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

Weekly Summary Tables

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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)

No.	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
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
									28(-8–53)	≥ 90			~10 weeks
								Symptomatic disease	54(45-62)	14+			~23 weeks
								Hospitalization	74(43-88)				

No.	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
							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	mRNA-1273	Documented infection	64(26-83)	0+ up to 13 days post dose 2	70(52-81)	14+	~20.5 weeks
							AZD1222		43(2-67)		41(16-58)		~8 weeks
					Delta^ specifically	Included	Ad26.COV2.S	Documented infection	23(-14-48)		—		~29 weeks
							BNT162b2		51(44-58)		65(62-69)		~16 weeks
101	Glatman-Freedman et al (September 27, 2021)	Israel	Retrospective cohort	Adolescents aged 12-15 y	Delta^	Excluded	mRNA-1273	Documented infection	62(49-72)	—	79(73-84)	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	AZD1222 Ad26.COV2.S BNT162b2	Documented infection	35(25-43)	—	50(41-58)	7+	~11 weeks
								Symptomatic disease	42(32-51)		—		
								Hospitalization	56(46-64)		68(62-73)		
99	Pilishvili et al* (September 22,2021)	USA	Test-negative case control	1482 HCPs as cases and 3449 HCPs as control	Alpha††	Excluded	mRNA-1273 AZD1222 Ad26.COV2.S	Symptomatic disease	66(50-76)	—	83(72-90)	14+	~14 weeks
									45(29-57)		54(42-63)	15-28	
									54(33-68)			85-98	
								Symptomatic disease - immunocompromising condition	39.1 (−45.0-74.4)	14+ through Dose 2 or later (at	—	—	
								Symptomatic disease - pregnancy	77.1 (32.2- 92.2)		—	—	

No.	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
										least 1 dose)			
							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 immunocompromising conditions	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+	—	—	
									68 (49–80)	>28			
96		Israel			Alpha^	Excluded	BNT162b2	Documented infection	54.3 (50.6-57.8)	14-20	97.3 (96.7-97.8)	22-28	2 weeks

No.	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
	Glatman-Freedman et al* (September 16, 2021)		Retrospective longitudinal cohort	All Israeli residents aged 16+				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
								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

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									—		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	Dagan et al* (September 7,2021)	Israel	Prospective Cohort	10,861 vaccinated pregnant females	Alpha^	Excluded	BNT162b2 & mRNA-1273	Documented infection	71 (33-94)	21-27	96 (89-100)	7-56	~11 weeks
								Symptomatic infection	76 (30-100)		97 (91-100)		
								Hospitalization	—		89 (43-100)		

No.	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
				matched with 10,861 controls									
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 (September 6, 2021)	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
							Ad26.COV2.S		95.5 (88.2-98.3)		—		
88	Tande et al* (September 6,2021)	USA – Mayo Clinic, Minnesota	Retrospective Cohort	Asymptomatic screening of 46,008 patients: pre-surgical, pre-op PCR tests	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
					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

No.	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
							Ad26.COV2.S		51(-2 – 76)		—		
86	Bruxvoort et al (September 2, 2021)	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 (September 2,2021)	Israel	Prospective cohort	1,250 HCWs from six Israeli hospitals	Alpha^	Excluded	BNT162b2	Documented infection	—	—	91.9 (69.9-97.9)	14+	~18 weeks
								Symptomatic infection			96.2 (50.4-99.7)	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) *[Update to Aug 27 preprint]* *Note: See Duration of Protection Table for further context*	Qatar	Test-negative case control	142,300 cases and 848,240 controls among residents of Qatar (12+)	Alpha^ then Beta^ (Jan-Jun), then Delta^ (Jul-Sep)	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
								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
							BNT162b2	Documented infection	63.4 (42.6-76.6)		73.3 (63.6-80.4)	28-63	7 weeks

No.	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^						17.9 (-12.9-40.3)	147+	~32 weeks
81	Goldberg et al (August 25, 2021) *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, 60+ y fully vaccinated Mar 2021 (~4 mos prior)			91 (85-95)	109-159	22 weeks
								Severe disease, 60+ y fully vaccinated Jan 2021 (~6 mos prior)			86 (82-90)	168-203	28 weeks
80#	Tartof et al (August 23, 2021)	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	—	—	73 (72-74)	7+	~29 weeks
								Hospitalization			90 (89-92)		
					Delta specifically^			Documented infection			75 (71-78)		
								Hospitalization			93 (84-96)		
								Documented infection			91 (88-92)		

No.	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-Delta variants specifically^			Hospitalization			95 (90-98)		
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 (August 18,2021)	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)		
77	Tenforde et al (August 18, 2021)	USA	Case control	1,194 cases and 1,895 controls	Alpha and Delta^ (March-July)	Unknown	BNT162b2 or mRNA-1273	Hospitalization, all	—	—	86 (82-88)	14+	~24 weeks
								Hospitalization, Non-immuno-compromised			90 (87-92)		
								Hospitalization, Immuno-compromised			63 (44-76)		
					Alpha^ (March-May)			Hospitalization, all			87 (83-90)		
					Delta^ (June-July)			Hospitalization, all			84 (79-89)		
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	USA	Retrospective cohort	10,428,783 residents of	Non-VOC and Alpha†† (Pre-	Unknown	BNT162b2	Documented infection	—	—	74.2 (69–78.7)	14+	~16 weeks
							mRNA-1273				74.7(66.2-81.1)		

No.	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
	(August 18,2021)			skilled nursing facilities	Delta circulation) ^								
					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 (August 11, 2021)	Qatar	Test-negative case control	2,175 cases with confirmed Delta infection and matched controls (aged 12+)	Delta specifically^	Included	BNT162b2	Documented infection	65.5 (40.9-79.9)	14+	59.6 (50.7-66.9)	14+	~25 weeks
							mRNA-1273		79.7 (60.8-89.5)		86.1 (78.0-91.3)		
							BNT162b2	Severe, critical, or fatal disease	100.0 (CI omitted since there were no events among vaccinated)		97.3 (84.4-99.5)		
							mRNA-1273		100.0 (CI omitted, no events among vaccinated)		100.0 (CI omitted, no events among vaccinated)		
							BNT162b2	Symptomatic COVID-19	76.3 (46.7-90.7)		56.1 (41.4-67.2)		
							mRNA-1273		85.7 (62.7-95.7)		85.8 (70.6-93.9)		
							BNT162b2	Asymptomatic COVID-19	25.2 (0.0-78.7)		35.9 (11.1-53.9)		
							mRNA-1273		57.4 (0.0-92.9)		80.2 (54.2-92.6)		
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)		

No.	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
								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 contacts (aged 18+) of 113,582 index cases (aged 18+)	Alpha^	Unknown	AZD1222	Documented infection among household contacts (adj. for vaccination status of index case)	2 (-11-14)	14+	87 (77-93)	7+	~15 weeks
							BNT162b2		-18 (-43-2)		65 (60-70)		
							mRNA-1273		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 (July 28,2021)	UK	Test-negative case control	69,545 cases and 229,662 test negative controls aged 50+	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	

No.	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
											92 (91-94)	14+, dose interval 65-84 days	
							AZD1222	Documented infection, 80 y+	42 (29-53)		—		
											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+	

No.	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 (July 22, 2021)	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)		

No.	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
58	Butt et al (June 22,2021)	Qatar	Test-negative case control	1255 pregnant women	Alpha and Beta^	Excluded	BNT162b2 and mRNA-1273	Documented infection	40.3 (0.0-80.4)	14+	67.7 (30.5-86.9)	14+	~17 weeks
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 some with dose 2			

No.	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
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#	Nasreen et al (September 30, 2021) *[Update to July 16 preprint]*	Canada	Test-negative Case Control	682,071 symptomatic community-dwelling	Non-VOC specifically^	Excluded Unknown	BNT162b2	Symptomatic infection	63 (56-68)	14+	92 (87-95)	14+	~28 weeks
								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)		

No.	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
				individuals (age 16+) in Ontario			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)		
					Delta specifically^		BNT162b2	Symptomatic infection	57 (53-61)		92 (89-94))		~28 weeks
								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)	Finland	Prospective cohort	Two study cohorts: 901,092 Finnish elderly aged 70	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)		

No.	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 774,526 chronically ill aged 16-69 years			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 (June 27, 2021)	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 (July 14,2021) *[Update to Jun 22 preprint]*	USA	Test negative case control	77014 veterans within Veterans Health Administration	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)		
								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)		

No.	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
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 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	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	

No.	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
				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	14,697 IBD patients in VA hospitals	Unknown	Included	BNT162b2 & mRNA-1273	Documented infection	-1 (-50-32)	14+ up to 7 days post dose 2	69 (44-83)	7+	14 weeks
								Hospitalization/death	9 (-114-61)		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+	

No.	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
					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	
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	97 (94-99)	>7 days	
								Asymptomatic	36 (-51-69)		86 (69-97)		

No.	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
										post dose 2			
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) *[Update to Mar 24 preprint]*	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)		
								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. (April 30, 2021)	USA	Retrospective cohort	24,145 adults in the Mayo Clinic Network	Original & Alpha¥	Excluded	Ad26.COV2.S	Documented infection	77 (30-95)	≥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.	Israel				Included	BNT162b2	Documented infection	58 (57-59)		93 (93-93)		

No.	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
	(Apr 24, 2021)		Prospective cohort	5,600,000+ individuals ≥16 years	Original and Alpha^			Hospitalization	69 (68-71)	>14 days post dose 1 to <7 days post dose 2	94 (94-95)	≥7 days	
								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	—		
							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. (Apr 22, 2021)	UK - England	Case-control	170,226 80-83-year-olds	Alpha^	Excluded	BNT162b2	Documented infection[4]	55 (40-66)	21-27	70 (55- 80)	35-41	
								Hospitalization[4]	50 (19-69)	21-27	75 (52-87)	35-41	
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	

No.	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	—		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	
								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.				Alpha^	Excluded	BNT162b2	Documented infection	91 (89-93) ≥35 days post dose 1 most with dose 2				

No.	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
	(Mar 17, 2021)	Israel – Maccabi System	Retrospective Cohort	1.79 million enrollees, adults <90 years				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	
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.* (Jun 23, 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

ǂUnless 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.

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.
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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
3	Bar-On et al (October 7, 2021)	Israel	Retrospective cohort	4,621,836 Israeli residents (16+) who had been fully vaccinated at least 5 months prior	Delta^	Excluded	BNT162b2	16-29 y: Documented infection	Complete vaccination with two doses	94.3 (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		95.5 (90.3-97.9)		6 weeks
								60+: Severe disease		94.7 (93.6-95.5)		8 weeks
								60+: Death		93.2 (89.4-95.7)		
2	Patalon et al (August 31,2021)	Israel	Test-negative case control	149, 379 individuals ≥ 40 years with two doses only 32,697 individuals ≥ 40 years and above with three-doses	Delta^	Excluded	BNT162b2	Documented infection	Complete vaccination with two doses	79 (72-84)	14-20	3 weeks
			Matched case-control							84 (79-88)	14-20	
1	Bar-On et al (August 31,2021)	Israel	Retrospective cohort	1,144,690	Delta^	Excluded	BNT162b2	Documented infection	Complete vaccination with two doses	92 (90- 93)	12+	3 weeks
								Severe disease		94 (91-96)		

*Values >0 indicate greater effectiveness with booster dose compared to full primary series.

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.

<table>
<tr><th>#</th><th>Reference (date)</th><th>Country</th><th>Population</th><th>Dominant Variants</th><th>Vaccine product</th><th>Study Period</th><th>Descriptive Findings</th></tr>
<tr><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>
<tr><td>49</td><td>Janssen Briefing document for US FDA (October 14, 2021)</td><td>multiple</td><td>General population</td><td>Multiple</td><td>Ad26.COV2.S</td><td>September 21, 2020-July 9, 2021</td><td>Final results from RCT

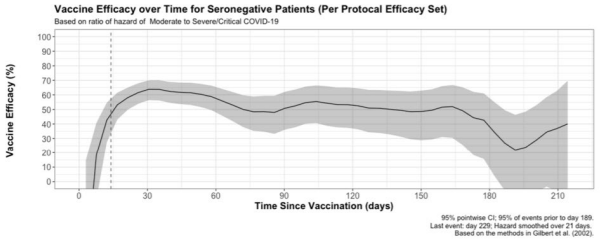
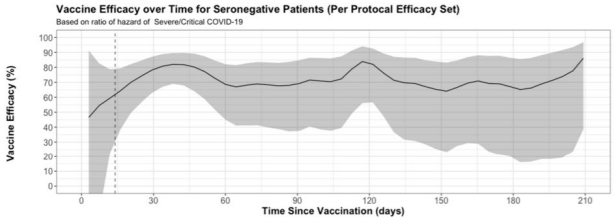
Figure 2: Vaccine Efficacy Over Time of Molecularly Confirmed Moderate to Severe/Critical COVID-19 with Onset at Least 1 Day After Vaccination, PP Set (Seronegative; Study VAC31518COV3001) Final Analysis of Double-Blind Phase
 

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)
<table><tr><th></th><th colspan="2">Ad26.5e10 vp
#Cases (N) PY</th><th colspan="2">Placebo
#Cases (N) PY</th><th>VE% (95% CI)</th></tr><tr><td>Analysis set: PP</td><td>(19577)</td><td></td><td>(19608)</td><td></td><td></td></tr><tr><td>Moderate to severe/critical[a]</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>Day 2 to Day 14</td><td>82 (19577)</td><td>748.66</td><td>88 (19608)</td><td>749.83</td><td>6.7% (-27.54; 31.77)</td></tr><tr><td>Day 15 to Day 28</td><td>51 (19400)</td><td>1483.44</td><td>184 (19398)</td><td>1480.09</td><td>72.3% (62.10; 80.13)</td></tr><tr><td>Day 29 to Day 56</td><td>119 (19113)</td><td>2877.42</td><td>306 (18924)</td><td>2837.44</td><td>61.7% (52.46; 69.23)</td></tr><tr><td>Day 57 to end DB Phase</td><td>314 (17586)</td><td>6460.98</td><td>573 (17090)</td><td>6158.91</td><td>47.8% (39.95; 54.62)</td></tr><tr><td>Day 57 to Day 112</td><td>157 (17586)</td><td>5040.02</td><td>308 (17090)</td><td>4860.10</td><td>50.8% (40.24; 59.70)</td></tr><tr><td>Day 113 to end DB Phase</td><td>157 (11379)</td><td>4900.35</td><td>265 (10572)</td><td>4529.34</td><td>45.2% (33.04; 55.34)</td></tr></table>
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
  </td></tr>
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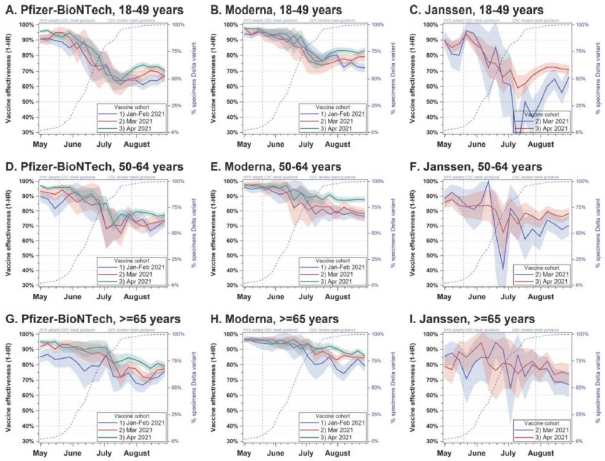
<table>
<tr>
<td>48</td>
<td>Rosenberg et al (October 9, 2021)</td>
<td>USA</td>
<td>General adult population of New York</td>
<td>Delta for part of study period</td>
<td>Comirnaty mRNA-1273 Ad26.COV2.S</td>
<td>May 1-September 3, 2021</td>
<td>Cohort study based on adminsitrative datbases. Estimated 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.
 
