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

Weekly Summary Tables

Updated December 9, 2021

Prepared by:

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

and

World Health Organization

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

TABLE OF CONTENTS

1.	Summary of Study Results for Post-Authorization COVID-19 Vaccine Effectiveness	3
1.1	Inclusion criteria for VE studies	35
1.2	VE Studies that do not meet criteria	35
2.	Summary of Study Results for Post-Authorization COVID-19 Booster Dose Vaccine Effectiveness	51
3.	Duration of Protection Studies	53
4.	Summary of Study Results for Post-Authorization COVID-19 Vaccine Effectiveness Against Transmission	93
5.	Vaccine Impact: Summary of Ecologic Study Results for Post-Authorization COVID-19 Vaccine Products	96
6.	Review Papers and Meta-analyses	139

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

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

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose[±]	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
128	Wu et al* (December 2, 2021)	USA	Retrospective cohort	29,152 matched pairs of cancer patients in the Veterans Affairs health system	Non-VOC, Alpha[††]	Excluded	BNT162b2 & mRNA-1273	Documented infection	45 (8-66)	14+	58 (39-73)	14+	15 weeks
127	Vokó et al* (November 24, 2021)	Hungary	Retrospective cohort	3.7 million Hungarian residents aged 16+	Alpha^	Included	BNT162b2	Documented infection	41.0 (39.5-42.4)	0+ (up to <7 days post dose 2)	84.0 (83.3-84.7)	14+	~19 weeks
								Death	64.3 (61.8-66.6)		90.3 (88.9-91.5)		
							Sinopharm	Documented infection	34.0 (31.8-36.1)		72.8 (71.2-74.4)		~10.5 weeks
								Death	39.4 (34.1-44.3)		86.0 (83.7-87.9)		
							Sputnik V	Documented infection	48.7 (47.1-50.2)		88.1 (86.5-84.9)		~11 weeks
								Death	78.0 (74.3-81.2)		97.8 (95.5-98.9)		
							AZD1222	Documented infection	49.2 (47.7-50.6)		73.7 (71.1-76.0)		~11.5 weeks
								Death	71.3 (67.9-74.4)		85.8 (73.5-92.4)		
							mRNA-1273	Documented infection	60.8 (58.6-63.0)		88.2 (85.8-90.3)		~15 weeks
								Death	68.7 (62.5-73.8)		93.8 (90.3-96.1)		
126	Hall et al (December 1, 2021)	United Kingdom	Prospective cohort	35,768 HCWs (18+ years) undergoing routine asymptomatic testing	Non-VOC, Alpha, Delta^	Included	BNT162b2	Documented infection	57 (41-69)	21-27	Dose interval <6 weeks: 85 (71-92)	14-73	~8 weeks
											Dose interval <6 weeks: 58 (40-71)	>193	36 weeks
									58 (42-70)	>55	Dose interval 6+ weeks: 81 (68-89)	14-73	~8 weeks
											Dose interval 6+ weeks: 43 (17-61)	>193	33 weeks
							AZD1222	Documented infection	42 (-92-83)	21-27	49 (16-69)	14-73	~8 weeks
									29 (-43-65)	>55	51 (18-71)	>133	~23 weeks
125	Thiruvengadam et al (November 25,2021)	India	Test-negative case control	2766 cases and 2377 controls	Delta^	Excluded	AZD1222	Documented infection	46.2 (31.6-57.7)	21+	63.1 (51.5-72.1)	14+	~10 weeks
123	Desai et al (November 23,2021)*	India	Test-negative case control	1068 matched case-control HCW pairs	Delta^	Included	BBV152	Symptomatic disease	−1 (−51 – 33)	21+	50 (33-62)	14+	~4 weeks
											46 (22-62)	28+	
											57 (21-76)	42+	
						Excluded					47 (29-61)	14+	

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
122	Paixao et al (November 12,2021)	Brazil	Test-negative case control	19,838 pregnant women	Gamma and Delta††	Excluded	CoronaVac	Symptomatic disease	5.0 (-18.2–23.7)	14+	41.0 (27.0-52.2)	14+	~28.5 weeks
121	Ng et al* (November 1, 2021)	Singapore	Retrospective cohort	1204 household contacts of 301 index cases	Delta index cases, specifically	Unknown	BNT162b2 & mRNA-1273	Documented infection	—	—	61.6 (37.5-80.4)	15+	~16.5 weeks
								Symptomatic infection			67.9 (41.3-87.8)		
								Severe disease			100 (CI omitted, no events among vaccinated)		
120	Al Hosani et al (October 27,2021)	United Arab Emirates	Retrospective cohort	176,640 individuals aged 15+	Non-VOC and Alpha^	Included	BBIBP-CorV	Hospitalization	-35 (-45– -26)	14+	74 (72-76)	14+	~34 weeks
								ICU admissions	0 (-17–15)		91 (88-93)		
								Deaths	12 (-95–61)		96 (69-99)		
119	Poukka et al (November 8, 2021)	Finland	Retrospective cohort	427,905 HCWs aged 16-69 years	Non-VOC, Alpha, Delta^	Excluded	BNT162b2	Documented infection	40 (33-46)	42+	83 (80-85)	14-90	~11 weeks
											55 (45-64)	181+	~29.5 weeks
								Hospitalization	82 (68-90)		99 (97-100)	14-90	~11 weeks
											98 (89-100)	181+	~38 weeks
							mRNA-1273	Documented infection	61 (45-72)		84 (68-92)	14-90	~11 weeks
											69 (-124-96)	91-180	~24 weeks
								Hospitalization	89 (22-98)		100 (-inf-100)	14-90	~11 weeks
											100 (-inf-100)	181+	~34 weeks
							Heterologous mRNA	Documented infection	—	—	100 (-inf-100)	14-90	~11 weeks
											100 (-inf-100)	181+	~29.5 weeks
								Hospitalization			100 (-inf-100)	14-90	~11 weeks
											100 (-inf-100)	181+	~38 weeks
							AZD1222	Documented infection	22 (-3-42)	42+	89 (73-95)	14-90	~11 weeks
											63 (-166-95)	91-180	~24 weeks
								Hospitalization	88 (10-98)	42+	100 (-inf-100)	14-90	~11 weeks
											100 (-inf-100)	181+	~25 weeks
							Heterologous AZD1222 + mRNA	Documented infection	—	—	80 (72-86)	14-90	~11 weeks
											62 (30-79)	91-180	~24 weeks
								Hospitalization			100 (-inf-100)	14-90	~11 weeks
											100 (-inf-100)	181+	~25 weeks
					Non-VOC, Alpha^		BNT162b2 & mRNA-1273 (homologous or heterologous)	Documented infection	38 (23-50)	42+	77 (71-82)	14-90	~11 weeks
											55 (34-69)	91-180	~24 weeks
								Hospitalization	90 (27-99)		95 (64-99)	14-90	~11 weeks
											100 (-inf-100)	91-180	~24 weeks
							AZD1222	Documented infection	15 (-15-37)	42+	100 (-inf-100)	14-90	~11 weeks
											100 (-inf-100)	91-180	~24 weeks
								Hospitalization	100 (-inf-100)	42+	100 (-inf-100)	14-90	~11 weeks
							Heterologous AZD1222 + mRNA	Documented infection	—	—	100 (-inf-100)	14-90	~11 weeks
											100 (-inf-100)	91-180	~24 weeks

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
								Hospitalization			100 (-inf-100)	14-90	~11 weeks
					Delta^		BNT162b2 & mRNA-1273 (homologous or heterologous)	Documented infection	45 (37-51)	42+	85 (81-88)	14-90	~11 weeks
											56 (46-65)	181+	~29.5 weeks
								Hospitalization	83 (68-91)		100 (97-100)	14-90	~11 weeks
											98 (88-100)	181+	~38 weeks
							AZD1222	Documented infection	49 (-16-77)		88 (71-95)	14-90	~11 weeks
											62 (-177-95)	91-180	~24 weeks
								Hospitalization	42 (-330-92)		100 (-inf-100)	14-90	~11 weeks
											100 (-inf-100)	181+	~25 weeks
							Heterologous AZD1222 + mRNA	Documented infection	—	—	80 (72-86)	14-90	~11 weeks
											63 (33-80)	91-180	~24 weeks
								Hospitalization			100 (-inf-100)	14-90	~11 weeks
											100 (-inf-100)	181+	~25 weeks
118	Embi et al (November 5, 2021)	USA	Test-negative case control	20,101 immunocompromised and 69,116 immunocompetent adults (18+) in nine states	Non-VOC, †† Alpha, †† Delta^	Included	BNT162b2	Hospitalization: immunocompromised	—	—	71 (65-76)	14+	~33 weeks
								Hospitalization: immunocompetent			88 (86-89)		
							mRNA-1273	Hospitalization: immunocompromised			81 (76-85)		
								Hospitalization: immunocompetent			93 (92-94)		
					Non-VOC, Alpha††		BNT162b2 & mRNA-1273	Hospitalization: immunocompromised			76 (69-81)		
								Hospitalization: immunocompetent			91 (90-93)		
					Delta^			Hospitalization: immunocompromised			79 (74-83)		
								Hospitalization: immunocompetent			90 (89-91)		
117	Sheikh et al* (October 20,2021)	Scotland	Retrospective cohort	1,563,818 adults	Alpha and Delta^	Unknown	BNT162b2	Death in 40-59 years	100 (CI omitted)	14+ up to 13 days post dose 2	95 (79-99)	14+	~25 weeks
								Death in ≥ 60 years	75 (26-91)		87 (77-93)		
							AZD1222	Death in 40-59 years	96 (85-99)		88 (76-93)		
								Death in ≥ 60 years	97 (86-99)		90 (84-94)		
					Delta specifically^		BNT162b2	Death	92 (66-98)		90 (83-94)		
							AZD1222		96 (89-99)		91 (86-94)		
116	Reis et al* (October 20,2021)	Israel	Retrospective cohort	94,354 vaccinated adolescents aged 12-18 matched with 94,354 controls	Delta^	Excluded	BNT162b2	Documented infection	59 (52-65)	14-20	90 (88-92)	7-21	~12 weeks
									66 (59-72)	21-27			
								Symptomatic disease	57 (39-71)	14-20	93 (88-97)		
									82 (73-91)	21-27			

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
115	Nordström et al* (October 18, 2021)	Sweden	Retrospective cohort	541,071 vaccinated individuals and 180,716 unvaccinated matched individuals	Delta^	Excluded	BNT162b2	Symptomatic disease	—	—	78 (78-79)	14+	~11 weeks
							mRNA-1273				87 (84-88)		
							AZD1222				50 (41-58)		
							AZD1222/ BNT162b2				67 (59-73)		
							AZD1222/ mRNA-1273				79 (62-88)		
114#	Skowronski et al (October 26,2021)	Canada	Test-negative case control	380,532 specimens in British Columbia including 27,439 cases (estimates also available for Quebec, but not included here)	Non-VOC, Alpha, Delta, Gamma^	Excluded	BNT162b2	Documented infection	—	—	90 (90-90)	14+	~37 weeks
											90 (89-90)	28-55	
											81 (78-83)	168+	
								Hospitalization			98 (97-98)	14+	
											98 (98-99)	28-55	
											98 (94-99)	168+	
							mRNA-1273	Documented infection			91 (90-91)	14+	
											94 (93- 94)	28-55	
											71 (65-75)	168+	
								Hospitalization			97 (96-98)	14+	
											99 (96-100)	28-55	
											96 (83-99)	168+	
							AZD1222	Documented infection			71 (69-74)	14+	
											74 (67-79)	28-55	
											69 (64-72)	84+	
								Hospitalization			94 (90-96)	14+	
											88 (62-96)	28-55	
											95 (89-98)	84+	
							Heterologous mRNA	Documented infection			91 (90- 92)	14+	
											93(91-94)	28-55	
											93(80-97)	112-139	
								Hospitalization			98 (96-99)	14+	
											97 (92-100)	28-55	
											97 (94-99)	84-111	
							Heterologous AZD1222 + mRNA	Documented infection			90 (89-91)	14+	
											91 (89-92)	28-55	
											92 (44-99)	112-139	
								Hospitalization			99 (98-100)	14+	
											99 (91-100)	28-55	
					Delta specifically^		BNT162b2	Documented infection			91 (91-92)	14+	
											92 (92-93)	28-55	

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
											80 (76, 84)	196+	
								Hospitalization			98 (97-98)	14+	
											99 (98-99)	28-55	
											98 (91-99)	168+	
							mRNA-1273	Documented infection			92 (91-93)	14+	
											94 (93- 95)	28-55	
											80 (73-85)	168+	
								Hospitalization			97 (96- 98)	14+	
											99 (96-100)	28-55	
											84 (63-93)	112-139	
							AZD1222	Documented infection			70 (66-73)	14+	
											68 (60-75)	28-55	
											65 (57-72)	84+	
								Hospitalization			92 (86-95)	14+	
											84 (51-95)	28-55	
											92 (81-97)	84+	
							Heterologous mRNA	Documented infection			98 (97-99)	14+	
											93 (91-94)	28-55	
											88 (82-91)	196+	
								Hospitalization			98 (97-99)	14+	
											96 (88-99)	28-55	
											98 (85-100)	168+	
							Heterologous AZD1222 + mRNA	Documented infection			91 (89-92)	14+	
											90 (88-92)	28-55	
											85 (77-90)	84-111	
								Hospitalization			99 (97-100)	14+	
											99 (90-100)		
					Alpha specifically^		BNT162b2	Documented infection			96 (93-98)	14+	
								Hospitalization			96 (83-99)		
							mRNA-1273	Documented infection			95 (85-98)		
								Hospitalization			—		
							AZD1222	Documented infection			74 (29-90)		
								Hospitalization			—		
							Heterologous mRNA	Documented infection			96 (93-98)		
								Hospitalization			97 (87-99)		
							Heterologous AZD1222 + mRNA	Documented infection			74 (29-90)		
								Hospitalization			—		
					Gamma specifically^		BNT162b2	Documented infection			93 (89-95)		
								Hospitalization			95 (83-99)		
							mRNA-1273	Documented infection			95 (85, 99)		
							AZD1222	Documented infection			90 (61, 98)		

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
							Heterologous mRNA	Documented infection			94 (75, 99)		
							Heterologous AZD1222 + mRNA	Documented infection			96 (70, 99)		
113	Lin et al (October 26,2021)	USA	Retrospective cohort	812,665 cases registered in North Carolina	Alpha and Delta^	Unknown	BNT162b2	Symptomatic disease	—	—	94.9 (94.5-95.2)	2 months	~33 weeks
											70.1 (68.9-71.2)	7 months	
								Hospitalization			96.4 (94.7-97.5)	2 months	
											87.7 (84.3-90.4)	7 months	
								Death			95.9 (92.9-97.6)	2 months	
											88.4 (83-92.1)	7 months	~32 weeks
							mRNA-1273	Symptomatic disease			96 (95.6-96.4)	2 months	
											81.9 (81-82.7)	7 months	
								Hospitalization			97.5 (96.3-98.3)	2 months	
											92.3 (89.7-94.3)	7 months	
								Death			96 (91.9-98)	3 months	
											93.7 (90.2-95.9)	7 months	~29 weeks
							Ad26.COV2.S	Symptomatic disease			79 (77.1-80.7)	1 month	
											64.3 (62.3-66.1)	5 months	
								Hospitalization			89.8 (78.8-95.1)	2 months	
								Death			89.4 (52.3-97.6)	3 months	
112	Nordstrom et al (October 25,2021)	Sweden	Retrospective cohort	842,974 pairs of vaccinated and unvaccinated Swedish individuals	Delta^	Excluded	BNT162b2	Symptomatic disease	—	—	92 (92-93)	15-30	~30 weeks
											23 (-2 – 41)	210+	
							mRNA-1273				96 (94-97)	15-30	
											59 (18-79)	210+	
							AZD1222				68 (52-79)	15-30	
											-19 (-97 – 28)	210+	
							AZD1222 and any mRNA vaccine				89 (79-94)	15-30	
											66 (41-80)	210+	
111	Ranzani et al (October 20,2021)	Brazil	Test-negative case control	7,434 individuals residing in a favela in Rio De Janeiro	Gamma and Delta^	Excluded	AZD1222	Symptomatic disease	45.2(16.2-64.1)	28-41 days	—	—	~32 weeks
									58.6(28.0-76.2)	42-55 days			
									36.7(7.9-56.4)	>56 days			
								Asymptomatic disease	29.8(-44.2- 65.8)	>21 days			
110	Chin et al*(October 20, 2021)	USA	Retrospective cohort	827 propensity matched incarcerated men	Delta^	Included	mRNA-1273	Documented infection	—	—	56.6 (42.0-67.5)	14+	~27 weeks
								Symptomatic disease			84.2 (56.4-94.3)		
						Previously infected only		Documented infection			80.5 (52.8-92.0)		
						Excluded		Documented infection			49.5 (31.5-62.7)		
109		Puerto Rico	Retrospective cohort	87,704 PCR confirmed		Unknown	BNT162b2	Hospitalization (45-74y)	—	—	92 (90.8-93)	14+	~20 weeks
								Hospitalization (75-84y)			93.3 (91.3-95)		

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
	Irizarry et al(November 17, 2021) *[Updated version of Robles-Fontan et al (October 20,2021)]*			infections for individuals 12 years or older	Non-VOC, Alpha, Beta and Delta^^			Hospitalization (85+y)			97.1 (95.8-98)		
								Death (45-74y)			86 (81-89)		
								Death (75-84y)			87 (80-92)		
								Death (85+y)			95.2 (91.5-97)		
							mRNA-1273	Hospitalization (45-74y)			82 (78-85)		
								Hospitalization (75-84y)			91.5 (89-94)		
								Hospitalization (85+y)			97.2 (96-98)		
								Death (45-74y)			69 (52-79)		
								Death (75-84y)			87 (79-92)		
								Death (85+y)			96.2 (93.9-98)		
							Ad26.COV2.S	Hospitalization (45-74y)			96.1 (95-97)		
								Hospitalization (75-84y)			98 (96.7-99)		
								Hospitalization (85+y)			99.2 (98.6-99.5)		
								Death (45-74y)			93.8 (90-96)		
								Death (75-84y)			96.6 (91.7-98)		
								Death (85+y)			99.3 (98.6-99.6)		
							BNT162b2	Documented infection[xx]			87 (85-89)	14+	
											57(53-60)	144+	
								Hospitalisation			92(85-95)	14+	
											80(73-85)	144+	
								Death			97(86-100)	14+	
											86(75-92)	144+	
							mRNA-1273	Documented infection[xx]			90(88-91)	14+	~18 weeks
											73(70-76)	144+	
								Hospitalisation			95(89-97)	14+	
											90(84-94)	144+	
								Death			99(89-100)	14+	
											93(81-97)	144+	
							Ad26.COV2.S	Documented infection[xx]			62(54-68)	14+	~22 weeks
											36(30-42)	144+	
								Hospitalisation			81(60-91)	14+	
											67(53-76)	144+	
								Death			78(16-94)	14+	
											72(49-85)	144+	
							BNT162b2	Documented infection[xx]			56 (53-59)	at day 137	~20 weeks
							mRNA-1273				71 (68-74)	at day 139	~18 weeks
							Ad26.COV2.S				27 (17-37)	at day 158	~22 weeks

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
108	Olson et al* (October 19, 2021)	USA	Test-negative case control	179 case patients and 285 controls aged 12-18 years	Delta^	Unknown	BNT162b2	Hospitalization (12-15y)	—	—	91 (74-97)	14+	~12 weeks
								Hospitalization (16-18y)			94 (78-99)		
107	Arregoces et al (October 19, 2021)	Colombia	Matched-pair cohort study	3,346,826 adults aged 60+ in Colombia	Mu^	Excluded	BNT162b2	Hospitalization	—	14+	90.3 (87.1-92.7)	14+	~9 weeks
								Post-hospitalization death			98.5 (97.8-98.9)		
								Death without prior hospitalization			89.2 (85.6-91.9)		
							CoronaVac	Hospitalization			67.2 (63.7-70.4)		~11 weeks
								Post-hospitalization death			77.1 (75.5-78.6)		
								Death without prior hospitalization			69.8 (66.7-72.6)		
							AZD1222	Hospitalization			75.4 (48.2-88.3)		~7 weeks
								Post-hospitalization death			96.3 (88.4-98.8)		
								Death without prior hospitalization			88.7 (64.8-96.4)		
							Ad26.COV2.S	Hospitalization	80(19.9-95.0)		—		~4 weeks
								Death without prior hospitalization	75(0.0-93.8)		—		
106	Ranzani et al (October 18, 2021)	Brazil	Test-negative case control	11,817 adults In Mato-Grosso do Sul	Gamma^	Excluded	Ad26.COV2.S	Symptomatic disease	50.9 (35.5-63.0)	28+	—	—	~10 weeks
								Hospitalization	72.9 (35.1-91.1)				
								ICU Admission	92.5 (54.9-99.6)				
								Death	90.5 (31.5-99.6)				
105	Liu et al (October 7, 2021)	USA	Test-negative case control	10,283 matched adult residents (18+) of New York City	Non-VOC, then Alpha, then Delta††	Excluded	BNT162b2 & mRNA-1273	Overall: Documented infection	—	—	58.9 (52-64.8)	14+	~35 weeks
								Immunocompromised: Documented infection	—	—	56.8 (44.7-66.2)		
104	Bruxvoort et al (October 1, 2021)	USA	Test-negative case control	8,153 cases and matched controls among Kaiser Permanente patients (aged	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

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
				18+) in Southern California	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)				
							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

