2) 8th month or greater after the second dose: 35 / 30,006 / 64 / 42,013 / 20.0 (-29.0 to 50.3) / 29 / 20,856 / 42 / 39,738 / -28.4 (-129.3 to 28.1)
76	Young-Xu et al (December 15, 2021)	USA	Male 65+ year old veterans in VA system	NonVOC, Alpha, Delta	Comirnaty mRNA-1273	January-September 2021	Matched case control study **Table. Change in Estimated Messenger RNA Vaccine Effectiveness Against Laboratory-Confirmed SARS-CoV-2 Infections, January to September 2021** Adjusted vaccine effectiveness by month from full vaccination, % (95% CI)[a] Month / Pre-Delta (January to April) / Rising Delta (May to June) / High Delta (July to September) 1 / 94.5 (90.7-96.7) / 92.1 (87.2-95.1) / 62.0 (45.6-73.5) 2 / 88.5 (86.1-90.5) / 90.6 (87.8-92.7) / 60.9 (51.5-68.4) 3 / 87.9 (85.9-89.5) / 87.3 (80.8-91.7) / 57.8 (52.5-62.5) 4 / NA / 86.6 (83.0-89.5) / 38.3 (33.5-42.7) 5 / NA / 67.3 (63.2-70.9) / 18.9 (13.7-23.8) 6 / NA / NA / 18.4 (13.3-23.3) 7 / NA / NA / 23.4 (17.3-29.0) 8 / NA / NA / 24.8 (18.8-30.4) **Figure. Estimated Messenger RNA Vaccine Effectiveness Against SARS-CoV-2 Infection by Delta Variant Period, January to September 2021** 

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<td>75</td>
<td>Machado et al (December 14, 2021)</td>
<td>Portugal</td>
<td>Non-institutionalized 65-<110 year olds</td>
<td>Alpha, Delta</td>
<td>Comirnaty mRNA-1273 ChAdOx1</td>
<td>February 2 (80+) or March 30 (65-79) - August 2021</td>
<td>Cohort study linking administrative databases.
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<tr><td>42-69 days</td><td>68 (64-71)</td><td>64 (53-72)</td><td>97 (94-98)</td><td>81 (66-90)</td><td>97 (92-98)</td><td>88 (78-94)</td></tr>
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<tr><td>70-97 days</td><td>59 (53-64)</td><td>53 (43-62)</td><td></td><td>74 (60-84)</td><td></td><td>86 (78-91)</td></tr>
<tr><td>98+ days</td><td>39 (29-48)</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>98-123 days</td><td></td><td>50 (40-59)</td><td></td><td>74 (58-83)</td><td></td><td>80 (71-86)</td></tr>
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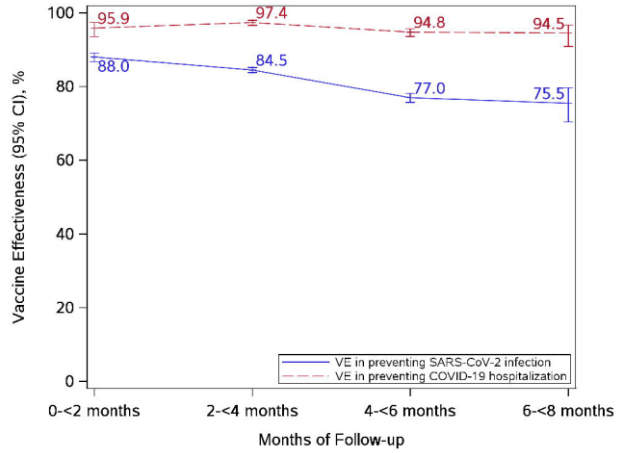
<td>USA</td>
<td>≥18 year olds Kaiser Permanente insured patients</td>
<td>NonVOC, Alpha, Delta</td>
<td>mRNA-1273</td>
<td>December 18, 2020-September 30, 2021</td>
<td>Cohort study

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73	Berec et al (December 12, 2021)	Czech Republic	General population	Alpha, Delta	Comirnaty mRNA-1273 ChAdOx1 Ad26.COV2.S	December 27, 2020-November 21, 2021	Cohort study of population of Czech Republic using adminsitrative databases, evaluating duraiton of protection of primary and ve of boosted mRNA.

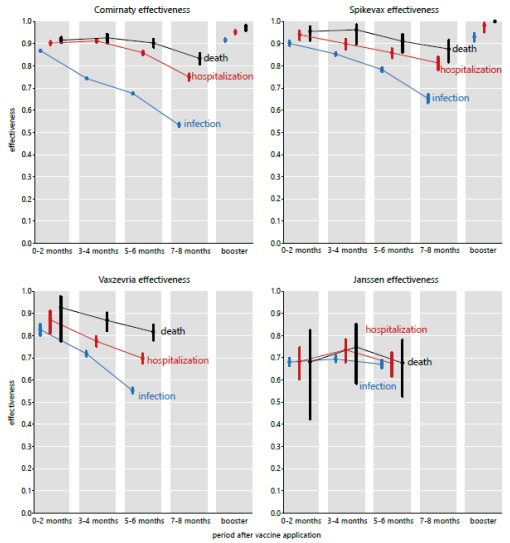
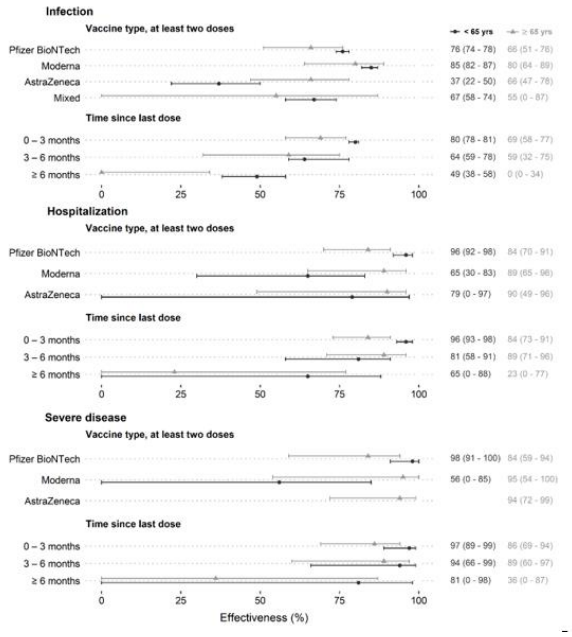
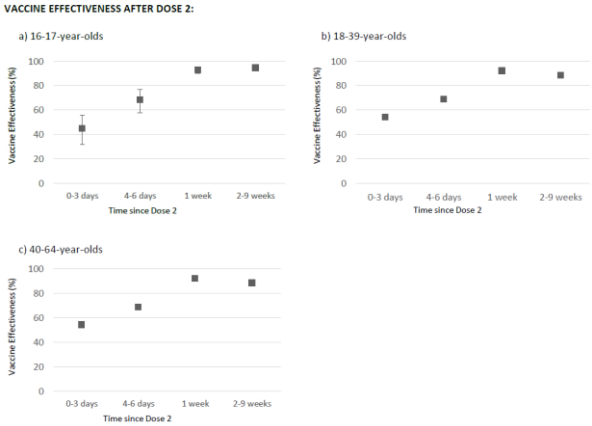


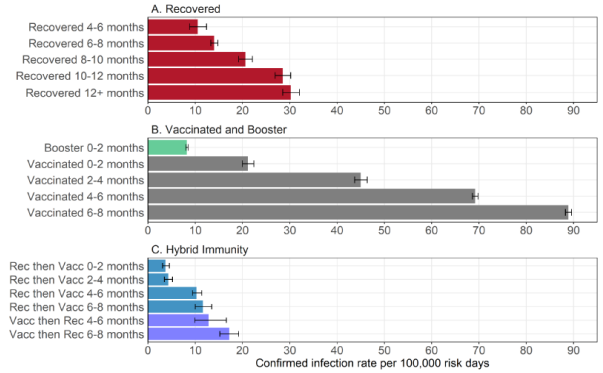
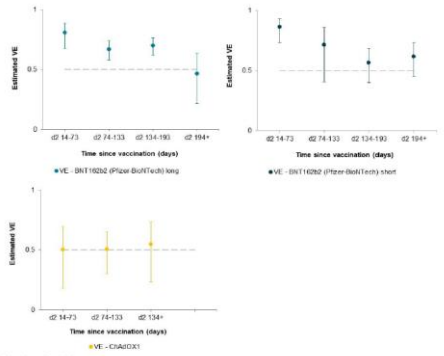
Fig. 2. Vaccine-acquired immunity against infection with respect to the delay from the full vaccine application, including the effect of a booster vaccine dose.

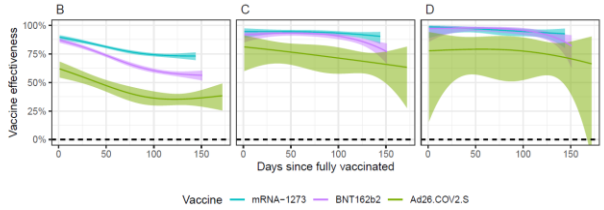
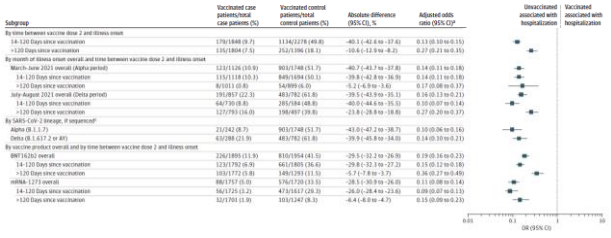
Table 1. Estimated increase of breakthrough infection hazard ratios (HRs) in times of the SARS-CoV-2 delta variant dominance for age groups having started vaccination in the same month.

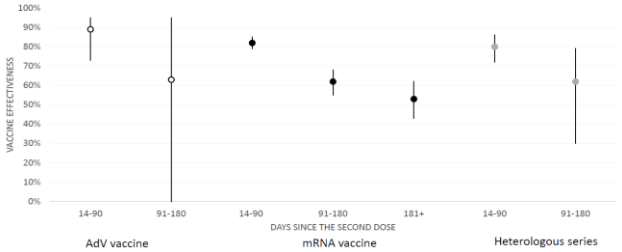
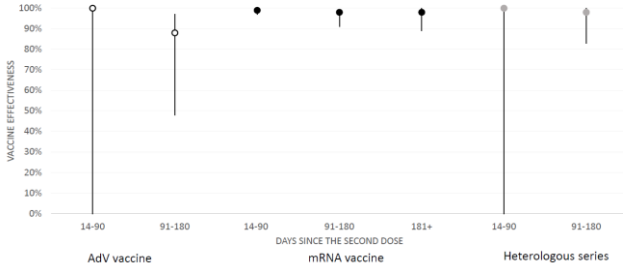
Vaccine	March (age 70-80y)		April (age 55-69y)		May (age 35-54y)	
	HR	95% CI	HR	95% CI	HR	95% CI
Comirnaty	1.28	1.09-1.52	1.04	0.95-1.14	1.33	1.27-1.40
Spikevax	0.82	0.41-1.67	1.56	1.08-2.25	1.59	1.29-1.98
Vaxzevria	1.64	1.05-2.57	1.12	0.74-1.70	1.24	0.82-1.86
Janssen	2.70	0.37-19.63	0.40	0.20-0.78	0.91	0.34-2.43

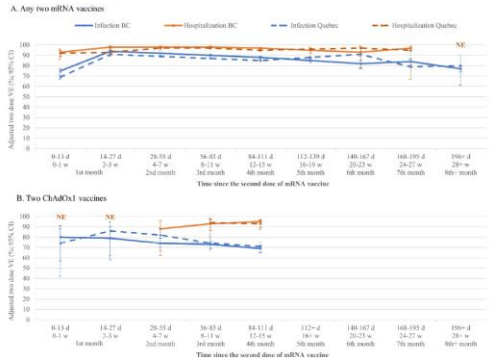
72	Bjork et al (December 9, 2021)	Sweden	General population	Alpha, Delta	Comirnaty mRNA-1273 ChAdOx1	December 27, 2020-November 2, 2021	Case-control study based on surveillance data, matching on age/sex and no adjustment for other confounders. 
71	Kshirsagar et al (December 9, 2021)	USA	Fully vaccinated persons	NonVOCs, Alpha, Delta	Comirnaty mRNA-1273 Ad26.COV2.S	March 10-October 14, 2021	Cohort study of fully vaccinated persons evaluating risk of reinfection by vaccination. There was an increase in the rate of hospitalization starting ~110-125 days after full vaccination for all three vaccines depending on age group, with a steeper increase for Janssen.