</td>
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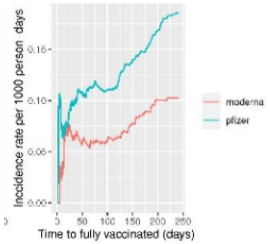
<tr>
<td>47</td>
<td>Liu et al (October 7, 2021)</td>
<td>USA</td>
<td>General population of NYC</td>
<td>Alpha, Delta, others</td>
<td>Comirnaty mRNA-1273</td>
<td>January 18-September 21, 2021</td>
<td>Hospital database cohort study. They found that there was an increased incidence rate with the increased 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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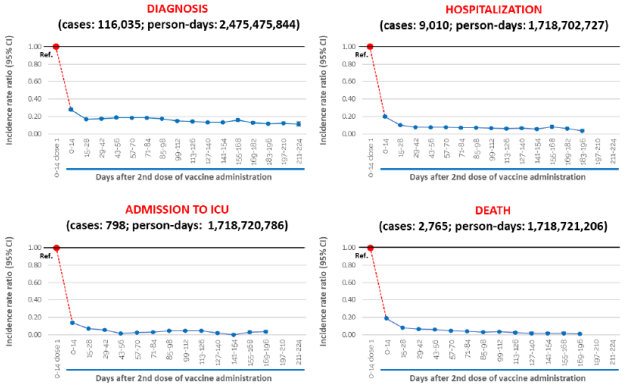
<tr>
<td>46</td>
<td>Italian Instituo Superiore di Sanita (September 30, 2021)</td>
<td>Italy</td>
<td>≥16 year old general population who received at least 1 dose of mRNA vaccine</td>
<td>Alpha, Delta</td>
<td>Comirnaty mRNA-1273</td>
<td>December 27, 2020-August 29, 2021</td>
<td>Compared different 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.
 
</td>
</tr>
<tr>
<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>
</table></td>
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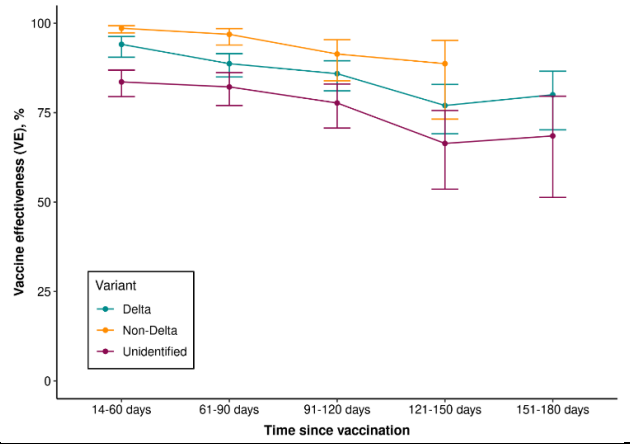
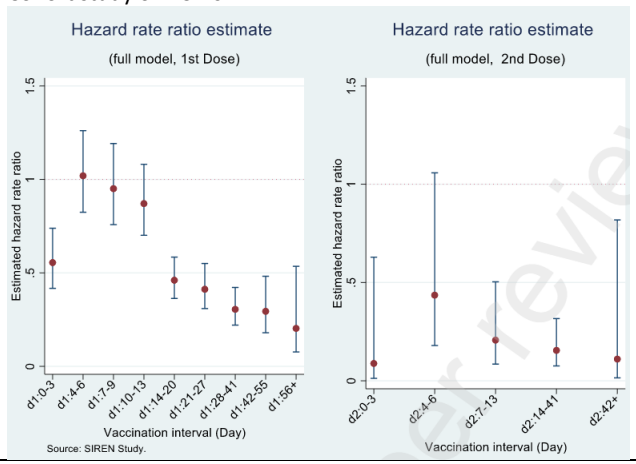
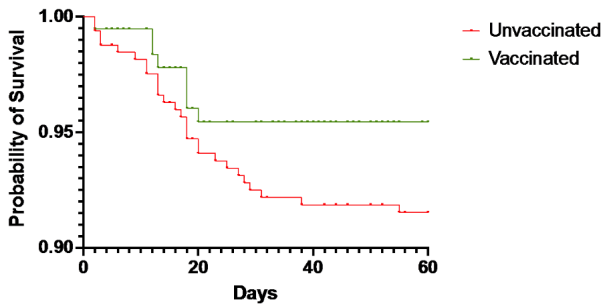
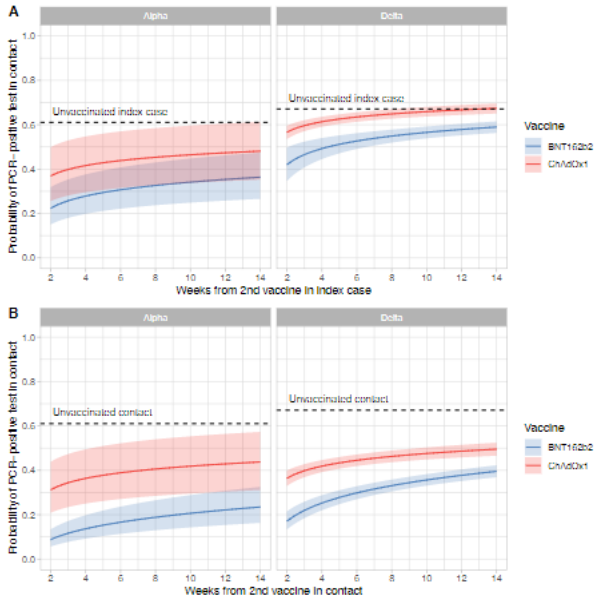
44	Bruxvoort et al (October 1, 2021)	USA	General population	Delta, Alpha+others	mRNA-1273	March 1-July 27, 2021	
43	Payne et al (July 21, 2021)	UK	HCWs	Alpha	Comirnaty	December 7, 2020-March 12, 2021	Cohort study of HCWs 

42	Holt et al (September 27, 2021)	UAE	Dialysis patients	Unknown	Sinopharm's HB02	March 14, 2020 to August 22, 2021	Cohort study of dialysis patients in Abu Dhabi. Note many details unclear. KM curve out to 60 days comparing mortality in vaccinated and unvaccinated 

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  **Figure 1. Estimated probability of a positive PCR test in contacts by time since second vaccination in index cases (panel A) and in contacts (panel B), variant, and vaccine type.**

<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>
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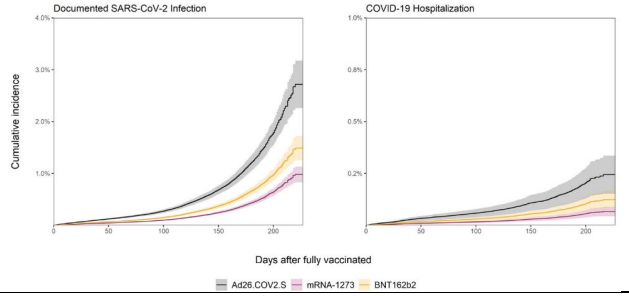
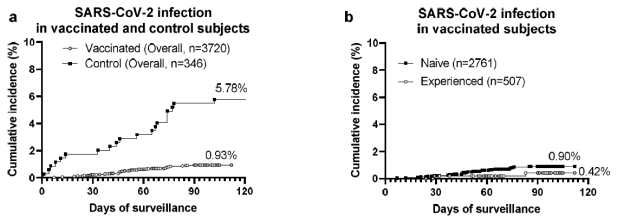
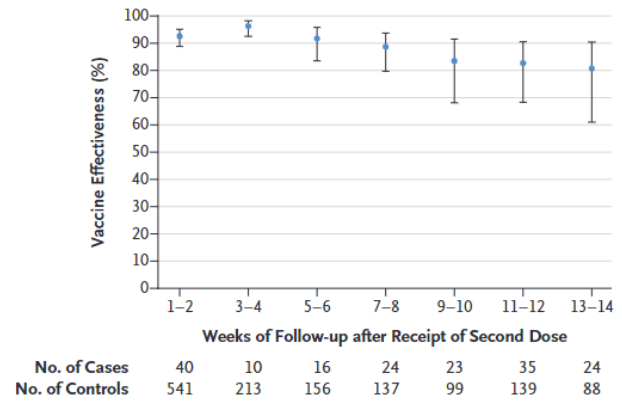
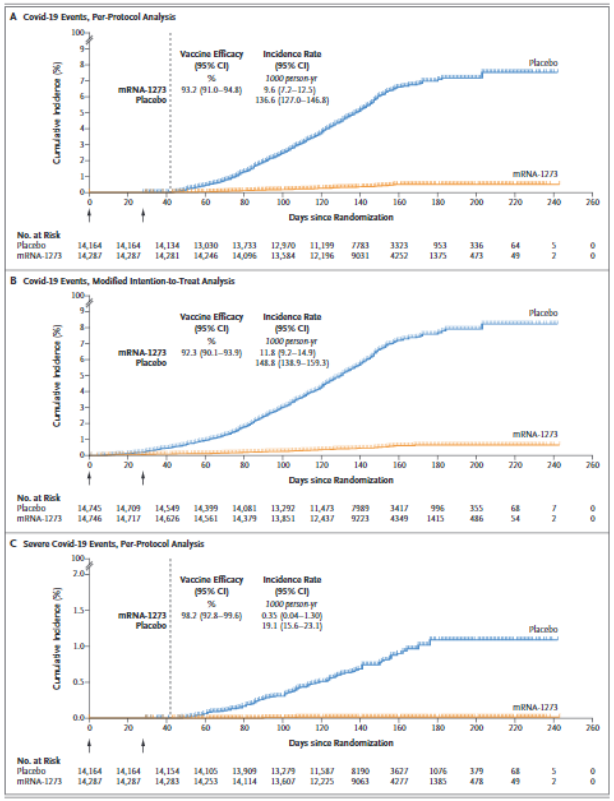
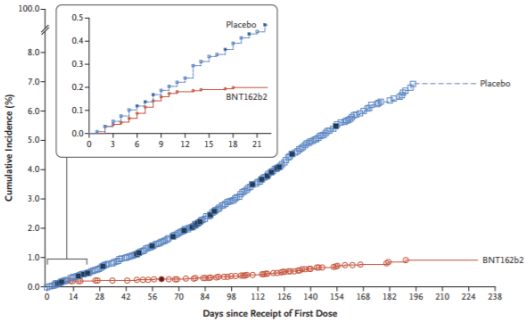
<tr>
<td>39</td>
<td>Sharma et al (September 26, 2021)</td>
<td>USA</td>
<td>Fully vaccinated veterans</td>
<td>Multiple</td>
<td>Comirnaty mRNA-1273 Ad26.COV2.S</td>
<td>January 1-August 31, 2021</td>
<td>Study of breakthrough infection/hospitalization among fully vacciantated veterans. Note only 2% were in the analysis at day 200


</td>
</tr>
<tr>
<td>38</td>
<td>Rovida et al (September 23, 2021)</td>
<td>Italy</td>
<td>HCW</td>
<td>Alpha</td>
<td>Comirnaty</td>
<td>January 18-May 10, 2021</td>
<td>HCW cohort study


</td>
</tr>
</table>

37	Pilishvili et al (September 22, 2021)	USA	HCW	Multiple	Comirnaty mRNA-1273	December 28-May 19, 2021	TND case control among HCWs evaluated VE every 2 weeks for 14 weeks. 