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
102#	Eyre et al (September 29, 2021)	England	Retrospective cohort	139,164 contacts who sought testing exposed to 99,597 index cases of all ages Household close contacts	Alpha^ specifically	Included	BNT162b2	Documented infection	31 (25-36)	0+ up to 13 days post dose 2	94 (90-96)	14+	~20.5 weeks
							AZD1222		11 (3-18)		71 (51-83)		~8 weeks
					Delta^ specifically	Included	BNT162b2	Documented infection	42 (39-45)		90 (87-92)		~29 weeks
							AZD1222		46 (42-50)		72 (68-75)		~16 weeks
101	Glatman-Freedman et al (September 27, 2021)	Israel	Retrospective cohort	Adolescents aged 12-15 y	Delta^	Excluded	BNT162b2	Documented infection	—	—	91.5 (88.2-93.9)	8-28	2 weeks
100	Meyer et al (September 23,2021)	Germany	Retrospective cohort	252 residents and staff of a nursing home Non-household close contacts	Alpha^	Unknown	BNT162b2	Documented infection	—	—	45 (0-69)	7+	~11 weeks
								Symptomatic disease			68 (36-84)		
								Hospitalization			88 (37-98)		
99	Pilishvili et al* (September 22,2021)	USA	Test-negative case control	1482 HCPs as cases and 3449 HCPs as control	Alpha††	Excluded	BNT162b2 & mRNA-1273	Symptomatic disease	—	—	88.9 (84.7-92.0)	14+	~14 weeks
											96.3 (92.5-98.2)	15-28	
											80.7 (61.0-90.4)	85-98	
								Symptomatic disease - immunocompromising condition	39.1 (−45.0-74.4)	14+ through Dose 2 or later (at least 1 dose)	—	—	
								Symptomatic disease - pregnancy	77.1 (32.2- 92.2)		—	—	
							BNT162b2	Symptomatic disease	77.6 (70.9-82.7)	14+ up to <7 post 2nd dose	88.8 (84.6-91.8)	7+	
							mRNA-1273		88.9 (78.7-94.2)		96.3 (91.3-98.4)		
98#	Skowronski et al (September 22,2021)	Canada	Test-negative case control	7116 test-positive cases and 60,958 test-negative controls among adults 50-69 years	Alpha and Gamma^	Excluded	BNT162b2	Documented infection	75 (72-78)	21+	—	—	—
								Hospitalization	83 (75-89)				
							mRNA-1273	Documented infection	82 (76-87)				
								Hospitalization	85 (63-94)				
							AZD1222	Documented infection	61 (54-66)				
								Hospitalization	96 (86-99)				
					Alpha specifically^		BNT162b2	Documented infection	77 (71-81)				
								Hospitalization	79 (58-90)				
							mRNA-1273	Documented infection	85 (74-92)				
								Hospitalization	80 (17-95)				

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
							AZD1222	Documented infection	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	Glatman-Freedman et al* (September 16, 2021)	Israel	Retrospective longitudinal cohort	All Israeli residents aged 16+	Alpha^	Excluded	BNT162b2	Documented infection	54.3 (50.6-57.8)	14-20	97.3 (96.7-97.8)	22-28	2 weeks
								Symptomatic disease	58.3 (54.7-61.6)		97.9 (97.4-98.3)		
								Hospitalization	74.5 (69.1-79.0)		99.0 (98.4-99.3)		
								Severe/critical disease	77.3 (71.2-82.1)		99.2 (98.6-99.5)		
								Death	71.7 (64.1-77.7)		98.6 (97.0-99.3)		
95#	Andrews et al (September 14, 2021)	England	Test-negative case control	1,475,391 symptomatic cases and 3,299,344 test-negative control patients among adults (16+)	Alpha specifically^	Excluded	BNT162b2	Symptomatic disease	45.7 (44-47.3)	28+	95 (93.8-95.9)	14+	~33.5 weeks
									—		95 (93.8-96)	14-69	~8 weeks
									—		94.8 (88.4-97.7)	70+	~33.5 weeks
								Hospitalization	85.2 (81.6-88.1)	28+	97.9 (91.4-99.5)	14+	~33.5 weeks
								Death	73.1 (65-79.3)	28+	96.3 (89.9-98.6)	14+	~33.5 weeks
							AZD1222	Symptomatic disease	44.5 (42.9-46.1)	28+	81.7 (79-84)	14+	~20.5 weeks
									—		81.9 (79.2-84.3)	14-69	~8 weeks
									—		76.2 (49.8-88.7)	70+	~20.5 weeks
								Hospitalization	82.5 (78.7-85.7)	28+	93.9 (84.9-97.5)	14+	~20.5 weeks
									—		93.8 (84.7-97.5)	70+	~20.5 weeks
								Death	79.1 (68.8-86)	28+	100 (CI omitted, no deaths	14+	~20.5 weeks

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
											among vaccinated)		
							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
									—		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

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
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 matched with 10,861 controls	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)		
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)		

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
								Hospitalization, overall	—		88 (84-92)	14-27	~2 weeks
											86 (74-93)	112+	~22 weeks
								Emergency department or urgent care visit	—		92 (88-95)	14-27	~2 weeks
											86 (74-93)	112+	~22 weeks
89	Iliaki et al* (October 18, 2021) *[Update to September 6 preprint]*	USA	Retrospective Cohort	4,317 HCWs	Alpha††	Excluded	BNT162b2 & mRNA-1273	Documented infection	80.2(57.5-90.8)	14+	95.2(80.0-98.8)	14+	~10 weeks
88	Tande et al* (September 6,2021)	USA – Mayo Clinic, Minnesota	Retrospective Cohort	Asymptomatic screening of 46,008 patients: pre-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
							Ad26.COV2.S		51(-2 – 76)		—		
86	Bruxvoort et al*(November 24, 2021) *[Update to September 2,2021 Preprint]*	USA	Matched prospective cohort	352,878 vaccinated 352,878 unvaccinated individuals	Delta and Alpha^	Included	mRNA-1273	Documented infection	—	—	87.4 (85.6-89.1)	14+	~20 weeks
								Asymptomatic infection			72.7 (57.6-82.4)		
								Symptomatic infection			88.3 (86.5-89.9)		
								Hospitalization			95.8 (92.5-97.6)		
								Death			97.9 (84.5-99.7)		
85	Giansante et al* (September 2, 2021)	Italy	Retrospective cohort	9839 staff and HCWs	Delta and Alpha^	Excluded	BNT162b2 and mRNA-1273	Documented infection	85.5(75.9-91.3)	14+ up to <7 post 2nd dose	84.8 (73.2-91.4)	14+	~16 weeks
								Symptomatic infection	81.7(62.7-91)		87.1 (69.3-94.6)		
				Only 7190 HCWs				Documented infection	87.8 (76.5-93.7)		84.4 (69.7-92.0)		
								Symptomatic infection	83.1 (60.0-92.9)		86.5 (62.9-95.1)		
84		Israel	Prospective cohort		Alpha^	Excluded	BNT162b2	Documented infection	—	—	91.9 (69.9-97.9)	14+	~18 weeks

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
	Katz et al (September 2,2021)			1,250 HCWs from six Israeli hospitals				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
					Delta specifically^		BNT162b2	Documented infection	63.4 (42.6-76.6)		73.3 (63.6-80.4)	28-63	7 weeks
											17.9 (-12.9-40.3)	147+	~32 weeks
81	Goldberg et al (October 27, 2021) *[Update to Aug 25 preprint]* *Note: See Duration of Protection Table for further context*	Israel	Retrospective cohort	9,395,923 adults (16+) in Israel	Delta^	Excluded	BNT162b2	Documented infection, 16-39 y fully vaccinated May 2021 (~2 mos prior)	—	—	73 (67-78)	55-98	13 weeks
								Documented infection, 16-39 y fully vaccinated Jan 2021 (~6 mos prior)			50 (45-55)	168-203	28 weeks
								Documented infection, 40-59 y fully vaccinated May 2021 (~2 mos prior)			80 (71-86)	55-98	13 weeks
								Documented infection, 40-59 y fully vaccinated Jan 2021 (~6 mos prior)			58 (54-62)	168-203	28 weeks
								Documented infection, 60+ y fully vaccinated May 2021 (~2 mos prior)			75 (58-85)	55-98	13 weeks

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

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
	(October 14, 2021) [*Update to Aug 18 preprint]*		Prospective cohort	384,543 individuals aged 18 years or older	Alpha^ (December - May)			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* (November 4, 2021) [*Update to Aug 18 MMWR*)	USA	Test-negative case control	4513 hospitalized adults (18+)	Alpha and Delta^	Included	BNT162b2	Hospitalization, all	—	—	81 (77-84)	14+	~30 weeks
											85 (82-88)	14-120	~15 weeks
											64 (51-73)	120+	~30 weeks
							mRNA-1273	Hospitalization, all			89 (86-92)	14+	~28 weeks
											91 (87-93)	14-120	~15 weeks
											85 (77-91)	120+	~28 weeks
							BNT162b2 or mRNA-1273	Hospitalization, Immunocompetent			90 (87-91)	14+	~30 weeks
								Hospitalization, Immunocompromised			51 (31-65)		
					Alpha specifically^		BNT162b2 or mRNA-1273	Hospitalization, all			90 (84-94)		
					Delta specifically^			Hospitalization, all			86 (79-90)		
76	Chin et al (August 18, 2021)	USA	Retrospective cohort	60,707 incarcerated people in California prisons	Non-VOC^	Excluded	BNT162b2 or mRNA-1273	Documented infection, all	74 (64-82)	14+	97 (88-99)	14+	~5 weeks
								Documented infection, cohort at moderate/high risk for severe COVID-19	74 (62-82)		92 (74-98)		
							mRNA-1273	Documented infection, all	71 (58-80)		96 (67-99)		
75	Nanduri et al (August 18,2021)	USA	Retrospective cohort	10,428,783 residents of skilled nursing facilities	Non-VOC and Alpha†† (Pre-Delta circulation) ^	Unknown	BNT162b2	Documented infection	—	—	74.2 (69–78.7)	14+	~16 weeks
							mRNA-1273				74.7(66.2-81.1)		
					Alpha†† (Delta circulating but not dominant) ^		BNT162b2	Documented infection			66.5 (58.3-73.1)		~22 weeks
							mRNA-1273				70.4 (60.1-78.0)		

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
					Delta^		BNT162b2	Documented infection			52.4 (48–56.4)		~28 weeks
							mRNA-1273				50.6 (45–55.7)		
74#	Tang et al* (November 2, 2021) *[Update to Aug 11 preprint]*	Qatar	Test-negative case control	Cases with confirmed Delta (~2800 per analysis) or Beta infection and matched controls (~11,200) among residents of Qatar of all ages	Delta specifically^	Included	BNT162b2	Documented infection	42.8 (18.2-60.1)	14+	50.6 (45.4-55.3)	14+	~25 weeks
							mRNA-1273		73.2 (57.3-83.2)		72.0 (66.1-76.9)		
							BNT162b2	Severe, critical, or fatal disease	84.5 (-25.2-98.1)		94.1 (85.9-97.6)		
							mRNA-1273		87.5 (23.4-95.8)		96.1 (71.4-99.5)		
							BNT162b2	Symptomatic COVID-19	56.2 (30.6-72.4)		44.4 (37.0-50.9)		
							mRNA-1273		82.5 (65.2-91.2)		73.9 (65.9-79.9)		
							BNT162b2	Asymptomatic COVID-19	46.7 (-56.2-81.8)		46.0 (32.3-56.9)		
							mRNA-1273		61.8 (-9.6-86.7)		53.6 (33.4-67.6)		
					Beta specifically^		BNT162b2	Documented infection	18.9 (-1.8-35.4)		74.3 (70.3-77.7)		
							mRNA-1273		66.3 (55.8-74.2)		80.8 (69.0-88.2)		
							BNT162b2	Severe, critical, or fatal disease	74.8 (-7.6-94.1)		92.7 (81.5-97.1)		
							mRNA-1273		72.5 (7.7-91.8)		100.0 (CI omitted due to zero events among vaccinated)		
73	Chemaitelly et al (August 9, 2021)	Qatar	Retrospective cohort	782 kidney transplant recipients	Alpha and Beta^	Excluded	BNT162b2 and mRNA-1273	Documented infection	—	—	46.6 (0.0-73.7)	14+	~17 weeks
											66.0 (21.3-85.3)	42+	
											73.9 (33-89.9)	56+	
								Severe infection			72.3 (0.0-90.9)	14+	
											85.0 (35.7-96.5)	42+	
											83.8 (31.3-96.2)	56+	
72	Puranik et al (August 9, 2021)	USA	Retrospective cohort	77,607 adults	Alpha and Delta ^	Excluded	BNT162b2	Documented infection	16 (-20-42)	1-7	76 (69-81)	14+	~ 26 weeks
								Hospitalization	75 (-30-97.4)		85 (73-93)		

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
								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	

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
												19-29 days	
											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)		—		

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

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
58	Butt et al* (October 7, 2021) *[Update to June 22 preprint]*	Qatar	Retrospective cohort	814pregnant women	Alpha and Beta^	Excluded	BNT162b2	Documented infection	—	—	87.7 (43.5-97.3)	14+	~17 weeks
							mRNA-1273				100.0 (0-100.0)		
57	Prunas et al (July 16, 2021)	Israel	Retrospective cohort	253,564 Israeli individuals from 65,264 households with at least 1 infected individual and at least 2 members	Original and Alpha¶	Unknown	BNT162b2	Documented infection among household contacts	—	—	80.5 (78.9-82.1)	10+	~8.5 weeks
56	Whitaker et al (July 9,2021)	UK	Prospective cohort	5,642,687 patients reporting to 718 English general practices	Original and Alpha$^{\psi}$	Included	BNT162b2	Symptomatic COVID-19	48.6 (27.9-63.3)	28-90‡	93.3 (85.8-96.8)	14+	~20 weeks
							AZD1222		50.2 (40.8-58.2)		78.0 (69.7-84.0)		
55	John et al (July 13,2021)	USA	Retrospective cohort	40,074 patients with cirrhosis within Veterans Health Administration, propensity matched	Original and Alpha ††	Excluded	BNT162b2 and mRNA-1273	Documented infection	64.8 (10.9-86.1)	28+ (including some with dose 2)	78.6 (25.5-93.8)	7+	~10 weeks
								Hospitalization	100.0 (99.3-100.0)		100.0 (99-100)		
								COVID-19 related death	100.0 (99.3-100.0)		100.0 (99-100)		
54	Bertollini et al (July 13, 2021)	Qatar	Prospective cohort	10,092 matched pairs of Qatari adults arriving at an international airport.	Original, Alpha and Beta^	Included	BNT162b2 and mRNA-1273	Documented infection	—		78 (72-83)	14+	~4 weeks
53	Goldshtein et al* (July 12,2021)	Israel	Retrospective cohort	15060 pregnant Israeli women	Original and Alpha¶	Excluded	BNT162b2	Documented infection	54 (33-69)	11-27, including some with dose 2	—		~5 weeks
									78 (57-89)	28+, includes some with dose 2			

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
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)		

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
				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) *[Update to June 28 preprint]*	Finland	Prospective cohort	Two study cohorts: 901,092 Finnish elderly aged 70 years and	Original and Alpha^	Excluded	BNT162b2 & mRNA-1273 (elderly cohort)	Documented infection	45 (36-53)	21+ days	75 (65-82)	7+	16 weeks
								Hospitalization	63 (49-74)		93 (70-98)		
							BNT162b2 & mRNA-1273	Documented infection	40 (26-51)		77 (65-85)		
								Hospitalization	82 (56-93)		90 (29-99)		

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
				774,526 chronically ill aged 16-69 years			(Chronically ill cohort)						
							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 (October 6,2021)* *[Update to Jul 14 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)		
42#	Sheikh et al (June 14, 2021)	Scotland	TND	Scottish population	Alpha^	Unknown	BNT162b2	Documented infection	38 (29-45)	28+	92 (90–93)	14+	
						Unknown	AZD1222	Documented infection	37 (32-42)	28+	73 (66–78)	14+	

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
					Delta^	Unknown	BNT162b2	Documented infection	30 (17-41)	28+	79 (75–82)	14+	~20 weeks (but most much less)
						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 that predispose for severe	original & Alpha¶¶	Excluded	BNT162b2	Documented infection	7 (-1-15)	>14	82 (79-84)	>7	10 weeks
								COVID-Hospitalization	35 (18-49)	>14	93 (89-96)	>7	
								COVID-Mortality	7 (-15-25)	>14	94 (90-96)	>7	

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
				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+	
							BNT162b2 & mRNA-1273	Symptomatic infection	43 (22-59)		88 (61-96)	7+	

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
					Beta or Gamma specifically^		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 post dose 2	97 (94-99)	>7 days	
								Asymptomatic	36 (-51-69)		86 (69-97)		

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
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.* (November 2, 2021) *[Update to April 30 preprint]*	USA	Retrospective cohort	97,787 adults in the Mayo Clinic Network	Alpha and Delta^	Excluded	Ad26.COV2.S	Documented infection	74.2 (64.9-81.6)	≥15	—		
24	Fabiani et al.* (Apr 29, 2021)	Italy	Retrospective cohort	9,878 HCWs	Unknown	Excluded	BNT162b2	Documented infection	84 (40-96)	14-21	95 (62-99)	≥7 days	
								Symptomatic infection	83 (15-97)		94 (51-99)		
23	Gras-Valenti et al.*(Apr 29, 2021)	Spain	Case-control	268 HCWs	Original & Alpha¥¥	Included	BNT162b2	Documented infection	53 (1-77)	>12	—		
22	Tenforde et al.* (Apr 28, 2021)	USA	Test-negative case-control	Hospitalized adults ≥65 years	Original and Alpha¥	Unknown	BNT162b2 & mRNA-1273	Hospitalization	64 (28-82)	≥14 days post dose 1 to 14 days post dose 2	94 (49-99)	≥14 days	
21	Goldberg et al.	Israel				Included	BNT162b2	Documented infection	58 (57-59)		93 (93-93)		

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
	(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.* (October 18, 2021) *[Update to Apr 22 preprint]*	UK - England	Case-control	170,226 80-83-year-olds	Alpha^	Excluded	BNT162b2	Documented infection	55 (40-66)	21-27	70 (55- 80)	35-41	
								Hospitalization	50 (19-69)	21-27	75 (52-87)	35-41	
								Emergency visit	58 (31–74)		79(60-90)		
16	Bjork et al.* (September 29, 2021) [*Update to Apr 21 preprint]*	Sweden	Retrospective cohort	805,741 Swedish adults aged 18-64 years	Original & Alpha^	Unknown	BNT162b2	Documented infection	42 (14-63)	≥14	86 (72-94)	≥7	4 weeks
15	Glampson et al.* (Sep 17, 2021) *[Update to Jul 15 preprint]*	UK	Retrospective cohort	2,183,939 adults ≥16 in Northwest London	Alpha^	Included	BNT162b2	Documented infection	78 (73-82)	22-28	—		
							AZD1222	Documented infection	74 (65-81)	22-28			
14	Andrejko et al.* (Jul 20, 2021) [update to May 25 preprint]	USA	Test-negative case control	1023 California adults ≥18 years	B.1.427/ B.1.429 & Alpha^	Excluded	BNT162b2 & mRNA-1273	Documented infection	66.9 (28.7--84.6)	≥15	87.4 (77.2-93.1)	≥15	~14 weeks
								Asymptomatic infection	—		68.3 (27.9-85.7)	≥15	

N4.	Reference (date)	Country	Design	Population	Dominant Variants	History of COVID	Vaccine Product	Outcome Measure	1st Dose VE % (95%CI)	Days post 1st dose±	2nd Dose VE % (95% CI)	Days post 2nd dose	Max Duration of follow up after fully vaccinated
								Symptomatic infection	—		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. (Mar 17, 2021)	Israel – Maccabi System	Retrospective Cohort	1.79 million enrollees, adults <90 years	Alpha^	Excluded	BNT162b2	Documented infection	91 (89-93) ≥35 days post dose 1 most with dose 2				
								Symptomatic infection	99 (95-99) ≥35 days post dose 1 most with dose 2				

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

Purple text indicates new or updated study.
Product Manufacturers: BNT162b2 (Pfizer), mRNA-1273 (Moderna), AZD1222 (Astra-Zeneca), Ad26.COV2.S (Janssen), Coronavac
±Unless noted otherwise, days post 1st dose are prior to receiving dose 2.
‡Unclear if 1st dose VE estimates includes any individuals who received a second dose.
*Manuscripts with an asterisk (*) are peer-reviewed publications.
^Indicates predominant variant identified by study authors. If no ^ then variants identified through secondary source when possible. Please see additional footnotes.

¶The rise of SARS-CoV-2 variant Alpha in Israel intensifies the role of surveillance and vaccination in elderly | medRxiv
¥CDC Says More Virulent British Strain Of Coronavirus Now Dominant In U.S. : Coronavirus Updates : NPR
£Coronavirus (COVID-19) Infection Survey, UK - Office for National Statistics
¶¶Denmark logs more contagious COVID variant in 45% of positive tests | Reuters
¥¥COVID variant first detected in UK now dominant strain in Spain
££Reporte-circulacion-variantes-al-9.04.21-PUBLICADO-FINAL.pdf (minsal.cl)
††Based on https://outbreak.info/location-reports
ψhttps://www.gov.uk/government/publications/covid-19-variants-genomically-confirmed-case-numbers/variants-distribution-of-cases-data
Manuscripts that are cited in the WHO COVID-19 Weekly Epidemiological Updates (see Special Focus Update on SARS-CoV-2 Variants of Interest and Variants of Concern, Table 3, included in every other Weekly Epidemiological Update): https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports.
xxVE estimate presented with 99% CIs.