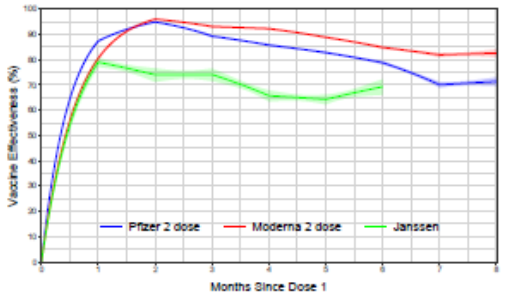
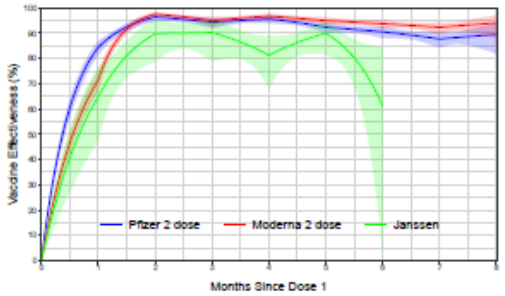
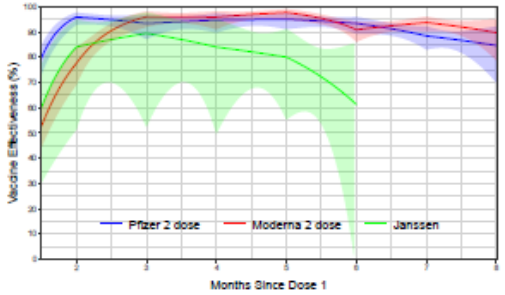
70	Powell et al (December 11, 2021)	UK	General population with a focus on adolescents	Delta	Comirnaty	Week 32(~Aug 15) (16-17yo) and Week 37 (12-15 yo and week 15-21 for adults)-November 23	TND study among adolescents as well as various adults age groups. 
69	Bajema et al (December 9, 2021)	USA	Veterans	nonVOCs, Alpha, Delta	Comirnaty mRNA-1273	February 1–September 30, 2021	TND among 1,896 U.S. veterans. Adjusted VE against hospitalization 14–119 days following 2nd dose of Moderna vaccine dose was 89.6% (95% CI = 80.1%–94.5%) and after the 2nd Pfizer-BioNTech dose was 86.0% (95% CI = 77.6%–91.3%); at ≥120 days VE was 86.1% (95% CI = 77.7%–91.3%) for Moderna and 75.1% (95% CI = 64.6%–82.4%) for Pfizer-BioNTech.

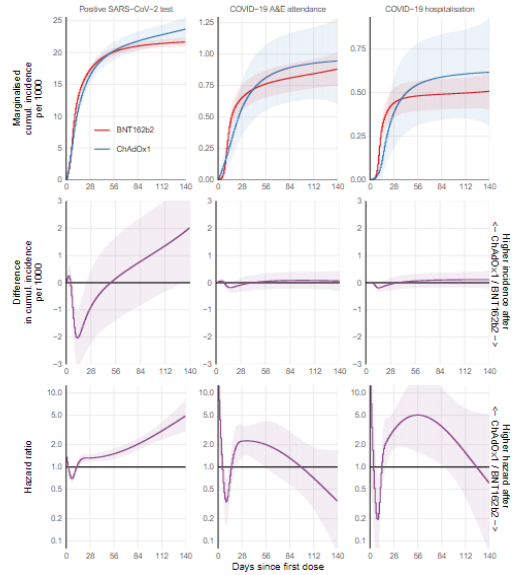
67	Goldberg et al (December 5, 2021)	Israel	General population	Delta	Comirnaty	August 1-September 31, 2021	Analysis of surveillance data comparing the following groups: Recovered: Previously infected individuals 90 or more days after confirmed infection who had never been vaccinated; Recovered then Vaccinated: Previously infected individuals who later were 7 or more days after receiving a single vaccine dose; Vaccinated then Recovered: Individuals who had been vaccinated with one or two doses and were later infected; Vaccinated: Individuals seven days or more after receiving the second dose, and who had not been infected before the start of the study period; Booster: Individuals who received a third (booster) dose 12 or more days previously and had not been infected before the start of the study period.  *Figure 3: Estimated covariate-adjusted rates of confirmed infections per 100,000 at-risk days obtained from the Poisson regression analysis for the study period August 1, 2021, to September 30, 2021, stratified by sub-cohorts. Confidence intervals are not adjusted for multiplicity.*
64	Hall et al (December 1, 2021)	UK	18+ year HCWs	Alpha→Delta	Comirnaty AZD2222	December 7, 2020-September 21, 2021	Cohort study of HCWs looking a VE against infection over time in those with and without prior infection. Pfizer long interval is doses separated by ≥6 weeks; short interval by <6 weeks **Figure 1: Adjusted Vaccine Effectiveness over time after two doses: BNT162b2 (Pfizer-BioNTech) short and long interval and ChAdOX1 (combined short and long interval)** 

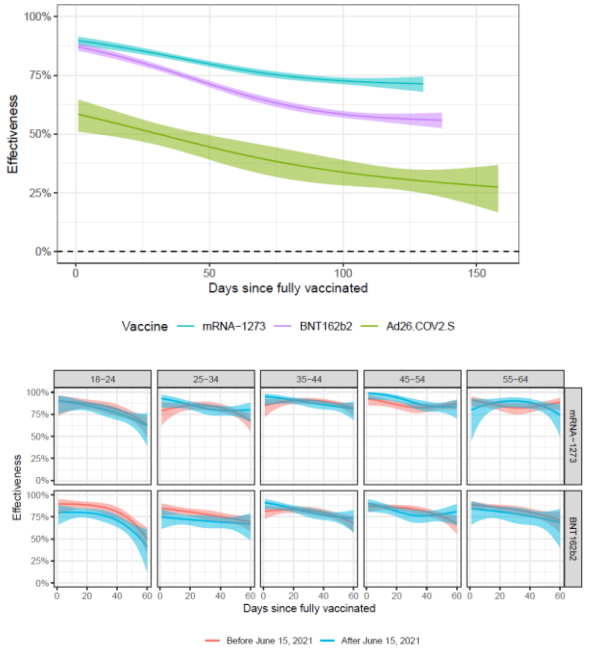
2	Israel et al (November 25, 2021) (updated with results from publication, see ref 2 below)	Israel	18+ years	Delta	Comirnaty	May 15-September 17, 2021	Test-negative design case control using administrative database of Leumit Health Services among 2-dose vaccine recipients. Compared with the initial 90 days after the vaccine, they found an increased risk of infection with time elapsed since vaccination. **Table 4 | Adjusted odds ratios for risk of SARS-CoV-2 in matched cohort** Adjusted odds ratio (95% CI) / P value Time since second vaccine (days): 21-89: Reference / — 90-119: 2.37 (1.67 to 3.36) / <0.001 120-149: 2.66 (1.94 to 3.66) / <0.001 150-179: 2.82 (2.07 to 3.84) / <0.001 ≥180: 2.82 (2.07 to 3.85) / <0.001 Age (continuous in years): 1.01 (1.00 to 1.01) / 0.008 Male sex: 1.05 (0.99 to 1.11) / 0.08 Socioeconomic status (continuous 1-20): 0.97 (0.96 to 0.98) / <0.001 Based on a conditional regression model fitted in a cohort matched for week of testing, age category (<18-39, 40-59, ≥60 years), and demographic group.
63	Irizarry et al (November 19, 2021)	USA (Puerto Rico)	12+ years	Predelta and delta	Comirnaty mRNA-1273 Ad26.COV2.S	December 15, 2020-October 15, 2021	Analysis of surveillance data linked to immunization registry data. VE against B) Infection c) Hospitalizations D) death by time since 2 weeks post complete series completion. Shading represents 99% CI. 
61	Andrews et al (November 15, 2021)	UK	50+	Delta	Comirnaty AZD2222	September 13-November 1, 2021	TND booster dose study that also calculated the VE of a 2nd dose >140 days after receipt of the 2nd dose. VE against symptomatic diseaes for two doses of ChAdOx1-S and BNT162b2 ≥20 weeks after being given were 44.1% (41.9 to 46.1) and 62.5% (61.0 to 63.9), respectively.
59	Tenforde et al (November 4, 2021)	USA	Hospitalized patients	Mix, alpha, and delta	Comirnaty mRNA-1273	March 11-August 15, 2021	Case-control study among hospitalized patients. When the mRNA-1273 and BNT162b2 vaccines were compared, estimated vaccine effectiveness was similar within 120 days of vaccination. In contrast, beyond 120 days, the results corresponded to an estimated effectiveness of 85% for the mRNA-1273 and 64% for the BNT162b2 vaccine to prevent COVID-19 hospitalizations. 

58	Poukka et al (November 4, 2021)	Finland	16-69 year old HCWs	Mix and delta	Comirnaty mRNA-1273 AZD2222 heterologous	December 27,2020-August 26 (infection) October 26 (hospitalization), 2021	HCW cohort study based on registries. No difference seen between delta and pre-delta periods. VE against infection  VE against hospitalization 

56	Skowronski et al (October 26, 2021)	Canada	General population	Alpha, Gamma, Delta	AZD1222 Comirnaty mRNA-1273 And heterologous schedules of the above	May 30-Oct 2, 2021	TND study in BC and Quebec. In both provinces, two-dose mRNA VE ≥95% against hospitalization was maintained through the seventh month post-vaccination. Two-dose mRNA VE against any infections peaked above 90% at 2–3 weeks post-vaccination, but remained about 80% or more through the eighth month. Given greater sample size, findings are most robust for BNT162b2 with similar pattern for mRNA-1273 and mixed mRNA or ChAdOx1/mRNA recipients, recognizing limited follow-up beyond the fourth or fifth month. For homologous two-dose ChAdOx1 recipients, VE ≥70% was also maintained for at least the fourth month post-vaccination. There was no indication of greater decline in two-dose protection against Delta. Among adults ≥70-years-old, mRNA VE was ≥80% against infection and ≥90% against hospitalization to at least the fifth month. **Figure 3. Adjusted two-dose vaccine effectiveness against infection and hospitalization, by time since vaccination, mRNA and ChAdOx1 vaccines, ≥18-year-olds, British Columbia and Quebec, Canada** 

55	Lin et al (October 26, 2021)	USA	General population	multiple	Comirnaty mRNA-1273 Ad26.COV2.S	December 13, 2020-Sept 8, 2021	Administrative database cohort study in North Carolina. For Pfizer two-dose,VE peaks at 94.9% (95% CI, 94.5 to 95.2) at 2 months (post the first dose). VE starts to decline after 2 months and drops to 70.1% (95% CI, 68.9 to 71.2) after 7 months. For Moderna two-dose,VE peaks at 79.0% (95% CI, 77.1 to 80.7) at 2 months (post the first dose). VE starts to decline after 2 months and is 81.9% (95% CI, 81.0 to 82.7after 7 months. For the Janssen one-dose regimen, vaccine effectiveness ramps to a peak level of 79.0% (95% CI, 77.1 to 80.7) at 1 month. Effectiveness starts to decline after 1 month and drops to 64.3% (95% CI, 62.3 to 66.1) after 5 months. **A. COVID-19**  **B. Hospitalization**  **C. Death** 

54	Nordstrom et al (October 25, 2021)	Sweden	General population	Alpha, Delta,	AZD1222 Comirnaty mRNA-1273 And AZD1222→ mRNA-1273	January 12-October 4, 2021	National cohort study based on database linkage. Vaccine effectiveness of BNT162b2 against infection waned progressively from 92% (95% CI, 92-93, P<0·001) at day 15-30 to 47% (95% CI, 39-55, P<0·001) at day 121-180, and from day 211 and onwards no effectiveness could be detected (23%; 95% CI, -2-41, P=0·07). The effectiveness waned slightly slower for mRNA-1273, being estimated to 59% (95% CI, 18-79) from day 181 and onwards. In contrast, effectiveness of ChAdOx1 nCoV-19 was generally lower and waned faster, with no effectiveness detected from day 121 and onwards (-19%, 95% CI, -97-28), whereas effectiveness from heterologous ChAdOx1 nCoV-19 / mRNA was maintained from 121 days and onwards (66%; 95% CI, 41-80). Overall, vaccine effectiveness was lower and waned faster among men and older individuals. For the outcome severe Covid-19, effectiveness waned from 89% (95% CI, 82-93, P<0·001) at day 15-30 to 42% (95% CI, -35-75, P=0·21) from day 181 and onwards, with sensitivity analyses showing notable waning among men, older frail individuals, and individuals with comorbidities.
52	Hulme et al (October 18, 2021)	UK	HCW	Alpha, delta	Comirnaty AZD1222	January 4-June 13	Comparative VE Cohort study of HCWs based on linking databases who were vaccinated with AZD1222 or Comirnaty between January 4-February 28, 2021 who were followed for 20 weeks. **Figure 2: Comparative effectiveness** For each outcome based on the fully adjusted model, the marginal cumulative incidence for ChAdOx1 and BNT162b2, their difference, and the hazard ratio are shown. Models that assumed piecewise-constant hazards gave similar effect estimates (supplementary Figure S2). The models with less extensive confounder adjustment gave very similar estimates (supplementary Figure S1) suggesting that recipients of each vaccine were similar after accounting for differences in vaccine allocation over space and time (as did all models). 