36	El Sahly et al (September 22, 2021)	USA	RCT participants	Multiple	mRNA-1273	July 27, 2020-March 26, 2021	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 

<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>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><th></th></tr>
<tr><td></td><td></td><td>1000 person-yr</td><td></td><td></td><td>1000 person-yr</td><td></td><td>% (95% CI)</td></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>
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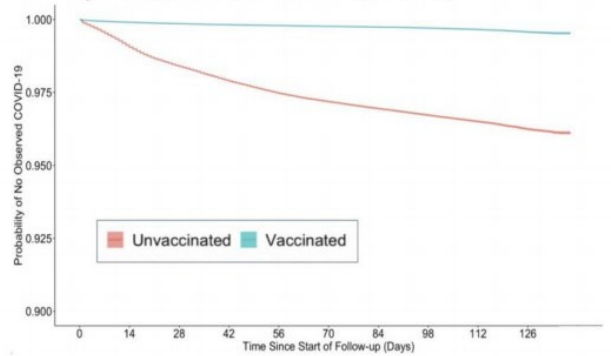
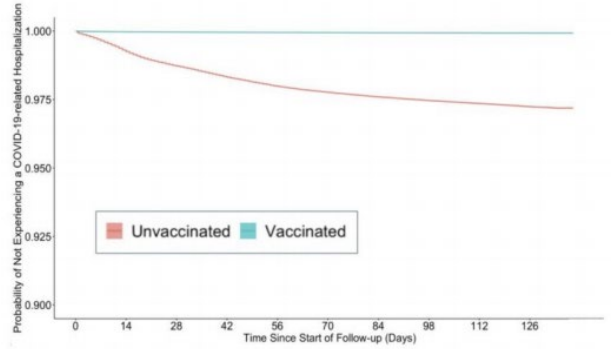
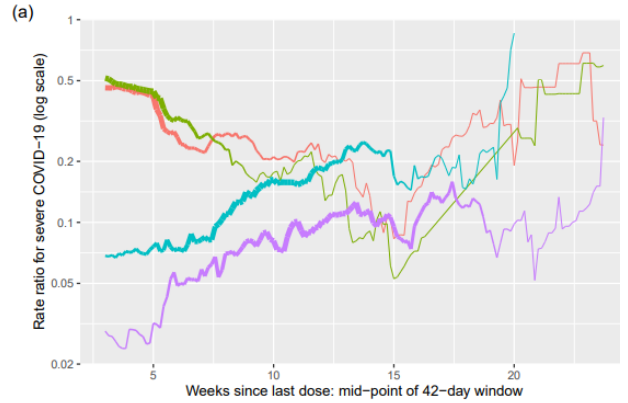
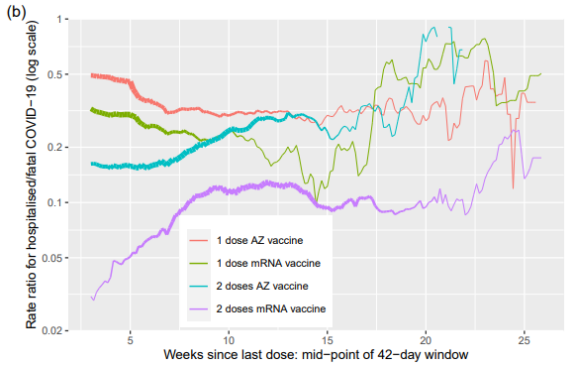
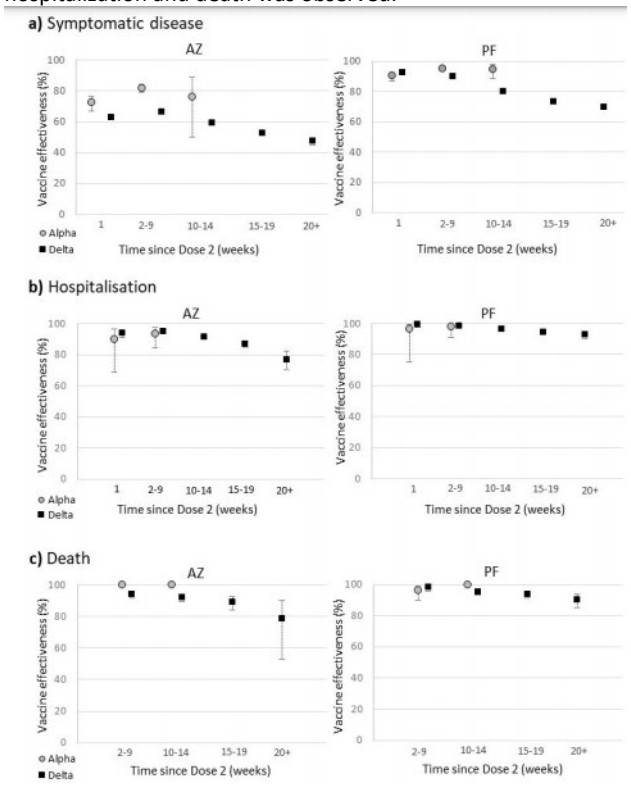
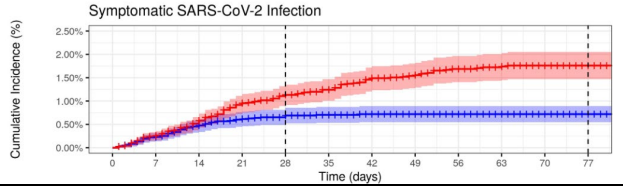
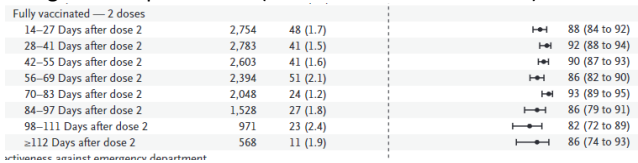
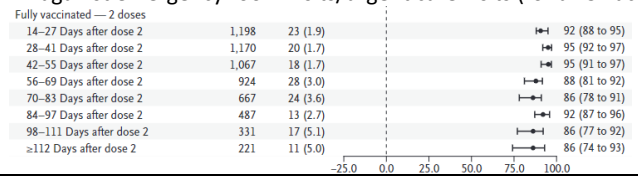
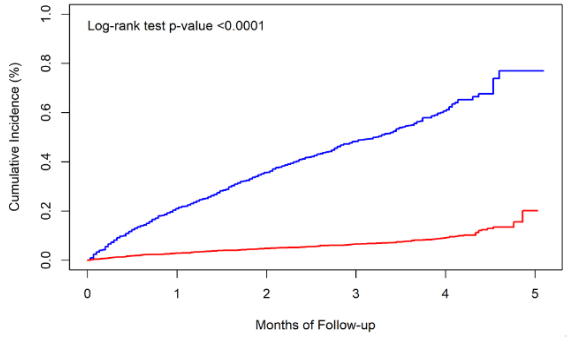
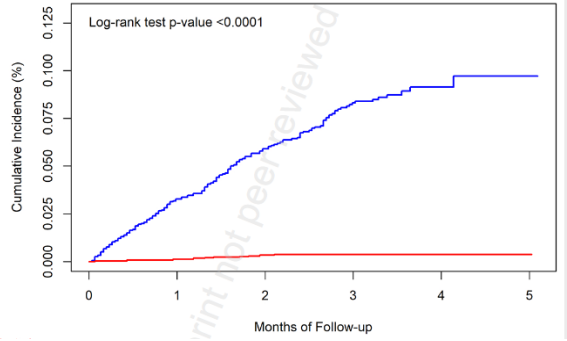
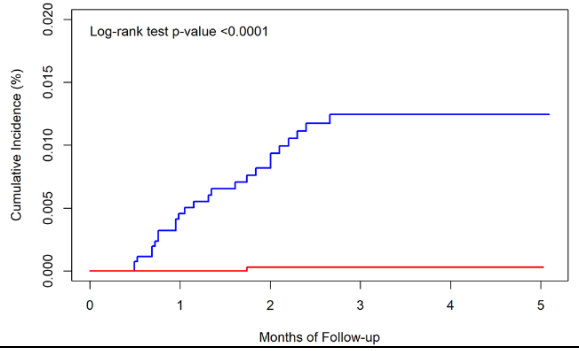
32	Pfizer (September 17, 2021)	Multiple	≥16-year-old RCT participants	Delta	Comirnaty	July 1-August 31, 2021	RCT participants were evaluated for duration of protection against symptomatic disease, with the original placebo recipients receiving the vaccine after unblinding. The mean time from Dose 2 of 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.
31	de Gier et al (September 17, 2021)	Netherlands	Hospitalized patients	Delta (just for duration of protection)	Comirnaty mRNA-1273 Ad26.COV2.S AZD1222	July 4-August 29, 2021 (just for duration of protection)	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.
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.

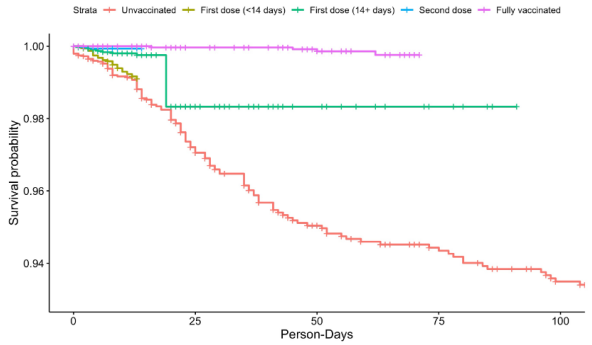
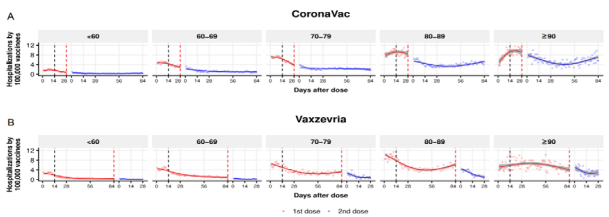
29	Polinski et al (September 12, 2021)	USA	≥18 years of age	Alpha/Delta	Ad26.COV2.S	March 1, 2021-July 31, 2021	Retrospective cohort study used insurance claims data linked to health data sources to evaluate VE of Ad26.COV2.S against COVID-19 diagnosis and hospitalization among vaccinated individuals 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. **2a) Time to observed COVID-19 in the national cohort**   **2b) Time to COVID-19-related hospitalization in the national cohort** 

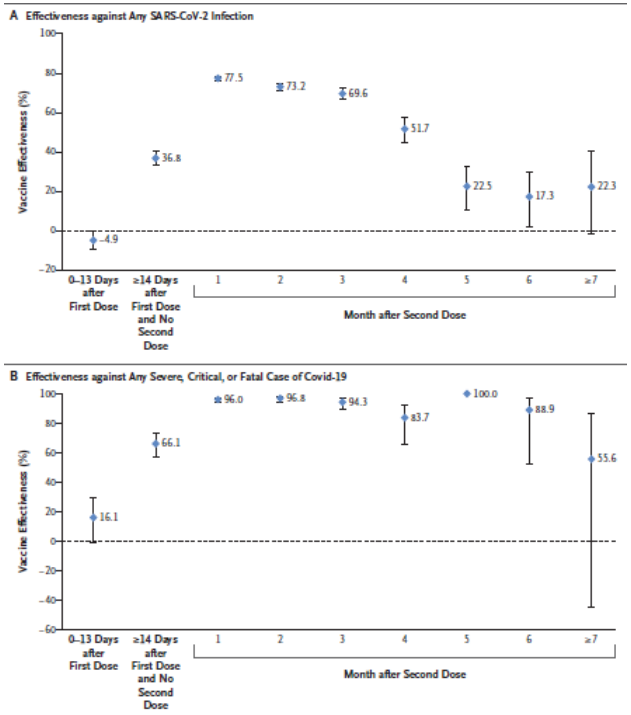
28	McKeigue et al (September 15, 2021)	Scotland	Population of Scotland	Alpha/Delta	Comirnaty mRNA-1273 AZD1222	December 1, 2020-August 19, 2021	Matched case-control study (REACT-SCOT) assessed rate ratios over time comparing rate of severe COVID-19 and the rate of hospitalization or death among those 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:  
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%).

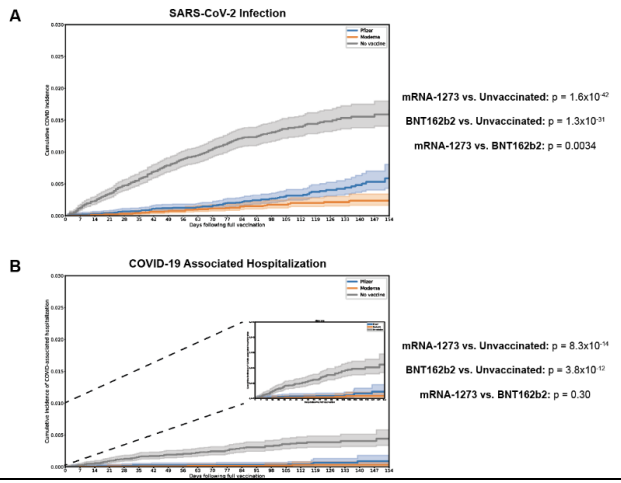
26	Andrews et al (September 14, 2021)	UK	Symptomatic cases and test-negative controls 16 years and older	Alpha/Delta	Comirnaty mRNA-1273 AZD1222	December 8, 2020-September 3, 2021	This test-negative case-control study assessed VE of 2 doses of Comirnaty, mRNA-1273, and AZD1222 against symptomatic disease, 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.

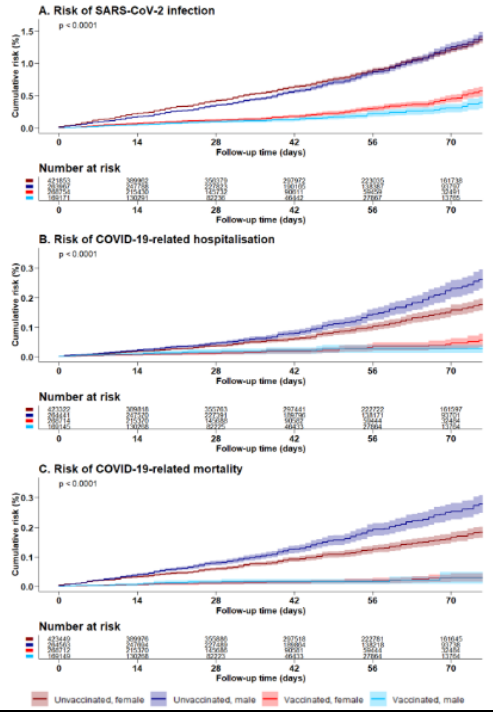
25	Dagan et al (September 9, 2021)	Israel	Pregnant women	Alpha/Delta	Comirnaty	December 20, 2020-June 3, 2021	Cohort study of pregnant women that showed no drop in VE through 56 days post dose 2 
24	Thompson et al (September 9, 2021)	USA	≥50 years of age	Multiple including alpha/delta	Comirnaty mRNA-1273 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** / **Level/Category** / **Symptomatic Infection [N = 974 positive events]** Time Relative to Full vaccination: Day 0 — 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.

21	Bruxvoort et al (September 2, 2021)	USA	General population	Delta/alpha	mRNA-1273	December 18-June 30, 2021	Cohort study among Kaiser insurance clients. KM curves for disease, hospitalization, and death, where red are fully vaccinated and blue and unvaccinated. A. COVID-19 diagnosis  B. COVID-19 hospitalization  C. COVID-19 hospital death 
20	Iliaki et al	USA	HCW		Comirnaty mRNA-1273	December-March 31, 2021	Cohort study among HCWs. For KM curve, defintions used include 1) unvaccinated 2) "first dose <14 days" within 14 days after the 1st dose (except for those receiving

	(September 6, 2021)				Ad26.COV2.S		J&J/Janssen), 3) "first dose 14+" 14+ days after the 1st dose and prior to the 2nd dose (except for those receiving J&J/Janssen), 4) "2nd dose" < 14 days after the 2nd dose; or < 14 days after the single dose (for those receiving J&J/Janssen), and 5) "fully vaccinated" – 14+ days after receiving full course (1 or 2 doses depending on brand). 
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). 
15	Puranik et al (August 8, 2021)	USA	25K vaccinated+ 25K unvaccinated Mayo Clinic Health System clients	Alpha→Delta	BNT162b2 mRNA-1273	January-July 2021	Cohort study evaluating vaccine effectiveness against infection by month of outcome. While they did not do a true duration of protection analysis, they provided these KM curves showing cumulative incidence of infection and hospitalization over time.