1.1 Inclusion criteria for VE studies

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

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

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

1. Hunter P and Brainard J. Estimating the effectiveness of the Pfizer COVID-19 BNT162b2 vaccine after a single dose. A reanalysis of a study of 'real-world' vaccination outcomes from Israel. *medRxiv*. Published online 2021:2021.02.01.21250957. doi: 10.1101/2021.02.01.21250957
2. Institut National de Santé Publique du Québec. Preliminary Data on Vaccine Effectiveness and Supplementary Opinion on the Strategy for Vaccination Against COVID-19 in Quebec in a Context of Shortage. Gouvernement du Québec. 2021:Publication No 3111. Available at: https://www.inspq.qc.ca/sites/default/files/publications/3111-vaccine-effectiveness-strategy-vaccination-shortage-covid19.pdf.
3. Weekes M, Jones NK, Rivett L, et al. Single-dose BNT162b2 vaccine protects against asymptomatic SARS-CoV-2 infection. *Authorea*. Published online Feb 24, 2021. doi: 10.22541/au.161420511.12987747/v1

4. Aran D. Estimating real-world COVID-19 vaccine effectiveness in Israel using aggregated counts. Published online Mar 4, 2021. Available at: https://github.com/dviraran/covid_analyses/blob/master/Aran_letter.pdf.
5. Shah ASV, Gribben C, Bishop J, et al. Effect of vaccination on transmission of COVID-19: an observational study in healthcare workers and their households. *medRxiv*. Published online 2021:2021.03.11.21253275. doi: 10.1101/2021.03.11.21253275
6. Monge S, Olmedo C, Alejos B, et al. Direct and indirect effectiveness of mRNA vaccination against SARS-CoV-2 infection in long-term care facilities in Spain. *Emerg Infect Dis*. 2021;27(10):2595-2603. doi: https://doi.org/10.3201/eid2710.211184
7. Jameson AP, Sebastian T, Jacques LR. Coronavirus disease 2019 (COVID-19) vaccination in healthcare workers: An early real-world experience. *Infect Control Hosp Epidemiol*.:1-2. doi:10.1017/ice.2021.171
8. Vahidy FS, Pischel L, Tano ME, et al. Real World Effectiveness of COVID-19 mRNA Vaccines against Hospitalizations and Deaths in the United States. *medRxiv*. Published online 2021:2021.04.21.21255873 doi: 10.1101/2021.04.21.21255873
9. Swift MD, Breeher LE, Tande AJ, et al. Effectiveness of Messenger RNA Coronavirus Disease 2019 (COVID-19) Vaccines Against Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) Infection in a Cohort of Healthcare Personnel. *Clin Inf Dis.* Published online Apr 26, 2021:2021;ciab361. doi: 10.1093/cid/ciab361
10. Zaqout A, Daghfal J, Alaqad I, et al. The initial impact of a national BNT162b2 mRNA COVID-19 vaccine rollout. *medRxiv*. Published online 2021:2021.04.26.21256087 doi: 10.1101/2021.04.26.21256087
11. Cavanaugh AM, Fortier S, Lewis P, et al. COVID-19 Outbreak Associated with a SARS-CoV-2 R.1 Lineage Variant in a Skilled Nursing Facility After Vaccination Program – Kentucky, March 2021. *MMWR Morb Mortal Wkly Rep.* 2021;70:639-643. doi: 10.15585/mmwr.mm7017e2
12. Menni C, Klaser K, May A, et al. Vaccine side-effects and SARS-CoV-2 infection after vaccination in users of the COVID Symptom Study app in the UK: a prospective observational study. *Lancet Infect Dis.* 2021; 21; 939-49. Published online April 27, 2021. doi: 10.1016/S1473-3099(21)00224-3.
13. Tang L, Hijano DR, Gaur AH, et al. Asymptomatic and Symptomatic SARS-CoV-2 Infections After BNT162b2 Vaccination in a Routinely Screened Workforce. *JAMA.* Published online May 6, 2021:2021;325(24):2500-2502. doi: 10.1001/jama.2021.6564
14. Chodick G, Tene L, Rotem Ran S, et al. The Effectiveness of the Two-Dose BNT162b2 Vaccine: Analysis of Real-World Data. *Clin Infect Dis.* Published online May 17, 2021:2021;ciab438. doi: 10.1093/cid/ciab438
15. Lopez Bernal J, Andrews N, Gower C, et al. Effectiveness of BNT162b2 mRNA vaccine and ChAdOx1 adenovirus vector vaccine on mortality following COVID-19. *medRxiv*. Published online 2021:2021.05.14.21257600 doi: 10.1101/2021.05.14.21257218
16. Bianchi FB, Germinario CA, Migliore G, et al. BNT162b2 mRNA COVID-19 Vaccine Effectiveness in the Prevention of SARS-CoV-2 Infection: A Preliminary Report. *J Infect Dis.* Published online May 19, 2021:2021;jiab262. doi: 10.1093/infdis/jiab262
17. Walsh J, Skally M, Traynor L, et al. Impact of first dose of BNT162b2 vaccine on COVID-19 infection among healthcare workers in an Irish hospital. *Ir J Med Sci*. Published online May 2021:1-2. doi:10.1007/s11845-021-02658-4

18. Yassi A, Grant JM, Lockhart K, et al. Infection control, occupational and public health measures including mRNA-based vaccination against SARS-CoV-2 infections to protect healthcare workers from variants of concern: a 14-month observational study using surveillance data. *PLoS ONE*. 2021;16(7):e0254920. doi:10.1371/journal.pone.0254920
19. Kumar S, Saxena S, Atri M, Chamola SK. Effectiveness of the Covid-19 vaccine in preventing infection in dental practitioners: results of a cross-sectional questionnaire-based survey. *medRxiv*. Published online 2021:2021.05.28.21257967. doi:10.1101/2021.05.28.21257967
20. Shrestha NK, Nowacki AS, Burke PC, Terpeluk P, Gordon SM. Effectiveness of mRNA COVID-19 Vaccines among Employees in an American Healthcare System. *medRxiv*. Published online 2021:2021.06.02.21258231. doi:10.1101/2021.06.02.21258231
21. Riley S, Wang H, Eales O, et al. *REACT-1 Round 12 Report: Resurgence of SARS-CoV-2 Infections in England Associated with Increased Frequency of the Delta Variant*.; 2021. https://spiral.imperial.ac.uk/bitstream/10044/1/89629/2/react1_r12_preprint.pdf
22. Ben-Dov IZ, Oster Y, Tzukert K, et al. The 5-months impact of tozinameran (BNT162b2) mRNA vaccine on kidney transplant and chronic dialysis patients. *medRxiv*. Published online June 16, 2021:2021.06.12.21258813. doi:10.1101/2021.06.12.21258813
23. Victor PJ, Mathews KP, Paul H, Murugesan M, Mammen JJ. Protective Effect of COVID-19 Vaccine Among Health Care Workers During the Second Wave of the Pandemic in India. *Mayo Clin Proc*. Published online 2021.
24. Chodick G, Tene L, Patalon T, et al. Assessment of Effectiveness of 1 Dose of BNT162b2 Vaccine for SARS-CoV-2 Infection 13 to 24 Days After Immunization. *JAMA Netw Open.* Published online Jun 7, 2021:2021;4(6):e2115985. doi: 10.1001/jamanetworkopen.2021.15985
25. Bahl A, Johnson S, Maine G, et al. Vaccination reduces need for emergency care in breakthrough COVID-19 infections: A multicenter cohort study. *medRxiv*. Published online 2021:2021.06.09.21258617. doi:10.1101/2021.06.09.21258617
26. Zacay G, Shasha D, Bareket R, et al. BNT162b2 Vaccine Effectiveness in Preventing Asymptomatic Infection with SARS-CoV-2 Virus: A Nationwide Historical Cohort Study. *Open Forum Infect Dis*. Published online June 9, 2021:2021;8(6). doi: 10.1093/ofid/ofab262
27. Ross C, Spector O, Tsadok MA, Weiss Y, Barnea R. BNT162b2 mRNA vaccinations in Israel: understanding the impact and improving the vaccination policies by redefining the immunized population. *medRxiv*. Published online 2021:2021.06.08.21258471. doi:10.1101/2021.06.08.21258471
28. Malinis M, Cohen E, Azar MM. Effectiveness of SARS-CoV-2 vaccination in fully-vaccinated solid organ transplant recipients. *Am J Transplant*. Published online June 2021. doi:10.1111/ajt.16713
29. Ramakrishnan, M., & Subbarayan, P. Impact of vaccination in reducing Hospital expenses, Mortality and Average length of stay among COVID 19 patients. A retrospective cohort study from India. *medRxiv*, Published online 2021: 2021.06.18.21258798. doi:10.1101/2021.06.18.21258798
30. Sansone E, Sala E, Tiraboschi M, et al. Effectiveness of BNT162b2 vaccine against SARS-CoV-2 among healthcare workers. *Med Lav*. Published online 15 June 2021. doi: 10.23749/mdl.v112i3.11747.

31. Mazagatos C, Monge S, Olmedo C, et al. Effectiveness of mRNA COVID-19 vaccines in preventing SARS-CoV-2 infections and COVID-19 hospitalizations and deaths in elderly long-term care facility residents, Spain, weeks 53 2020 to 13 2021. *Euro Surveill.* 2021;26(24):pii=2100452. doi: 10.2807/1560-7917.ES.2021.26.24.2100452.
32. Tanislav C, Ansari TE, Meyer M, et al. Effect of SARS-CoV-2 vaccination among health care workers in a geriatric care unit after a B.1.1.7-variant outbreak [published online ahead of print, 2021 Jun 19]. *Public Health.* 2021. doi: 10.1016/j.puhe.2021.06.003
33. Jaiswal A, Subbaraj V, Wesley J, et al. COVID-19 vaccine effectiveness in preventing deaths among high-risk groups in Tamil Nadu, India. *Indian J Med Res*. Accessed online ahead of print 23 June 2021. doi: 10.4103/ijmr.ijmr_1671_21.
34. Harris RJ, Hall JA, Zaidi A, et al. Effect of Vaccination on Household Transmission of SARS-CoV-2 in England. *N Engl J Med.* Published online Jun 23, 2021. doi: 10.1056/NEJMc2107717
35. Hitchings MDT, Ranzani OT, Torres MSS et al. Effectiveness of CoronaVac among healthcare workers in the setting of high SARS-CoV-2 Gamma variant transmission in Manaus, Brazil: A test-negative case-control study. *medRxiv*, Published online 2021: 2021.04.07.21255081 .21258798. doi:10.1101/2021.04.07.21255081
36. Knobel P, Serra C, Grau S, et al. COVID-19 mRNA vaccine effectiveness in asymptomatic healthcare workers [published online ahead of print, 2021 Jun 24]. *Infect Control Hosp Epidemiol*. 2021;1-7. doi:10.1017/ice.2021.287
37. Kale P, Bihari C, Patel N, et al. Clinicogenomic analysis of breakthrough infections by SARS CoV2 variants after ChAdOx1 nCoV-19 vaccination in healthcare workers. *medRxiv*, Published online 2021:2021.06.28.21259546. doi: 10.1101/2021.06.28.21259546
38. Mateo-Urdiales A, Alegiani SS, Fabiani M, et al. Risk of SARS-CoV-2 infection and subsequent hospital admission and death at different time intervals since first dose of COVID-19 vaccine administration, Italy, 27 December 2020 to mid-April 2021. *Euro Surveill.* 2021;26(25):pii=2100507. doi: 10.2807/1560-7917.ES.2021.26.25.2100507
39. Gazit S, Mizrahi B, Kalkstein N, et al. BNT162b2 mRNA Vaccine Effectiveness Given Confirmed Exposure; Analysis of Household Members of COVID-19 Patients. *medRxiv*, published online 2021.06.29.21259579. doi:10.1101/2021.06.29.21259579
40. Paris C, Perrin S, Hamonic S, et al. Effectivness of mRNA-BNT162b2, mRNA-1273, and ChAdOx1 nCoV-19 vaccines against COVID-19 in health care workers: an observational study using surveillance data. *Clin Microbiol Infect*. Published online Jun 29, 2021. doi: 10.1016/j.cmi.2021.06.043
41. Kojima N, Roshani A, Brobeck M, et al. Incidence of Severe Acute Respiratory Syndrome Coronavirus-2 infection among previously infected or vaccinated employees. *medRxiv*, Published online 2021:2021.07.03.21259976. doi: 10.1101/2021.07.03.21259976
42. Lumley SF, Rodger G, Constantinides B, et al. An observational cohort study on the incidence of SARS-CoV-2 infection and B.1.1.7 variant infection in healthcare workers by antibody and vaccination status. *Clin Inf Dis.* Published online Jul 12, 2021:2021;ciab608. doi: 10.1093/cid/ciab608
43. Rovida F, Cassaniti I, Paolucci S, et al. SARS-CoV-2 vaccine breakthrough infections are asymptomatic or mildly symptomatic and are infrequently transmitted. *medRxiv*, Published online 2021.06.29.21259500. doi:10.1101/2021.06.29.21259500

44. Williams C, Al-Bargash D, Macalintal C, et al. COVID-19 Outbreak Associated with a SARS-CoV-2 P.1 Lineage in a Long-Term Care Home after Implementation of a Vaccination Program – Ontario, April-May 2021. *Clin Inf Dis.* Published online Jul 8, 2021:2021;ciab617. doi: 10.1093/cid/ciab617
45. Bailly B, Guilpain L, Bouiller K, et al. BNT162b2 mRNA vaccination did not prevent an outbreak of SARS COV-2 variant 501Y.V2 in an elderly nursing home but reduced transmission and disease severity [published online ahead of print, 2021 May 16]. *Clin Infect Dis*. 2021;ciab446. doi:10.1093/cid/ciab446
46. Charmet T, Schaeffer L, Grant R, et al. Impact of original, B.1.1.7, and B.1.351/P.1 SARS-CoV-2 lineages on vaccine effectiveness of two doses of COVID-19 mRNA vaccines: Results from a nationwide case-control study in France [published online ahead of print, 2021 Jul 13]. *Lancet Regional Health—Eur.* 2021;8:100171. doi: 10.1016/j.lanepe.2021.100171
47. Bermingham CR, Morgan J, Ayoubkhani D, et al. Estimating the effectiveness of the first dose of COVID-19 vaccine against mortality in England: a quasi-experimental study. *medRxiv*, Published online 2021.07.12.21260385. doi:10.1101/2021.07.12.21260385
48. Alencar CH, de Goes Cavalcanti LP, de Almeida MM, et al. High Effectiveness of SARS-CoV-2 Vaccines in Reducing COVID-19-Related Deaths in over 75-Year-Olds, Ceará State, Brazil. *Trop Med Infect Dis.* 2021;6(3):129. doi: 10.3390/tropicalmed6030129
49. Waldman SE, Adams JY, Albertson TE, et al. Real-world impact of vaccination on COVID-19 incidence in health care personnel at an academic medical center. *Infect Control Hosp Epidemiol*. Published online Jul 21, 2021:2021;1-21. doi: 10.1017/ice.2021.336
50. Vignier N, Bérot V, Bonnave N, et al. Breakthrough infections of SARS-CoV-2 gamma variant in fully vaccinated gold miners, French Guiana, 2021 [published online ahead of print, 2021 Jul 21]. *Emerg Infect Dis*. 2021;27(10). doi: 10.3201/eid2710.211427
51. Pramod S, Govindan D, Ramasubramani P, et al. Effectiveness of Covishield vaccine in preventing Covid-19 – A test-negative case-control study. *medRxiv*, Published online 2021.07.19.21260693. doi:10.1101/2021.07.19.21260693
52. Rubin D, Eisen M, Collins S, et al. SARS-CoV-2 Infection in Public School District Employees Following a District-Wide Vaccination Program – Philadelphia County, Pennsylvania, March 21-April 23, 2021. *MMWR Morb Mortal Wkly Rep.* Published online 2021 Jul 23. doi: 10.15585/mmwr.mm7030e1
53. Mor O, Zuckerman NS, Hazan I, et al. BNT162b2 Vaccination efficacy is marginally affected by the SARS-CoV-2 B.1.351 variant in fully vaccinated individuals. *medRxiv*, Published online 2021.07.20.21260833. doi:10.1101/2021.07.20.21260833
54. Thiruvengadam, R et al. Cellular Immune Responses are Preserved and May Contribute to Chadox1 ChAdOx1 nCoV-19 Vaccine Effectiveness Against Infection Due to SARS-CoV-2 B·1·617·2 Delta Variant Despite Reduced Virus Neutralisation. *SSRN*, Published online 2021 Jul 16. https://ssrn.com/abstract=3884946.
55. Murillo-Zamora E, Trujilo X, Huerta M, et al. Effectiveness of BNT162b2 COVID-19 vaccine in preventing severe symptomatic infection among healthcare workers. *Medicina.* 2021;57(8):746. doi: https://doi.org/10.3390/medicina57080746
56. Blanco, S et al. Evaluation of the Gam-COVID-Vac and Vaccine-Induced Neutralizing Response Against SARS-CoV-2 Lineage P.1 (Manaus) Variant in an Argentinean Cohort. *SSRN*, Published online 2021 Jul 27. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3893461.

57. Aslam, S, Adler, E, Mekeel, K, Little, SJ. Clinical effectiveness of COVID-19 vaccination in solid organ transplant recipients. *Transpl Infect Dis*. Published online 2021 Jul 29. doi: 10.1111/tid.13705.
58. Cserep G, Morrow D, Latchford K, Jesset R, Dosa A, Kirmizis D. The effect of a single dose of BNT162b2 vaccine on the incidence of severe COVID-19 infection in patients on chronic hemodialysis: a single-centre study [published online ahead of print, 2021 Jul 29]. *Clin Exp Nephrol*. 2021;1-5. doi:10.1007/s10157-021-02118-4
59. Hetemäki Iivo, et al. An outbreak caused by the SARS-CoV-2 Delta variant (B.1.617.2) in a secondary care hospital in Finland, May 2021. *Euro Surveill.* Published online 2021 Jul 28. doi: https://doi.org/10.2807/1560-7917.ES.2021.26.30.2100636
60. Ghosh S, Shankar S, Chatterjee K, et al. COVIDSHIELD (AZD1222) VaccINe effectiveness among healthcare and frontline Workers of Indian Armed Forces: Interim results of VIN-WIN cohort study. *Med J Armed Forces India.* 2021;77(2):S264-S270. doi: 10.1016/j.mjafi.2021.06.032
61. Muthukrishnan J, Vardhan V, Mangalesh S, et al. Vaccination status and COVID-19 related mortality: A hospital based cross sectional study. *Med J Armed Forces India.* 2021;77(2):S278-S282. doi: 10.1016/j.mjafi.2021.06.034
62. Sakre M, Agrawal S, Ravi R, et al. COVID 19 vaccination: Saviour or unfounded reliance? A cross sectional study among the air warriors. *Med J Armed Forces India.* 2021;77(2):S502-S504. doi: 10.1016/j.mjafi.2021.06.017
63. Bobdey S, Kaushik SK, Sahu R, et al. Effectiveness of ChAdOx1 nCOV-19 Vaccine: Experience of a tertiary care institute. *Med J Armed Forces India.* 2021;77(2):S271-S277. doi: 10.1016/j.mjafi.2021.06.006
64. Vaishya R, Sibal A, Malani A, Prasad KH. SARS-CoV-2 infection after COVID-19 immunization in healthcare workers: A retrospective, pilot study. *Indian J Med Res.* Published online 2021 Aug 3. doi: 10.4103/ijmr.ijmr_1485_21
65. Bhattacharya A, Ranjan P, Ghosh T, et al. Evaluation of the dose-effect association between the number of doses and duration since the last dose of COVID-19 vaccine, and its efficacy in preventing the disease and reducing disease severity: A single centre, cross-sectional analytical study from India [published online ahead of print, 2021 Jul 30]. *Diabetes Metab Syndr.* 2021;15(5). doi: 10.1016/j.eimc.2021.06.021
66. Lakhia RT, Trivedi JR. The CT Scan Lung Severity Score and Vaccination Status in COVID-19 patients in India: Perspective of an Independent Radiology Practice. *medRxiv*, Published online 2021 Aug 3. doi:10.1101/2021.07.15.21260597
67. Elliott P, Haw D, Wang H, et al. Exponential growth, high prevalence of SARS-CoV-2 and vaccine effectiveness associated with Delta variant. *Science.*, Published online 2021 Nov 2. doi: 10.1126/science.abl9551
68. Mizrahi B, Lotan R, Kalkstein N, et al. Correlation of SARS-CoV-2 Breakthrough Infections to Time-from-vaccine; Preliminary Study. *Nature Communications*, Published online 2021 November 4. doi: https://doi.org/10.1038/s41467-021-26672-3
69. Riemersma K, Grogan E, Kita-Yarbro A, et al. Vaccinated and unvaccinated individuals have similar viral loads in communities with a high prevalence of the SARS-CoV-2 delta variant. *medRxiv*, Published online 2021 July 31. doi: 10.1101/2021.07.31.21261387.
70. Wickert D P, Almand E A, Baldovich K J, et al. Estimates of Single Dose and Full Dose BNT162b2 Vaccine Effectiveness among USAF Academy cadets, 1 Mar - 1 May 2021. *medRxiv*, Published online 2021 July 31. doi: 10.1101/2021.07.28.21261138.