51	Robles-Fontan et al (October 18, 2021)	USA (Puerto Rico)	General population	Multiple, with delta time frame analysis	Comirnaty mRNA-1273 Ad26.COV2.S	December 15,2020-October 1, 2021	Cohort study of Puerto Rican population.  Figure S2: Time varying effectiveness estimates by age group and vaccine manufacturer before and after arrival of the Delta variante. The ribbons represent point-wise 99% confidence intervals.

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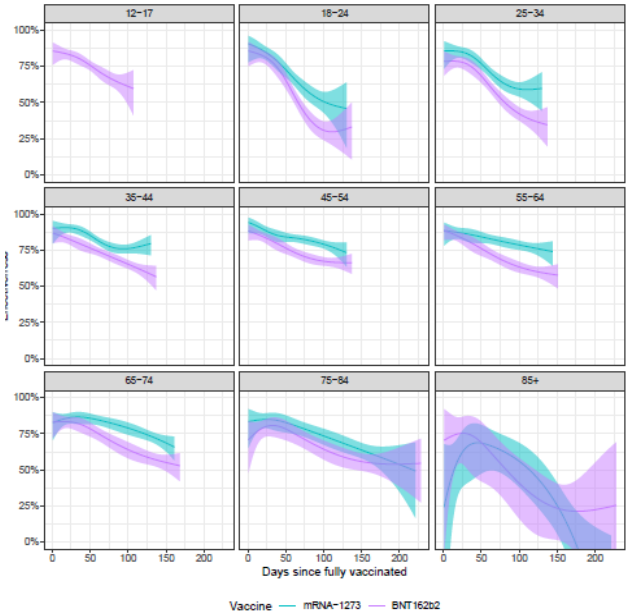
<td> 
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<td>50</td>
<td>De Gier et al (October 14, 2021)</td>
<td>Netherlands</td>
<td>General population</td>
<td>Delta</td>
<td>Comirnaty mRNA-1273 Ad26.COV2.S AZD1222</td>
<td>August 9-September 24, 2021</td>
<td>Study of unvaccinated and vaccinated index cases and their contacts to evaluate transmission. They did not have sufficent sample size but evaluated if VE against transmission differed by time since vaccination of the index case

Table S2. Secondary attack rate of SARS-CoV-2 and VET adjusted for time since full vaccination of the contact (< or >= 60 days, only in analysis of fully vaccinated contacts), age group of the index case and contact and week of notification date of the index case, stratified by time since full vaccination of the index case.
<table>
<tr><th>Analysis</th><th>Unvaccinated index - infected contacts / all contacts (SAR)</th><th>Index fully vaccinated < 60 days ago - infected contacts / all contacts (SAR)</th><th>Index fully vaccinated < 60 days ago - adjusted VET (%) (95% CI)</th><th>Index fully vaccinated >= 60 days ago - infected contacts / all contacts (SAR)</th><th>Index fully vaccinated >= 60 days ago - adjusted VET (%)(95% CI)</th></tr>
<tr><td>Unvaccinated household contacts</td><td>547/2517 (22%)</td><td>24/209 (11%)</td><td>67 (47;79)</td><td>14/94 (15%)</td><td>55 (19;76)</td></tr>
<tr><td>Fully vaccinated household contacts</td><td>164/1505 (11%)</td><td>99/1278 (8%)</td><td>57 (40;69)</td><td>157/792 (20%)</td><td>28 (-4;50)</td></tr>
</table></td>
</tr>
</table>

49	Janssen Briefing document for US FDA (October 14, 2021)	multiple	General population	Multiple	Ad26.COV2.S	September 21, 2020-July 9, 2021	Final results from RCT

Figure 2: Vaccine Efficacy Over Time of Molecularly Confirmed Moderate to Severe/Critical COVID-19 with Onset at Least 1 Day After Vaccination, PP Set (Seronegative; Study VAC31518COV3001) Final Analysis of Double-Blind Phase

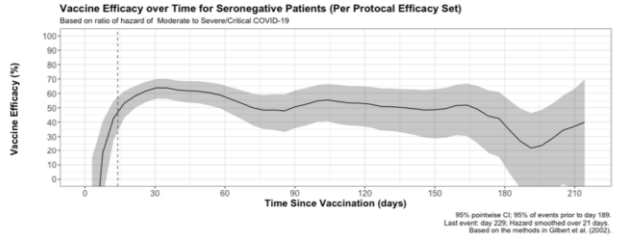
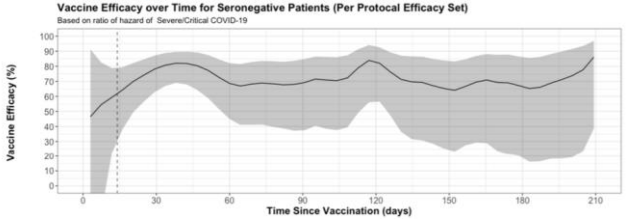
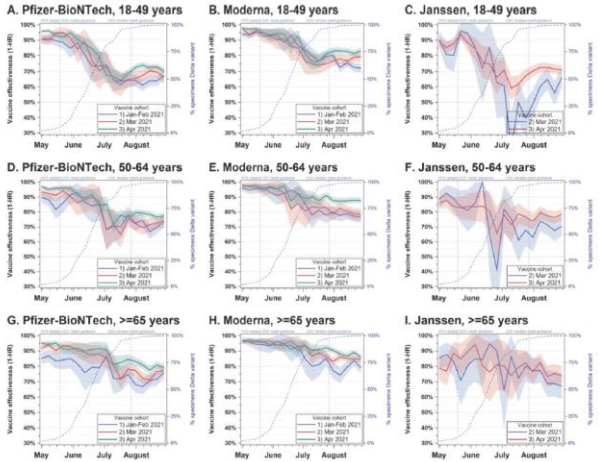


Table 3: Vaccine Efficacy of Molecularly Confirmed Moderate to Severe/Critical COVID-19 with Onset at Least 1 Day After Vaccination; Per Protocol Set Final Analysis of Double-Blind Phase Study (VAC31518COV3001)

	Ad26 5e10 vp #Cases (N) PY		Placebo #Cases (N) PY		VE% (95% CI)
Analysis set: PP	(19577)		(19608)		
Moderate to severe/critical[a]					
Day 2 to Day 14	82 (19577)	748.66	88 (19608)	749.83	6.7% (-27.54; 31.77)
Day 15 to Day 28	51 (19400)	1483.44	184 (19398)	1480.09	72.3% (62.10; 80.13)
Day 29 to Day 56	119 (19113)	2877.42	306 (18924)	2837.44	61.7% (52.46; 69.23)
Day 57 to end DB Phase	314 (17586)	6460.98	573 (17090)	6158.91	47.8% (39.95; 54.62)
Day 57 to Day 112	157 (17586)	5040.02	308 (17090)	4860.10	50.8% (40.24; 59.70)
Day 113 to end DB Phase	157 (11379)	4900.35	265 (10572)	4529.34	45.2% (33.04; 55.34)

Figure 4: Vaccine Efficacy Over Time of Molecularly Confirmed Severe/Critical COVID-19 with Onset at Least 1 Day After Vaccination, PP Set (Seronegative; Study VAC31518COV3001) Final Analysis of Double-Blind Phase



<table>
<tr>
<td>48</td>
<td>Rosenberg et al (October 9, 2021)</td>
<td>USA</td>
<td>General adult population of New York</td>
<td>Delta for part of study period</td>
<td>Comirnaty mRNA-1273 Ad26.COV2.S</td>
<td>May 1-September 3, 2021</td>
<td>Cohort study based on adminsitrative datbases. Estimated VE for cases declined contemporaneously across age, products, and time-cohorts. VE for hospitalization for adults 18-64 years was >86% across cohorts, without time trend.
 
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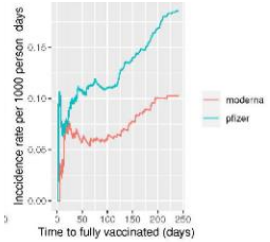
<tr>
<td>47</td>
<td>Liu et al (October 7, 2021)</td>
<td>USA</td>
<td>General population of NYC</td>
<td>Alpha, Delta, others</td>
<td>Comirnaty mRNA-1273</td>
<td>January 18-September 21, 2021</td>
<td>Hospital database cohort study. They found that there was an increased incidence rate with the increased time from vaccination, especially 120 days after vaccination.
 

<table>
<tr><th></th><th colspan="3">Pfizer/BNT162b2</th><th colspan="3">Moderna/mRNA-1273</th></tr>
<tr><th>Time to fully vaccination</th><th>Total person-days at risk[1]</th><th>Incidence</th><th>Incident rate / 1000 person-days</th><th>Total person-days at risk</th><th>Incidence</th><th>Incident rate / 1000 person-days</th></tr>
<tr><td>210-240 days</td><td>3074</td><td>6</td><td>1.952</td><td>443</td><td>1</td><td>2.257</td></tr>
<tr><td>180-210 days</td><td>16811</td><td>24</td><td>1.428</td><td>5543</td><td>5</td><td>0.902</td></tr>
<tr><td>150-180 days</td><td>34847</td><td>16</td><td>0.459</td><td>16525</td><td>6</td><td>0.363</td></tr>
<tr><td>120-150 days</td><td>66486</td><td>27</td><td>0.406</td><td>32243</td><td>7</td><td>0.217</td></tr>
<tr><td>90-120 days</td><td>105697</td><td>15</td><td>0.142</td><td>52162</td><td>5</td><td>0.096</td></tr>
<tr><td>60-90 days</td><td>150864</td><td>16</td><td>0.106</td><td>74806</td><td>5</td><td>0.067</td></tr>
<tr><td>30-60 days</td><td>203392</td><td>26</td><td>0.128</td><td>100706</td><td>5</td><td>0.050</td></tr>
<tr><td>0-30 days</td><td>259596</td><td>26</td><td>0.100</td><td>126977</td><td>8</td><td>0.063</td></tr>
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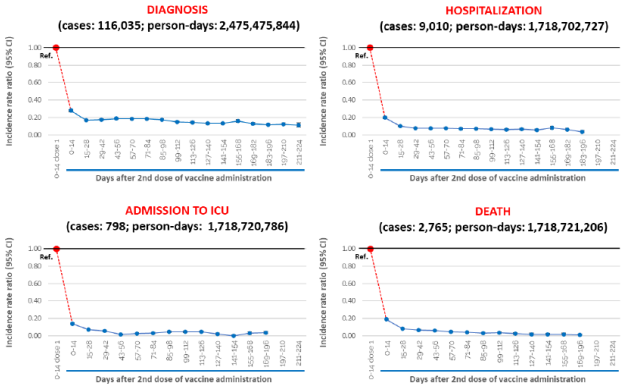
<td>46</td>
<td>Italian Instituo Superiore di Sanita (September 30, 2021)</td>
<td>Italy</td>
<td>≥16 year old general population who received at least 1 dose of mRNA vaccine</td>
<td>Alpha, Delta</td>
<td>Comirnaty mRNA-1273</td>
<td>December 27, 2020-August 29, 2021</td>
<td>Compared different time points post vaccination dose 2 to day 0-14 post dose 1. They did not observe a reduction of the protective effect of vaccination, against symptomatic or asymptomatic COVID-19 diagnosis, after about seven months since the 2nd dose (VE 89%), nor against diagnosis with subsequent hospitalization (VE 96%), admission to ICU (VE 96%), or death (VE 99%) after about 6 months. Persons >80+, nursing home residents, persons with comorbidities or immunocompromised did see a decline in VE against infection though confidence intervals are wide for the latter.