							
13	Tartof et al (August 23, 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]; 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].
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 unvaccinated to calculate

<table>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>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>11</td><td>Gomes et al (August 21, 2021)</td><td>Germany</td><td>≥80 years</td><td>Alpha</td><td>BNT162b2</td><td>January 9-April 11, 2021</td><td>Cohort study of all ≥80-year-olds living in Bavaria. Kaplan-Meier curves were generated though no VE estimate is given by time since vaccination.
Fig 3. Risk of SARS-CoV-2 infection and related outcomes after two BNT162b2 vac doses in Bavarian persons aged 80 years and above.
 
</td></tr>
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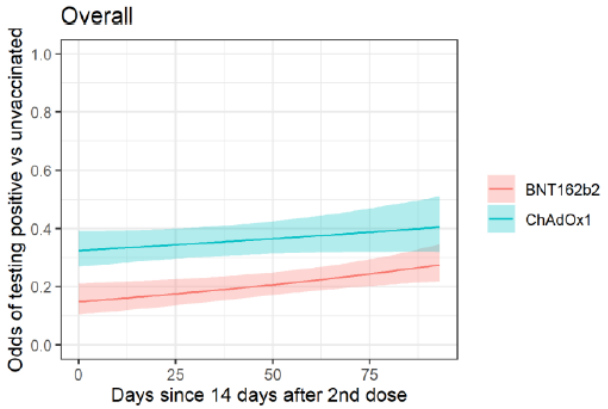
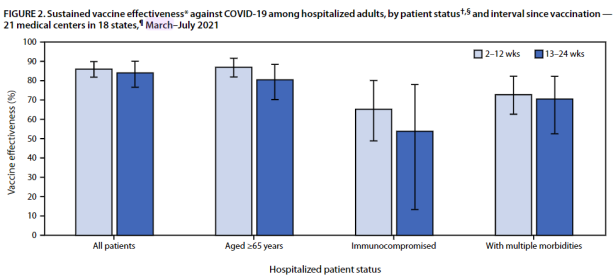
10	Pouwels et al (August 19, 2021)	UK	General adult population	Alpha, Delta	BNT162b2 mRNA-1273	December 1, 2020-August 1, 2020	COVID-19 infection survey is a household longitudinal survey with testing. During the delta dominant period, in those 18 to 64 years, VE of BNT162b2 against new PCR-positives 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). 
9	Tenforde et al (August 18, 2021)	USA	Hospitalized patients	Alpha > Delta	BNT162b2 mRNA-1273	March 11-July 14, 2021	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. 
8	Yassi et al	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.

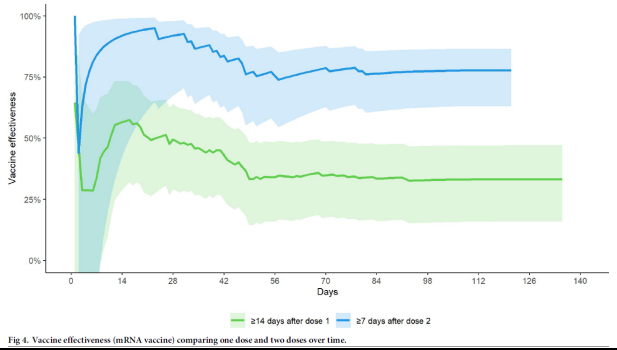
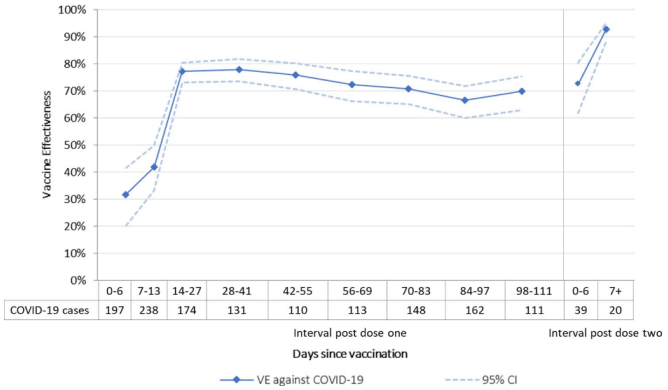
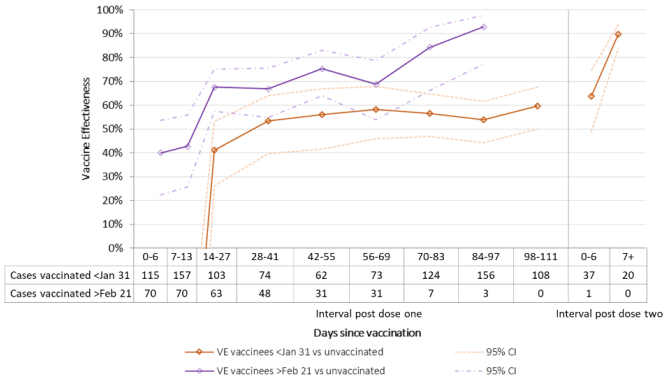
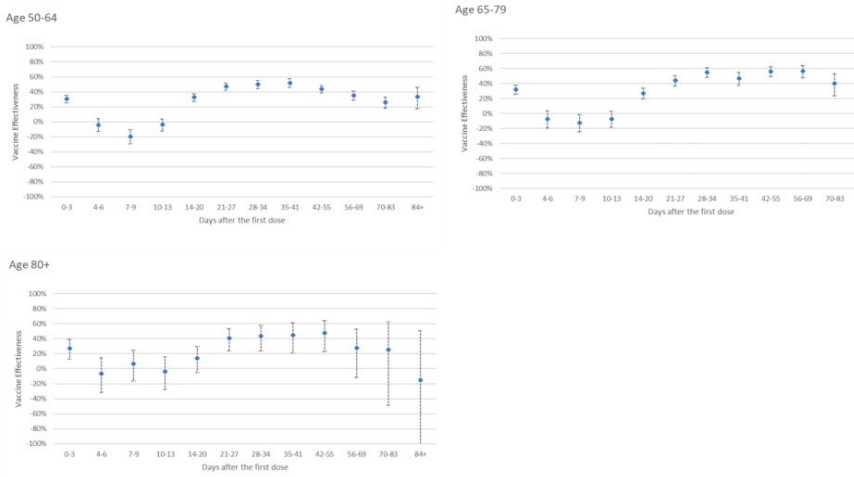
							 Fig 4. Vaccine effectiveness (mRNA vaccine) comparing one dose and two doses over time.
7	Chemaitelly et al (August 9, 2021)	Qatar	Immunosuppressed kidney transplant patients	Alpha/Beta	BNT162b2 mRNA-1273	February 1-July 21, 2021	Retrospective cohort study finding VE against infection was 73.9% (95% 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 

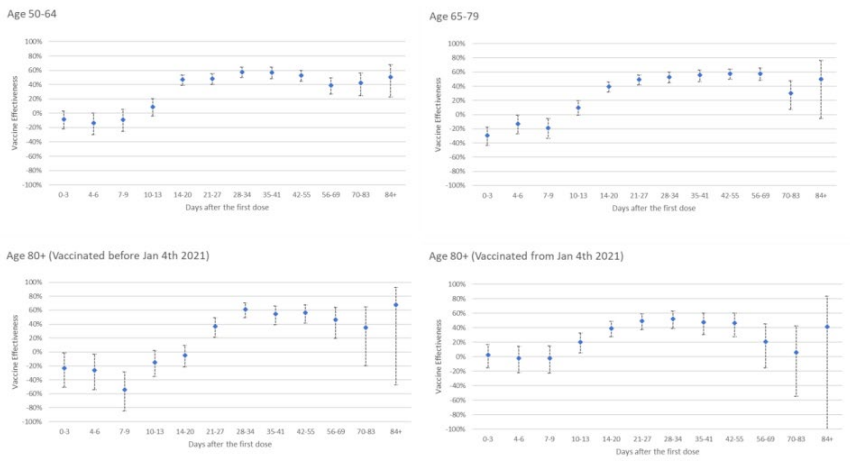
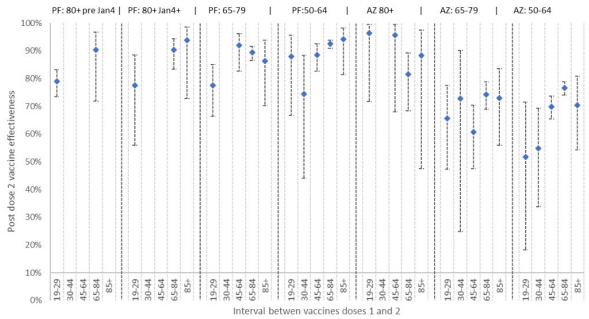
							(b) Pfizer  **Figure 4: Two dose vaccine effectiveness by age group, vaccine type and interval between doses** 
4	Public Health England Week 20 (May 20, 2021)	UK	65+ year old population	Alpha/Delta	BNT162b2 AZD1222	December-May 2021	This is a test-negative case control study linking surveillance and 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+.

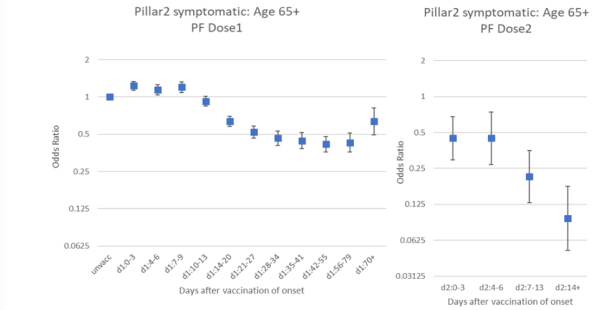
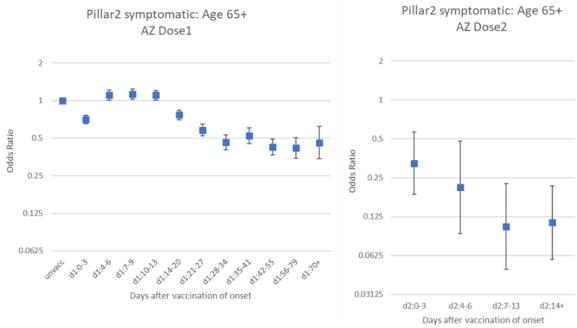
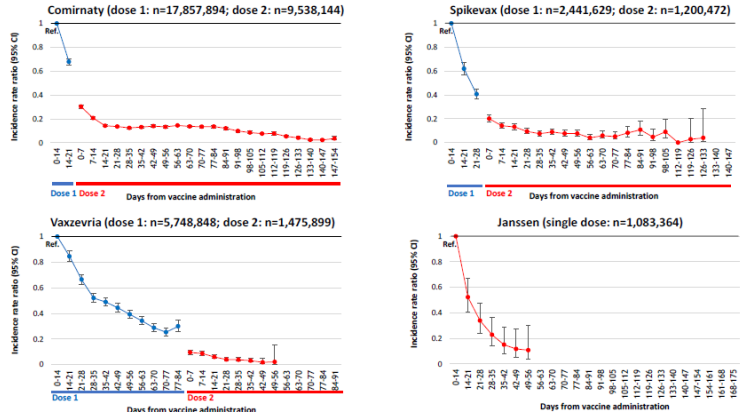
							Figure 1: Odds ratios for becoming a case by days after vaccination – Dose 1 and Dose 2 (Pfizer-BioNTech) among individuals aged 65 years and older  **Figure 2: Odds ratios for becoming a case by days after vaccination – Dose 1 and Dose 2 (AstraZeneca) among individuals aged 65 years and older** 
3	Italian 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

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
9	Eyre et al (September 29, 2021)	England	Retrospective cohort	99,597 index cases and 139,164 contacts of all ages	Alpha^ specifically	Included	BNT162b2	Transmission to contacts	26 (20-30)	0+ up to 13 days post dose 2	82 (71-88)	14+	~20.5 weeks
							AZD1222		18 (12-24)		63 (37-78)		~8 weeks
					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	Israel	Retrospective cohort		Original and Alpha¶	Unknown	BNT162b2	Infectiousness given Infection	—	—	41.3(9.5-73.0)	10+	

#	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
	(July 16, 2021)			253,564 Israeli individuals from 65,264 households with at least 1 infected individual and at least 2 members				Transmission			88.5(82.3-94.8)		
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. Vaccine Impact: Summary of Ecologic Study Results for Post-Authorization COVID-19 Vaccine Products[#]

#	Reference (date)	Country	Design	Population	Dominant Variants	Vaccine Product	Descriptive Findings
71	Vahidy et al*(October 12, 2021)	US	Cross-sectional	27,291 employees of a healthcare system in Houston, Texas.	Alpha, Beta, Gamma and Delta^	mRNA-1273, BNT162b2 and Ad26.COV2.S	This study was conducted in Houston-Methodist health care system in Texas from December 2020 to June 2021, with the objective of evaluating reduction in SARS-CoV-2 infections, after the roll-out of COVID-19 vaccines. The study estimated that the mean SARS-CoV-2 weekly positivity rate prior to initiation of the HCW vaccination programme (11.8%) was significantly higher compared with the positivity rate following vaccination initiation (2.4%, p<0.001). The infection rate amongst HCWs participating in surveillance testing has consistently remained below 3.1% since January. The short-term disability use utilisation by employees progressively declined by 69.8% during the most recent reporting period- 30th May to June 2021, with utilisation numbers approaching pre-pandemic levels.
70	Nordstrom et al* (October 11, 2021)	Sweden	Retrospective cohort	1,789,728 individuals from 814,806 families	Alpha^	mRNA-1273, BNT162b2, & AZD1222	This nationwide retrospective cohort study evaluated the association between the risk of SARS-CoV-2 infection in nonimmune individuals and the immunity status of their family members. Immune persons were those with either a previous SARS-CoV-2 infection or full vaccination by April 14, 2021, and only families with 2-5 members were included. Incidence of COVID-19 infection among nonimmune individuals between April 15-May 26 was assessed using Cox proportional hazards regression by family size, with the number of immune family members as the main variable of interest. The study found a significant inverse dose-response association wherein the risk of infection in nonimmune persons decreased as the number of immune family members increased, regardless of family size. Relative to families with no immune members, the risk of COVID-19 infection among nonimmune family members was reduced by 45-61%, 75-86%, 91-94%, and 97% in families with 1, 2, 3, or 4 immune members, respectively. The results were similar for the outcome of hospitalization for COVID-19 among nonimmune persons.
69	Paetzold (October 7, 2021)	Austria	Retrospective cohort	Austrian population	Beta^	BNT162b2	This nation-wide retrospective cohort study utilised data from the Austrian Epidemiological Reporting system to assess the impact of cross-protection to unvaccinated individuals during a period of Beta