71. Chia P Y, Ong S W X, Chiew C J, et al. Virological and serological kinetics of SARS-CoV-2 Delta variant vaccine-breakthrough infections: a multi-center cohort study. *medRxiv*, Published online 2021 July 31. doi: 10.1101/2021.07.28.21261295.
72. Keegan L, Truelove SA, Lessler J, et al. Progress of the Delta variant and erosion of vaccine effectiveness, a warning from Utah. *medRxiv*, Published online 2021 August 09. doi: 10.1101/2021.08.09.21261554
73. Ye P, Fry L , Liu L,COVID outbreak after the 1st dose of COVID vaccine among the nursing home residents: What happened? *Geriatric Nursing.* Published online 2021 June 25. doi: 10.1016/j.gerinurse.2021.06.022
74. Tregoning, J.S., Flight, K.E., Higham, S.L. *et al.* Progress of the COVID-19 vaccine effort: viruses, vaccines and variants versus efficacy, effectiveness and escape. *Nat Rev Immunol*. Published online 2021 August 09. doi: 10.1038/s41577-021-00592-1.
75. Starrfelt J, Danielsen A.S, et al. High vaccine effectiveness against COVID-19 infection and severe disease among residents and staff of long-term care facilities in Norway, November – June 2021. *medRxiv.* Published online 2021 August 09. doi: doi.org/10.1101/2021.08.08.21261357
76. Herlihy R, Bamberg W, Burakoff A, et al. Rapid Increase in Circulation of the SARS-CoV-2 B.1.617.2 (Delta) Variant — Mesa County, Colorado, April–June 2021. MMWR Morb Mortal Wkly Rep. ePub: 6 August 2021. doi: 10.15585/mmwr.mm7032e2
77. Brown CM, Vostok J, Johnson H, et al. Outbreak of SARS-CoV-2 Infections, Including COVID-19 Vaccine Breakthrough Infections, Associated with Large Public Gatherings — Barnstable County, Massachusetts, July 2021. MMWR Morb Mortal Wkly Rep 2021;70:1059-1062. doi: 10.15585/mmwr.mm7031e2external icon
78. North C, Barczak A et al. Determining the Incidence of Asymptomatic SARS-CoV-2 among Early Recipients of COVID-19 Vaccines: A Prospective Cohort Study of Healthcare Workers before, during and after Vaccination [DISCOVER-COVID-19], *Clinical Infectious Diseases*, Published online 2021 August 07. doi: 10.1093/cid/ciab643
79. Israel A, Merzon E, Schaffer AA, et al. Elapsed time since BNT 162b2 vaccine and risk of SARS-CoV-2 infection in a large cohort. *medRxiv*, Published online 2021 August 05. doi: 10.1101/2021.08.03.21261496
80. Issac A, Kochuparambil JJ, Elizabeth L. SARS-CoV-2 Breakthrough Infections among the Healthcare Workers Post-Vaccination with ChAdOx1 nCoV-19 Vaccine in the South Indian State of Kerala. *medRxiv*, Published online 2021 August 08. doi: 10.1101/2021.08.07.21261587
81. Marco A, Teixido N, Guerrero RA, et al. Outbreak of SARS-CoV-2 in a prison: Low effectiveness of a single dose of the adenovirus vector ChAdOx1 vaccine in recently vaccinated inmates. *medRxiv*, Published online 2021 August 05. doi: 10.1101/2021.08.03.21258337
82. Bitan DT, Kridin K, Cohen AD, Weinstein O. COVID-19 hospitalization, mortality, vaccination, and postvaccination trends among people with schizophrenia in Israel: a longitudinal cohort study. *Lancet Psychiatry.* Published online 2021 Aug 5. doi: 10.1016/S2215-0366(21)00256-X
83. Public Health England. SARS-CoV-2 variants of concern and variants under investigation in England: Technical briefing 20. Published online 2021 Aug 6. Available from:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1009243/Technical_Briefing_20.pdf

84. Pezzotti P, Fabiani M et al. Impact of vaccination on the risk of SARS-CoV-2 infection and hospitalization and death in Italy(27.12.2020-14.07.2021). *Ministere della Salute*. Published online 2021 July 27. Available from: https://www.epicentro.iss.it/vaccini/covid-19-report-valutazione-vaccinazione.
85. Moline HL, Whitaker M, Deng L, et al. Effectiveness of COVID-19 Vaccines in Preventing Hospitalization Among Adults Aged ≥65 Years — COVID-NET, 13 States, February–April 2021. *MMWR Morb Mortal Wkly Rep.* 2021;70:1088-1093. doi: http://dx.doi.org/10.15585/mmwr.mm7032e3.
86. Kang M, Yi Y, Limei S, et al. Effectiveness of Inactivated COVID-19 Vaccines Against COVID-19 Pneumonia and Severe Illness Caused by the B.1.617.2 (Delta) Variant: Evidence from an Outbreak in Guangdong, China. *SSRN*. Published online 2021 Aug 5. Available from: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3895639.
87. Elavarasi A, Sagiraju HKR, Garg RK, et al. Clinical features, demography and predictors of outcomes of SARS-CoV-2 infection in a tertiary care hospital in India-A cohort study. *medRxiv*, Published online 2021 August 12. doi: 10.1101/2021.08.10.21261855
88. Singer SR, Angulo FJ, Swerdlow DL et al. Vaccine Against SARS-CoV-2 Variant Beta (B.1.351) Among Persons Identified Through Contact Tracing in Israel. *SSRN.* Published online 2021 Aug 13. Available from: https://ssrn.com/abstract=3904701
89. Kang M, Xin H, Yuan J, et al. Transmission dynamics and epidemiological characteristics of Delta variant infections in China. *medRxiv*, Published online 2021 August 13. doi: 10.1101/2021.08.12.21261991.
90. Cavanaugh AM, Spicer KB, Thoroughman D, Glick C, Winter K. Reduced Risk of Reinfection with SARS-CoV-2 After COVID-19 Vaccination — Kentucky, May–June 2021. *MMWR Morb Mortal Wkly Rep.* 2021;70:1081-1083. doi: http://dx.doi.org/10.15585/mmwr.mm7032e1
91. Li XN, Huang Y, Wang W, et al. Efficacy of inactivated SARS-CoV-2 vaccines against the Delta variant infection in Guangzhou: A test-negative case-control real-world study [published online ahead of print, 2021 Aug 14]. *Emerg Microbes Infect*. 2021;1-32. doi:10.1080/22221751.2021.1969291.
92. Cabezas C, Coma E, Mora-Fernandez N, et al. Associations of BNT162b2 vaccination with SARS-CoV-2 infection and hospital admission and death with covid-19 in nursing homes and healthcare workers in Catalonia: prospective cohort study. *BMJ.* 2021;374:n1868. doi: 10.1136/bmj.n1868
93. Rosenberg ES, Holtgrave DR, Dorabawila V, et al. New COVID-19 Cases and Hospitalizations Among Adults, by Vaccination Status – New York, May 3-July 25, 2021. *MMWR Morb Mortal Wkly Rep.* Published online 2021 Sep 17. doi: http://dx.doi.org/10.15585/mmwr.mm7037a7
94. Baltas I, Boshier FAT, Williams CA, et al. Post-vaccination COVID-19: A case-control study and genomic anlysis of 119 breakthrough infections in partially vaccinated individuals. *Clin Infect Dis*. Published online 2021 Aug 19;ciab714. doi: 10.1093/cid/ciab714

95. Braeye T, Cornelissen L, Catteau L, et al. Vaccine effectiveness against infection and onwards transmission of COVID-19: Analysis of Belgian contact tracing data, January-June 2021, Vaccine, 2021. Published online Aug 19, 2021. doi: https://doi.org/10.1016/j.vaccine.2021.08.060.
96. Theiler RN, Wick M, Mehta R, et al. Pregnancy and birth outcomes after SARS-CoV-2 vaccination in pregnancy. *Am J Obstet Gynecol.* Published online 2021 Aug 20. doi: 10.1016/j.ajogmf.2021.100467
97. Gomes D, Beyerlein A, Katz K, et al. Is the BioNTech-Pfizer COVID-19 vaccination effective in elderly populations? Results from population data from Bavaria, Germany. *PLOS One*. Published online 2021 November 5. doi: 10.1371/journal.pone.0259370
98. Kislaya I, Rodrigues EF, Borges V, et al. Delta variant and mRNA Covid-19 vaccines effectiveness: higher odds of vaccine infection breakthroughs. *medRxiv*. Published online 2021 August 22. doi: 10.1101/2021.08.14.21262020
99. Cerqueira-Silva T, Oliveira VA, Pescarini J, et al. Influence of age on the effectiveness and duration of protection in Vaxzevria and CoronaVac vaccines. *medRxiv*. Published online 2021 August 27. doi: 10.1101/2021.08.21.21261501
100. Servillita V, Morris MK, Sotomayor-Gonzalez A, et al. Predominance of antibody-resistant SARS-CoV-2 variants in vaccine breakthrough cases from the San Francisco Bay Area, California. *medRxiv*. Published online 2021 August 25. doi: 10.1101/2021.08.19.21262139
101. Barchuk A, Cherkashin M, Bulina A. Vaccine Effectiveness against Referral to hospital and Severe Lung Injury Associated with COVID-19: A Population-Based Case-Control Study in St. Petersburg, Russia. *medRxiv*. Published online 2021 August 26. doi: 10.1101/2021.08.18.21262065
102. Fowlkes, A., Gaglani, M., Groover, K., Thiese, M. S., Tyner, H., & Ellingson, K. (2021). Effectiveness of COVID-19 Vaccines in Preventing SARS-CoV-2 Infection Among Frontline Workers Before and During B.1.617.2 (Delta) Variant Predominance — Eight U.S. Locations, December 2020–August 2021. *MMWR. Morbidity and Mortality Weekly Report*, *70*(34). https://doi.org/10.15585/mmwr.mm7034e4
103. Ujjainiya R, Tyagi A, Sardana V, et al. High failure rate of ChAdOx1-nCoV19 immunization against asymptomatic infection in healthcare workers during a Delta variant surge: a case for continued use of masks post-vaccination. *medRxiv*. Published online 2021 August 28. doi: 10.1101/2021.02.28.21252621
104. Sagiraju HKR, Elavarasi A, Gupta N, et al. The effectiveness of SARS-CoV-2 vaccination in preventing severe illness and death – real-world data from a cohort of patients hospitalized with COVID-19. *medRxiv*. Published online 2021 August 29. doi: 10.1101/2021.08.26.21262705
105. Seppälä Elina, Veneti Lamprini, Starrfelt Jostein, Danielsen Anders Skyrud, Bragstad Karoline, Hungnes Olav, Taxt Arne Michael, Watle Sara Viksmoen, Meijerink Hinta. Vaccine effectiveness against infection with the Delta (B.1.617.2) variant, Norway, April to August 2021. *Euro Surveill.* Published 2021 September 2. doi: https://doi.org/10.2807/1560-7917.ES.2021.26.35.2100793
106. Keehner J, Binkin N, Laurent L. Resurgence of SARS-CoV-2 Infection in a Highly Vaccinated Health System Workforce. *N Engl J Med.* Published online Sep 1, 2021. doi: 10.1056/NEJMc2112981.

107. Tareq AM, Emran TB, Dhama K, et al. Impact of SARS-CoV-2 delta variant (B.1.617.2) in surging second wave of COVID-19 and efficacy of vaccines in tackling the ongoing pandemic. *Hum Vaccin Immunother.* Published online September 2, 2021. doi: 10.1080/21645515.2021.1963601
108. Hu Z, Tao B, Li Z, et al. Effectiveness of inactive COVID-19 vaccines against severe illness in B.1.617.2 (Delta) variant-infected patients in Jiangsu, China. *medRxiv*. Published online 2021 September 5. doi: 10.1101/2021.09.02.21263010
109. Veneti L, Salamanca BV, Seppala E, et al. No difference in risk of hospitalization between reported cases of the SARS-CoV-2 Delta variant and Alpha variant in Norway. *medRxiv*. Published online 2021 September 5. doi: 10.1101/2021.09.02.21263014
110. Kertes J, Gez SB, Saciuk Y, et al. Effectiveness of the mRNA BNT162b2 vaccine six months after vaccination: findings from a large Israeli HMO. *medRxiv*. Published online 2021 September 7. doi: 10.1101/2021.09.01.21262957
111. Puranik A, Lenehan PJ, O'Horo JC, et al. Durability analysis of the highly effective BNT162b2 vaccine against COVID-19. *medRxiv*. Published online 2021 September 7. doi: 10.1101/2021.09.04.21263115
112. Murugesan M, Mathews P, Paul H, et al. Protective Effect Conferred by Prior Infection and Vaccination on COVID-19 in a Healthcare Worker Cohort in South India. *SSRN*, Published online 2021 Aug 31. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3914633.
113. González S, Olszevicki S, Salazar M, et al. Effectiveness of the first component of Gam-COVID-Vac (Sputnik V) on reduction of SARS-CoV-2 confirmed infections, hospitalisations and mortality in patients aged 60-79: a retrospective cohort study in Argentina. *EClinicalMedicine*. 2021;40. doi:10.1016/j.eclinm.2021.101126
114. Villela DAM, de Noronha TG, Bastos LS, et al. Effectiveness of mass vaccination in Brazil against severe COVID-19 cases. *medRxiv*. Published online 2021 September 15. doi: 10.1101/2021.09.10.21263084
115. McKeigue PM, McAllister D, Hutchinson SJ, et al. Efficacy of vaccination against severe COVID-19 in relation to Delta variant and time since second dose: the REACT-SCOT case-control study. m*edRxiv*. Published online 2021 September 15. doi: 10.1101/2021.09.12.21263448
116. McKeigue PM, McAllister D, Robertson C, et al. Efficacy of two doses of COVID-19 vaccine against severe COVID-19 in those with risk conditions and residual risk to the clinically extremely vulnerable: the REACT-SCOT case-control study. *medRxiv.* Published online 2021 September 16. doi: 10.1101/2021.09.13.21262360
117. de Gier B, Kooijman M, Kemmeren J, et al. COVID-19 vaccine effectiveness against hospitalizations and ICU admissions in the Netherlands, April-August 2021. *medRxiv.* Published online 2021 September 17. doi: 10.1101/2021.09.15.21263613
118. Blaiszik, B., Graziani, C., Olds, J. L., & Foster, et al. The Delta Variant Had Negligible Impact on COVID-19 Vaccine Effectiveness in the USA. *medRxiv*. Published online 2021 September 22. doi: https://doi.org/10.1101/2021.09.18.21263783
119. Baden LR, Sahly HME, Essink B,et al. Covid-19 in the Phase 3 Trial of mRNA-1273 During the Delta-variant Surge. *medRxiv*. Published online 2021 September 22. doi: https://doi.org/10.1101/2021.09.17.21263624
120. Ruban, A. charle. pon, Mohamed, A., & Kalyanaraman, S. Effectiveness of vaccination in preventing severe SARS CoV-2 infection in South India-a hospital based cross sectional study. *medRxiv*. Published online September 23, 2021. doi: https://doi.org/10.1101/2021.09.17.21263670

121. McEvoy CM, Lee A, Misra PS, et al. Real-world effectiveness of 2-dose SARS-CoV-2 vaccination in kidney transplant recipients. *medRxiv*. Published online September 23, 2021. doi: https://doi.org/10.1101/2021.09.21.21263457
122. Bleicher A, Kadour-Peero E, Sagi-Dain L, et al. Early exploration of COVID-19 vaccination safety and effectiveness during pregnancy: interim descriptive data from a prospective observational study. *Vaccine*. Published online September 25, 2021. doi: https://doi.org/10.1016/j.vaccine.2021.09.043
123. Manley HJ, Aweh GN, Hsu CM, et al. SARS-CoV-2 vaccine effectiveness and breakthrough infections in maintenance dialysis patients. *medRxiv*. Published online September 29, 2021. doi: https://doi.org/10.1101/2021.09.24.21264081
124. Chen X, Wang W, Chen X, et al. Prediction of long-term kinetics of vaccine-elicited neutralizing antibody and time-varying vaccine-specific efficacy against the SARS-CoV-2 Delta variant by clinical endpoint. *medRxiv*. Published online September 27, 2021. doi: https://doi.org/10.1101/2021.09.23.21263715
125. de Leo S. Effectiveness of the mRNA BNT162b2 vaccine against SARS-CoV-2 severe infections in the Israeli over 60 population: a temporal analysis done by using the national surveillance data. *medRxiv*. Published online September 28, 2021. doi: https://doi.org/10.1101/2021.09.27.21264130
126. Arifin WN, Musa KI, Hanis TM, et al. A brief analysis of the COVID-19 death data in Malaysia. *medRxiv*. Published online September 29, 2021. doi: https://doi.org/10.1101/2021.09.28.21264234
127. Young-Xu Y, Smith J, Korves C. SARS-Cov-2 Infection versus Vaccine-Induced Immunity among Veterans. Infectious Diseases (except HIV/AIDS); 2021. doi:10.1101/2021.09.27.21264194
128. Hollinghurst J, Hollinghurst R, North L, et al. COVID-19 risk factors amongst 14,876 care home residents: An observational longitudinal analysis including daily community positive test rates of COVID-19, hospital stays, and vaccination status in Wales (UK) between 1st September 2020 and 1st May 2021. *medRxiv*. Published online October 3, 2021. doi: https://doi.org/10.1101/2021.09.30.21264338
129. Wang L, Wang Q, Davis PB, et al. Increased risk for COVID-19 breakthrough infection in fully vaccinated patients with substance use disorders in the United States between December 2020 and August 2021. *World Psych*. Published online October 5, 2021. doi: 10.1002/wps.20921
130. Vaishya R, Sibal A, Malani A, et al. Symptomatic post-vaccination SARS-CoV-2 infections in healthcare workers – A multicenter cohort study. *Diabetes Metab Syndr.* 2021;15(6):102306. doi: https://doi.org/10.1016/j.dsx.2021.102306
131. Rosenberg ES, Dorabawila V, Easton D, et al. COVID-19 vaccine effectiveness in New York State. *NEJM.* Published online December 1, 2021. doi: 10.1056/NEJMoa2116063
132. Dolzhikova, I., Gushchin, V., et al(2021). One-shot immunization with Sputnik Light (the first component of Sputnik V vaccine) is effective against SARS-CoV-2 Delta variant: efficacy data on the use of the vaccine in civil circulation in Moscow. *MedRxiv*,.Published online October 14 2021. doi: https://doi.org/10.1101/2021.10.08.21264715
133. Uschner, D., Bott, M., Santacatterina, M et al. (2021). Breakthrough SARS-CoV-2 Infections after Vaccination in North Carolina. *MedRxiv*, Published online October 13, 2021. doi: https://doi.org/10.1101/2021.10.10.21264812

134. Singh C, Naik BN, Pandey S, et al. Effectiveness of COVID-19 vaccine in preventing infection and disease severity: A case control study from an Eastern State of India. *Epidemiol Infect*. Published online October 11, 2021. doi: https://doi.org/10.1017/S0950268821002247
135. de Gier B, Andeweg S, Backer JA, et al. Vaccine effectiveness against SARS-CoV-2 transmission to household contacts during dominance of Delta variant (B.1.617.2), August-September 2021, the Netherlands. *medRxiv*. Published online October 14, 2021. doi: https://doi.org/10.1101/2021.10.14.21264959
136. Cohn BA, Cirillo PM, Murphy CC, et al. SARS-CoV-2 vaccine protection and deaths among US veterans during 2021. *Science*. Published online November 4, 2021. doi: https://doi.org/10.1101/2021.10.13.21264966
137. Pattni K, Hungerford D, Adams S, et al. Effectiveness of the BNT162b2 (Pfizer-BioNTech) and the ChAdOx1 nCoV-19 (Oxford-AstraZeneca) vaccines for reducing susceptibility to infection with the Delta variant (B.1.617.2) of SARS-CoV-2. *medRxiv*. Published online October 14, 2021. doi: https://doi.org/10.1126/science.abm0620.
138. Di Fusco M, Moran MM, Cane A, et al. Evaluation of COVID-19 vaccine breakthrough infections among immunocompromised patients fully vaccinated with BNT162b2. *medRxiv*, Published online October 16, 2021. doi: https://doi.org/10.1101/2021.10.12.21264707
139. Hulme WJ, Williamson EJ, Green ACA, et al. Comparative effectiveness of ChAdOx1 versus BNT162b2 COVID-19 vaccines in Health and Social Care workers in England: a cohort study using OpenSAFELY. *medRxiv*, Published online October 18, 2021. doi: https://doi.org/10.1101/2021.10.13.21264937
140. Laing ED, Weiss CD, Samuels EC, et al. Durability of antibody responses and frequency of clinical and subclinical SARS-CoV-2 infection six months after BNT162b2 COVID-19 vaccination in healthcare workers. *medRxiv*. Published online October 18, 2021. doi: https://doi.org/10.1101/2021.10.16.21265087
141. Moshe Mittelman, Ori Magen, Noam Barda, Noa Dagan, Howard S Oster, Avi Leader, Ran Balicer; Effectiveness of the BNT162b2mRNA Covid-19 Vaccine in Patients with Hematological Neoplasms. *Blood* 2021. Published online October 18, 2021. doi: https://doi.org/10.1182/blood.2021013768
142. Rosa-Diez, G., Papaginovic Leiva, M. M., Lombi, F.,et al. (2021). Safety and Effectiveness of COVID-19 SPUTNIK V Vaccine in Dialysis Patients. *MedRxiv*, 2021.Published online October 25, 2021. Doi: https://doi.org/10.1101/2021.10.21.21265349
143. Kurita, J., Sugawara, T., & Ohkusa, Y. (2021). Vaccine Effectiveness for the COVID-19 in Japan. *MedRxiv*, 2021.Published online 22 October 2021. Doi: https://doi.org/10.1101/2021.06.20.21259209
144. Brunelli, S. M., Sibbel, S., Karpinski, S., Marlowe, G., Walker, A. G., Giullian, J., Van Wyck, D., Kelley, T., Lazar, R., Zywno, M. L., Connaire, J. J., Young, A., & Tentori, F. (2021). Comparative Effectiveness of BNT162b2 versus Ad26.COV2.S for the Prevention of COVID-19 among Dialysis Patients. *MedRxiv*, 2021.Published online October 25, 2021. https://doi.org/10.1101/2021.10.21.21265339
145. Chadeau-Hyam, M., Wang, H., Eales, O.,et al. (2021). REACT-1 study round 14: High and increasing prevalence of SARS-CoV-2 infection among school-aged children during September 2021 and vaccine effectiveness against infection in England. *MedRxiv*, 2021.Published online October 22,2021. https://doi.org/10.1101/2021.10.14.21264965