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<td>45</td>
<td>Martinez Bas et al (September 30, 2021)</td>
<td>Spain</td>
<td>≥18 year old general population</td>
<td>Alpha, Delta</td>
<td>Comirnaty mRNA-1273
AZD1222
Ad26.COV2.S</td>
<td>April 1-August 31, 2021</td>
<td>Cohort study of contacts of cases.
<table>
<tr><td></td><td colspan="2">Adjust VE (95% CI)</td></tr>
<tr><td></td><td><90 days since last dose</td><td>≥90 days since last dose</td></tr>
<tr><td>unvaccinated</td><td>REF</td><td>REF</td></tr>
<tr><td>1 dose of Janssen</td><td>52 (44-59)</td><td>28 (-8-53)</td></tr>
<tr><td>1 dose of Spikevax</td><td>65 (56-73)</td><td>NA</td></tr>
<tr><td>2 doses of Spikevax</td><td>85(80-88)</td><td>67 (50-78)</td></tr>
<tr><td>1 dose of Comirnaty</td><td>57 (51-61)</td><td>NA</td></tr>
<tr><td>2 doses of Comirnaty</td><td>70 (67-73)</td><td>63 (58-68)</td></tr>
<tr><td>1 dose of Vaxzervia</td><td>40 (31-47)</td><td>52 (37-64)</td></tr>
<tr><td>2 doses of Vaxzervia</td><td>54 (47-60)</td><td>NA</td></tr>
<tr><td>1 dose of Vaxzervia+1 dose of Comirnaty</td><td>85 (69-93)</td><td>NA</td></tr>
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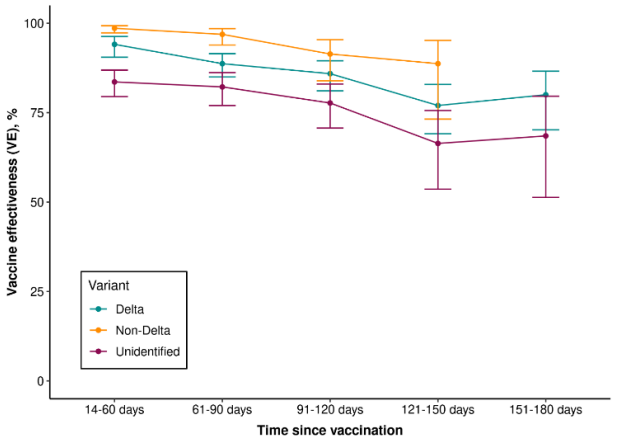
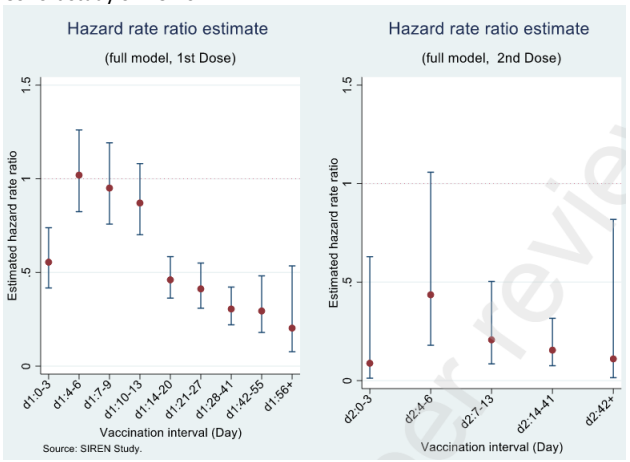
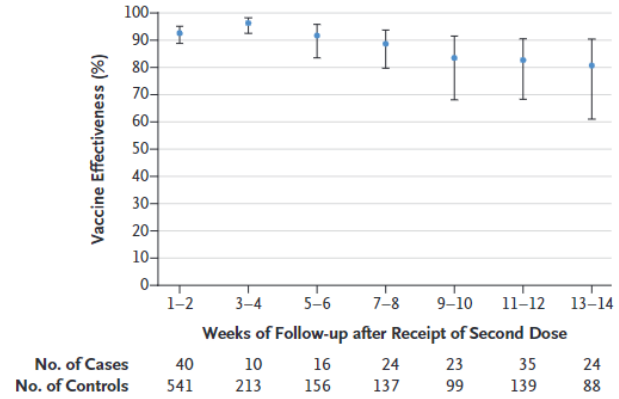
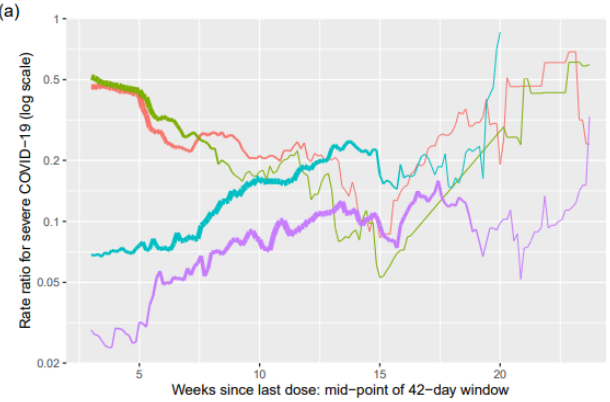
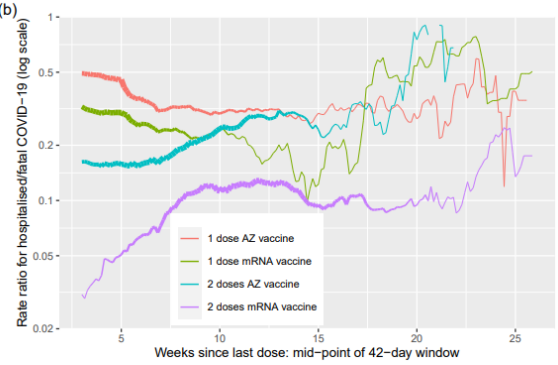
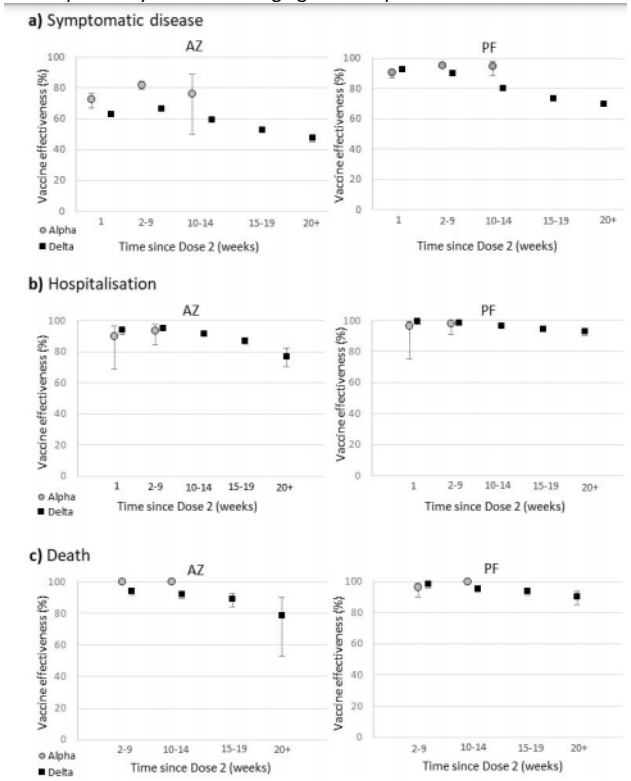
44	Bruxvoort et al (October 1, 2021)	USA	General population	Delta, Alpha+others	mRNA-1273	March 1-July 27, 2021	TND study among persons insured by Kaiser Permante Southern California. 
43	Payne et al (July 21, 2021)	UK	HCWs	Alpha	Comirnaty	December 7, 2020-March 12, 2021	Cohort study of HCWs 
41	Eyre et al (September 29, 2021)	UK	contacts of symptomatic and asymptomatic SARS-CoV-2-infected index cases	Alpha/Delta	Comirnaty AZD1222	January 1-July 31, 2021	Transmission study. Independently of contact vaccination status, for each doubling of weeks since 14 days after second vaccinationin index cases, the odds of a contact testing PCR-positive increased 1.13-fold (95%CI 1.09-1.17) for ChAdOx1 and 1.20-fold (1.10-1.31) for BNT162b2 with no evidence of a difference between vaccines (p=0.19). Higher probabilities of PCR-positive results in contacts 14 days after second vaccination for Delta vs. Alpha meant that by 12 weeks post second ChAdOx1 dose there was no evidence that onward Delta transmission rates differed between those not vaccinated and those having received two ChAdOx1dosesand the impact of BNT162b2had also attenuatedsubstantially

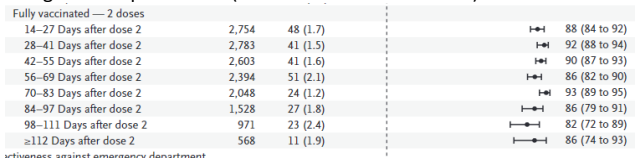
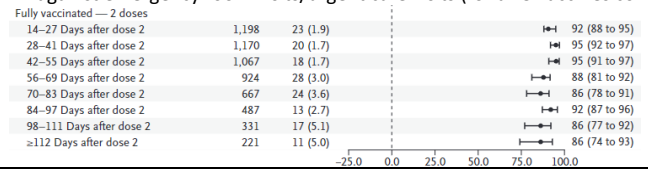
<table>
<tr>
<td>40</td>
<td>Nunes et al (September 23, 2021)</td>
<td>Portugal</td>
<td>Cohort of 80-109 year olds</td>
<td>Multiple</td>
<td>Comirnaty mRNA-1273</td>
<td>February 2-August 13, 2021</td>
<td>Cohort study done by linking adminsitrative records. VE against hospitalization in persons ≥ 98 days post dose 2 was 89% (71–96) compared to 14-41 days post dose 2 was 81% (64–91). VE against COVID-19-related deaths in persons ≥ 98 days post dose 2 was 74% (60–83) compared to 14-41 days post dose 2 was 86% (68–93). Neither were statisically different.
<table>
<tr><th>Outcome by vaccine status</th><th>Person-years</th><th>Events (n)</th><th>Rate</th><th>Rate ratio</th><th>95% CI</th><th>Confounder-adjusted HR</th><th>95% CI</th><th>VE</th><th>95% CI</th></tr>
<tr><td colspan="10">Hospitalisation</td></tr>
<tr><td>14 to 41 days</td><td>32,505</td><td>10</td><td>0.31</td><td>0.03</td><td>0.01–0.05</td><td>0.18</td><td>0.09–0.36</td><td>82</td><td>64–91</td></tr>
<tr><td>42 to 69 days</td><td>32,059</td><td>11</td><td>0.34</td><td>0.03</td><td>0.02–0.05</td><td>0.19</td><td>0.09–0.39</td><td>81</td><td>61–91</td></tr>
<tr><td>70 to 97 days</td><td>31,161</td><td>16</td><td>0.51</td><td>0.04</td><td>0.03–0.07</td><td>0.22</td><td>0.12–0.43</td><td>78</td><td>57–88</td></tr>
<tr><td>≥98 days</td><td>33,321</td><td>6</td><td>0.18</td><td>0.02</td><td>0.01–0.03</td><td>0.11</td><td>0.04–0.29</td><td>89</td><td>71–96</td></tr>
<tr><td colspan="10">Death</td></tr>
<tr><td>14–41 days</td><td>32,506</td><td>7</td><td>0.22</td><td>0.02</td><td>0.01–0.05</td><td>0.14</td><td>0.07–0.32</td><td>86</td><td>68–93</td></tr>
<tr><td>42–69 days</td><td>32,062</td><td>13</td><td>0.41</td><td>0.05</td><td>0.03–0.08</td><td>0.16</td><td>0.09–0.30</td><td>84</td><td>70–91</td></tr>
<tr><td>70–97 days</td><td>31,164</td><td>20</td><td>0.64</td><td>0.07</td><td>0.05–0.11</td><td>0.13</td><td>0.08–0.23</td><td>87</td><td>77–92</td></tr>
<tr><td>≥98 days</td><td>33,326</td><td>51</td><td>1.53</td><td>0.17</td><td>0.13–0.22</td><td>0.26</td><td>0.17–0.40</td><td>74</td><td>60–83</td></tr>
</table>
</td>
</tr>
<tr>
<td>37</td>
<td>Pilishvili et al (September 22, 2021)</td>
<td>USA</td>
<td>HCW</td>
<td>Multiple</td>
<td>Comirnaty mRNA-1273</td>
<td>December 28-May 19, 2021</td>
<td>TND case control among HCWs evaluated VE every 2 weeks for 14 weeks.