#	Reference (date)	Country	Design	Population	Dominant Variants	Vaccine Product	Descriptive Findings
							variant driven outbreak from January to May 2021. The primary findings from the study illustrate a stark difference in the vaccination coverage from March to April- from 5% to 60%, and the large scale rollout of the BNT162b2 vaccine was associated with a significant reduction in new SARS-CoV-2 infections among the age-cohort of unvaccinated children of around 40-65% relative to the same age-cohort from the control regions.
68	Liu et al (October 7, 2021)	USA	Test-negative case control	14,362 matched adult residents (18+) of New York City	Non-VOC, then Alpha, then Delta††	BNT162b2 & mRNA-1273	Among other analyses, this study assesses the impact of full vaccination on reducing SARS-CoV-2 infection rates and the risk of severe COVID-19 outcomes between January 18-September 21, 2021, using electronic health records from a quaternary care academic medical center in New York City. Monthly incidence were highest among unvaccinated persons throughout the study period compared to those fully vaccinated with either vaccine. Using logistic regression, the study found that vaccination reduced the odds of SARS-CoV-2 infection by 88.4% compared to a matched cohort from the pre-vaccination period (adj. OR 0.116, 95% CI 0.0998-0.135). A Cox regression analysis of infected persons comparing cases from pre- and post-vaccination periods found that vaccination significantly reduced the hazard of death by 80% (aHR 0.2, 0.0824-0.487). It also reduced the hazard of mechanical ventilation and tracheostomy, and increased the hazard of hospitalization, though these findings were not statistically significant. A similar analysis comparing vaccinated cases to contemporaneous unvaccinated cases found that vaccination significantly reduced the hazard of hospitalization by 27.7% (aHR 0.723, 0.6-0.872). The hazards of mechanical ventilation, tracheostomy, and death were also reduced, though these findings were not statistically significant.
67	Wisnivesky et al (October 5, 2021)	USA	Prospective cohort	464 New York City residents	Non-VOC, Alpha, Delta††	BNT162b2, mRNA-1273, Ad26.COV2.S	This prospective cohort study was undertaken to assess whether vaccination was associated with Post-Acute Sequelae of COVID(PASC) in New York City. A total 464 participants were recruited from the registry. The study did not find any significant differences in change in PASC symptoms from

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							baseline to six months between vaccinated and unvaccinated participants.
66	Hollinghurst et al (October 3, 2021)	UK	Prospective cohort	14,786 older care home residents (aged 65+) living in Wales	Non-VOC, Alpha, Delta††	BNT162b2, mRNA-1273, AZD1222, Ad26.COV2.S	This longitudinal observational cohort study was undertaken to identify individual level risk factors for SARS-CoV-2 infection with the inclusion of community positive test rate of COVID-19, hospital admissions and vaccination status among residents of care home. Results indicated a high proportion of observations with a positive PCR test had not been vaccinated (96%), and of those with a positive test who were unvaccinated a significant proportion were hospital inpatients (19%).The estimated community positive test rate of COVID-19 was largely correlated with the positive test rate amongst care home residents, with peaks in November and January. There was a large decrease in testing and positive tests amongst care home residents after February when the vaccination program was ongoing.
65	Ronchini et al. September 30th 2021)	Italy	Prospective cohort	2121 personnel working at a large cancer centre in Milan	Non-VOC, Alpha, Delta††	BNT162b2 & AZD122	This prospective surveillance program was conducted from April 2020 and monitoring was continued till June 2021. The study estimated that the probability of infection after vaccination was significantly lower than in non-vaccinated subjects. The time of acquiring an infection varied from few days 105 post-vaccination to >4 months after completion of the vaccination. Secondly, the study also reported that infections in individuals who had a serologically positive response to vaccination are of significantly shorter duration than the first infections in non-vaccinated individuals. Thirdly, the levels of anti-SARS-CoV-2 circulating IgGs were inversely correlated with the frequency and duration of viral detection.
64	Paredes et al(September 30th, 2021)	USA	Retrospective cohort	27,814 cases	Non-VOC, Alpha, Delta, Gamma, Beta	BNT162b2, mRNA-1273, Ad26.COV2.S	This retrospective cohort study estimated the risk of hospitalisation with 9 VOCs/VOIs using epidemiologic and genomic data from Washington. Overall, cases infected with any VOC presented a higher risk of hospitalization, compared to cases without a classified VOC/VOI. The highest risk of hospitalization were found in cases infected with the Gamma variant (HR 3.17, 95% CI 2.15-4.67) and in cases infected with the Beta variant (HR 2.97, 95% CI 1.65-5.35). The study also estimated that being unvaccinated and

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							infected with Gamma, Delta or Alpha variant increased the likelihood of hospitalization.
63	Agrawal et el(September 29,2021)	Scotland	Prospective cohort	5.4 million Scottish population	Non-VOC, Alpha††	BNT162b2, AZD1222	This prospective cohort study used data from the Early Pandemic Evaluation and Enhanced Surveillance of COVID-19 (EAVE II) national surveillance platform to estimate the frequency of COVID-19 hospitalisation or death in people who received at least one vaccine dose and characterise these individuals in Scotland. The study follow-up period lasted till April 18,2021. Severe COVID-19 outcomes were associated with older age(adjusted RR 4·75, 95% CI 3·85–5·87), comorbidities (adjusted RR 4·24, 3·34–5·39), hospitalisation in the previous 4 weeks (adjusted RR, 3·00, 95%CI 2·47–3·65), high-risk occupations (adjusted RR, I2·14, 95%CI 1·62–2·81), care home residence (adjusted RR 1·63, 95%CI 1·32–2·02), socioeconomic deprivation (adjusted RR 1·57, 95%CI 1·30–1·90), male sex (adjusted RR 1·27, 95%CI 1·13–1·43), and being an ex-smoker (adjusted RR 1·18, 95%CI 1·01–1·38). A history of COVID-19 before vaccination was protective (adjusted RR 0·40, 95%CI 0·29–0·54).
62	Arifin et al (September 29, 2021)	Malaysia	Ecologic	25,935 deaths among the population of Malaysia	Non-VOC, Beta, Delta††	BNT162b2, CoronaVac, AZD1222	This ecologic study analyzed national surveillance COVID-19-related death and vaccination data. The data was combined using logistic regression with frequency weighting. Of the 25,935 total COVID-19 related deaths up to September 28, 2021, 69.9% were unvaccinated, 22.5% were partially vaccinated (receipt of any dose through <14 days after final dose), and 7.5% were fully vaccinated (>14 days after final dose). Compared to unvaccinated persons, partially vaccinated groups had a 4.9 times lower risk of death, and fully vaccinated groups had an 8.8 times lower risk of death.
61	Acharya et al (September 29, 2021)	USA	Retrospective cohort	869 test samples from individuals (aged 1+) who sought testing at a community-based testing site in San Francisco or City of Davis/Yolo County testing program in California	Delta^	BNT162b2, mRNA-1273, Ad26.COV2.S	This study compares cycle threshold values (Ct-values) among fully vaccinated versus unvaccinated and symptomatic versus asymptomatic individuals from two testing sites: one in San Francisco (UeS-symptomatic or asymptomatic) and one in Davis, California (HYT- asymptomatic only) during a period of dominant Delta transmission (June 17-August 31, 2021). A total of 869 test samples were included, and Ct-values were compared using two sided t-tests. In

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							contrast to other studies that have found higher Ct-values (corresponding to lower viral load) among vaccinated compared to unvaccinated persons, the study found no statistically significant differences in mean Ct-values among fully vaccinated versus unvaccinated samples for either population: UeS 23.1 vs. 23.4, and HYT 25.5 vs. 25.4. Both the vaccinated and unvaccinated groups had varied Ct-values (<15 to >30). There were also no significant differences in Ct-values between asymptomatic vs. symptomatic cases.
60	De Leo (September 28, 2021)	Israel	Ecologic	Adults aged 60+ in Israel	Delta^	BNT162b2	This study used national surveillance data to assess the impact of the BNT162b2 booster shot on vaccine effectiveness (VE) estimates among adults aged 60 or more. VE estimates were calculated daily based on incidence rate ratios of severe SARS-CoV-2 infections. On August 3 (the beginning of the study period), the daily VE was 76.8%, substantially lower than measured VE against severe disease in Israel from January-April (97.5%). Booster vaccination began in July, and by September 2 (the end of the study period), 40% of fully vaccinate persons had received a booster shot of BNT162b2. Daily VE rose steadily along with booster coverage throughout August, reaching 93.8% on September 1.
59	Holt et al* (September 27, 2021)	UAE	Prospective cohort	1296 dialysis patients in the UAE	Beta††	Sinopharm	This prospective study looked at responses to the Sinopharm vaccine and SARS-CoV-2 infection in a cohort of dialysis patients at kidney care facilities in Abu Dhabi from March 2020-August 2021. Of 512 PCR-positive patients, 64% were unvaccinated and 37% were vaccinated. Vaccinated cases had significantly shorter duration of infection, or COVID positive days, compared to unvaccinated cases (median 14 versus 17 days, p=0.0001). Among 32 of the cases for which complete antibody information was available, there was no difference between antibody levels in vaccinated and unvaccinated patients. From March 2020 until the start of vaccination in January 2021, the case fatality ratio (CFR) was about 8.9% (17/190), whereas in the post-vaccination period (end of March-August 2021) the CFR fell to 5.2% (13/250). The overall CFRs in unvaccinated and vaccinated patients were 8.7% and 4.3% respectively. Among 32 of the cases for which

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							complete antibody information was available, there was no difference in antibody levels between vaccinated and unvaccinated patients.
58	Haas et al(September 22,2021)*	Israel	Retrospective cohort	All Israeli residents aged ≥16 years	Alpha^	BNT162b2	This retrospective surveillance utilised data from Israeli Ministry of Health from the first 112 days(December 20,2020 to April 10,2021) to estimate the averted burden of four outcomes: documented infections, COVID-19 related hospitalizations, severe disease and deaths. At the end of the follow-up period, 79.8% of Israeli residents aged ≥ 16 years and above were at least partially vaccinated. Age-specific incidence rate was calculated. The study estimated a considerable difference in rates of SARS-CoV-2 infections when stratified by age and time and were generally highest in January and February, 2021. The largest rate differences in hospitalisation and deaths between unvaccinated and vaccinated groups were observed among people aged 65 years or older. The study also reported that overall 158 665 (95% CI 144 640–172 690) SARS-CoV-2 infections, 24 597 (18 942–30 252) hospitalisations, 17 432 (12 770–22 094) severe or critical hospitalisations, and 5532 (3085–7982) deaths were averted among the at least partly vaccinated population who were aged 16 years or older up to April 10, 2021.
57	Alkhafaji et al (October 11, 2021) *[Update to Sep 22 preprint]*	Saudi Arabia	Retrospective cohort	331 hospitalized patients with COVID-19 disease at a single center	Unknown	BNT162b2 and AZD1222	This study assessed the impact of vaccination on disease outcomes (ICU admission, mechanical ventilation, death, length of hospital stay) among 331 patients hospitalized with COVID-19 at King Fahad University Hospital between April and July 2021. Chi square tests were performed to evaluate associations between variables, including vaccination status and outcomes. Nearly two thirds of participants had received no doses of vaccine, 16.8% had received both doses, and the remaining 19.2% had received one dose. Unvaccinated participants had significantly longer hospital stays than those who had received at least one dose (p=0.02): receipt of any dose reduced the length of hospital stay by 19.7%. Those who had received a vaccine dose >14 days before were significantly less likely to require admission to intensive care (ICU) than those who had received a dose within 14 days (p=0.03). Receipt of any vaccine

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							dose reduced the mortality rate in the cohort by 50%, but the relationship was not statistically significant (p=0.16). No statistically significant differences were observed by vaccine or by doses received in the cohort.
56	Barandalla et al(September 15, 2021)*	Spain	Retrospective cohort	All Spanish residents aged ≥18 years	Alpha and Delta^	BNT162b2, mRNA-1273, Ad26.COV2.S and AZD1222	This study evaluated the impact of vaccination on nation-wide COVID 19 hospitalizations by age-groups, from February 2020 to June 2021 using data from the website of Health Ministry. The reference groups for calculating the incidence rate differed by age-groups and time periods in accordance with the country-specific vaccination policies. The study included 363,960 COVID-19 hospitalizations till June 21st, 2021 and approximately 55% of the population had received at least 1 dose of any vaccine, with a higher proportion receiving BNTB162b2. The adjusted risk of hospitalization increased exponentially on average 71.5% for each decade older above 20 years-old. The study reported a strong inverse relationship between vaccination rollout and COVID-19 hospitalizations, which was noticed in the oldest age groups that became vaccinated earlier.
55	Prato' et al* (September 17, 2021)	Italy	Retrospective cohort	671 HCW in a hospital in Northern Italy	Alpha††	BNT162b2	This study is a retrospective cohort study with an aim to determine if vaccination with the Pfizer BNT162b2 mRNA vaccine can lessen the duration of sick leave among healthcare workers (HCWs) by determining the incidence of asymptomatic infection caused by SARS CoV-2 virus post-vaccination. This study included 671 HCWs with a median age of 39 yeas (range: 22-70 years), who were mostly women (86%). The study concluded that positive cases were reduced from 15.6% to 7.5% after the vaccination period (p <0.0001). This study concluded that even in the case of asymptomatic infection, vaccinated HCWs have a reduced incidence and shorter sick leave following vaccination.
54	Schwarzer et al (September 16, 2021)	Germany	Retrospective cohort	9 staff and 23 residents of a senior citizen home in Bremen, Germany with confirmed SARS-CoV-2 infection	Non-VOC^	BNT162b2	This study evaluated the impact of one dose of BNT162b2 (partial vaccination) on the severity of disease during a COVID-19 outbreak at a senior citizen home. Of 32 PCR-confirmed infections, 22 were among partially vaccinated persons (all residents) while 10 were among unvaccinated persons (9 staff and 1 resident). The majority of cases among partially