146. McKeigue, P. M., McAllister, D. A., Hutchinson, S. J., Robertson, C., Stockton, D., Colhoun, H. M., & Cell, for the P. H. S. C.-19 E. and R. (2021). Efficacy of vaccination against severe COVID-19 in relation to Delta variant and time since second dose: the REACT-SCOT case-control study. *MedRxiv*, 2021.Published online October 23, 2021. https://doi.org/10.1101/2021.09.12.21263448
147. Sajal De, Dibakar Sahu, Diksha Mahilang et al. Effectiveness of partial COVID-19 vaccination on the outcome of hospitalized COVID-19 patients during the second pandemic In India, 25 October 2021, PREPRINT (Version 1) available at Research Square [https://doi.org/10.21203/rs.3.rs-964720/v1]
148. Taquet, M., Dercon, Q., & Harrison, P. J. (2021). Six-month sequelae of post-vaccination SARS-CoV-2 infection: a retrospective cohort study of 10,024 breakthrough infections. *MedRxiv*, 2021.Published online October 28, 2021. doi: https://doi.org/10.1101/2021.10.26.21265508
149. Bozio CH, Grannis SJ, Naleway AL, et al. Laboratory-confirmed COVID-19 among adults hospitalized with COVID-19-Like Illness with infection-induced or mRNA vaccine-induced SARS-CoV-2 immunity—Nine states, January-September 2021. *MMWR Morb Mortal Wkly Rep.* 2021;70(44):1539-1544. doi: http://dx.doi.org/10.15585/mmwr.mm7044e1
150. Ben-Tov A, Banon T, Chodick G, et al. BNT162b2 messenger RNA COVID-19 vaccine effectiveness in patients with inflammatory bowel disease: Preliminary rea-world data during mass vaccination campaign. *Gastroenterology.* 2021;161(5):1715-1717. doi: https://doi.org/10.1053/j.gastro.2021.06.076
151. Abu-Raddad L, Chemaitelly H, Ayoub HH, et al. Association of prior SARS-CoV-2 infection with risk of breakthrough infection following mRNA vaccination in Qatar. *JAMA.* Published online November 1, 2021. doi:10.1001/jama.2021.19623
152. Mhawish H, Mady A, Alaklobi F, et al. Comparison of severity of immunized versus non-immunized COVID-19 patients admitted to ICU: A prospective observational study. *Ann Med Surg*. Published online October 15, 2021. doi: https://doi.org/10.1016/j.amsu.2021.102951
153. Macchia A, Ferrante D, Angeleri P, et al. Evaluation of a COVID-19 Vaccine Campaign and SARS-CoV-2 Infection and Mortality Among Adults Aged 60 Years and Older in a Middle-Income Country. *JAMA Netw Open*. 2021;4(10):e2130800. doi:10.1001/jamanetworkopen.2021.30800
154. Elliott P, Haw D, Wang H, et al. Exponential growth, high prevalence of SARS-CoV-2, and vaccine effectiveness associated with the Delta variant. *Science*. 2021 Nov 2;eabl9551. doi: 10.1126/science.abl9551.
155. Acharya S, Mahindra G, Nirala P, et al. Protection offered by COVID-19 vaccines in reducing SARS-CoV-2 infection frequency; severity and mortality, among Indian Healthcare Workers: Multi-center, pan-Fortis study. *Research Square.* Published online 2021 November 8. doi: 10.21203/rs.3.rs-1055978/v1
156. Gardner BJ & Kilpatrick AM. Third doses of COVID-19 vaccines reduce infection and transmission of SARS-CoV-2 and could prevent future surges in some populations: a modeling study. *medRxiv.* Published online 2021 November 4. doi: 10.1101/2021.10.25.21265500
157. Bergwerk M, Gonen T, Lustig Y, et al. Covid-19 breakthrough infections in vaccinated health care workers. *NEJM.* 2021;385:1474-1484. doi: 10.1056/NEJMoa2109072

158. Singanayagam A, Hakki S, Dunning J, et al. Community transmission and viral load kinetics of the SARS-CoV-2 delta (B.1.617.2) variant in vaccinated and unvaccinated individuals in the UK: a prospective, longitudinal, cohort study. *The Lancet Infectious Diseases*. Published online 2021 October 28. doi:10.1016/s1473-3099(21)00648-4
159. Rosero-Bixby L. Vaccine effectiveness of Pfizer-BioNTech and Oxford-AstraZeneca to prevent severe COVID-19 in Costa Rica by September and October 2021: A nationwide, observational study of hospitalisations prevalence. *medRxiv*. Published online 2021 November 9. doi:10.1101/2021.11.08.21266087.
160. Niessen AF, Knol MJ, Hahne SJ, Bonten MJ, Bruijning-Verhagen PP. Vaccine effectiveness against COVID-19 related hospital admission in the Netherlands: a test-negative case-control study. *medRxiv* Published online 2021 November 10. doi:10.1101/2021.11.09.21266060.
161. Cohen K, Islam N, Jarvis MS, et al. Comparative Efficacy over time of the mRNA-1273 (Moderna) vaccine and the BNT162b2 (Pfizer-BioNTech) vaccine. *Research Square.* Published online 2021 November 12. doi: https://doi.org/10.21203/rs.3.rs-1071804/v1.
162. Robilotti EV, Whiting K, Lucca A, et al. Clinical and genomic characterization of SARS CoV-2 infections in mRNA vaccinated health care personnel in New York City. *Clin Infect Dis*. Published online 2021 October 13. doi: https://doi.org/10.1093/cid/ciab886
163. Maltezou HC, Panagopoulos P, Sourri F, et al. COVID-19 vaccination significantly reduces morbidity and absenteeism among healthcare personnel: A prospective multicenter study. *Vaccine.* Published online 2021 October 30. doi: https://doi.org/10.1016/j.vaccine.2021.10.054
164. Starrfelt J, Buanes EA, Juvet LK, et al. Age and product dependent vaccine effectiveness against SARS-CoV-2 infection and hospitalisation among adults in Norway: a national cohort study, January-September 2021. *medRxiv.* Published online 2021 November 12. doi: 10.1101/2021.11.12.21266222
165. National Centre for Immunisation Research and Surveillance (NCIRS). IN FOCUS Report: Vaccination among COVID-19 cases in the NSW Delta outbreak, Reporting period: 16 June to 7 October 2021. NSW Ministry of Health. Published online 2021 November. Available at: https://www.health.nsw.gov.au/Infectious/covid-19/Documents/in-focus/covid-19-vaccination-case-surveillance-051121.pdf
166. Texas Department of State Health Services. COVID-19 cases and deaths by vaccination status. Texas Health and Human Services. Published online 2021 November 8. Available at: https://www.dshs.texas.gov/immunize/covid19/data/Cases-and-Deaths-by-Vaccination-Status-11082021.pdf
167. Narayan P, Kumar S, Mohan M, et al. Uptake and impact of vaccination against COVID-19 among healthcare workers – evidence from a multicentre study. *Am J Infect Control.* Published online 2021 November 11. doi: https://doi.org/10.1016/j.ajic.2021.10.036
168. Bianchi FP, Tafuri S, Migliore G, et al. BNT162b2 mRNA COVID-19 vaccine effectiveness in the prevention of SARS-CoV-2 infection and symptomatic disease in five-month follow-up: A retrospective study. *Vaccines*. 2021 9(10):1143. doi: https://doi.org/10.3390/vaccines9101143
169. Bhatnagar T, Chaudhari S, Manickam P, et al. Effectiveness of BBV152/Covaxin and AZD1222/Covishield Vaccines Against Severe COVID-19 and B.1.617.2/Delta Variant in India, 2021: A Multi-Centric Hospital-Based Case-Control Study. *SSRN*, Published 2021 November 11. doi: http://dx.doi.org/10.2139/ssrn.3955739

170. Abu-Raddad LJ, Chemaitelly H, Ayoub HH, et al. Protection offered by mRNA-1273 versus BNT162b2 vaccines against SARS-CoV-2 infection and severe COVID-19 in Qatar. 2021. *medRxiv*. Published online 2021 November 13. doi:10.1101/2021.11.12.21266250.
171. Lan F-Y, Sidossis A, Iliaki E, et al. Continued Effectiveness of COVID-19 Vaccination among Urban Healthcare Workers during Delta Variant Predominance. *medRxiv*. Published online 2021 November 16. doi:10.1101/2021.11.15.21265753.
172. Prieto-Alhambra D, Hermosilla E, Coma E, et al. Comparative effectiveness and safety of homologous two-dose ChAdOx1 versus heterologous vaccination with ChAdOx1 and BNT162b2: a cohort analysis. *Research Square.* Published online 2021 November 18. doi: 10.21203/rs.3.rs-1074858/v1
173. Pascucci D, Nurchis MC, Sapienza M, et al. Evaluation of the Effectiveness and Safety of the BNT162b2 COVID-19 Vaccine in the Vaccination Campaign among the Health Workers of Fondazione Policlinico Universitario Agostino Gemelli IRCCS. Policlinico Universitario Agostino Gemelli IRCCS. International Journal of Environmental Research and Public Health. 2021; 18(21):11098. https://doi.org/10.3390/ijerph182111098.
174. Naleway AL, Groom HC, Crawford PM, et al. Incidence of SARS-CoV-2 infection, emergency department visits, and hospitalizations because of COVID-19 among persons aged ≥12 years, by COVID-19 vaccination status – Oregon and Washington, July 4-September 25, 2021. *MMWR Morb Mortal Wkly.* 2021;70:1608-1612. http://dx.doi.org/10.15585/mmwr.mm7046a4.
175. Dashkevich AM, Vysotskaya VS, Hlinskaya IN, et al. COVID-19 in the Republic of Belarus: pandemic features and the interim safety and efficacy assessment of the Gam-COVID-Vac vaccine. *medRxiv*. Published online 2021 November 16. doi: 10.1101/2021.11.15.21265526.
176. Iskander J, Frost J, Russell S, et al. Effectiveness of vaccination against reported SARS-CoV-2 infection in United States Coast Guard personnel between May and August 2021: A time-series analysis. *medRxiv*. Published online 2021 November 21. doi: 10.1101/2021.11.19.21266537.
177. Clifford S, Waight P, Hackman J, et al. Effectiveness of BNT162b2 and ChAdOx1 against SARS-Cov-2 household transmission: a prospective cohort study in England. *medRxiv*. Published online 2021 November 24. doi: 10.1101/2021.11.24.21266401.
178. Lippi G & Mattiuzzi C. Primary COVID-19 vaccine cycle and booster doses efficacy: analysis of Italian nationwide vaccination campaign. *Research Square*. Published online November 30, 2021. doi: 10.21203/rs.3.rs-1116534/v1
179. Grant R, Charmet T, Schaeffer L, et al. Impact of SARS-CoV-2 Delta variant on incubation, transmission settings and vaccine effectiveness: Results from a nationwide case-control study in France. *The Lancet Regional Health - Europe.* 2021; 00; 100278. Published online November 25, 2021. doi: 10.1016/j.lanepe.2021.100278.
180. Kläser K, Molteni E, Graham M, et al. COVID-19 due to the B.1.617.2 (Delta) variant compared to B.1.1.7 (Alpha) variant of SARS-CoV-2: two prospective observational cohort studies. *medRxiv*. Published online 2021 November 26. doi: 10.1101/2021.11.24.21266748v1.
181. Dickerman BA, Gerlovin H, Madenci AL, et al. Comparative Effectiveness of BNT162b2 and mRNA-1273 Vaccines in U.S. Veterans. *N Engl J Med.* Published online 2021 December 1. doi: 10.1056/NEJMoa2115463.

182. Borges MC, Palacios R, Brango HA, et al. Projeto S: A stepped-wedge randomized trial to assess CoronaVac effectiveness in Serrana, Brazil. *SSRN.* Published online 2021 November 29. doi: http://dx.doi.org/10.2139/ssrn.3973422
183. Reischig T, Kacer M, Vlas T, et al. Insufficient response to mRNA SARS-CoV-2 vaccine and high incidence of severe COVID-19 in kidney transplant recipients during pandemic. *Am J Transplant.* Published online 2021 December 3. doi: 10.1111/ajt.16902
184. Goldberg Y, Mandel M, Bar-On YM, et al. Protection and waning of natural and hybrid COVID-19 immunity. *medRxiv*. Published online 2021 December 5. doi: 10.1101/2021.12.04.21267114.
185. Yassi A, Barker S, Lockhart K, et al. Healthcare worker risk of COVID-19: A 20-month analysis of protective measures from vaccination and beyond. *medRxiv*. Published online 2021 December 6. doi: 10.1101/2021.12.02.21267190
186. Coburn SB, Humes E, Lang R, et al. COVID-19 infections post-vaccination by HIV status in the United States. *medRxiv*. Published online 2021 December 6. doi: 10.1101/2021.12.02.21267182

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
8	Sharma et al (November 30, 2021)	USA	Matched retrospective cohort	129,130 matched pairs of veterans who received a second dose at least 6 months prior	Delta††	Included	BNT162b2 primary series + BNT162b2 booster	Documented infection	Receipt of 2 doses at least 180 days prior	45.7 (37.9-52.5)	0+	~7 weeks
								Hospitalization		44.8 (26.6-58.4)		
							mRNA-1273 primary series + mRNA-1273 booster	Documented infection		46.6 (36.4-55.3)		
								Hospitalization		50.0 (26.2-66.1)		
7	Andrews et al (November 15, 2021)	England	Test-negative case control	271,747 adults aged 50+ years in England	Delta††	Included (if >90 days prior)	BNT162b2 primary series + BNT162b2 booster	Symptomatic disease	Complete vaccination with two doses of primary series at least 140 days prior	84.4 (82.8-85.8)	14+	~4.5 weeks
							AZD1222 primary series + BNT162b2 booster			87.4 (84.9-89.4)		
							BNT162b2 primary series + BNT162b2 booster		Unvaccinated individuals	94.0 (93.4-94.6)		
							AZD1222 primary series + BNT162b2 booster			93.1 (91.7-94.3)		
6	Barda et al*(October 29, 2021)	Israel	Retrospective cohort	1158269 Israeli individuals	Delta^	Excluded	BNT162b2 primary series + BNT162b2 booster	Documented infection	Complete vaccination with two doses at least 5 months ago	88(87-90)	7+	~7 weeks
								Symptomatic disease		91(89-92)		
								Hospitalization		93(88-97)		
								Severe disease		92(82-97)		
								Death		81(59-97)		
5	Saciuk et al* (November 2, 2021)	Israel	Retrospective cohort	947,131 persons fully vaccinated at least 6 months prior (Jan-Feb 2021) among active members of the Maccabi HMO	Delta^	Excluded	BNT162b2 primary series + BNT162b2 booster	Documented infection	Complete vaccination with two doses	89.1 (87.5-90.5)	7+	10 weeks
4	ENSEMBLE 2 (October 14,2021)	North and South America,	Randomized-placebo control trial	31,300 participants	Non-VOC, Alpha, Delta	Unknown	Ad26.COV2.S primary series + Ad26.COV2.S booster dose	Documented infection	Complete vaccination one dose	51.1(29.5-66.4)	71+	~24 weeks
								Asymptomatic infection		34.2(-6.4–59.8)		

#	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
		Africa, Asia and Europe						Moderate Symptomatic infection		70.7(45.4-85.1)		
								Moderate and severe/critical infection		75.2(54.5-87.3)		
					Alpha^			Documented infection		94.2(62.9-99.9)		
					Mu^					63.1(-27.9–91.6)		
3	Bar-On et al (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 primary series + BNT162b2 booster	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* (November 30, 2021) *[Update to August 31 preprint]*	Israel	Test-negative case control	306,710 Israeli adults ≥ 40 years with either 2 or 3 doses	Delta^	Excluded	BNT162b2 primary series + BNT162b2 booster	Documented infection	Complete vaccination with two doses	85 (83-86)	14-20	~7 weeks
										86 (85-87)	28-65	
			Matched case-control					Documented infection		87 (85-88)	14-20	
										83 (82-85)	28-65	
								Hospitalization		92 (87-95)	14-20	
										97 (95-98)	28-65	
1	Bar-On et al* (October 7,2021)	Israel	Retrospective cohort	1,144,690	Delta^	Excluded	BNT162b2 primary series + BNT162b2 booster	Documented infection	Complete vaccination	92 (90- 93)	12+	3 weeks
								Severe disease		94 (91-96)		

#	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
	[Update to August 31 Preprint]								with two doses			

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

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

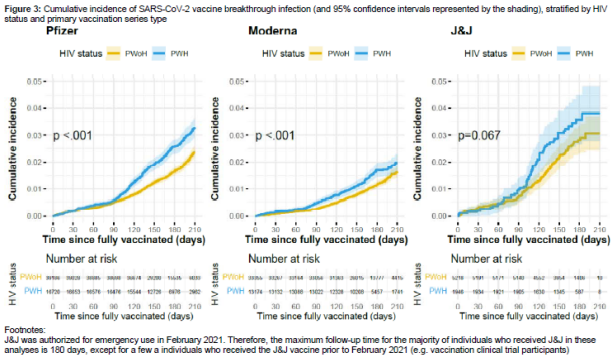
1. Bomze D, Sprecher E, Gamzu R. Effect of a nationwide booster vaccine rollout in Israel on SARS-CoV-2 infection and severe illness in young adults. *Travel Med Infect Dis*. Published online 2021 October 30. doi: https://doi.org/10.1016/j.tmaid.2021.102195
2. Lippi G & Mattiuzzi C. Primary COVID-19 vaccine cycle and booster doses efficacy: analysis of Italian nationwide vaccination campaign. *Research Square*. Published online November 30, 2021. doi: 10.21203/rs.3.rs-1116534/v1

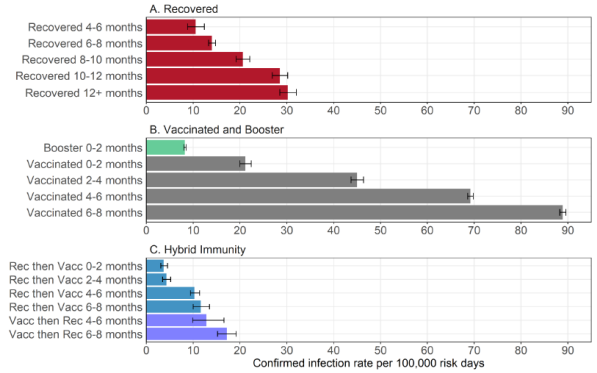
3. Duration of Protection Studies

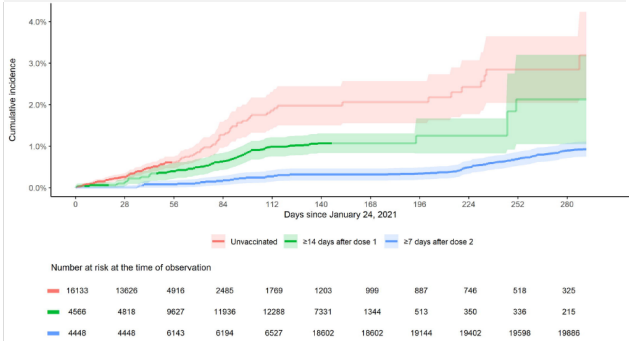
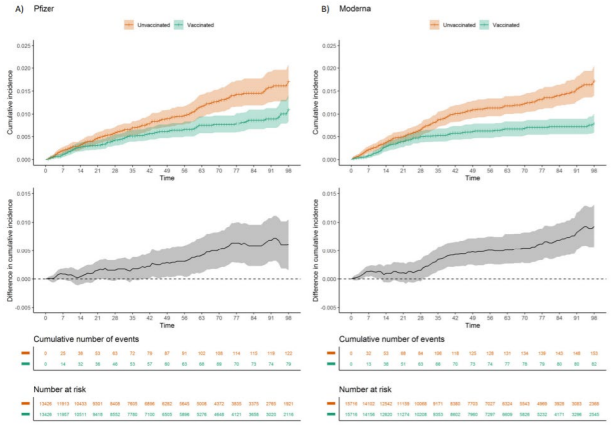
These are studies that assess duration of protection criteria as outlined above along with those studies that do not meet aforementioned criteria that are relevant to evaluating duration of protection. Some of these studies are also in the above table but duplicated here for ease.