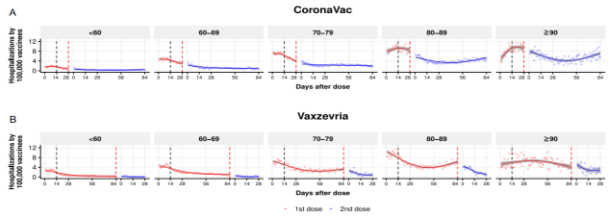
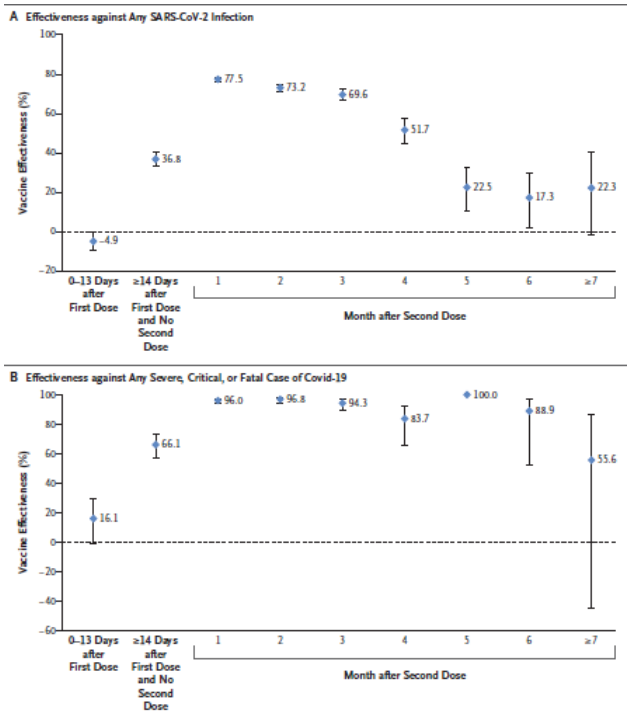
</td>
</tr>
<tr>
<td>36</td>
<td>El Sahly et al (September 22, 2021)</td>
<td>USA</td>
<td>RCT participants</td>
<td>Multiple</td>
<td>mRNA-1273</td>
<td>July 27, 2020-March 26, 2021</td>
<td>Findings from the double blinded placebo controlled RCT. VE against disease was similar at 2 weeks-<2 months (91.8%), 2 months-<4 months (94%), and ≥4 months (92.4%) post dose 2</td>
</tr>
</table>

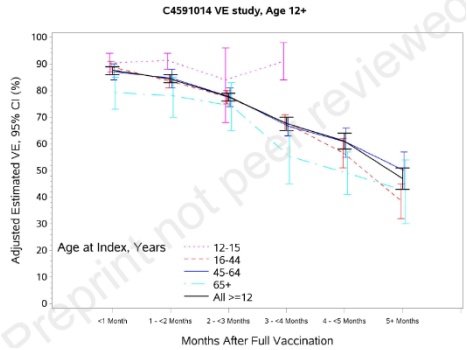
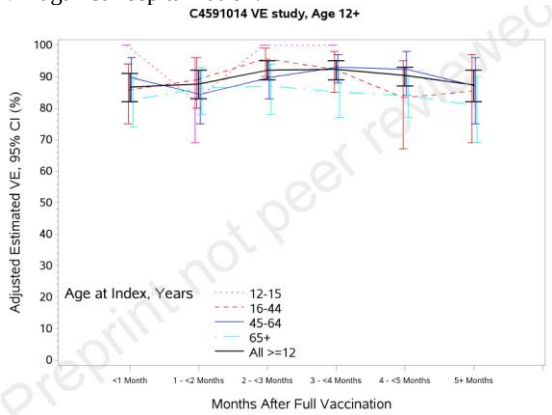
<table>
<tr><td>35</td><td>Baden et al (September 22, 2021)</td><td>USA</td><td>≥18-year-old RCT participants</td><td>Delta</td><td>mRNA-1273</td><td>July 1-August 27, 2021</td><td>RCT participants were followed after unblinding. Initial vaccine recipients (mRNA-1273e) were vaccinated between 7/27/20-12/16/20 while those vaccinated after unblinding (mRNA-1273p) were vaccianted between 12/29/20-4/30/21. Median follow-up times from the first dose were 13 months in the mRNA-1273e (including double-blind and open-label phases) and 7.9 months in the mRNA-1273p (only open-label phase) groups. While there was a significant difference in disease incidence rates between the groups, there was no difference in severe disease incidence rates though numbers are small.
<table>
<tr><th></th><th colspan="3">mRNA-1273e N=14746</th><th colspan="3">mRNA-1273p* N=11431</th><th>mRNA-1273p vs mRNA-1273e</th></tr>
<tr><th>Covid-19 Cases†</th><th>Cases n</th><th>Person-yr</th><th>Rate/1000 Person-yr</th><th>Cases n</th><th>Person-yr</th><th>Rate/1000 Person-yr</th><th>Reduction of observed incidence rate % (95% CI)</th></tr>
<tr><td>All cases</td><td>162</td><td>2102</td><td>77.1</td><td>88</td><td>1796</td><td>49.0</td><td>36.4 (17.1-51.5)</td></tr>
<tr><td>≥18-<65 yr</td><td>136</td><td>1558</td><td>87.3</td><td>68</td><td>1289</td><td>52.8</td><td>39.6 (18.6-55.5)</td></tr>
<tr><td>≥65 yr</td><td>26</td><td>544</td><td>47.8</td><td>20</td><td>507</td><td>39.5</td><td>17.4 (-53.9-56.3)</td></tr>
<tr><td>Severe</td><td>13</td><td>2102</td><td>6.2</td><td>6</td><td>1796</td><td>3.3</td><td>46.0 (-52.4-83.2)</td></tr>
<tr><td>≥18-<65 yr</td><td>7</td><td>1558</td><td>4.5</td><td>4</td><td>1289</td><td>3.1</td><td>30.9 (-171.7- 85.2)</td></tr>
<tr><td>≥65 yr</td><td>6</td><td>544</td><td>11.0</td><td>2</td><td>507</td><td>3.9</td><td>64.2 (-100.2-96.5)</td></tr>
</table></td></tr>
<tr><td>34</td><td>Hagan et al (September 21, 2021)</td><td>USA</td><td>Incarcerated persons</td><td>Delta</td><td>Comirnaty
mRNA-1273
Ad26.COV2.S</td><td>July 11-August 14, 2021</td><td>Outbreak investigation in a prison found that the attack rate among fully vaccinated persons was significantly higher in those vaccinated 4-6 months ago (89%) compared to those vaccinated 2 weeks-2 months ago (61%). This was combined for 3 vaccines used in the population.</td></tr>
<tr><td>33</td><td>Thomas et al (September 15, 2021)</td><td>Multiple</td><td>≥12-year-old RCT participants</td><td>Multiple</td><td>Comirnaty</td><td>July 27, 2020-March 13, 2021</td><td>Findings from the double blinded placebo controlled RCT. VE against disease was 96.2% (93.3-98.1) at 7 days-<2 months, 90.1% (86.6-92.9) at 2 months-<4 months, and 83.7% (74.7-89.9) at ≥4 months post dose 2.
<table>
<tr><th rowspan="2">Efficacy End Point</th><th colspan="3">BNT162b2 (N=23,040)</th><th colspan="3">Placebo (N=23,037)</th><th rowspan="2">Vaccine Efficacy</th></tr>
<tr><th>No. of cases</th><th>Surveillance time</th><th>No. at risk</th><th>No. of cases</th><th>Surveillance time</th><th>No. at risk</th></tr>
<tr><th></th><th colspan="2">1000 person-yr</th><th></th><th colspan="2">1000 person-yr</th><th></th><th>% (95% CI)</th></tr>
<tr><td>Overall: first occurrence of Covid-19 after receipt of first dose</td><td>131</td><td>8.412</td><td>22,505</td><td>1034</td><td>8.124</td><td>22,434</td><td>87.8 (85.3 to 89.9)</td></tr>
<tr><td>After receipt of first dose up to receipt of second dose</td><td>46</td><td>1.339</td><td>22,505</td><td>110</td><td>1.331</td><td>22,434</td><td>58.4 (40.8 to 71.2)</td></tr>
<tr><td><11 Days after receipt of first dose</td><td>41</td><td>0.677</td><td>22,505</td><td>50</td><td>0.675</td><td>22,434</td><td>18.2 (−26.1 to 47.3)</td></tr>
<tr><td>≥11 Days after receipt of first dose up to receipt of second dose</td><td>5</td><td>0.662</td><td>22,399</td><td>60</td><td>0.656</td><td>22,369</td><td>91.7 (79.6 to 97.4)</td></tr>
<tr><td>After receipt of second dose to <7 days after</td><td>3</td><td>0.424</td><td>22,163</td><td>35</td><td>0.422</td><td>22,057</td><td>91.5 (72.9 to 98.3)</td></tr>
<tr><td>≥7 Days after receipt of second dose</td><td>82</td><td>6.649</td><td>22,132</td><td>889</td><td>6.371</td><td>22,001</td><td>91.2 (88.9 to 93.0)</td></tr>
<tr><td>≥7 Days after receipt of second dose to <2 mo after</td><td>12</td><td>2.923</td><td>22,132</td><td>312</td><td>2.884</td><td>22,001</td><td>96.2 (93.3 to 98.1)</td></tr>
<tr><td>≥2 Mo after receipt of second dose to <4 mo after</td><td>46</td><td>2.696</td><td>20,814</td><td>449</td><td>2.593</td><td>20,344</td><td>90.1 (86.6 to 92.9)</td></tr>
<tr><td>≥4 Mo after receipt of second dose</td><td>24</td><td>1.030</td><td>12,670</td><td>128</td><td>0.895</td><td>11,802</td><td>83.7 (74.7 to 89.9)</td></tr>
</table></td></tr>
<tr><td>32</td><td>Pfizer (September 17, 2021)</td><td>Multiple</td><td>≥16-year-old RCT participants</td><td>Delta</td><td>Comirnaty</td><td>July 1-August 31, 2021</td><td>RCT participants were evaluated for duration of protection against symptomatic disease, with the original placebo recipients receiving the vaccine after unblinding. The mean time from Dose 2 of Comirnaty to 01 July 2021 was approximately 5 months for the crossover group and 10 months for the original group. There was a 26.3% (7.4%- 41.4%) relative vaccine efficacy for the group vaccinated later (crossover group) compared to the group vaccinated earlier (original group), with a difference in incidence rates of -18.6 per 1000 person-years of follow-up.</td></tr>
<tr><td>31</td><td>de Gier et al (September 17, 2021)</td><td>Netherlands</td><td>Hospitalized patients</td><td>Delta (just for duration of protection)</td><td>Comirnaty
mRNA-1273
Ad26.COV2.S
AZD1222</td><td>July 4-August 29, 2021 (just for duration of protection)</td><td>Incidence rate ratios were calculated based on national coverage and vaccination status of hospitalized cases. All 4 vaccines were combined in calculating the VE by time since vacciantion, and VE was only calculated during the delta dominant period when 99% of sequenced isolates were delta. No drop in VE against hospitalization nor in VE against ICU admission was seen between those vaccinated up to 20 weeks since full vacciantion among 15-49, 50-69, ≥70 year olds.</td></tr>
</table>