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							vaccinated residents were asymptomatic (20/22) while the other 2 experienced mild symptoms (tiredness, temporary lower oxygen saturation, or slightly elevated body temperature). Among the infected unvaccinated staff and resident, 9 of the 10 cases experienced severe symptoms (fever >38.5°C, dry cough, exhaustion, dyspnea, chest pain, ageusia, weakness, hospitalization, death), including 1 death (resident) and 1 hospitalization (staff). The remaining unvaccinated case experienced mild symptoms.
53	Glatman-Freedman et al* (September 16, 2021)	Israel	Retrospective longitudinal cohort	All Israeli residents aged 16+	Alpha^	BNT162b2	This study evaluated the effects of BNT162b2 vaccines on both prevention of COVID-19 related outcomes and on hospitalization, deaths and severe/critical illness amongst vaccinated individuals. The rate reductions for hospitalizations, severe/critical disease and deaths for 16-year-old individuals who became SARS-CoV-2-positive on days 14-20 after the first vaccine dose were 44.2% (95% CI: 27.3-57.3), 46.8% (95% CI: 32.9-57.9) and 36.4% (95% CI: 18.6-50.4%), respectively. The rate reductions for hospitalizations, severe/critical disease and deaths for individuals who became SARS-CoV-2-positive on days 22-28 after the first vaccine dose were 56.1% (95% CI: 35.0-70.4), 66.2% (95% CI: 44.2-79.6) and 47.4% (95% CI: 4.3-71.2), respectively. The study also reported that further analysis by stratifying age group demonstrated that the rate reductions for hospitalizations and severe/critical disease among 80-year-old individuals were lower than other age categories during the first three evaluation periods.
52	Scobie et al (September 10,2021)	USA	Retrospective cohort	Adults ≥18 years from 13 US jurisdictions.	Delta^	BNT162b2, mRNA-1273, and Ad26.COV2.S	This study analyzed rates of COVID-19 cases, hospitalizations and deaths in adults ≥ 18 years during the period of April 4 to July 17, 2021 across 13 US jurisdictions. The weekly prevalence of the SARS-CoV-2 Delta variant increased from <1% to 90% during the study period. Averaged weekly, age-standardized rates (per 100,000) were higher among unvaccinated and partially vaccinated than among fully vaccinated persons for reported cases (112.3 versus 10.1), hospitalizations (9.1 versus 0.7), and deaths (1.6 versus 0.1) during April 4–June 19, as well as during June 20–July 17 (89.1 versus 19.4; 7.0 versus 0.7; 1.1 versus 0.1, respectively). Higher hospitalization and death rates were observed in older age groups,

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							regardless of vaccination status, resulting in a larger impact of age-standardization on overall incidence for these outcomes.
51	Delahoy et al (September 10, 2021)	USA	Retrospective cohort	Hospitalized children and adolescents aged 0-17 years from 14 US states	Delta^	BNT162b2	This retrospective cohort study analyzed data from the COVID-NET surveillance system to describe COVID-19–associated hospitalizations from March 1, 2020 to August 14, 2021. The cumulative incidence of hospitalization during the entire study period was 49.7 per 100,000 children and adolescents. During June 20–July 31, 2021 which coincided with a rising prevalence of the Delta variant, the hospitalization rate among unvaccinated adolescents (aged 12–17 years) was 10.1 times higher than that among fully vaccinated adolescents. Hospitalization rates were comparatively higher among children aged 0-4 years. Among all hospitalized children and adolescents with COVID-19, the proportions with indicators of severe disease (such as intensive care unit [ICU] admission) during the period of Delta variant were similar to those earlier in the pandemic (March 1, 2020–June 19, 2021).
50	Isitt et al (September 7, 2021)	Sweden	Retrospective cohort	58,174 Long Term Care Facility (LTCF) residents, 62,306 adults aged 80+, and 1,748,657 adults aged 18-79 in Region Stockholm	Alpha††	BNT162b2, mRNA-1273, and AZD1222	This study compared pre- and post-vaccination incidence rate ratios (IRR) of SARS-CoV-2 infections and deaths among groups of adults in Region Stockholm and estimated infections and deaths prevented by vaccination through May 2, 2021. The vaccinated groups included LTCF residents or adults receiving home care (beginning December 27, 2020), and adults aged 80+ (beginning March 8). At least 80% of these groups had received at least one dose by 4 weeks after the start of vaccination, and the majority received mRNA vaccines. Compared to the unvaccinated control group (adults aged 18-79), the IRR for infection in the LTCF/home care group fell from 1.70 in the pre-vaccination period (95% CI 1.54-1.88) to 0.59 postvaccination (0.49-0.71), while the IRR in the 80+ cohort fell from 0.38 (0.33-0.44) to 0.17 (0.09-0.27) (3112 infections prevented).. The IRR for death also decreased in both groups compared to the control group: from 179 pre-vaccination (146-221) to 45 postvaccination (35-59) in the LTCF/home care group, and from 20 pre-vaccination (16-26) to 9 post-

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							vaccination (5-18) in the 80+ cohort (808 deaths prevented).
49	Pritchard et al (September 5, 2021)	United Kingdom	Longitudinal household survey	482,677 individuals (aged 2+) from a randomly selected, representative sample of private households in the UK	Non-VOC^ (before December 2020), Alpha^ (December 2020-May 2021), and Delta^ (June-July 2021)	AZD1222, BNT162b2, mRNA-1273	This longitudinal household survey included PCR results from swabs and questionnaires collected between 19 July 2020 and 17 July 2021 in the UK's national COVID-19 Infection Survey. The authors estimated associations between test positivity and 60 demographic and behavioral characteristics—including vaccination—using logistic regression. After national vaccine rollout began in December 2020, there was a large, sustained reduction in positivity among vaccinated individuals relative to unvaccinated individuals (no OR available). Positivity rates in June-July 2021 (Delta predominance) were higher among unvaccinated relative to vaccinated groups.
48	Bager et al* (September 3, 2021)	Denmark	Retrospective cohort	88,858 SARS-CoV-2 cases in Denmark	Alpha and Delta^	AZD1222, BNT162b2, mRNA-1273, and	This study assessed the risk of hospitalization for Delta-infected SARS-CoV-2 individuals relative to the risk of hospitalization in Alpha-infected persons. Of 44 patients hospitalized with Delta during the study period (1 January-11 July, 2021), 30 were unvaccinated, 10 had received one dose within less than 14 days of testing positive (effectively unprotected), 2 tested positive >14 days after one dose up to 14 days post-dose 2 (one effective dose), and 2 tested positive >14 days after two doses (two effective doses). Among persons who had received one or two effective doses there was no significant difference in adjusted risk of hospitalization between Delta and Alpha cases (RR 1.29, 95% CI 0.30-5.48 for one dose and 1.25, 0.34-4.59 for two doses). On the other hand, among unvaccinated persons and those who received one dose within 14 days, the risk of hospitalization among Delta cases was significantly higher than for Alpha cases (RR 3.01, 95% CI 2.02-4.50 for unvaccinated and 3.98, 2.27-6.99 for one dose =<14 days). The study also presents adjusted RRs for Delta hospitalization relative to Alpha hospitalization overall and by age group.
47	Jablonska et al (September 3, 2021)	Europe/Israel	Time-series analysis	General populations of 32 countries in Europe/Israel	Alpha^	AZD1222 and BNT162b2	This study is a time-series analysis that aimed at estimating the real-life impact of vaccination on COVID-19 mortality with adjustment for variants and other factors in 32 countries across Europe and Israel. The time-series analysis, performed using non-linear

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							Poisson mixed regression models, revealed that vaccination efficacy regarding protection against death was 72% with a lower reduction for variants (70% reduction and 78% reduction for Alpha and other non-alpha variants, respectively). Neutralization titers against the Alpha variant were 3.3-fold and 2.5-fold lower for Pfizer and AstraZeneca vaccines, respectively.
46	Esquenazi et al (September 2, 2021)	USA	Retrospective cohort	Healthcare workers in an inpatient rehabilitation facility	Alpha and Beta^	BNT162b2	This report summaries the comparative results and experiences of an inpatient rehabilitation facility during the COVID-19 pandemic before and after the Pfizer vaccine was given to staff. This report demonstrated the rate of infection and protective advantage of healthcare workers, with a significant reduction in the rate of infection. Prior to vaccination, the infection rate among inpatient staff was reported as 23% and dropped to 2.5% after vaccination.
45	Havers et al (August 29,2021)	USA	Retrospective Cohort	General population	Delta^	BNT162b2, mRNA-1273, and Ad26.COV2.S	This study is a cohort study that utilizes surveillance data from COVID-NET to examine characteristics associated with breakthrough cases. Multivariable logistic regression was used to examine the factors associated with vaccine breakthrough cases; the models included age, race, Hispanic ethnicity, long-term care facility residence, and prevalence of underlying medical conditions. The association between vaccination and severe COVID-19 (defined as ICU admission or in-hospital death) was also examined. From January 1, 2021 to June 30, 2021 fully vaccinated cases increased from 1 (.01%) to 321 (16.1%) per month. Among 4,732 sampled cases, fully vaccinated persons admitted with COVID-19 were older compared to unvaccinated persons, more likely to have 3 or more underlying medical conditions, and be residents of long-term care facilities.
44	Griffin et al(August 27,2021)	USA	Retrospective cohort	9,651,332 Los Angeles County residents	Delta^	BNT162b2, mRNA-1273, and Ad26.COV2.S	This study estimated the age-adjusted infection and hospitalization rates amongst vaccinated and unvaccinated residents of Los Angeles county from May 1- July 25 2021. Overall, the proportion of individuals hospitalized, required admission to intensive care and required ventilation were lower in fully vaccinated individuals compared to partially vaccinated and unvaccinated individuals. Among all Los Angeles County residents, the age-adjusted 7-day

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							incidence and hospitalization rates increased exponentially among unvaccinated, fully vaccinated, and partially vaccinated persons, with the highest rates among unvaccinated persons in late June. The authors noted that in the month of July with a predominance of Delta variant, the cycle threshold values were similar for unvaccinated, partially vaccinated and fully vaccinated.
43	Kissler et al (Aug 25, 2021)	USA	Convenience sample (prospective)	173 individuals with SARS-CoV-2 infection among staff and players affiliated with the National Basketball Association (NBA)	Alpha, Delta, Non-VOC^	BNT162b2, mRNA-1273, and Ad26.COV2.S	This study evaluated SARS-CoV-2 infections among players and staff affiliated with the NBA between November 28, 2020 and August 11, 2021. The authors compared viral proliferation, viral clearance, and peak viral concentration between vaccinated and unvaccinated cases, as well as among other subgroups. There was no observed significant difference in mean peak viral concentration or viral proliferation duration between vaccinated and unvaccinated individuals. Breakthrough infections (among fully vaccinated) had a faster viral clearance time relative to unvaccinated cases [5.5 days (95% CI 4.6-6.5) vs. 7.5 days (95% CI 6.8-8.2)], resulting in a shorter duration of infection (8.7 days vs. 11 days). The authors found no difference in viral trajectories between those who received BNT162b2 and those who received Ad26.COV2.S (viral trajectories of mRNA-1273 were not assessed due to small sample size).
42	Harris et al (Aug 20, 2021)	USA	Ecologic	General populations of the 112 most populous counties in the US (147 million persons total)	Delta^	BNT162b2, mRNA-1273, and Ad26.COV2.S	This study looked at the relationship between vaccination coverage—using the percent of the county population that was fully vaccinated as of mid-July—and COVID-19 incidence and hospitalization between July 30-August 12. When comparing the 50% of counties with the lowest vaccination coverage to the 50% of counties with the highest (mean coverage 42.61% versus 57.3%), counties with lower coverage experienced significantly higher COVID-19 incidence and hospitalization rates (incidence: 543.8 versus 280.7 per 100,000; hospitalizations: 55.37 versus 20.48 per 100,000). Log-linear regression analysis revealed that an increase of 10 percentage points in vaccination coverage was associated with a 28.3% decrease in COVID-19 incidence, a 44.9% decrease in

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							hospitalizations, and a 16.6% decrease in hospitalizations per 100 cases.
41	Escobar-Agreda et al (August 5, 2021)	Peru	Survival analysis	998,295 adults aged 18-59 with SARS-CoV-2 infection in Peru	Non-VOC††	Sinopharm	This study assessed the survival of healthcare workers (HCWs) infected with SARS-CoV-2 in periods before and after vaccination by comparing the hazard of death in the second wave of SARS-CoV-2 transmission (2021, just before and during vaccination) to the first wave (2020, pre-vaccination). At the start of the second wave (before vaccination), the hazard of death among infected HCW was twice the hazard of death in the first wave (HR=2). After vaccination began in February, the hazard ratio decreased over time, reaching 0.125 as of 3.5 months after the start of vaccination among HCW. The authors also compared survival among infected HCW to survival of infected members of the general population (who were unvaccinated at the time) during the second wave. Survival was greater among infected HCW than those infected in the general population, particularly starting 14 days after the administration of dose 2 among HCW began (March 15 onward).
40	Lakhia et al (August 3, 2021)	India	Retrospective cohort	229 adult patients (>17 y) with confirmed or suspected COVID-19 who received a high-resolution CT scan at a radiology practice in Ahmedabad, India	Delta^	AZD1222 (SII) and COVAXIN	This study evaluated the impact of vaccination on lung involvement among 205 confirmed COVID-19 cases (positive RT-PCR or antigen test) and 24 suspected cases (classic symptoms but negative RT-PCR) who received a CT scan between April-July, 2021 at an independent radiology practice. Lung involvement was assessed by CT severity score (CT-SS), with higher scores corresponding to more severe cases. Of confirmed cases (n=205), 14% were fully vaccinated, 15% were partially vaccinated, and 71% were unvaccinated or within 14 days of dose 1. The CT-SS was significantly lower in fully vaccinated confirmed cases relative to partially or unvaccinated confirmed cases (median 0 vs. 4 vs. 11, p=0.02). Multivariable linear regression revealed that higher age and a positive RT-PCR test were associated with higher CT-SS, while partial or full vaccination was associated with lower CT-SS compared to unvaccinated patients.
39	Banho et al (July 31,2021)	Brazil	Retrospective cohort	Residents of São José do Rio Preto,	Gamma	AZD1222 and CoronaVac	This retrospective study was conducted between October 2020 to June 2021 to report the spread of the P.1(Gamma) variant in São José do Rio Preto,