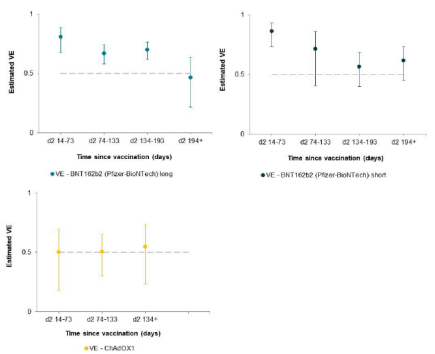
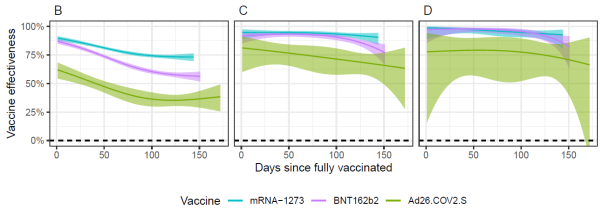
We would like to highlight

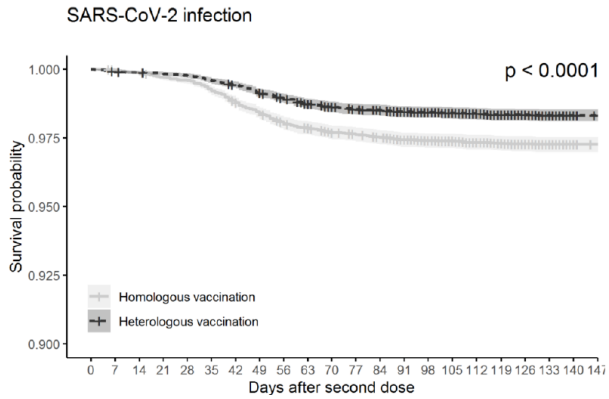
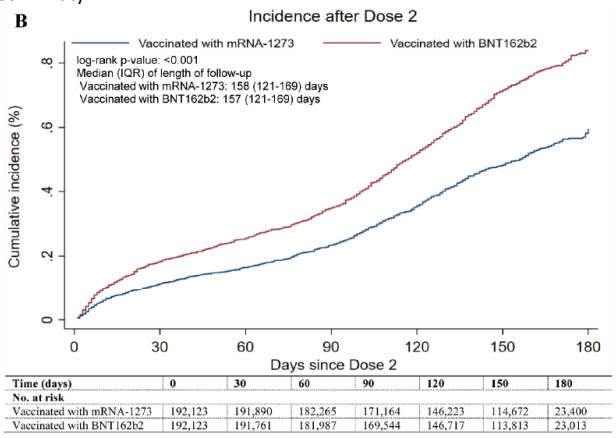
- It is currently challenging to disentangle any apparent reduction in VE over time due to waning immunity from reduction due to immune escape by the Delta variant.
- Countries have implemented different dose intervals and vaccination strategies that can make comparisons across studies challenging.
-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

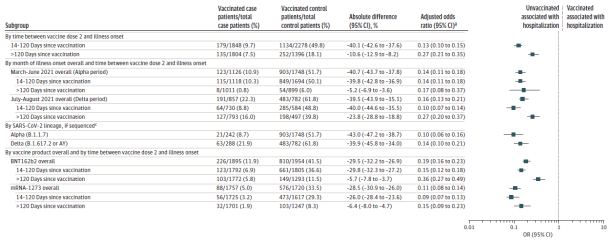
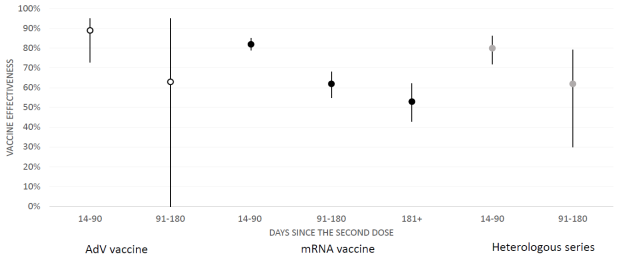
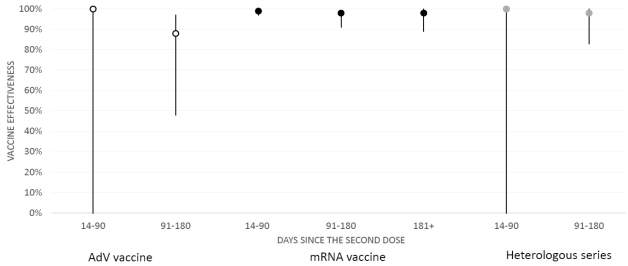
#	Reference (date)	Country	Population	Dominant Variants	Vaccine product	Study Period	Descriptive Findings
69	Bajema et al (December 9, 2021)	USA	Veterans	nonVOCs, Alpha, Delta	Comirnaty mRNA-1273	February 1–September 30, 2021	TND among 1,896 U.S. veterans. Adjusted VE against hospitalization 14–119 days following 2nd dose of Moderna vaccine dose was 89.6% (95% CI = 80.1%–94.5%) and after the 2nd Pfizer-BioNTech dose was 86.0% (95% CI = 77.6%–91.3%); at ≥120 days VE was 86.1% (95% CI = 77.7%–91.3%) for Moderna and 75.1% (95% CI = 64.6%–82.4%) for Pfizer-BioNTech.
68	Coburn et al (December 6, 2021)	USA	Vaccinated persons living with HIV (PWH) and Persons without HIV (PWoH)	nonVOCs, Alpha, Delta	Comirnaty mRNA-1273 Ad26.COV2.S	December 11, 2020-September 30, 2021	Cohort study of vaccinated persons with and without HIV looking at risk of breakthrough infection.  Footnotes: J&J was authorized for emergency use in February 2021. Therefore, the maximum follow-up time for the majority of individuals who received J&J in these analyses is 180 days, except for a few a individuals who received the J&J vaccine prior to February 2021 (e.g. vaccination clinical trial participants)

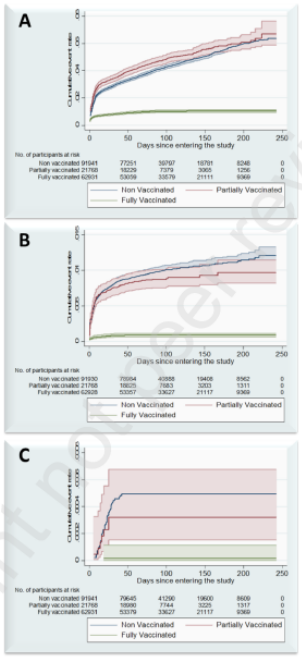
67	Goldberg et al (December 5, 2021)	Israel	General population	Delta	Comirnaty	August 1-September 31, 2021	Analysis of surveillance data comparing the following groups: Recovered: Previously infected individuals 90 or more days after confirmed infection who had never been vaccinated; Recovered then Vaccinated: Previously infected individuals who later were 7 or more days after receiving a single vaccine dose; Vaccinated then Recovered: Individuals who had been vaccinated with one or two doses and were later infected; Vaccinated: Individuals seven days or more after receiving the second dose, and who had not been infected before the start of the study period; Booster: Individuals who received a third (booster) dose 12 or more days previously and had not been infected before the start of the study period.  *Figure 3: Estimated covariate-adjusted rates of confirmed infections per 100,000 at-risk days obtained from the Poisson regression analysis for the study period August 1, 2021, to September 30, 2021, stratified by sub-cohorts. Confidence intervals are not adjusted for multiplicity.*

<table>
<tr>
<td>66</td>
<td>Yassi et al (December 5, 2021)</td>
<td>Canada</td>
<td>Healthcare workers</td>
<td>Delta</td>
<td>Comirnaty mRNA-1273</td>
<td>August 29, 2021-November 11, 2021 (for table 4) and January 24, 2021-November 11, 2021 for KM curve</td>
<td>Cohort and TND study of HCWs looking at test positivy rate among persons vaccinated before and after March 1 stratified by interval between doses.
Table 4. SARS-COV2 PCR Confirmed test results in the 4th wave in full-vaccinated VCH HCWS by date of first dose and dose schedule
<table>
<tr><th>Dose schedule</th><th>First dose</th><th>Positive tests (n)</th><th>Negative tests (n)</th><th>Total tests (n)</th><th>Positivity (%)</th><th>P value</th></tr>
<tr><td>Less than 6 weeks between doses</td><td>First dose before March 1</td><td>30</td><td>524</td><td>554</td><td>5.4%</td><td>0.011</td></tr>
<tr><td>Less than 6 weeks between doses</td><td>First dose on or after March 1</td><td>1</td><td>21</td><td>22</td><td>4.5%</td><td>1.000</td></tr>
<tr><td>Over 6 weeks between doses</td><td>First dose before March 1</td><td>48</td><td>1415</td><td>1463</td><td>3.3%</td><td>0.487</td></tr>
<tr><td>Over 6 weeks between doses</td><td>First dose on or after March 1</td><td>19</td><td>706</td><td>725</td><td>2.6%</td><td>0.147</td></tr>
</table>

</td>
</tr>
<tr>
<td>65</td>
<td>Wu et al (December 2, 2021)</td>
<td>USA</td>
<td>Veterans with cancer</td>
<td>nonVOCs/Alpha</td>
<td>Comirnaty mRNA-1273</td>
<td>December 15, 2020-May 4, 2021</td>
<td>Cohort study of veterans with cancer. KM curve
 
</td>
</tr>
</table>

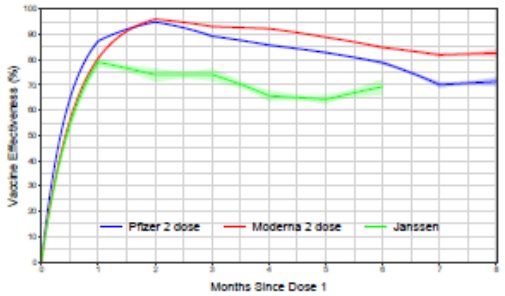
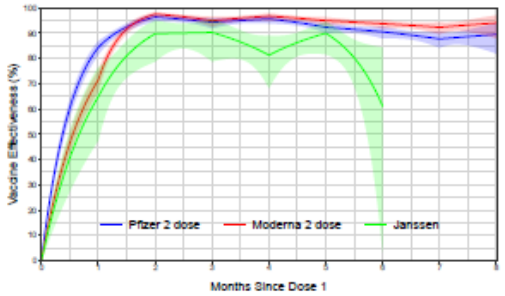
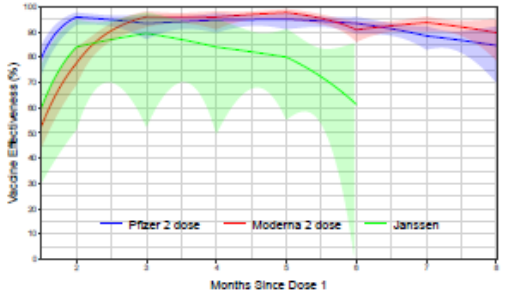
64	Hall et al (December 1, 2021)	UK	18+ year HCWs	Alpha→Delta	Comirnaty AZD2222	December 7, 2020-September 21, 2021	Cohort study of HCWs looking a VE against infection over time in those with and without prior infection. Pfizer long interval is doses separated by ≥6 weeks; short interval by <6 weeks **Figure 1: Adjusted Vaccine Effectiveness over time after two doses: BNT162b2 (Pfizer-BioNTech) short and long interval and ChAdOX1 (combined short and long interval)**  Number of participants: BNT162b2 long-interval: 14-73 days n=25571, 74-133 days n=23776, 134-193 days n=18255, over 193 days n=2704; BNT162b2 short-interval: 14-73 days n=2861, 74-133 days n=2822, 134-193 days n=2659, over 193 days n=2105; ChAdOx1: 14-73 days n=2394, 74-133 days n=2003, over 133 days n=995. aVE: adjusted Vaccine Effectiveness, model adjusted for time since vaccination and previous infection status (time since previous infection) and constant predictors: age, gender, ethnicity, comorbidities, workplace setting, frequency of contact with COVID-19 patients, geographical area (of workplace).
2	Israel et al (November 25, 2021) (updated with results from publication, see ref 2 below)	Israel	18+ years	Delta	Comirnaty	May 15-September 17, 2021	Test-negative design case control using administrative database of Leumit Health Services among 2-dose vaccine recipients. Compared with the initial 90 days after the vaccine, they found an increased risk of infection with time elapsed since vaccination. **Table 4 | Adjusted odds ratios for risk of SARS-CoV-2 in matched cohort** Adjusted odds ratio (95% CI) / P value Time since second vaccine (days): 21-89: Reference — 90-119: 2.37 (1.67 to 3.36) <0.001 120-149: 2.66 (1.94 to 3.66) <0.001 150-179: 2.82 (2.07 to 3.84) <0.001 ≥180: 2.82 (2.07 to 3.85) <0.001 Age (continuous in years): 1.01 (1.00 to 1.01) 0.008 Male sex: 1.05 (0.99 to 1.11) 0.08 Socioeconomic status (continuous 1-20): 0.97 (0.96 to 0.98) <0.001 Based on a conditional regression model fitted in a cohort matched for week of testing, age category (<18-39, 40-59, ≥60 years), and demographic group.
63	Irizarry et al (November 19, 2021)	USA (Puerto Rico)	12+ years	Predelta and delta	Comirnaty mRNA-1273 Ad26.COV2.S	December 15, 2020-October 15, 2021	Analysis of surveillance data linked to immunization registry data. VE against B) Infection c) Hospitalizations D) death by time since 2 weeks post complete series completion. Shading represents 99% CI. 

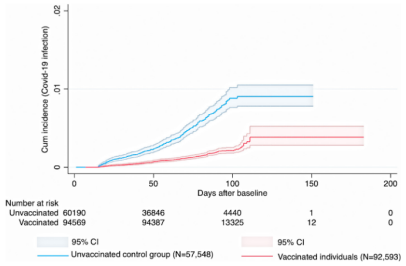
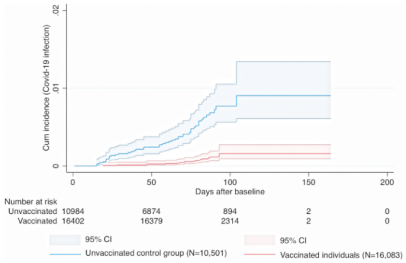
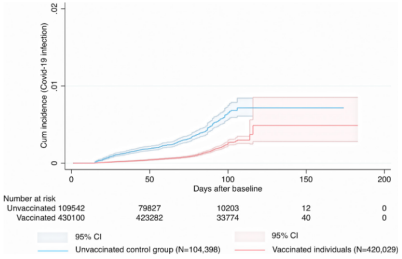
62	Prieto-Alhambra et al (November 18, 2021)	Spain	19-59 years	Delta	2 doses of AZD2222 versus AZD2222 + Comirnaty	June 1-October 11, 2021	Cohort study of persons vaccinated with 2 doses of AZ vs 1 dose of AZ+1 dose of Comirnaty evaluating infection during delta period. 
61	Andrews et al (November 15, 2021)	UK	50+	Delta	Comirnaty AZD2222	September 13-November 1, 2021	TND booster dose study that also calculated the VE of a 2nd dose >140 days after receipt of the 2nd dose. VE against symptomatic diseaes for two doses of ChAdOx1-S and BNT162b2 ≥20 weeks after being given were 44.1% (41.9 to 46.1) and 62.5% (61.0 to 63.9), respectively.
60	Abu-Raddad et al (November 13, 2021)	Qatar	General population	Mix	Comirnaty mRNA-1273	December 21, 2020-October 20, 2021	Cohort study of persons vaccinated with mRNA-1273 comparing to persons vaccinated with Comirnaty.  **Time (days)** | 0 | 30 | 60 | 90 | 120 | 150 | 180 **No. at risk** Vaccinated with mRNA-1273 | 192,123 | 191,890 | 182,265 | 171,164 | 146,223 | 114,672 | 23,400 Vaccinated with BNT162b2 | 192,123 | 191,761 | 181,987 | 169,544 | 146,717 | 113,813 | 23,013

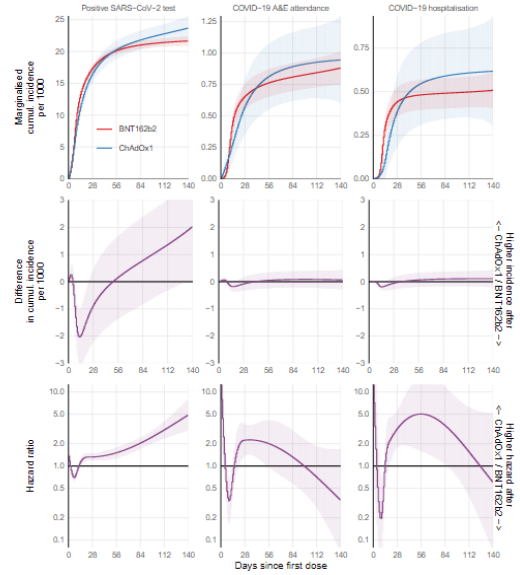
59	Tenforde et al (November 4, 2021)	USA	Hospitalized patients	Mix, alpha, and delta	Comirnaty mRNA-1273	March 11-August 15, 2021	Case-control study among hospitalized patients. When the mRNA-1273 and BNT162b2 vaccines were compared, estimated vaccine effectiveness was similar within 120 days of vaccination. In contrast, beyond 120 days, the results corresponded to an estimated effectiveness of 85% for the mRNA-1273 and 64% for the BNT162b2 vaccine to prevent COVID-19 hospitalizations. 
58	Poukka et al (November 4, 2021)	Finland	16-69 year old HCWs	Mix and delta	Comirnaty mRNA-1273 AZD2222 heterologous	December 27,2020-August 26 (infection) October 26 (hospitalization), 2021	HCW cohort study based on registries. No difference seen between delta and pre-delta periods. VE against infection  VE against hospitalization 

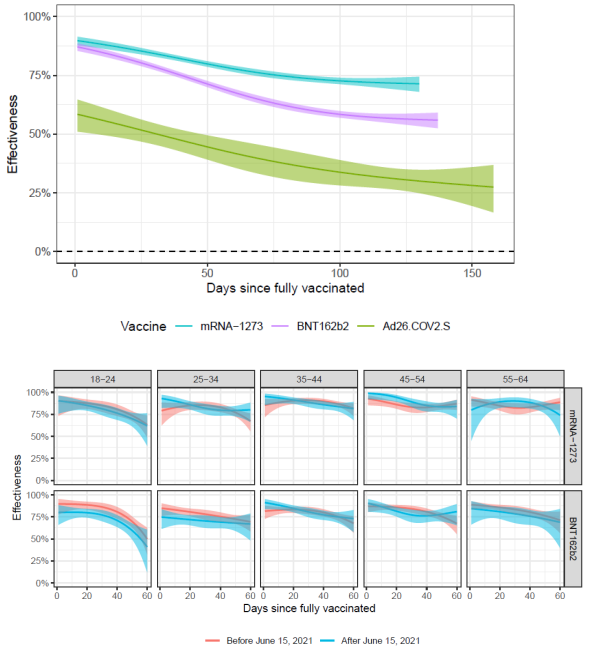
57	Al Hosani et al (October 27, 2021)	United Arab Emirates	General population—cases of SARS-CoV-2	Not specified	Sinopharm's BBIBP-CorV	September 1,2020-May 1, 2021	Cohort study of PCR+ cases looking at VE for progression to hospitalization, ICU, and death.  **Figure 3. Effectiveness of the Sinopharm BBIBP-CorV vaccine.** Graphs revealing the cumulative risk of: **A)** admission into a hospital general ward, **B)** admission into critical care units, and **C)** death. The number of patients in each category are listed below the graphs.

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

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

54	Nordstrom et al (October 25, 2021)	Sweden	General population	Alpha, Delta,	AZD1222 Comirnaty mRNA-1273 And AZD1222→ mRNA-1273	January 12-October 4, 2021	National cohort study based on database linkage. Vaccine effectiveness of BNT162b2 against infection waned progressively from 92% (95% CI, 92-93, P<0·001) at day 15-30 to 47% (95% CI, 39-55, P<0·001) at day 121-180, and from day 211 and onwards no effectiveness could be detected (23%; 95% CI, -2-41, P=0·07). The effectiveness waned slightly slower for mRNA-1273, being estimated to 59% (95% CI, 18-79) from day 181 and onwards. In contrast, effectiveness of ChAdOx1 nCoV-19 was generally lower and waned faster, with no effectiveness detected from day 121 and onwards (-19%, 95% CI, -97-28), whereas effectiveness from heterologous ChAdOx1 nCoV-19 / mRNA was maintained from 121 days and onwards (66%; 95% CI, 41-80). Overall, vaccine effectiveness was lower and waned faster among men and older individuals. For the outcome severe Covid-19, effectiveness waned from 89% (95% CI, 82-93, P<0·001) at day 15-30 to 42% (95% CI, -35-75, P=0·21) from day 181 and onwards, with sensitivity analyses showing notable waning among men, older frail individuals, and individuals with comorbidities.
53	Nordstrom et al (October 21,2021)	Sweden	General Population	Alpha, delta	Heterologous AZD1222 followed by Comirnaty or mRNA-1273	Unknown but probably December 2020 or January 2021 -August 23, 2021 (symptomatic)	Adminsitrative database cohort study evaluating VE of heterologous vaccine schedule. KM curve for those vaccinated with AZD1222 followed by Comirnaty or mRNA-1273 or AZD1222 versus unvaccinated  Fig. 1. Cumulative incidence and 95% confidence intervals for symptomatic Covid-19 infection in individuals given a heterologous ChAdOx1 nCoV-19 / BNT162b2 schedule and in corresponding controls.  Fig. 2. Cumulative incidence and 95% confidence intervals for symptomatic Covid-19 infection in individuals given a heterologous ChAdOx1 nCoV-19 / mRNA-1273 schedule, and in corresponding controls.  Fig. 3. Cumulative incidence and 95% confidence intervals for symptomatic Covid-19 infection in individuals given a homologous ChAdOx1 nCoV-19 / ChAdOx1 nCoV-19 schedule.

52	Hulme et al (October 18, 2021)	UK	HCW	Alpha, delta	Comirnaty AZD1222	January 4-June 13	Comparative VE Cohort study of HCWs based on linking databases who were vaccinated with AZD1222 or Comirnaty between January 4-February 28, 2021 who were followed for 20 weeks. **Figure 2: Comparative effectiveness** For each outcome based on the fully adjusted model, the marginal cumulative incidence for ChAdOx1 and BNT162b2, their difference, and the hazard ratio are shown. Models that assumed piecewise-constant hazards gave similar effect estimates (supplementary Figure S2). The models with less extensive confounder adjustment gave very similar estimates (supplementary Figure S1) suggesting that recipients of each vaccine were similar after accounting for differences in vaccine allocation over space and time (as did all models). 