30	Self et al (September 17, 2021)	USA	≥18 years who were hospitalized at 21 U.S. hospitals across 18 states	Alpha, Delta, Non-VOC	Comirnaty mRNA-1273 Ad26.COV2.S	March 11–August 15, 2021	This case-control study found that the for mRNA-1273 vaccine, there was no difference in VE against hospitalization among those were 14-120 days post full vaccination and those who were >120 days post full vaccination. For Comirnaty, VE against hopsitalization was 91% (88-93) for those 14-120 days post full vaccination while it was 77% (67-84) for those >120 das post full vaccination. Ad26.COV2.S did not have enough data to stratify by more than 28 days post full vaccination.
29	Polinski et al (September 12, 2021)	USA	≥18 years of age	Alpha/Delta	Ad26.COV2.S	March 1, 2021-July 31, 2021	Retrospective cohort study used insurance claims data linked to health data sources to evaluate VE of Ad26.COV2.S against COVID-19 diagnosis and hospitalization among vaccinated individuals and matched unvaccinated individuals (matched on age, sex, comorbid-risk, calendar date, location and other risk factors for COVID-19 severity). VE was stable over time up to 152 days after vaccination.
28	McKeigue et al (September 15, 2021)	Scotland	Population of Scotland	Alpha/Delta	Comirnaty mRNA-1273 AZD1222	December 1, 2020-August 19, 2021	Matched case-control study (REACT-SCOT) assessed rate ratios over time comparing rate of severe COVID-19 and the rate of hospitalization or death among those fully vaccinated with Comirnaty, mRNA-1273, and AZD1222 to unvaccinated persons. Rate ratios increased (effectiveness decreased) in first 2 months after second dose for all vaccines but then flattened out through 20-25 weeks post second dose: (a)  (b) 

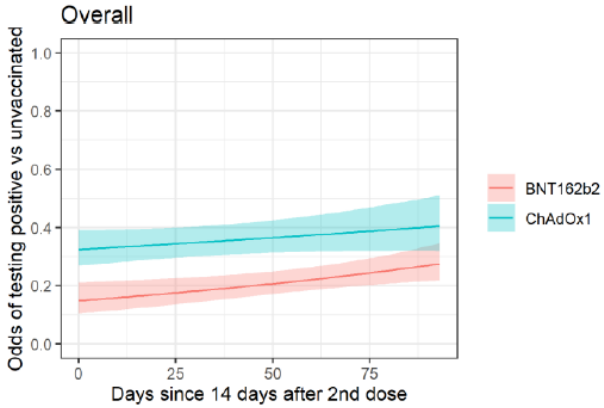
27	Bajema et al (September 10, 2021)	USA	Veterans ≥ 18 years	Alpha/Delta	BNT162b2 & mRNA-1273	February 1, 2021-August 6, 2021	Test-negative case-control study of adults hospitalized at 5 Veterans Affairs with COVID-like illness. No difference was found in VE against hospitalization <90 days vs. ≥ 90 days post second dose of BNT162b2 or mRNA-1273: 86.1% (76.5-91.8%) vs. 87.2 (78.2-92.5%).
26	Andrews et al (September 14, 2021)	UK	Symptomatic cases and test-negative controls 16 years and older	Alpha/Delta	Comirnaty mRNA-1273 AZD1222	December 8, 2020-September 3, 2021	This test-negative case-control study assessed VE of 2 doses of Comirnaty, mRNA-1273, and AZD1222 against symptomatic disease, hospitalization, and death over time separately for Alpha and Delta variants. VE against symptomatic disease peaked in early weeks post 2nd dose and then declined for Comirnaty and mRNA-1273 for both Alpha and Delta. Waning was greater for Delta than Alpha. Only limited waning against hospitalization and death was observed.  Waning was also greater for those 65+ years compared to 40-64 year-olds. Data for mRNA-1273 was only available thorugh 10-14 weeks post 2nd dose for symptomatic disease and shows high VE (90.3%) at 10-14 weeks.
25	Dagan et al (September 9, 2021)	Israel	Pregnant women	Alpha/Delta	Comirnaty	December 20, 2020-June 3, 2021	Cohort study of pregnant women that showed no drop in VE through 56 days post dose 2

24	Thompson et al (September 9, 2021)	USA	≥50 years of age	Multiple including alpha/delta	Comirnaty mRNA-1273 Ad26.COV2.S	January 1-June 22, 2021	Test negative case control study that found that VE against hospitalization remained >80% through at least 112 days post the dose 2 for Comirnaty and mRNA-1273. For Ad26.COV2.S, VE stayed high at time point ≥56 days after vaccination. VE against ER/urgent care visit is >80% through at least 112 days post dose 2 for Comirnaty and mRNA-1273. For Ad26.COV2.S, VE stayed high at time point ≥56 days after vaccination. VE against hospitalization (for all 3 vaccines combined)  VE against emergency room visits/urgent care visits (for all 3 vaccines combined) 
23	Puranik et al (September 7, 2021)	USA	Persons ≥14 days post dose 2 ("full vaccination") who received first dose after January 1	Multiple including alpha/delta	Comirnaty	January 1-August 8, 2021	Test negative case control study to assess duration of protection against symptomatic disease. Adjusted OR start showing waning at day 60 after full vaccination. Covariate: Time Relative to Full vaccination Level/Category: Day 0 — Symptomatic Infection [N = 974 positive events]: 1 (Reference) Day 30: 2.19 (0.89, 5.36) Day 60: 3.65 (1.78, 7.46) Day 90: 5.58 (2.72, 11.46) Day 120: 7.25 (3.47, 15.18) Day 150: 10.33 (5.03, 21.24)
22	Kertes et al (September 7, 2021)	Israel	Fully vaccinated population	Delta	Comirnaty	June 9-July 18, 2021	Study of Maccabi HMO clients who were 7 days post dose 2 by June 9 and had no history of prior infection. Found that those vaccinated in January-February had odds of infection of 1.61 (1.45-1.79) compared to those vaccinated in March-May of testing positive for SARS-CoV-2.
19	Keehner et al (September 1, 2021)	USA	~19,000 employees of University of California San Diego Health	Delta	BNT162b2 mRNA-1273	July -August 26, 2021	Cohort study of HCWs showed that among symptomatic cases occurring in July, HCW vaccinated in January or February had an attack rate of 6.7 per 1000 persons (95% CI, 5.9 to 7.8), whereas the attack rate was 3.7 per 1000 persons (95% CI, 2.5 to 5.7) among those who completed vaccination during the period from March through May. Among unvaccinated persons, the July attack rate was 16.4 per 1000 persons (95% CI, 11.8 to 22.9).
18	Nunes et al (August 29, 2021)	Portugal	1.5 million ≥65 year olds (duration of protection on only those 80+)	Alpha→delta	BNT162b2 mRNA-1273	?February-August 13, 2021	Cohort study using electronic databases. For those 80+, VE against hospitalization was 82 (64-91) at day 14-41 and 89% (71-96) at day 98+. For COVID related mortality, it was 86% (68-93) at day 14-41 and 74 (60-83) at day 98+. Noted limitations are that data delays could mean that outcomes such as hospitalization/mortality have not been recorded for more recent cases. Additionally, only 6% of the 80+ cohort remained unvaccinated during the study period, making these unvaccinated individuals probably quite different from the vaccinated.
17	Cerqueria-Silva et al (August 27, 2021)	Brazil	75.9 million vaccinated in Brazil	Gamma	CoronaVac AZD1222	January 18-July 24, 2021	This was a retrospective cohort study that calculated VE, as well as evaluated the daily hospitalization incidence per 100,000 vaccinees. For CoronaVac, there was low hospitalization

							incidence up to 84 days in vaccinees up to 79 years old. 80-89 and ≥90 age groups lowest incidence 28 days post dose 2 but then increased but were still lower than 1 dose recipients 
16	Chemaitelly et al* (October 6, 2021) *[Update to Aug 27 preprint]*	Qatar		Alpha→Beta →Delta	BNT162b2	January 1-August 15, 2021	Test-negative case-control study evaluating VE by time since vaccination stratified by age, VOC, and outcome. They see a drop in VE against infection over time since vaccination with no difference by those older/younger than 60. VE against severe disease is preserved (until sample size is insufficient). 
13	Tartof et al* (October 16, 2021)	USA	3.4 million Kaiser Permanante Southern California members ≥12 years	Delta for latter months of study	BNT162b2	December 14, 2020-August 8, 2021	Retrospective cohort study. VE against infection for the fully vaccinated decreased with increasing time since vaccination, declining from 88% (86–89) during the first month after full vaccination to 47% (43–51) after ≥5 months. Individuals ≥65 years of age had lower overall effectiveness against infections but declined at a similar rate (VE at <1 month after being fully vaccinated: 80% [73–85];

	[Update to Aug 23 preprint]						VE at ≥5 months: 43% [30–54]). Among fully vaccinated persons of all ages, protection against COVID-19-related hospitalization did not wane over time, with overall adjusted VE estimates of 87% (82–91) at < 1 month after being fully vaccinated, and 88% (82–92) at ≥5 months after full vaccination. At <1 month, VE against Delta: 93% [85–97] and VE against other variants: 97% [95–99]). At ≥4 months, VE against Delta infections: 53% [39–65] and VE against other variants: 67% [45–80]. VE against infection:  VE against hospitalization: 
12	Goldberg et al (August 24, 2021)	Israel	4.8 million fully vaccinated persons; >16 and ≥40 (depending on analysis) +unvaccinated in israel	Delta	BNT162b2	July 11-July 31 2021	The study compared the rate of breakthrough infection in July, when Delta was the dominant strain, between individuals who received 2 doses of the vaccine earlier this year to individuals who received two doses of the vaccine more recently, while adjusting for confounders. Rates of infection decline the more recently one was vaccinated; with severe disease, this is seen in those ≥60 years. A second analysis was done among the general population cohort of vaccinated and

<table>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>unvaccinated to calculate VE by age group and month of vaccination.
OUTCOME = Positive SARS-CoV-2 PCR test
<table><tr><th>Age</th><th>JanB</th><th>FebA</th><th>FebB</th><th>MarA</th><th>MarB</th><th>Apr</th><th>May</th></tr><tr><td>16-39</td><td>50% [45, 55]</td><td>47% [42, 52]</td><td>58% [55, 62]</td><td>62% [59, 64]</td><td>68% [65, 70]</td><td>74% [71, 77]</td><td>73% [67, 78]</td></tr><tr><td>40-59</td><td>58% [54, 62]</td><td>61% [58, 65]</td><td>63% [59, 66]</td><td>67% [63, 70]</td><td>74% [70, 77]</td><td>78% [73, 82]</td><td>80% [71, 86]</td></tr><tr><td>60+</td><td>57% [52, 62]</td><td>63% [57, 67]</td><td>65% [57, 71]</td><td>73% [66, 78]</td><td>72% [64, 77]</td><td>73% [63, 81]</td><td>75% [58, 85]</td></tr></table>OUTCOME = Severe COVID-19
<table><tr><th>Age</th><th>Jan</th><th>Feb</th><th>Mar</th></tr><tr><td>40-59</td><td>94% [87, 97]</td><td>98% [95, 99]</td><td>98% [94, 99]</td></tr><tr><td>60+</td><td>86% [82, 90]</td><td>88% [84, 91]</td><td>91% [85, 95]</td></tr></table></td></tr>
<tr><td>10</td><td>Pouwels et al* (October 14, 2021)

[Update to Aug 18 preprint]</td><td>UK</td><td>General adult population</td><td>Alpha, Delta</td><td>BNT162b2
mRNA-1273</td><td>December 1, 2020-August 1, 2020</td><td>COVID-19 infection survey is a household longitudinal survey with testing. During the delta dominant period, in those 18 to 64 years, VE of BNT162b2 against new PCR-positives reduced by 22% (95% CI 6% to 41%) for every 30 days from second vaccination. Reductions were numerically smaller for ChAdOx1 (change -7% per 30 days, 95% CI -18% to +2%) but there was no formal evidence of heterogeneity (p=0.14).
 