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				northeast region of the state of São Paulo			Brazil, and study the association of the Gamma variant with a change in the epidemiological profile, with increased numbers of severe COVID-19 cases and deaths, especially in the unvaccinated population. Following P.1 introduction, a rapid increase in prevalence was observed, reaching more than 96% of the sequenced genomes from March to June. There was a marked increase in mortality as variant P.1 became dominant increasing by 162% (95% CI: 127, 214) when comparing July-September 2020 to March-April 2021. Vaccination with CoronaVac vaccine and AstraZeneca was associated with a moderate reduction in the number of cases (best-fit slope –0.21, 95% CI: –0.03, –0.39). However, it was associated with a pronounced reduction in severe cases (–0.55, 95% CI: –0.34, –0.76) and deaths (–0.58, 95% CI: –0.39, –0.77)
38	Pezzotti et al (July 27, 2021)	Italy	Retrospective cohort	General population	Unknown	BNT162b2, mRNA-1273, AZD1222, Ad26.COV2.S	This study was undertaken by obtaining data from the National Vaccination Registry of the Ministry of Health for Italy, and included all Italian persons receiving one dose of any authorized COVID-19 vaccine from 27the December, 2020. The study estimated the incidence rate of SARS-CoV-2 infection and subsequent hospitalizations, admission to an ICU, and death. It is observed that the the incidence of COVID-19 diagnoses declined from 1.19 per 10,000 person-days in the first 14 days after the first dose to 0.28 in completely vaccinated persons. The hospitalization rate in vaccinated persons before 16 May 2021 decreased from 0.27 per 10,000 person-days in the first 14 days after the first dose to 0.03 in those completely vaccinated. The mortality rate in vaccinated persons before 16 May 2021 varied from 0.08 per 10,000 person-days in the first 14 days after the first dose to 0.01 in completely vaccinated persons.
37	Núñez López et al (July 27, 2021)	Spain	Prospective cohort	8329 HCW from La Paz University Hospital in Madrid	Non-VOC, Alpha††	BNT162b2	This prospective observational study was conducted between January 12, 2020 and July 3, 2021, comparing the incidence and prevalence of COVID-19 infections among HCW from the hospital before and after vaccination of the cohort. Vaccination occurred between January 10-19, 2021 (dose 1) and February 1-9 (dose 2) for about 90% of the HCW. Starting about

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							2 weeks after the first round of vaccinations, daily incidence of COVID-19 among HCW dropped substantially and reached 0 as of 8 days after the administration period of the second dose. Further positive cases among HCW during the study period occurred only among partially vaccinated or unvaccinated HCWs, and were minimal. Additionally, prior to vaccination of HCWs, the trend in the prevalence of COVID-19 infection among HCWs was approximately parallel to the trend in the prevalence of COVID-19 patients hospitalized in the same hospital. As of two weeks after the first round of vaccination, the curves began to diverge.
36	Bobdey et al (July 26, 2021)	India	Retrospective cohort	3196 employees and students of a tertiary care institute in Maharashtra	Non-VOC, Delta††	AZD1222 (SII)	One analysis in this study compared the secondary attack rates of COVID-19 among High Risk Contacts of cases during the pre-vaccination period (Jun-Oct 2020) versus during the post-vaccination study period (1 Feb-25 April, 2021). High Risk Contacts included people from the institute who live in the same dormitory and use the same bathrooms as confirmed cases. There were three cases from three different dormitories during the study period considered for the analysis. Two secondary cases occurred, resulting in a Secondary Attack Rate (SAR) of 4.25% during the post-vaccination period, significantly lower than the SAR of 21.42% in the pre-vaccination period ($p<0.05$).
35	Sakre et al* (July 26, 2021)	India	Ecologic	179,215 Healthcare Workers (HCW) and Frontline Workers (FLW) of the Indian Air Force	Delta††	AZD1222 (SII)	This cross-sectional study compared SARS-CoV-2 outcomes in fully vaccinated, partially vaccinated, and unvaccinated HCW/FLW from the Indian Air Force from April 1-30, 2021, a period of high transmission. By April 30, 87.6% of HCWs/FLWs in this population had received both doses of Covishield (AZD122- SII), while 10.4% had received one dose and 1.99% had received no dose. April 1-30, 2021. Prevalence of infection was much higher among the unvaccinated compared to fully vaccinated (42.05 vs. 5.41 per 1000 people). Of the recorded COVID-19 related deaths, (n=10), 60% were among unvaccinated HCW/FLW, while 20% were among partially and fully vaccinated HCW/FLW respectively. Of the 22 severe COVID-19 cases, 9% were fully vaccinated while 77% were unvaccinated.93% of fully vaccinated cases remained

#	Reference (date)	Country	Design	Population	Dominant Variants	Vaccine Product	Descriptive Findings
							asymptomatic compared to only 18.7% of unvaccinated cases.
34	Paetzold et al (July 24, 2021)	Austria	Retrospective cohort	General population aged 16 years and above.	Alpha and Beta^	BNT162b2	This study used Synthetic Control Method(SC) and difference-in-difference (DID) design to measure the impact of a rapid mass vaccination campaign on the number of infections, circulation of VoCs, hospitalizations, and intensive care unit admissions. The study reported that after four months post dose 1, there is a statistically significant difference in daily infections accounting for a reduction of 53.6%. The incidence of documented infections by age group followed the age gradient of the vaccination plan in an inverse relationship. In cases of hospitalization, the authors noted a 78% reduction after 11 weeks amongst recipients of Dose 1. For ICU admissions, the reduction noted was 31%.
33	Pastorino et al (July 23, 2021)	Multiple	Ecologic	General population from 40 countries	Unknown	Not specified	This study collected data on COVID-19 deaths reported from countries that had publicly available age-stratified data till end of May,2021 to estimate the proportion of COVID-19 deaths in the age group 0-69 compared to two pre-vaccination control periods. In total, 40 countries were included for the analysis. The proportions of COVID-19 deaths that occurred in people 0-69 years old were relatively lower in high-income countries. The data showed that the use of COVID-19 vaccines was associated with a marked change in the age distribution of COVID-19 deaths in the first 5 months of 2021.
32	Liang et al (July 17, 2021)	Multiple	Ecologic (Quasi-experimental)	General populations of 90 countries (about 6.4 billion people)	Unknown	Not specified	This study explored how vaccination coverage impacts COVID-19 case fatality ratios (CFRs, defined as total deaths attributed to COVID-19 per 100 confirmed cases) using a longitudinal dataset of 90 countries from November 2020 through the third week of April 2021. On average, it found that a 10% increase in vaccination coverage (total number of people who received at least one vaccine dose per 10 in the total population) was associated with a 7.6% reduction in CFR (95% CI -12.6- -2.7) after adjusting for country characteristics and nonpharmaceutical interventions. Further analyses showed that this relationship was significant only in countries with high government effectiveness and high-quality

#	Reference (date)	Country	Design	Population	Dominant Variants	Vaccine Product	Descriptive Findings
							transportation infrastructure, and only after coverage reached 0.8 per 10 people.
31	Yassi et al* (July 16, 2021)	Canada	Ecologic	25,558 HCW and general adult population of Vancouver, Canada	Alpha and Gamma^	BNT162b2 and mRNA-1273	This study aimed to assess the risk of COVID-19 infection in HCWs compared to the general population and the impact of vaccination on COVID-19 infection in HCWs in Vancouver throughout the pandemic (March 2020-May 13, 2021). Vaccination began in mid-December and was available and rolled out much faster for HCWs than for the general population. By the end of the study period, 86.5% of HCWs had received at least one dose of vaccine and 28.7% had received both doses, whereas only about 50% of the general public had received at least one dose. Before the rollout of vaccination, infection rates among HCWs and the general population were similar. After vaccination began, however, infection rates and positivity rates among HCWs dropped well below those of the public, even as VOCs became dominant (by mid-May, Alpha and Gamma comprised more than 92% of cases in Vancouver compared to <1% in February). Additionally, adjusted infection rates among partially and fully vaccinated HCWs were 37.2% and 79.2% lower respectively relative to unvaccinated HCWs (Dec-May).
30	Mor et al (July 23,2021)	Israel	Retrospective cohort	596 cases and 2515 controls	Beta	BNT162b2	This study was undertaken from information retrieved from the Israeli Ministry of Health database, and included vaccinated and unvaccinated cases that were positive for either the B.1.1.7 variant or B.1.351 variant. The matching was done with one single vaccinated case matched to one or up to 10 unvaccinated cases on a number of key variables. The study calculated the VE against Beta variant, assuming that the vaccine efficacy against the Alpha variant is 95%. The VE against the beta variant was estimated to be 93%(CI: 87%-97%).
29	Alencar et al (July 13,2021)	Brazil	Retrospective cohort	313,328 elderly people(75+) from Ceara, northeast Brazil	Unknown	AZD1222 and CoronaVac	This study used data from National Mortality System (SIM) and from the Immunization Program (SIPNI) between 17 January and 11 May 2021, for people aged 75 years and above to evaluate the impact of COVID-19 vaccinations on reducing the total number of deaths. The mortality rate among the unvaccinated elderly was more than 132 times higher, as compared

#	Reference (date)	Country	Design	Population	Dominant Variants	Vaccine Product	Descriptive Findings
							to those who had received two doses of a vaccine, with a protection ratio for deaths of 99.2%.
28	Visci et al (July 20,2021)	Italy	Retrospective cohort	20,109 HCWs and 4,474,292 residents	Unknown	BNT162b2 (majority) and mRNA-1273 and AZD1222(limited)	This retrospective cohort study included HCWs in Italy from March 9, 2020 to April 4, 2021. The study aimed to assess the patterns of SARS-CoV-2 infections in HCWs compared to the general population and to evaluate the impact of vaccination. In order to calculate the change in test positivity ratios amongst the general population and HCWs for each week, the authors conducted Joinpoint analyses. The results show a significant decrease in the ratio of positive tests in the general population from the end of January and amongst HCWs from the end of December 2020, indicating the impact of vaccination.
27	Mateo-Urdiales et al (July 7,2021)	Italy	Retrospective cohort	Healthcare workers	Unknown	BNT162b2 (majority) and mRNA-1273 and AZD1222(limited)	This retrospective cohort study was undertaken to describe the impact of vaccination on SARS-CoV-2 infections among HCWs aged 20-65 years. From 21st of December to 28th March, 2,977,506 doses of vaccines were administered in the study population. The total proportion of cases and symptomatic cases reported amongst HCWs, after adjusting, showed a sustained decrease beginning approximately one month after vaccination started. By the end of March 2021, there was a 74% reduction in the proportion of all cases amongst HCWs and an 81% reduction in the proportion of symptomatic cases amongst HCWs compared to September 2020.
26	Waldman et al* (July 21, 2021)	USA	Retrospective cohort	16,156 faculty, students, and staff at an academic medical center	Original and Alpha ††	BNT162b2 and mRNA-1273	This retrospective cohort study assessed the impact of vaccination on the incidence of SARS-CoV-2 infection, hospitalization, and mortality among faculty, students, and staff at the University of California Davis medical center. COVID-19 incidence decreased from 3.2% during the 8 weeks before vaccination began to 0.38% 4 weeks after the start of vaccination. A single dose of either vaccine reduced the hazard of testing positive by 48% (HR=0.52, CI 0.40-0.68) and the positivity rate for SARS-CoV-2 14+ days after the second dose was 0.04%. There were no hospitalizations or deaths among fully vaccinated (14+ days after dose 2) HCWs who tested positive.
25	Shacham et al (July 5, 2021)	USA	Ecologic	Residents of 115 counties and 2 cities in Missouri	Unknown	Unspecified (BNT162b2, mRNA-1273,	Ecologic study evaluating the relationship between the cumulative proportion of residents vaccinated and weekly incidence of COVID-19 by location in 115

#	Reference (date)	Country	Design	Population	Dominant Variants	Vaccine Product	Descriptive Findings
						Ad26.COV2.S available)	counties and 2 cities in Missouri (total n=117 locations) from January 4 to June 26, 2021 (25 weeks). The relationship was found to likely be linear during the study period and was adjusted for other variables related to COVID-19 (population, proportion of nonwhite residents, median household income, proportion of residents in public-facing occupations). The final adjusted linear model showed the relationship was significant, with every percent increase in population vaccinated resulting in 3 fewer weekly COVID-19 cases (β -3.74, p<0.001). Locations with higher proportions of nonwhite residents were also likely to experience lower weekly incidence of COVID-19 after adjusted for other variables (β -1.48, p=0.037).
24	Greene, Sharon et al (July 5,2021)	USA	Regression discontinuity	1,101,467 65-84-year-old NYC residents	Unknown	BNT162b2 and mRNA-1273	A regression discontinuity study comparing the rate of hospitalization and deaths among 65-84 year-olds during an 8-week post-implementation phase of SARS-CoV-2 vaccines in New York City with the pre-implementation period, controlling for the epidemic trend among 45-64-year-olds, a group without concurrent age-based vaccine eligibility. It is observed that hospitalization rates among 65-84 year-olds during the post-implementation period had a statistically significant decrease as compared to the pre-implementation period with a RR of 0.85(95% CI 0.74-0.97). Similar decrease in death rates was observed during the post-implementation period but this finding was not statistically significant (RR 0.85, 95% CI: 0.66–1.10, P = 0.22).
23	Victora et al (July 15,2021) [*Update to June 19 preprint]*	Brazil	Ecologic	Brazilian population	Gamma	AZD1222 and CoronaVac	Calculated proportionate mortality of COVID-19 deaths at ages 70-79 and 80+ and COVID-19 age-specific mortality rates using Brazilian Ministry of Health data from January 3- May 15, 2021 in a setting of predominant Gamma variant transmission. The proportion of all COVID-19 deaths for ages 80+ years in weeks 1-6 was 25% which subsequently reduced to 12.4% in week 19 following the vaccination program. For individuals aged 70-79 years, the proportionate mortality showed a substantial decline in April-May. The mortality rate ratio for persons aged 80+ relative to those aged 0-69 reduced from 13.3 in January to 8.0 in week 19, and a gradual decline in the rate ratios