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

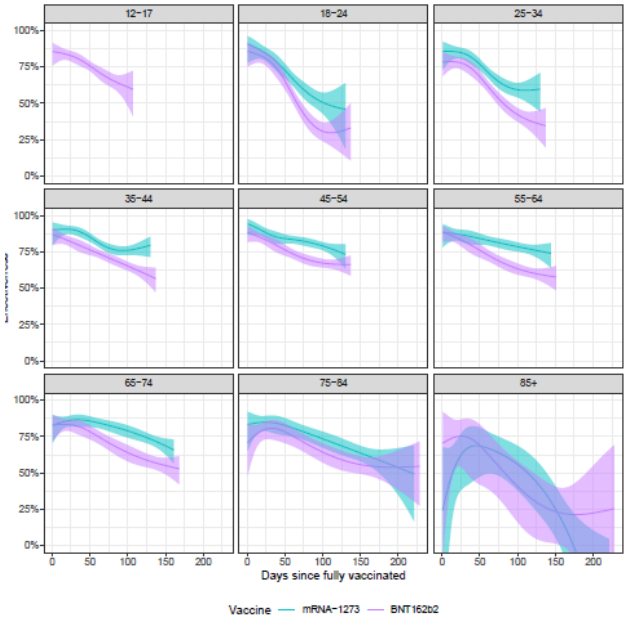
<table>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td> 
</td>
</tr>
<tr>
<td>50</td>
<td>De Gier et al (October 14, 2021)</td>
<td>Netherlands</td>
<td>General population</td>
<td>Delta</td>
<td>Comirnaty mRNA-1273 Ad26.COV2.S AZD1222</td>
<td>August 9-September 24, 2021</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>
</table>

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

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

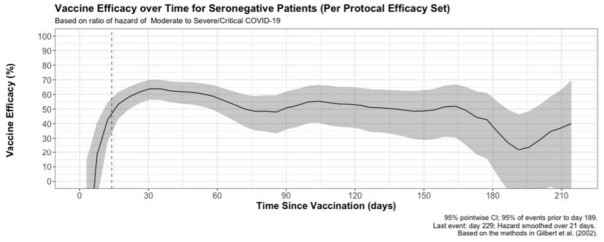
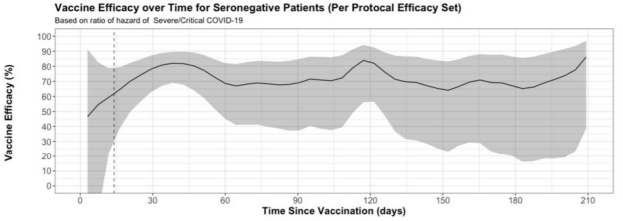
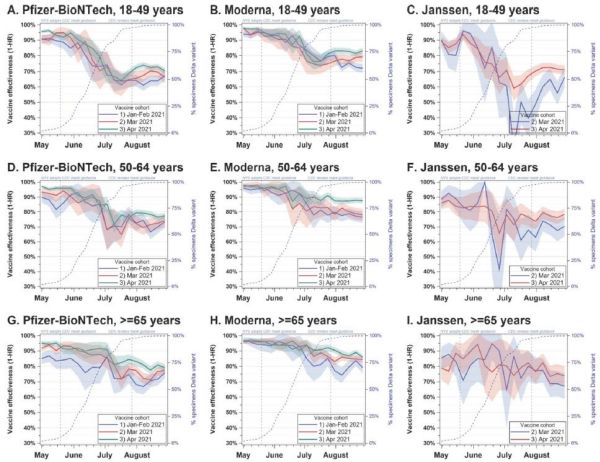
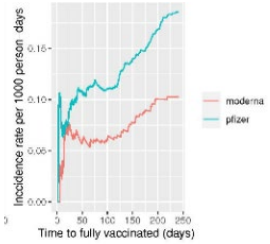


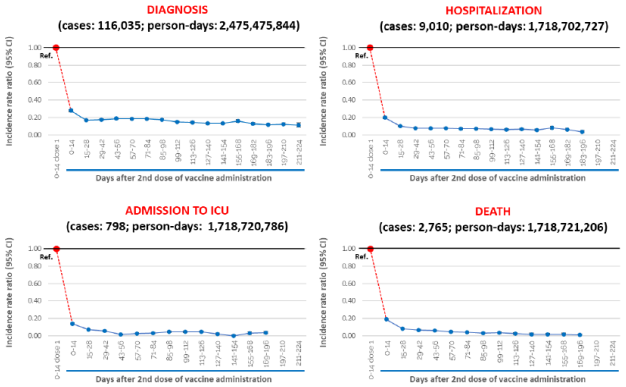
Table 3: Vaccine Efficacy of Molecularly Confirmed Moderate to Severe/Critical COVID-19 with Onset at Least 1 Day After Vaccination; Per Protocol Set Final Analysis of Double-Blind Phase Study (VAC31518COV3001)

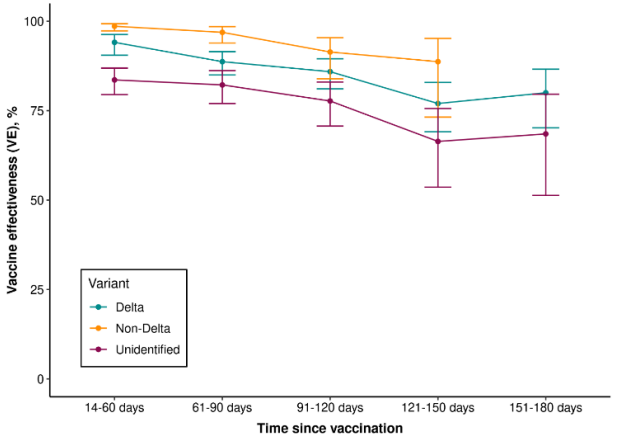
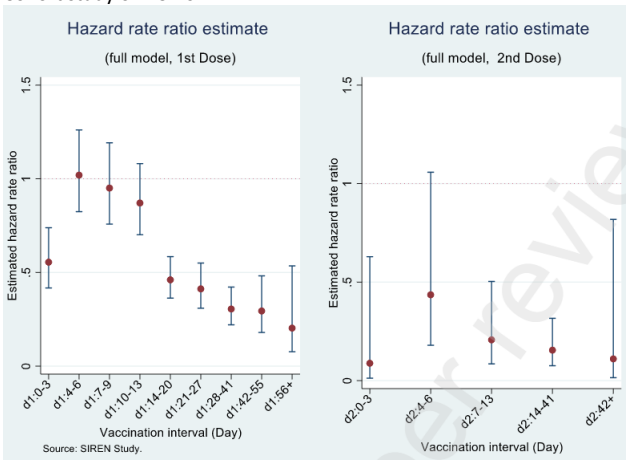
	Ad26 5e10 vp #Cases (N) PY	Placebo #Cases (N) PY	VE% (95% CI)
Analysis set: PP	(19577)	(19608)	
Moderate to severe/critical[a]			
Day 2 to Day 14	82 (19577) 748.66	88 (19608) 749.83	6.7% (-27.54; 31.77)
Day 15 to Day 28	51 (19400) 1483.44	184 (19398) 1480.09	72.3% (62.10; 80.13)
Day 29 to Day 56	119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

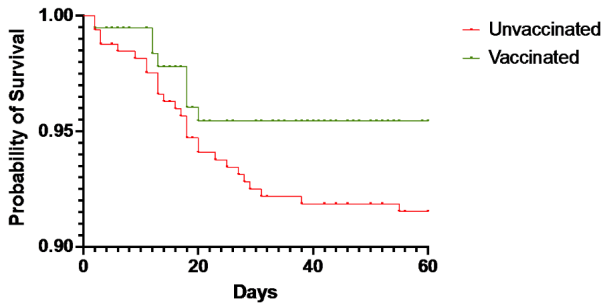
Figure 4: Vaccine Efficacy Over Time of Molecularly Confirmed Severe/Critical COVID-19 with Onset at Least 1 Day After Vaccination, PP Set (Seronegative; Study VAC31518COV3001) Final Analysis of Double-Blind Phase

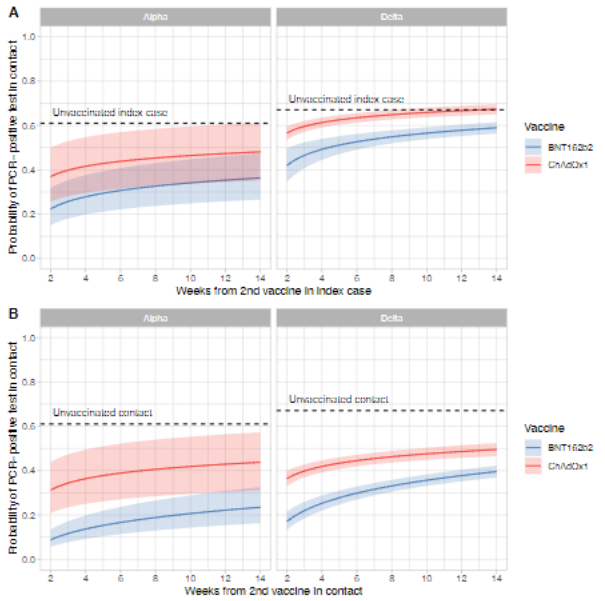


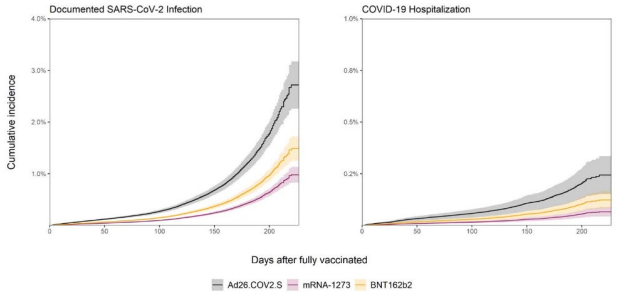
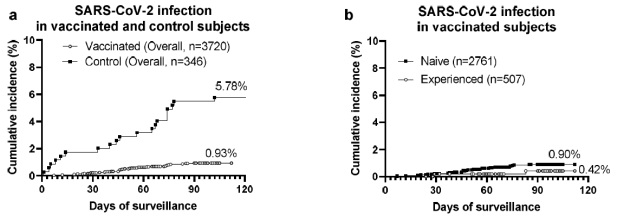
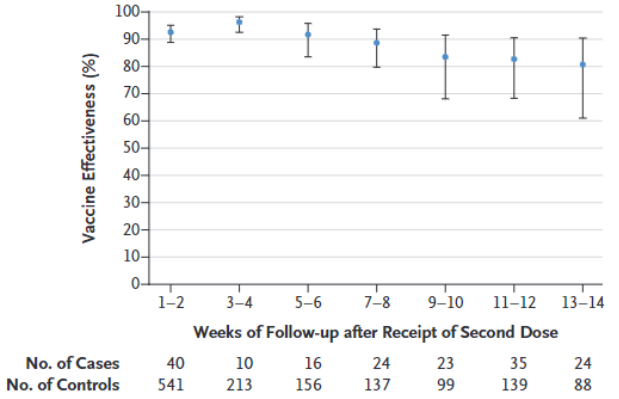
<table>
<tr>
<td>48</td>
<td>Rosenberg et al (October 9, 2021)</td>
<td>USA</td>
<td>General adult population of New York</td>
<td>Delta for part of study period</td>
<td>Comirnaty mRNA-1273 Ad26.COV2.S</td>
<td>May 1-September 3, 2021</td>
<td>Cohort study based on adminsitrative datbases. Estimated VE for cases declined contemporaneously across age, products, and time-cohorts. VE for hospitalization for adults 18-64 years was >86% across cohorts, without time trend.
 
</td>
</tr>
<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>
</table></td>
</tr>
</table>

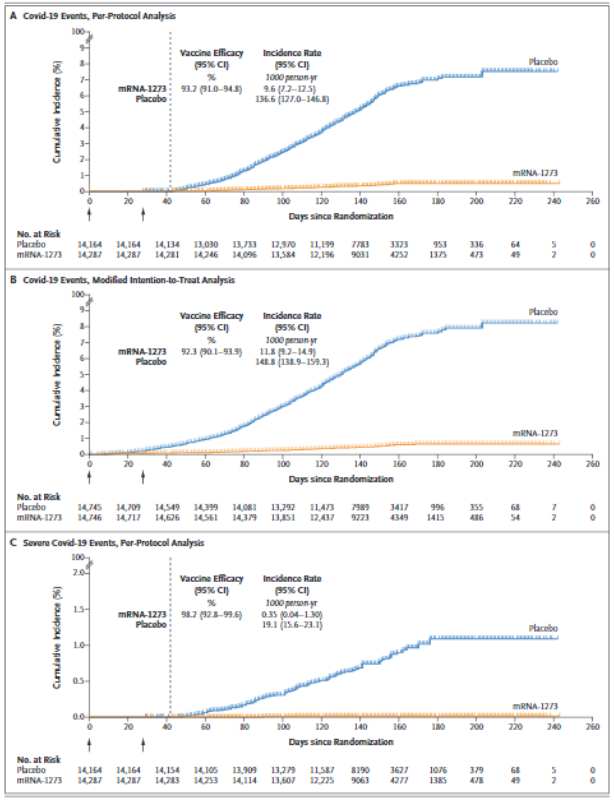
46	Italian Instituo Superiore di Sanita (September 30, 2021)	Italy	≥16 year old general population who received at least 1 dose of mRNA vaccine	Alpha, Delta	Comirnaty mRNA-1273	December 27, 2020-August 29, 2021	Compared different time points post vaccination dose 2 to day 0-14 post dose 1. They did not 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. 
45	Martinez Bas et al (September 30, 2021)	Spain	≥18 year old general population	Alpha, Delta	Comirnaty mRNA-1273 AZD1222 Ad26.COV2.S	April 1-August 31, 2021	Cohort study of contacts of cases. Adjust VE (95% CI) <90 days since last dose | ≥90 days since last dose unvaccinated: REF | REF 1 dose of Janssen: 52 (44-59) | 28 (-8-53) 1 dose of Spikevax: 65 (56-73) | NA 2 doses of Spikevax: 85(80-88) | 67 (50-78) 1 dose of Comirnaty: 57 (51-61) | NA 2 doses of Comirnaty: 70 (67-73) | 63 (58-68) 1 dose of Vaxzervia: 40 (31-47) | 52 (37-64) 2 doses of Vaxzervia: 54 (47-60) | NA 1 dose of Vaxzervia+1 dose of Comirnaty: 85 (69-93) | NA

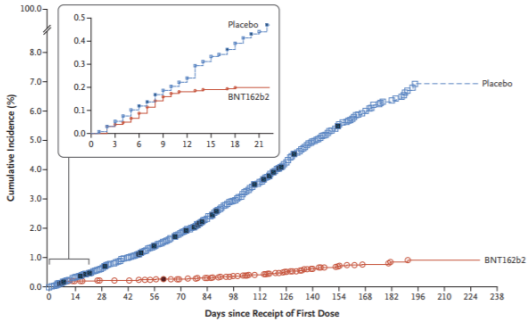
44	Bruxvoort et al (October 1, 2021)	USA	General population	Delta, Alpha+others	mRNA-1273	March 1-July 27, 2021	TND study among persons insured by Kaiser Permante Southern California. 
43	Payne et al (July 21, 2021)	UK	HCWs	Alpha	Comirnaty	December 7, 2020-March 12, 2021	Cohort study of HCWs 

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.**
40	Nunes et al (September 23, 2021)	Portugal	Cohort of 80-109 year olds	Multiple	Comirnaty mRNA-1273	February 2-August 13, 2021	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. Outcome by vaccine status / Person-years / Events (n) / Rate / Rate ratio / 95% CI / Confounder-adjusted HR / 95% CI / VE / 95% CI Hospitalisation 14 to 41 days: 32,505 / 10 / 0.31 / 0.03 / 0.01–0.05 / 0.18 / 0.09–0.36 / 82 / 64–91 42 to 69 days: 32,059 / 11 / 0.34 / 0.03 / 0.02–0.05 / 0.19 / 0.09–0.39 / 81 / 61–91 70 to 97 days: 31,161 / 16 / 0.51 / 0.04 / 0.03–0.07 / 0.22 / 0.12–0.43 / 78 / 57–88 ≥98 days: 33,321 / 6 / 0.18 / 0.02 / 0.01–0.03 / 0.11 / 0.04–0.29 / 89 / 71–96 Death 14–41 days: 32,506 / 7 / 0.22 / 0.02 / 0.01–0.05 / 0.14 / 0.07–0.32 / 86 / 68–93 42–69 days: 32,062 / 13 / 0.41 / 0.05 / 0.03–0.08 / 0.16 / 0.09–0.30 / 84 / 70–91 70–97 days: 31,164 / 20 / 0.64 / 0.07 / 0.05–0.11 / 0.13 / 0.08–0.23 / 87 / 77–92 ≥98 days: 33,326 / 51 / 1.53 / 0.17 / 0.13–0.22 / 0.26 / 0.17–0.40 / 74 / 60–83

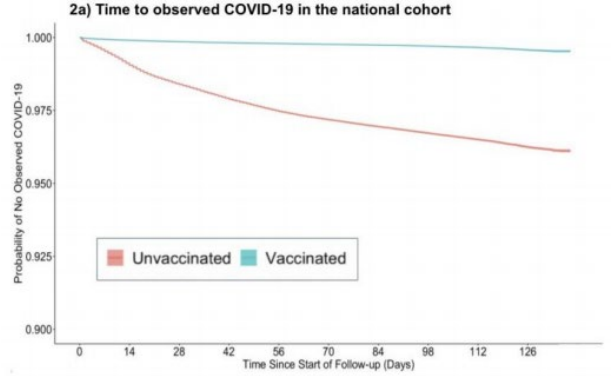
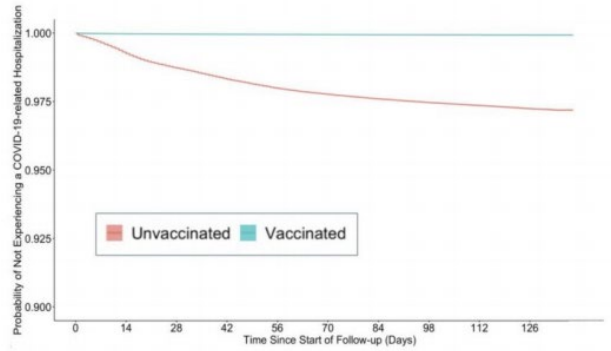
39	Sharma et al (September 26, 2021)	USA	Fully vaccinated veterans	Multiple	Comirnaty mRNA-1273 Ad26.COV2.S	January 1-August 31, 2021	Study of breakthrough infection/hospitalization among fully vaccianted veterans. Note only 2% were in the analysis at day 200 
38	Rovida et al (September 23, 2021)	Italy	HCW	Alpha	Comirnaty	January 18-May 10, 2021	HCW cohort study 
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. 

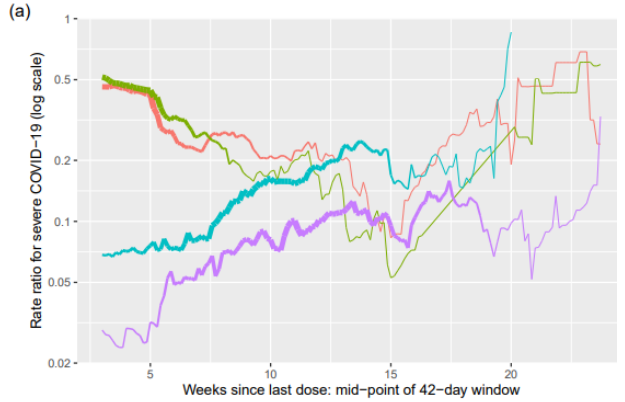
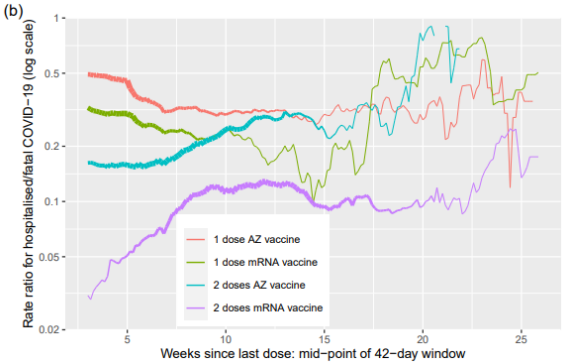
36	El Sahly et al (September 22, 2021)	USA	RCT participants	Multiple	mRNA-1273	July 27, 2020-March 26, 2021	Findings from the double blinded placebo controlled RCT. VE against disease was similar at 2 weeks-<2 months (91.8%), 2 months-<4 months (94%), and ≥4 months (92.4%) post dose 2 

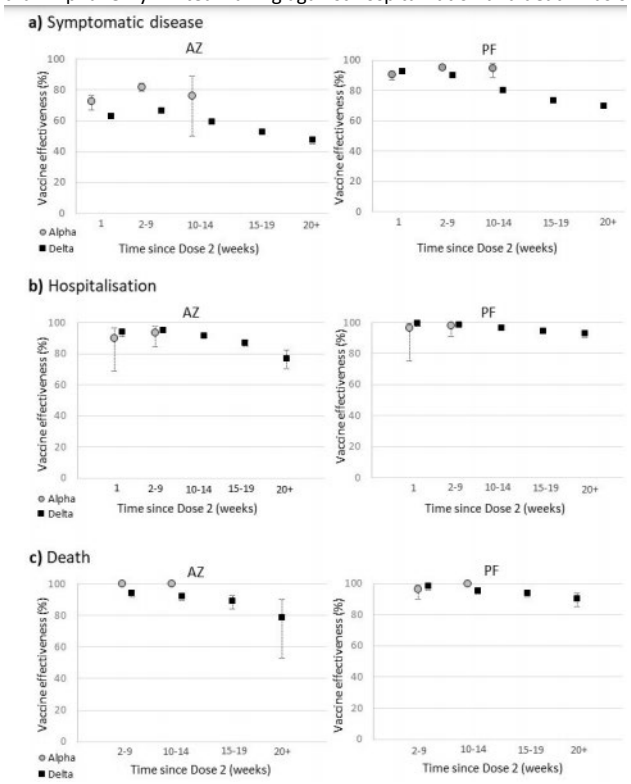
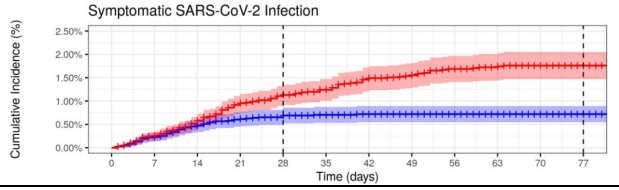
<table>
<tr>
<td>35</td>
<td>Baden et al (September 22, 2021)</td>
<td>USA</td>
<td>≥18-year-old RCT participants</td>
<td>Delta</td>
<td>mRNA-1273</td>
<td>July 1-August 27, 2021</td>
<td>RCT participants were followed after unblinding. Initial vaccine recipients (mRNA-1273e) were vaccinated between 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.