</td></tr>
<tr><td>9</td><td>Tenforde et al (August 18, 2021)</td><td>USA</td><td>Hospitalized patients</td><td>Alpha > Delta</td><td>BNT162b2
mRNA-1273</td><td>March 11-July 14, 2021</td><td>Test-negative design case control study of hospitalized patients. VE against COVID-19– associated hospitalization was 86% (95% CI = 82%–90%) 2–12 weeks and 84% (95% CI = 77%–90%) 13–24 weeks from receipt of the 2nd dose, with no significant change between these periods (p = 0.854). There was no difference in VE by timing since vaccine among those ≥/< 65 years, immunocompromised versus not and among those with ≥/< 3 chronic conditions.</td></tr>
</table>

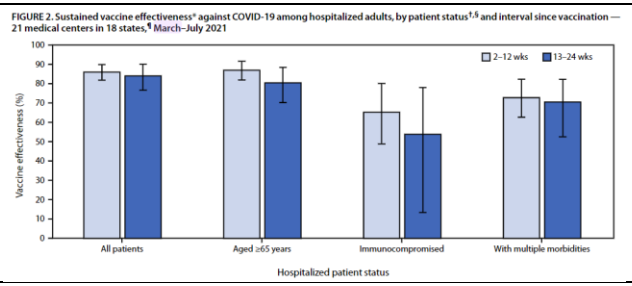
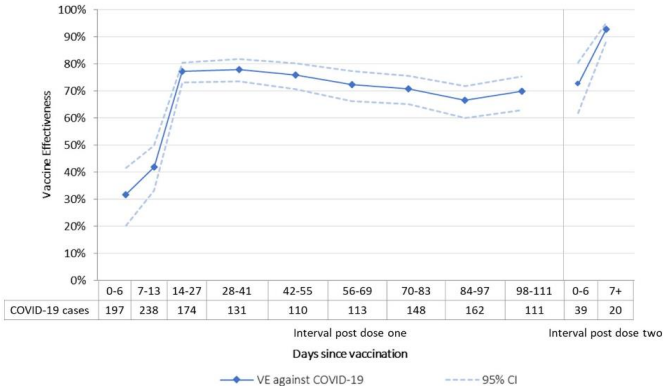
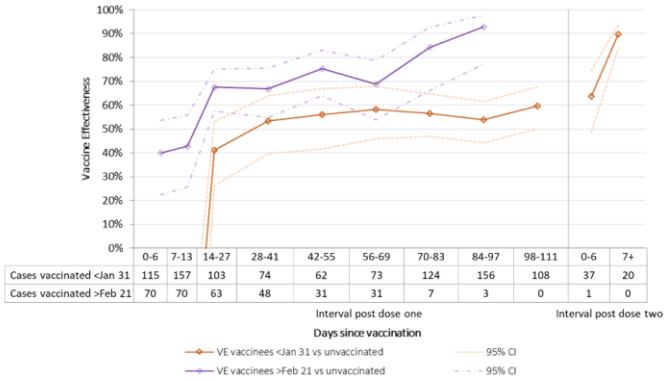
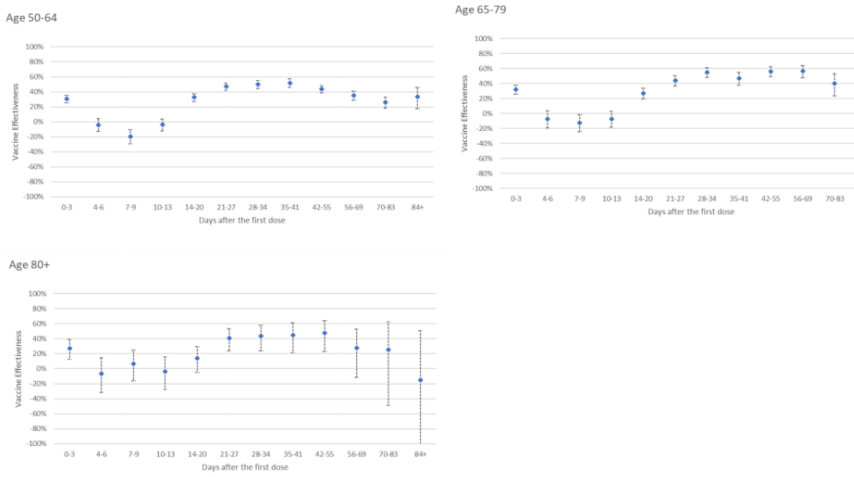
							
8	Yassi et al (July 16, 2021)	Canada	HCWs in Vancouver	Alpha/Gamma	BNT162b2 mRNA-1273	December 15-May 13, 2021	Retrospective cohort study of HCWs linking administrative databases. At 16 weeks (day 112) post dose 1 and 2 they don't see a decline in VE. Note that day 0-13 post dose 1 is included in the unvaccinated comparison group.
7	Chemaitelly et al (August 9, 2021)	Qatar	Immunosuppressed kidney transplant patients	Alpha/Beta	BNT162b2 mRNA-1273	February 1-July 21, 2021	Retrospective cohort study finding VE against infection was 73.9% (95% CI: 33.0-89.9%) at day 56+ post dose 2; VE against severe/critical/fatal disease was 83.8% (95% CI: 31.3-96.2) at day 56+ post dose 2.
6	Carazo et al (July 22, 2021)	Canada	HCWs in Quebec	Alpha	BNT162b2 mRNA-1273	January 17-June 5, 2021	This is a test-negative case control linking surveillance and vaccination data from administrative databases for HCWs. Across 16 weeks, no decline in single-dose VE against infection was observed with appropriate stratification based upon prioritized vaccination determined by higher versus lower likelihood of direct patient contact. Figure 2. Vaccine effectiveness against COVID-19 by interval since vaccination 

							Figure 3. Vaccine effectiveness against COVID-19 in healthcare workers vaccinated before January 31st 2021 (highest contacts with patients) and those vaccinated after February 20th 2021 (fewer contacts with patients) by interval since vaccination  0-6 7-13 14-27 28-41 42-55 56-69 70-83 84-97 98-111 0-6 7+ Cases vaccinated <Jan 31 115 157 103 74 62 73 124 156 108 37 20 Cases vaccinated >Feb 21 70 70 63 48 31 31 7 3 0 1 0
5	Amirthalingam et al (July 28, 2021)	UK	50+ year old population	Alpha/Delta	BNT162b2 AZD1222	January 4-June 18, 2021	This is a test-negative case control study linking surveillance and vaccination data from administrative databases. In summary, VE against disease potentially declines post dose 1 at day 70+ for AZD1222 and at day 56+ for BNT162b2 but there are wide/overlapping confidence intervals making conclusions challenging. Higher two-dose VE was observed with > 6-week intervals between BNT162b2 doses compared to the authorized 3-week schedule, including ≥ 80-year-olds. (This paper also includes information on GMTs at different time points post vaccination.) (a) AZ Vaccine 

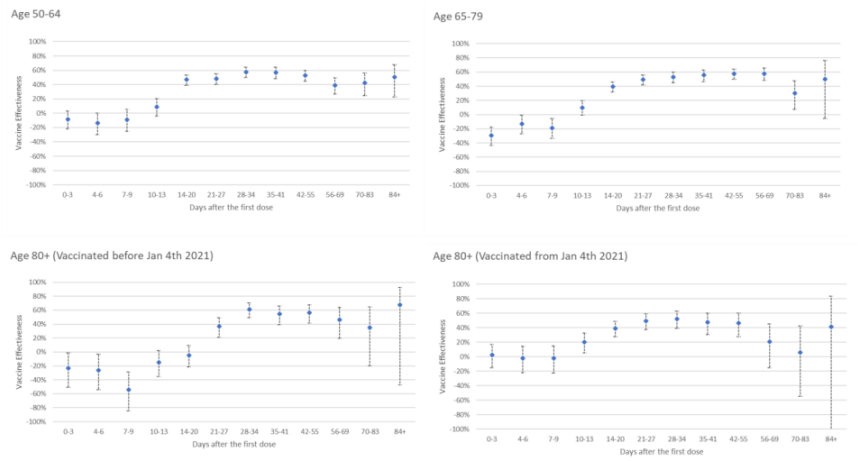
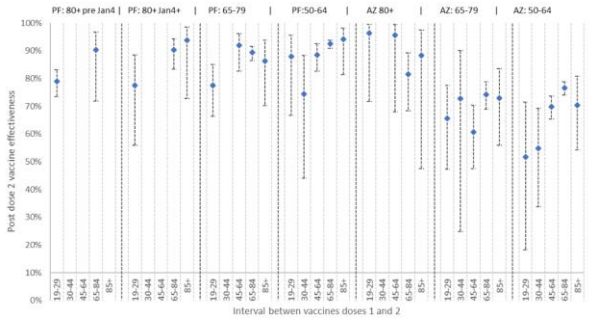
							(b) Pfizer  **Figure 4: Two dose vaccine effectiveness by age group, vaccine type and interval between doses** 
4	Public Health England Week 20 (May 20, 2021)	UK	65+ year old population	Alpha/Delta	BNT162b2 AZD1222	December-May 2021	This is a test-negative case control study linking surveillance and vaccination data from administrative databases. Comparisons for the first dose are made to unvaccinated, while comparisons for the second dose are made to 4-13 days post dose 2 to account for underlying differential risk between unvaccinated and vaccinated groups. AZD1222 post dose 1 not have any evidence of waning, while for BNT162b2 there is a slight increase in the odds of symptomatic disease at day 70+.

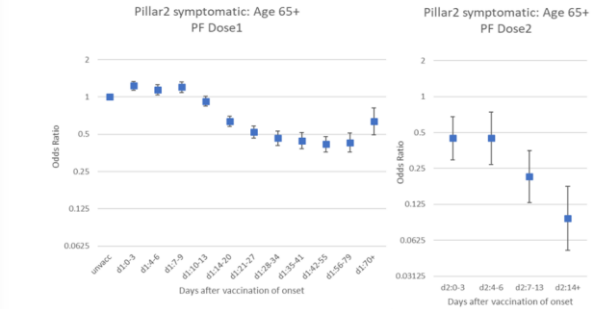
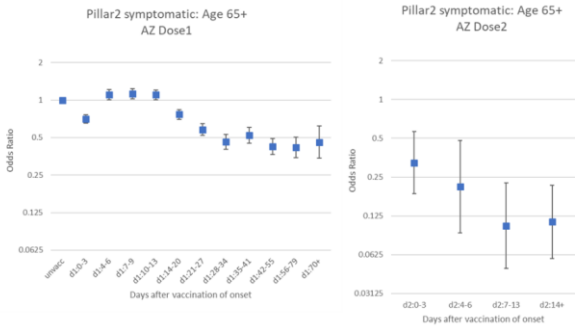
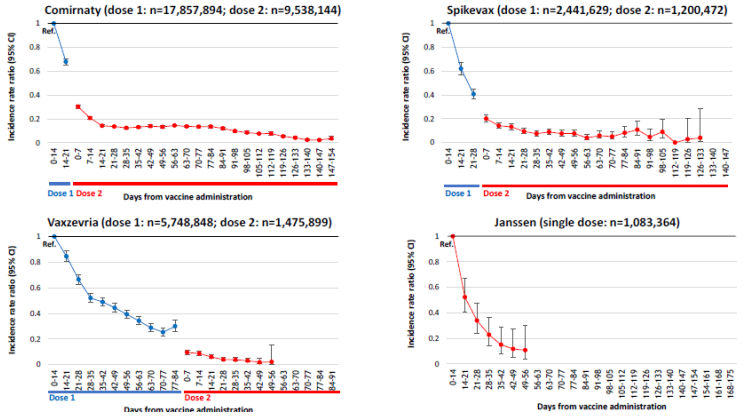
							Figure 1: Odds ratios for becoming a case by days after vaccination – Dose 1 and Dose 2 (Pfizer-BioNTech) among individuals aged 65 years and older  **Figure 2: Odds ratios for becoming a case by days after vaccination – Dose 1 and Dose 2 (AstraZeneca) among individuals aged 65 years and older** 
3	Italian Instituo Superiore di Sanita (July 30, 2021)	Italy	Italian general adult population with at least 1 dose of vaccine	Alpha	BNT162b2 AZD1222 mRNA-1273 Ad26.COV2.S	December 27, 2020-July 14, 2021	This study linked Italy's national vaccination registry with their surveillance data. For each of the outcomes evaluated, a multivariable negative binomial model was used to estimate the incidence rate ratio at different time intervals post dose 1 and 2, compared to the time period of 0-14 days after the first dose. VE is preserved against infection post complete vaccination for BNT162b2 at day 147-154, for mRNA-1273 at day 126-133, for AZD1222 at day 49-56, and for Ad26.COV2.S at day 49-56. VE against hospitalization, ICU admission, and mortality also do not change significantly over time.