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							was observed for ages 70-79 from 13.8 in week 1 to 5.0 in week 19.
22	Christie et al (June 7, 2021)	USA	Impact	US population	Unknown	Unspecified (BNT162b2, mRNA-1273	Calculated rates of COVID-19 cases, emergency department (ED) visits, hospital admissions, and deaths by age group during November 29–December 12, 2020 (pre-vaccine) and April 18–May 1, 2021. The rate ratios comparing the oldest age groups (≥70 years for hospital admissions; ≥65 years for other measures) with adults aged 18–49 years were 40%, 59%, 65%, and 66% lower, respectively, in the latter period
21	Guijarro et al (June 28, 2021) *[Update to Jun 3 preprint]*	Spain	Impact	HCW compared to community	Unknown	BNT162b2	Incidence rates of SARS-CoV-2 infection after the first dose of mRNA SARS-CoV-2 vaccine declined by 71% (Incidence Rate Ratio (IRR) 0.286 , 95% confidence interval (CI) 0.174-0.468) and by 97% (IRR 0.03 95% CI 0.013-0.068,) after the second dose as compared to the perivaccine time. SARS-CoV-2 incidence rates in the community (with a negligible vaccination rate) had a much lower decline: 2% (IRR 0.984; 95% CI 0.943-1.028) and 61% (IRR 0.390, 95% CI 0.375-0.406) for equivalent periods. Adjusting for the decline in the community, the reduction in the incident rates among HCW were 73% (IRR 0.272; 95% CI 0.164-0.451) after the first dose of the vaccine and 92 % (IRR 0.176, 95% CI 0.033-0.174;) after the second dose.
20	Sansone et al (May 13, 2021)	Italy	Impact	HCW	Alpha	BNT162b2	Community cases increased during the study period while cases in vaccinated HCWs only minimally increased and then stabilized.
19	White et al. (May 19, 2021)	USA	Impact	LTCF	Unknown	BNT162b2 and mRNA-1273	Evaluated an administrative database of a large LTCF company across USA. Evaluated 21,815 persons, . 80% Pfizer+20% Moderna; 60% 2 dose +24% 1 dose. Disease incidence goes down in vaccinated/unvaccinated.
18	Munitz et al (May 18, 2021)	Israel	Ecologic	Israeli Population	Alpha	BNT162b2	Evaluated the transmission dynamics of B.1.1.7(Alpha) variant and to study the impact of the national vaccination program on the general population and the elderly. The study analysed 292,268 RT-PCR samples collected from December 6,2020 to February 10,2021. In the first week of February, B.1.1.7 variant was the predominant variant identified in more than 90% of the positive tests. The B.1.1.7 variant was 1.45 more transmissible than the wild-type strain (95% confidence interval [CI]: 1.20–

#	Reference (date)	Country	Design	Population	Dominant Variants	Vaccine Product	Descriptive Findings
							1.60). The effective reproduction number for B.1.1.7 was estimated to be 1.71 (95% CI: 1.59– 1.85) compared with 1.12 (95% CI: 1.10–1.15) observed for the wild-type. To evaluate the impact of preventive policies against the B.1.1.7 variant, the authors stratified the distribution of new COVID-19 cases in different age groups. It was observed that an increase in the incidence of the variant was noted in the 60+ years aged group through January 13,2021, following which the incidence plateaued and subsequently declined, which coincided with the rapid uptake of vaccine in this age group.
17	Domi et al (May 6,2021)	USA	Impact	LTCF	unknown	BNT162b2	Evaluated data from 2501 nursing homes in the US in 17 states. Used zero-inflated negative binomial mixed effects regressions to model the associations of time since the vaccine clinic ending the week of December 27, 2020 (cohort 1), January 3, 2021 (cohort 2) or January 10, 2021 (cohort 3) controlling for county rate of COVID-19, bed size, urban location, racial and ethnic census, and level of registered nurses with resident cases and deaths of COVID-19 and staff cases of COVID-19. Resident and staff cases trended downward in all three cohorts following the vaccine clinics. Time following the first clinic at five and six weeks was consistently associated with fewer resident cases (IRR: 0.68 [95% CI: 0.54-0.84], IRR: 0.64 [95% CI: 0.48-0.86], respectively); resident deaths (IRR: 0.59 [95% CI: 0.45-0.77], IRR: 0.45 [95% CI: 0.31-0.65], respectively); and staff cases (IRR: 0.64 [95% CI: 0.56-0.73], IRR: 0.51 [95% CI: 0.42-0.62], respectively). Other factors associated with fewer resident and staff cases included facilities with less than 50 certified beds and high nurse staffing per resident day (>0.987). Contrary to prior research, higher Hispanic non-white resident census was associated with fewer resident cases (IRR: 0.42, 95% CI: 0.31-0.56) and deaths (IRR: 0.18, 95% CI: 0.12-0.27).
16	Haas et al. (May 13, 2021)	Israel	Impact	Israeli population	Alpha¶	BNT162b2	Used national surveillance data from the first 112 days (Dec 20, 2020 – Apr 10, 2021) of Israel's vaccination campaign to estimate averted burden of four outcomes: SARS-CoV-2 infections and COVID-19-related hospitalizations, severe or critical

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							hospitalizations, and deaths. Estimated that Israel's vaccination campaign averted 158,665 (95% CI: 115,899–201,431) SARS-CoV-2 infections, 24,597 (6,622–42,571) hospitalizations, 17,432 (3,065–31,799) severe and critical hospitalizations, and 5,533 (-1,146–12,213) deaths. Of these, 66% of hospitalizations and 91% of deaths averted were among those ≥65 years of age. 73% of SARS-CoV-2 infections and 79% of COVID-19-related hospitalizations and deaths averted stemmed from the protective effects in fully vaccinated persons.
15	Ackland et al. (Apr 22, 2021)	UK	ecologic	UK adults	Alpha^	BNT162b2, mRNA-1273, AZD1222	Used national data on cases and deaths to estimate CFR. Found that from the second half of January, the CFRs for older age groups show a marked decline. Since the fraction of the VOC has not decreased, this decline is likely to be the result of the rollout of vaccination.
14	Lillie et al.* (Apr 24, 2021)	UK	ecologic	Healthcare workers	Alpha^	BNT162b2	Symptomatic staff underwent routine testing together with routine (asymptomatic) Lateral Flow Device (LFD) testing of all clinical staff. Starting Jan 2021 827 (8.3%) of staff had received their first dose of vaccine, increasing to 8243 (82.5%) by the end of February. Cases of SARS-CoV-2 amongst staff reduced from 120 cases to 10 cases over the same period.
13	Rossman et al.* (Apr 19, 2021) *Update to Feb 9 preprint)*	Israel	Impact	Israeli population	Alpha^	BNT162b2	Analysis of data from the Israeli Ministry of Health collected between 28 August 2020 and 24 February 2021. Compared: (1) individuals aged 60 years and older prioritized to receive the vaccine first versus younger age groups; (2) the January lockdown versus the September lockdown; and (3) early-vaccinated versus late-vaccinated cities. A larger and earlier decrease in COVID-19 cases and hospitalization was observed in individuals older than 60 years, followed by younger age groups, by the order of vaccination prioritization. This pattern was not observed in the previous lockdown and was more pronounced in early-vaccinated cities.
12	Mor et al. (Apr 16, 2021)	USA	Impact	80 nursing homes located across 21 states.	unknown	BNT162b2 & mRNA-1273	Matched pairs analysis of 280 nursing homes in 21 states owned and operated by the largest long-term care provider in the United States. Compared data from nursing homes that had their initial vaccine clinics between December 18, 2020 and January 2,

#	Reference (date)	Country	Design	Population	Dominant Variants	Vaccine Product	Descriptive Findings
							2021, versus between January 3, 2021 and January 18, 2021. Outcomes were incident SARS-CoV-2 infections per 100 at-risk residents per week and hospital transfers and/or deaths per 100 residents with confirmed SARS-CoV-2 infection per day, averaged over a week. Adjusted for facility infection rates in the fall. After 1 week, early vaccinated facilities had a predicted 2.5 fewer incident SARS-CoV-2 infections per 100 at-risk residents per week (95% CI: 1.2–4.0).
11	PHE (Apr 8, 2021)	UK	Impact	UK adults	Alpha^	BNT162b2 & mRNA-1273	Daily impact of vaccination on deaths was estimated based on vaccine effectiveness against mortality multiplied by vaccine coverage. Observed deaths were then divided by the impact to estimate the expected deaths in the absence of vaccination. By the end of March 2021, they estimated that 9,100 deaths were averted in individuals aged 80 years and older, 1,200 in individuals aged 70 to 79, and 100 in individuals aged 60 to 69 years giving a total of 10,400 deaths averted in individuals aged 60 years or older.
10	Jones et al. (Apr 8, 2021)	UK	Ecologic	Cambridge University healthcare workers	Alpha^	BNT162b2	Screened vaccinated and unvaccinated HCWs for two weeks then compared proportion of positive tests in unvaccinated vs. vaccinated groups. Found four-fold decrease in risk of asymptomatic SARS-Cov-2 infection among HCWs ≥12 days post-vaccination compared to unvaccinated HCWs.
9	Rivkees et al. (Apr 7, 2021)	US - FL	Ecologic	Florida population	original and Alpha¥	BNT162b2 & mRNA-1273	Ecologic analysis of vaccinations in Florida. Through March 15, 2021, 4,338,099 individuals received COVID-19 vaccine, including 2,431,540 individuals who completed their vaccination series. Of all those vaccinated, 70% were 65 years of age and older, and 63% of those 65 years of age and older. Beginning February 1, 2021, the decline in the number of new cases per week became greater in those 65 years of age and older than those younger. By March 15, 2021, the number of new cases, hospitalizations, and deaths per day for those 65 years of age and older relative to mid-January, were 82%, 80%, and 92% lower respectively. In comparison, the number of new cases, hospitalizations, and deaths per day for those younger than 65 years of age were 70%, 60%, and 87% lower respectively. Reductions in rates in those 65 year of age and older, were thus greater than in

#	Reference (date)	Country	Design	Population	Dominant Variants	Vaccine Product	Descriptive Findings
							those who were younger (p-value <0.01, Wilcoxon test).
8	Milman et al. (Jun 11, 2021) *[Update to Mar 23 preprint]*	Israel	Ecologic	Maccabi Healthcare Services, 644,609 individuals in 177 communities	original & Alpha¶	BNT162b2	Rates of vaccination in each community are highly correlated with a later decline in infections among a cohort of under 16 years old which are unvaccinated. These results provide observational evidence that vaccination not only protects individual vaccinees but also provides cross-protection to unvaccinated individuals in the community.
7	Daniel et al. (Mar 23, 2021)	US - TX	Ecologic	Healthcare workers from the UTSW	original¥	BNT162b2 & mRNA-1273	After vaccination, they observed a greater than 90% decrease in the number of employees who are either in isolation or quarantine.
6	Benenson et al. (Mar 23, 2021)	Israel	Ecologic	Healthcare workers at Hadassah Hebrew University Medical Center	Alpha^	BNT162b2	Among vaccinated workers, the weekly incidence of COVID-19 since the first dose declined notably after the second week; the incidence of infection continued to decrease dramatically and then remained low after the fourth week.
5	Roghani (Mar 17, 2021)	US – TN	Ecologic	Residents of Tennessee	original¥	BNT162b2 & mRNA-1273	Between 12/17/20 and 3/3/21 found that the daily incidence among the entire population over 71 dropped from 0.1% to 0.01% of the age group (90% reduction) while for younger ages incidence dropped from 0.2% to 0.05% (75% reduction).
4	Puranik et al. (March 8, 2021)	US	Ecologic	87 million individuals from 580 counties in the United States	original¥	BNT162b2 & mRNA-1273	Compares the cumulative county-level vaccination rates with the corresponding COVID-19 incidence rates among 87 million individuals from 580 counties in the United States, including 12 million individuals who have received at least one vaccine dose. Found that cumulative county-level vaccination rate through March 1, 2021 is significantly associated with a concomitant decline in COVID-19, with stronger negative correlations in the Midwestern counties and Southern counties.
3	Rinott et al (March 8, 2021)	Israel	Ecologic	Persons needing ventilation	Orginal & alpha	BNT162b2	The number of COVID-19 patients aged ≥70 years (who had the highest 2-dose vaccination coverage, 84.3%) requiring mechanical ventilation was compared with that of patients aged <50 years, who had the lowest 2-dose vaccination coverage (9.9%). Since implementation of the second dose of the vaccination campaign, the ratio of COVID-19 patients requiring mechanical ventilation aged ≥70 years to those aged <50 years has declined 67%, from 5.8:1

#	Reference (date)	Country	Design	Population	Dominant Variants	Vaccine Product	Descriptive Findings
							during October–December 2020 to 1.9:1 in February 2021.
2	Dunbar et al. (Feb 10, 2021)	US - VA	Ecologic	Healthcare workers in an academic hospital	original[¥]	BNT162b2 & mRNA-1273	After 60% of employees received the 1st vaccine dose, the HCW COVID-19 infection rate decreased by 50%. HCWs who were 14-28 days and > 28 days post-first vaccine dose were less likely COVID-19 infected than non-vaccine recipients.
1	Domi et al. (Feb 4, 2021)	US	Ecologic	LTCF residents and staff	original[¥]	BNT162b2 & mRNA-1273	Used CMS NHSN Public File data and Tiberius data and created an analytic cohort based on the schedule of the vaccination clinics taking place during the first week of the program (12/18/20 to 12/27/20). Created a comparison group, composed of facilities located in the same county that did not have a first vaccination clinic during that period. Found that COVID-19 cases decreased at a faster rate among both residents and staff associated with nursing homes that had completed their first clinic. Vaccinated nursing homes experienced a 48% decline in new resident cases three weeks after the first clinic, compared to a 21% decline among non-vaccinated nursing homes located in the same county. Similarly, new staff cases declined by 33% in vaccinated nursing homes compared to 18% in non-vaccinated facilities.

#Includes studies published/posted up through Wednesday of current week.

^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

[††]Based on https://outbreak.info/location-reports

6. 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/10.1101/2021.08.23.21262500v1
7. https://www.medrxiv.org/content/10.1101/2021.08.25.21262529v1
8. https://www.sciencedirect.com/science/article/pii/S0141813021017359?via%3Dihub
9. https://www.scielo.br/j/ramb/a/gLN9kTh8kpghHGjdWY7z6ML/?lang=en
10. https://www.medrxiv.org/content/10.1101/2021.09.17.21263549v1
11. https://www.sciencedirect.com/science/article/pii/S0753332221009604?via%3Dihub
12. https://www.medrxiv.org/content/10.1101/2021.09.23.21264048v1
13. https://www.researchsquare.com/article/rs-936074/v1
14. 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
15. https://www.medrxiv.org/content/10.1101/2021.09.28.21264126v1

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