							Figure 16. Adjusted estimates of the Incidence Rate Ratio of diagnosis at different time intervals from the administration of the first and second dose compared to the reference period (0-14 days from the first dose) by vaccine brand 
2	Israel et al (August 5, 2021)	Israel	All fully vaccinated persons enrolled in Leumit Health Services	Delta	BNT162b2	May 15-July 26, 2021	There was a significantly higher rate of positive results among patients who received their second vaccine dose at least 146 days before the RT-PCR test compared to patients who have received their vaccine less than 146 days before: adjusted odds ratio for infection was 2.76 (95% CI 1.62-3.08) for ≥ 60-year-old patients; 2.22 (95% CI 1.62-3.08) for patients 40-59-years; and 1.67 (95% CI 1.21-2.29) for 18-39-year-old patients.
1	Mizrahi et al (July 31, 2021)	Israel	16+ year olds enrolled at Maccabi Health Services	Delta	BNT162b2	June 1-July 27, 2021	The study compared the rate of breakthrough infection during June and July, when Delta was the dominant strain, between individuals who received 2 doses of the vaccine earlier this year to individuals who received two doses of the vaccine more recently, while adjusting for confounders. The authors report that persons vaccinated between January and February 2021 had a 53% (95% CI: 40-68%) increased risk of breakthrough infection in June and July compared to individuals vaccinated between March and April 2021. There was no difference by age groups 16-39, 40-59, ≥60 years. No unvaccinated persons were included in the study; thus, vaccine effectiveness was not evaluated

Other data of interest:

- https://www.gov.il/BlobFolder/reports/vpb-12082021/he/files_publications_corona_vpb-12082021-01.pdf
- Salo et al HH transmission study in Finland, showing VE 10 weeks after 1 dose of an mRNA vaccine but is a mix of 1 and 2 dose recipients.
- Pfizer's press announcement of 4 month efficacy in adolescents https://www.pfizer.com/news/press-release/press-release-detail/follow-data-phase-3-trial-pfizer-biontech-covid-19-vaccine

Note as of January 7, 2022 version, only true duration of protection analyses are included. Please look at the update from December 30, 2021 if you wish to see full list of previously included studies with other data such as Kaplan-Meier curves. Missing reference numbers in table above indicate studies that have been removed.

4. Summary of Study Results for Post-Authorization COVID-19 Vaccine Effectiveness Against Transmission§

#	Reference (date)	Country	Design	Population	Dominant Variants (Alpha=B.1.1.7 Beta=B.1351 Gamma=P.1 Delta=B.1617.2	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
14	Lyngse et al (December 27, 2021)	Denmark	Retrospective cohort	11,937 primary cases and their household members	Omicron and Delta^	Included	BNT162b2, mRNA-1273, AZD1222, Ad26.COV2.S	Transmission to household members (fully vaccinated vs. unvaccinated cases) Transmission to household members (booster vs. fully vaccinated cases)	—	—	29.1 (21.3-36.3) 46 (29-60)	7+ (BNT162b2), 14+ (mRNA-1273 or after 1 dose of Ad26.COV2.S), 15+ (AZD1222)	
13	Clifford et al (November 24,2021)	UK	Prospective cohort	195 index cases and their 278 contacts	Alpha specifically ^ Delta specifically^	Unknown	BNT162b2 AZD1222 BNT162b2 AZD1222	Transmission to contacts	26 (-11– 54) -7 (-60-29) 9 (-16– 49) 14 (-11-52)	21+	57 (5- 85) 35 (-26-74) 31 (-3- 61) 42 (14- 69)	7+	~31 weeks
12	Ng et al* (November 1, 2021)	Singapore	Retrospective cohort	301 index cases and 1204 household contacts	Delta index cases, specifically	Unknown	BNT162b2 & mRNA-1273	Documented infection of household contacts	38 (-69-78)	0+, including within 14 days of dose 2	27 (-40-62)	15+	~16.5 weeks
11	Singanayagam et al*(October 28,2021)	England	Prospective cohort	233 contacts (arising from 163 index notifications) and 19 index cases	Delta^	Included	BNT162b2 and AZD1222	Documented infection	—	—	34 (-15–60)	7+	~10.5 weeks
10	de Gier et al* (October 14, 2021)	Netherlands	Retrospective cohort	4921 index cases and 7771 household contacts (aged 12+)	Delta^	Unknown	BNT162b2, AZD1222, mRNA-1273, & Ad26.COV2.S	Transmission to unvaccinated household contacts Transmission to fully vaccinated household contacts	38 (-2-62) 46 (22-63)	14+	63 (46-75) 40 (20-54)	14+ (or 28+ after a single dose of Ad26.COV2.S)	~32 weeks
9	Eyre et al (September 29, 2021)	England	Retrospective cohort	99,597 index cases and 139,164	Alpha^ specifically	Included	BNT162b2 AZD1222	Transmission to contacts	26 (20-30) 18 (12-24)	0+ up to 13 days post dose 2	82 (71-88) 63 (37-78)	14+	~20.5 weeks ~8 weeks

#	Reference (date)	Country	Design	Population	Dominant Variants (Alpha=B.1.1.7 Beta=B.1351 Gamma=P.1 Delta=B.1617.2	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
				contacts of all ages	Delta^ specifically		BNT162b2		13 (6-19)		65 (52-74)		~29 weeks
							AZD1222		2 (-6-10)		36 (28-43)		~16 weeks
8	Meyer et al (September 23,2021)	Germany	Retrospective cohort	Households of 14 SARS-CoV-2 positive nursing home staff (5 vaccinated, 9 unvaccinated)	Alpha^	Unknown	BNT162b2	Documented infection of household members	—	—	67.2 (no CI available)	7+	~11 weeks
7	Braeye et al (August 19,2021)	Belgium	Retrospective cohort	131,283 index cases	Alpha^	Included	BNT162b2	Transmission	—	—	62 (57-67)	14+	~20 weeks
							mRNA-1273				52 (33-69)		
6	de Gier et al* (August 5, 2021)	Netherlands	Retrospective cohort	113,582 index cases (aged 18+) and 253,168 household and other close contacts (all ages)	Alpha^	Unknown	AZD1222	Transmission to any household contacts (adjusted for contact vaccination status)	15 (4-26)	14+‡	58 (−12-84)	7+	~15 weeks
							BNT162b2		26 (12-37)		70 (61-77)		
							mRNA-1273		51 (8-74)		88 (50-97)		
							Ad26.COV2.S		77 (6-94)		—		
5	Layan, Gilboa et al (July 16,2021)	Israel	Prospective cohort	215 index cases and 687 household contacts from 210 Israeli households	Original and Alpha¶	Included	BNT162b2	Transmission to HHC by vaccinated vs. unvaccinated cases	—		78(30-94)	7+	~12 weeks
4	Prunas et al (December 20, 2021) *[Update to July 16 preprint]*	Israel	Retrospective cohort	253,564 Israeli individuals from 65,264 households with at least 1 infected individual and at least 2 members	Original and Alpha¶	Unknown	BNT162b2	Infectiousness given Infection	—	—	41.3 (9.5-73.0)	10+	
								Transmission			88.5 (82.3-94.8)		

#	Reference (date)	Country	Design	Population	Dominant Variants (Alpha=B.1.1.7 Beta=B.1351 Gamma=P.1 Delta=B.1617.2	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
3	Harris et al* (June 23, 2021) *[Update to Apr 28 preprint]*	UK	Retrospective cohort, case-control	970,128 household contacts of index case (unvaccinated, vaccinated with AZD1222 or BNT162b)	Alpha[£]	Unknown	AZD1222	Documented infection	48(38-57)	>21 days after dose 1, including some with dose 2	—		
							BNT162b2		46(38-53				
2	Salo et al (July 10, 2021) *[Update to May 30 preprint]*	Finland	Retrospective cohort	HCW and their unvaccinated spouses	Alpha[††]	Excluded	BNT162b2 & mRNA-1273	Documented infection in HCW's unvaccinated spouses	8.7 (-28.9-35.4)	2 weeks	—		*10 weeks since dose 1
								Documented infection in HCW's unvaccinated spouses	42.9 (22.3-58.1)	10 weeks (combo of 1+2 dose recipients)	—		
1	Shah et al. (Mar 11, 2021)	UK - Scotland	Retrospective Cohort	144,525 healthcare workers (HCWs) and 194,362 household members	original & Alpha[£]	excluded	BNT162b2 & AZD1222	Household members of HCWs: Documented infection[2]	30 (22-37)	≥14	54 (30-70)	≥14	

[§]Study results captured during literature search of vaccine effectiveness studies. Note this is not an exhaustive list of transmission studies.
Purple text indicates new or updated study.
Product Manufacturers: BNT162b2 (Pfizer), mRNA-1273 (Moderna), AZD1222 (Astra-Zeneca), Ad26.COV2.S (Janssen), Coronavac
[±]Unless noted otherwise, days post 1st dose are prior to receiving dose 2.
‡Unclear if 1st dose VE estimates includes any individuals who received a second dose.
*Manuscripts with an asterisk (*) are peer-reviewed publications.
^Indicates predominant variant identified by study authors. If no ^ then variants identified through secondary source when possible. Please see additional footnotes.
[¶]The rise of SARS-CoV-2 variant Alpha in Israel intensifies the role of surveillance and vaccination in elderly | medRxiv
[£]Coronavirus (COVID-19) Infection Survey, UK - Office for National Statistics
[††]Based on https://outbreak.info/location-reports

5. Review Papers and Meta-analyses

1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8266992/pdf/10787_2021_Article_839.pdf
2. https://www.medrxiv.org/content/10.1101/2021.05.20.21257461v2
3. https://www.eurosurveillance.org/content/10.2807/1560-7917.ES.2021.26.28.2100563
4. https://www.nature.com/articles/s41577-021-00592-1
5. https://www.cell.com/immunity/fulltext/S1074-7613(21)00303-4
6. https://www.medrxiv.org/content/10.1101/2021.08.25.21262529v1
7. https://www.sciencedirect.com/science/article/pii/S0141813021017359?via%3Dihub
8. https://www.scielo.br/j/ramb/a/gLN9kTh8kpghHGjdWY7z6ML/?lang=en
9. https://www.medrxiv.org/content/10.1101/2021.09.17.21263549v1
10. https://www.sciencedirect.com/science/article/pii/S0753332221009604?via%3Dihub
11. https://www.medrxiv.org/content/10.1101/2021.09.23.21264048v1
12. https://www.researchsquare.com/article/rs-936074/v1
13. https://www.mcmasterforum.org/find-evidence/products/project/covid-19-living-evidence-synthesis-6-what-is-the-efficacy-and-effectiveness-of-available-covid-19-vaccines-for-variants-of-concern
14. https://www.medrxiv.org/content/10.1101/2021.09.28.21264126v1
15. https://www.medrxiv.org/content/10.1101/2021.07.18.21260732v2
16. https://www.medrxiv.org/content/10.1101/2021.10.04.21264542v1
17. https://www.eurosurveillance.org/content/10.2807/1560-7917.ES.2021.26.41.2100920
18. https://europepmc.org/article/MED/34676000
19. http://medrxiv.org/content/early/2021/11/03/2021.11.03.21265819.abstract
20. https://www.cambridge.org/core/journals/epidemiology-and-infection/article/sarscov2-variants-and-effectiveness-of-vaccines-a-review-of-current-evidence/39243FCC3CED73D5F1D94E497F8823D3
21. https://www.spandidos-publications.com/10.3892/etm.2021.10843
22. https://idpjournal.biomedcentral.com/articles/10.1186/s40249-021-00915-3
23. https://eymj.org/DOIx.php?id=10.3349/ymj.2021.62.11.961
24. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3961378
25. https://www.sciencedirect.com/science/article/pii/S1201971221008572?via%3Dihub#sec0002
26. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8524740/
27. https://www.mdpi.com/2076-393X/9/11/1305

28. https://www.researchsquare.com/article/rs-1130796/v1
29. https://www.tandfonline.com/doi/full/10.1080/14760584.2022.1997601
30. https://www.medrxiv.org/content/10.1101/2021.12.15.21267799v1
31. https://link.springer.com/article/10.1007/s13205-021-03076-0
32. https://www.mdpi.com/2076-393X/9/12/1489
33. http://medrxiv.org/content/early/2021/12/31/2021.12.29.21268511
34. https://link.springer.com/article/10.1007%2Fs10787-021-00839-2

Please direct any questions about content to:

- Anurima Baidya (abaidya1@jh.edu)
- Karoline Walter (kwalte21@jhmi.edu)