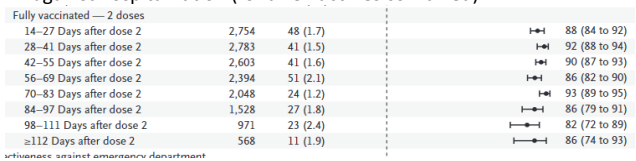
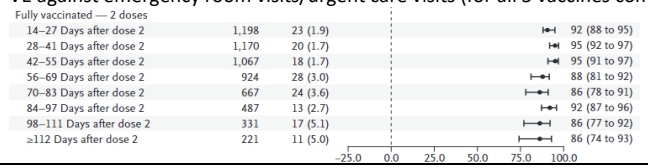
<table>
<tr><th rowspan="2">Efficacy End Point</th><th colspan="3">BNT162b2 (N=23,040)</th><th colspan="3">Placebo (N=23,037)</th><th>Vaccine Efficacy</th></tr>
<tr><th>No. of cases</th><th>Surveillance time
1000 person-yr</th><th>No. at risk</th><th>No. of cases</th><th>Surveillance time
1000 person-yr</th><th>No. at risk</th><th>% (95% CI)</th></tr>
<tr><td>Overall: first occurrence of Covid-19 after receipt of first dose</td><td>131</td><td>8.412</td><td>22,505</td><td>1034</td><td>8.124</td><td>22,434</td><td>87.8 (85.3 to 89.9)</td></tr>
<tr><td>After receipt of first dose up to receipt of second dose</td><td>46</td><td>1.339</td><td>22,505</td><td>110</td><td>1.331</td><td>22,434</td><td>58.4 (40.8 to 71.2)</td></tr>
<tr><td><11 Days after receipt of first dose</td><td>41</td><td>0.677</td><td>22,505</td><td>50</td><td>0.675</td><td>22,434</td><td>18.2 (−26.1 to 47.3)</td></tr>
<tr><td>≥11 Days after receipt of first dose up to receipt of second dose</td><td>5</td><td>0.662</td><td>22,399</td><td>60</td><td>0.656</td><td>22,369</td><td>91.7 (79.6 to 97.4)</td></tr>
<tr><td>After receipt of second dose to <7 days after</td><td>3</td><td>0.424</td><td>22,163</td><td>35</td><td>0.422</td><td>22,057</td><td>91.5 (72.9 to 98.3)</td></tr>
<tr><td>≥7 Days after receipt of second dose</td><td>82</td><td>6.649</td><td>22,132</td><td>889</td><td>6.371</td><td>22,001</td><td>91.2 (88.9 to 93.0)</td></tr>
<tr><td>≥7 Days after receipt of second dose to <2 mo after</td><td>12</td><td>2.923</td><td>22,132</td><td>312</td><td>2.884</td><td>22,001</td><td>96.2 (93.3 to 98.1)</td></tr>
<tr><td>≥2 Mo after receipt of second dose to <4 mo after</td><td>46</td><td>2.696</td><td>20,814</td><td>449</td><td>2.593</td><td>20,344</td><td>90.1 (86.6 to 92.9)</td></tr>
<tr><td>≥4 Mo after receipt of second dose</td><td>24</td><td>1.030</td><td>12,670</td><td>128</td><td>0.895</td><td>11,802</td><td>83.7 (74.7 to 89.9)</td></tr>
</table>
</td>
</tr>
</table>

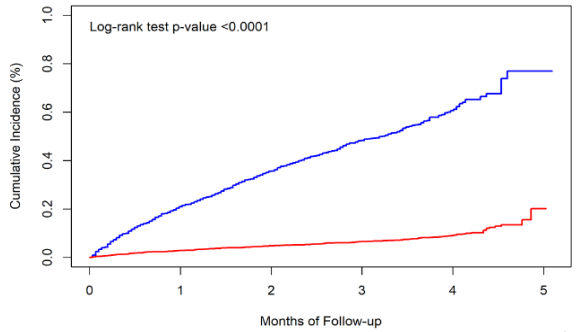
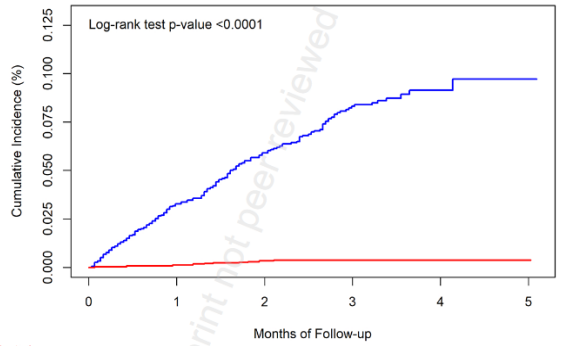
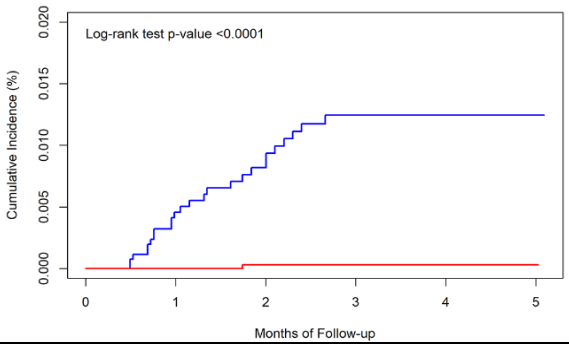
32	Pfizer (September 17, 2021)	Multiple	≥16-year-old RCT participants	Delta	Comirnaty	July 1-August 31, 2021	RCT participants were evaluated for duration of protection against symptomatic disease, with the original placebo recipients receiving the vaccine after unblinding. The mean time from Dose 2 of 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.

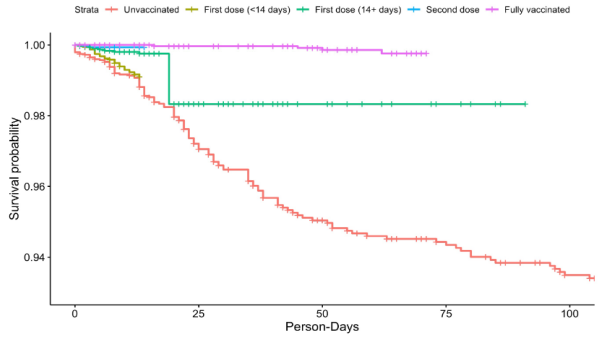
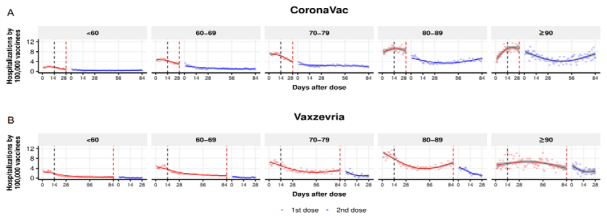
29	Polinski et al (September 12, 2021)	USA	≥18 years of age	Alpha/Delta	Ad26.COV2.S	March 1, 2021-July 31, 2021	Retrospective cohort study used insurance claims data linked to health data sources to evaluate VE of Ad26.COV2.S against COVID-19 diagnosis and hospitalization among vaccinated individuals 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**  Number at risk ccinated 1,524,153 1,416,988 1,293,348 1,211,193 1,121,773 983,584 854,584 781,035 382,373 237,039 ccinated 390,517 384,241 375,653 362,925 344,497 310,061 275,872 256,267 132,443 84,489 0 14 28 42 56 70 84 98 112 126 Time Since Start of Follow-up (Days) **2b) Time to COVID-19-related hospitalization in the national cohort** 

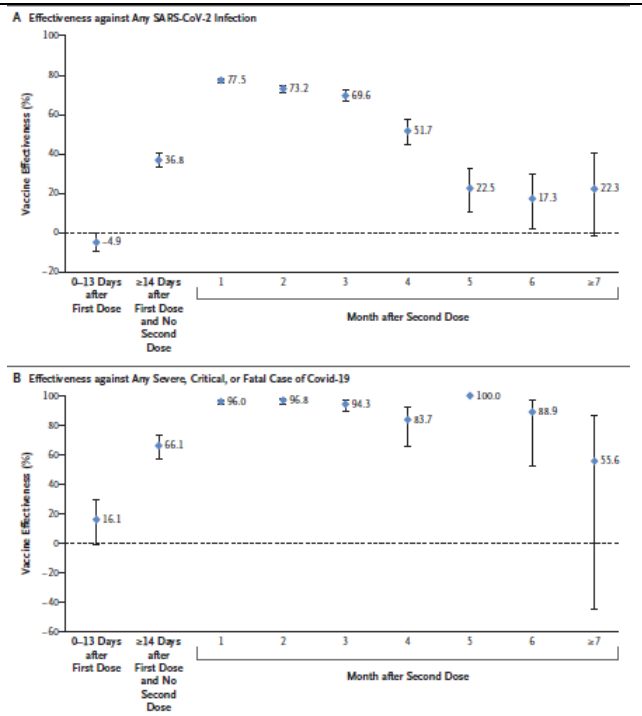
28	McKeigue et al (September 15, 2021)	Scotland	Population of Scotland	Alpha/Delta	Comirnaty mRNA-1273 AZD1222	December 1, 2020-August 19, 2021	Matched case-control study (REACT-SCOT) assessed rate ratios over time comparing rate of severe COVID-19 and the rate of hospitalization or death among those 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: (a)  (b) 
27	Bajema et al (September 10, 2021)	USA	Veterans ≥ 18 years	Alpha/Delta	BNT162b2 & mRNA-1273	February 1, 2021-August 6, 2021	Test-negative case-control study of adults hospitalized at 5 Veterans Affairs with COVID-like illness. No difference was found in VE against hospitalization <90 days vs. ≥ 90 days post second dose of BNT162b2 or mRNA-1273: 86.1% (76.5-91.8%) vs. 87.2 (78.2-92.5%).

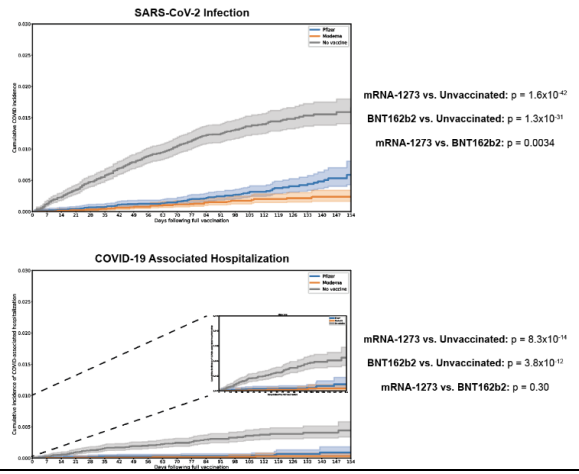
26	Andrews et al (September 14, 2021)	UK	Symptomatic cases and test-negative controls 16 years and older	Alpha/Delta	Comirnaty mRNA-1273 AZD1222	December 8, 2020-September 3, 2021	This test-negative case-control study assessed VE of 2 doses of Comirnaty, mRNA-1273, and AZD1222 against symptomatic disease, hospitalization, and death over time separately for Alpha and Delta variants. VE against symptomatic disease peaked in early weeks post 2nd dose and then declined for Comirnaty and mRNA-1273 for both Alpha and Delta. Waning was greater for Delta than Alpha. Only limited waning against hospitalization and death was observed.  Waning was also greater for those 65+ years compared to 40-64 year-olds. Data for mRNA-1273 was only available thorugh 10-14 weeks post 2nd dose for symptomatic disease and shows high VE (90.3%) at 10-14 weeks.
25	Dagan et al (September 9, 2021)	Israel	Pregnant women	Alpha/Delta	Comirnaty	December 20, 2020-June 3, 2021	Cohort study of pregnant women that showed no drop in VE through 56 days post dose 2 

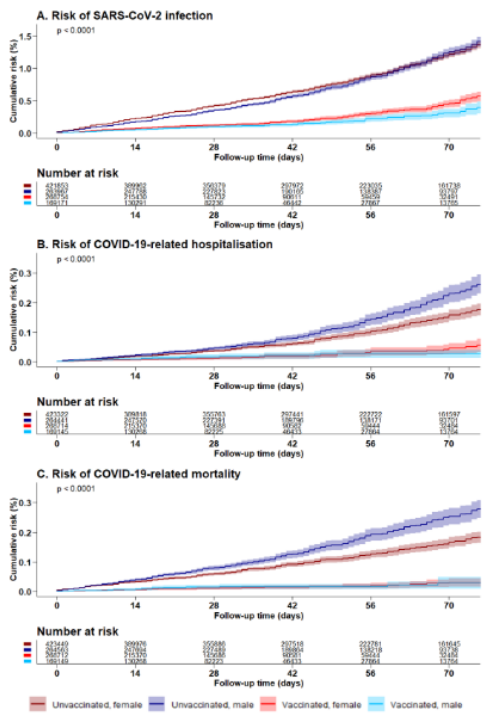
<table>
<tr>
<td>24</td>
<td>Thompson et al (September 9, 2021)</td>
<td>USA</td>
<td>≥50 years of age</td>
<td>Multiple including alpha/delta</td>
<td>Comirnaty
mRNA-1273
Ad26.COV2.S</td>
<td>January 1-June 22, 2021</td>
<td>Test negative case control study that found that VE against hospitalization 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)
 
Fully vaccinated — 2 doses
14–27 Days after dose 2 2,754 48 (1.7) 88 (84 to 92)
28–41 Days after dose 2 2,783 41 (1.5) 92 (88 to 94)
42–55 Days after dose 2 2,603 41 (1.6) 90 (87 to 93)
56–69 Days after dose 2 2,394 51 (2.1) 86 (82 to 90)
70–83 Days after dose 2 2,048 24 (1.2) 93 (89 to 95)
84–97 Days after dose 2 1,528 27 (1.8) 86 (79 to 91)
98–111 Days after dose 2 971 23 (2.4) 82 (72 to 89)
≥112 Days after dose 2 568 11 (1.9) 86 (74 to 93)
VE against emergency room visits/urgent care visits (for all 3 vaccines combined)
 
Fully vaccinated — 2 doses
14–27 Days after dose 2 1,198 23 (1.9) 92 (88 to 95)
28–41 Days after dose 2 1,170 20 (1.7) 95 (92 to 97)
42–55 Days after dose 2 1,067 18 (1.7) 95 (91 to 97)
56–69 Days after dose 2 924 28 (3.0) 88 (81 to 92)
70–83 Days after dose 2 667 24 (3.6) 86 (78 to 91)
84–97 Days after dose 2 487 13 (2.7) 92 (87 to 96)
98–111 Days after dose 2 331 17 (5.1) 86 (77 to 92)
≥112 Days after dose 2 221 11 (5.0) 86 (74 to 93)
−25.0 0.0 25.0 50.0 75.0 100.0</td>
</tr>
<tr>
<td>23</td>
<td>Puranik et al (September 7, 2021)</td>
<td>USA</td>
<td>Persons ≥14 days post dose 2 (“full vaccination”) who received first dose after January 1</td>
<td>Multiple including alpha/delta</td>
<td>Comirnaty</td>
<td>January 1-August 8, 2021</td>
<td>Test negative case control study to assess duration of protection against symptomatic disease. Adjusted OR start showing waning at day 60 after full vaccination.
<table>
<tr><th>Covariate</th><th>Level/Category</th><th>Symptomatic Infection [N = 974 positive events]</th></tr>
<tr><td rowspan="6">Time Relative to Full vaccination</td><td>Day 0</td><td>1 (Reference)</td></tr>
<tr><td>Day 30</td><td>2.19 (0.89, 5.36)</td></tr>
<tr><td>Day 60</td><td>3.65 (1.78, 7.46)</td></tr>
<tr><td>Day 90</td><td>5.58 (2.72, 11.46)</td></tr>
<tr><td>Day 120</td><td>7.25 (3.47, 15.18)</td></tr>
<tr><td>Day 150</td><td>10.33 (5.03, 21.24)</td></tr>
</table>
</td>
</tr>
<tr>
<td>22</td>
<td>Kertes et al (September 7, 2021)</td>
<td>Israel</td>
<td>Fully vaccinated population</td>
<td>Delta</td>
<td>Comirnaty</td>
<td>June 9-July 18, 2021</td>
<td>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.</td>
</tr>
</table>

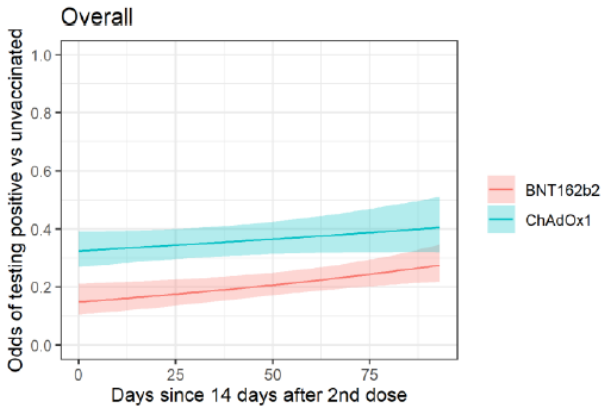
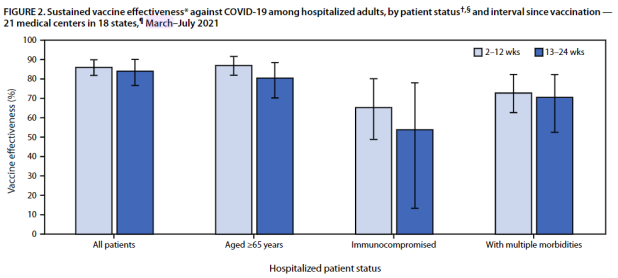
21	Bruxvoort et al (September 2, 2021)	USA	General population	Delta/alpha	mRNA-1273	December 18-June 30, 2021	Cohort study among Kaiser insurance clients. KM curves for disease, hospitalization, and death, where red are fully vaccinated and blue and unvaccinated. A. COVID-19 diagnosis  B. COVID-19 hospitalization  C. COVID-19 hospital death 
20	Iliaki et al (September 6, 2021)	USA	HCW		Comirnaty mRNA-1273 Ad26.COV2.S	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 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* (October 16, 2021) *[Update to Aug 23 preprint]*	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 VE by age group and month of vaccination. **OUTCOME = Positive SARS-CoV-2 PCR test** Age | JanB | FebA | FebB | MarA | MarB | Apr | May 16-39 | 50% [45, 55] | 47% [42, 52] | 58% [55, 62] | 62% [59, 64] | 68% [65, 70] | 74% [71, 77] | 73% [67, 78] 40-59 | 58% [54, 62] | 61% [58, 65] | 63% [59, 66] | 67% [63, 70] | 74% [70, 77] | 78% [73, 82] | 80% [71, 86] 60+ | 57% [52, 62] | 63% [57, 67] | 65% [57, 71] | 73% [66, 78] | 72% [64, 77] | 73% [63, 81] | 75% [58, 85] **OUTCOME = Severe COVID-19** Age | Jan | Feb | Mar 40-59 | 94% [87, 97] | 98% [95, 99] | 98% [94, 99] 60+ | 86% [82, 90] | 88% [84, 91] | 91% [85, 95]

11	Gomes et al (August 21, 2021)	Germany	≥80 years	Alpha	BNT162b2	January 9-April 11, 2021	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. 
10	Pouwels et al* (October 14, 2021) [*Update to Aug 18 preprint]*	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 (July 16, 2021)	Canada	HCWs in Vancouver	Alpha/Gamma	BNT162b2 mRNA-1273	December 15-May 13, 2021	Retrospective cohort study of HCWs linking administrative databases. At 16 weeks (day 112) post dose 1 and 2 they don't see a decline in VE. Note that day 0-13 post dose 1 is included in the unvaccinated comparison group.

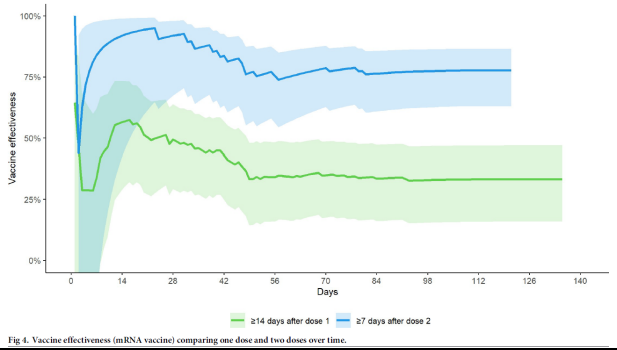
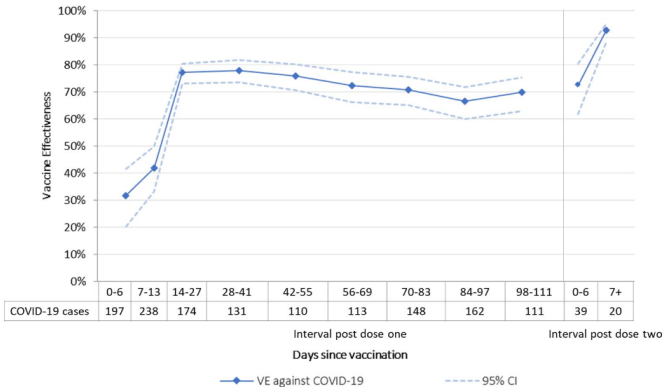
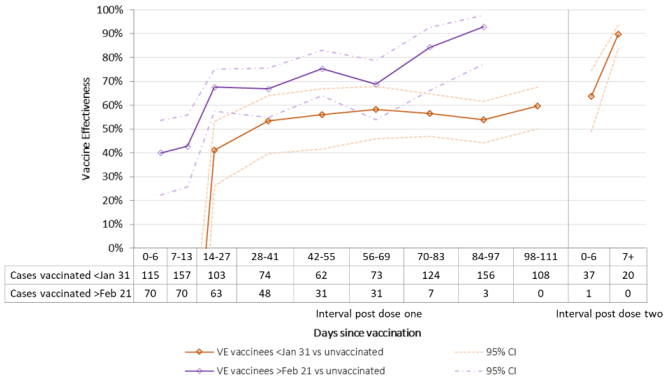
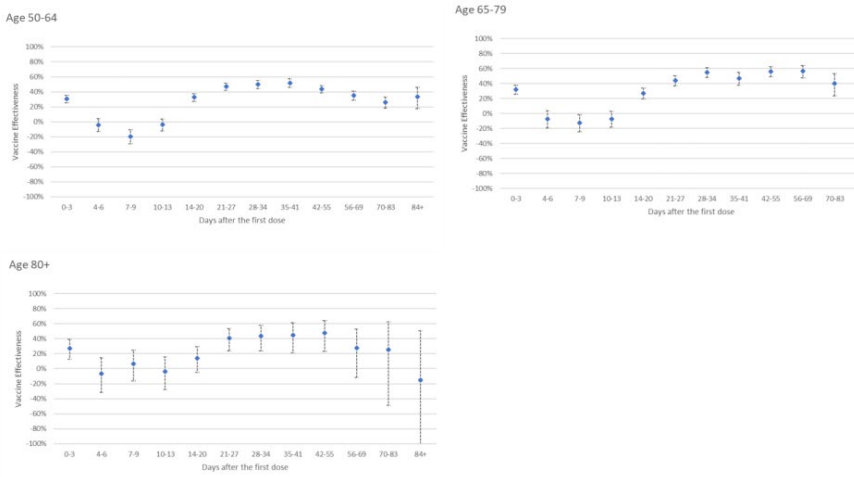
							 Fig 4. Vaccine effectiveness (mRNA vaccine) comparing one dose and two doses over time.
7	Chemaitelly et al (August 9, 2021)	Qatar	Immunosuppressed kidney transplant patients	Alpha/Beta	BNT162b2 mRNA-1273	February 1-July 21, 2021	Retrospective cohort study finding VE against infection was 73.9% (95%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

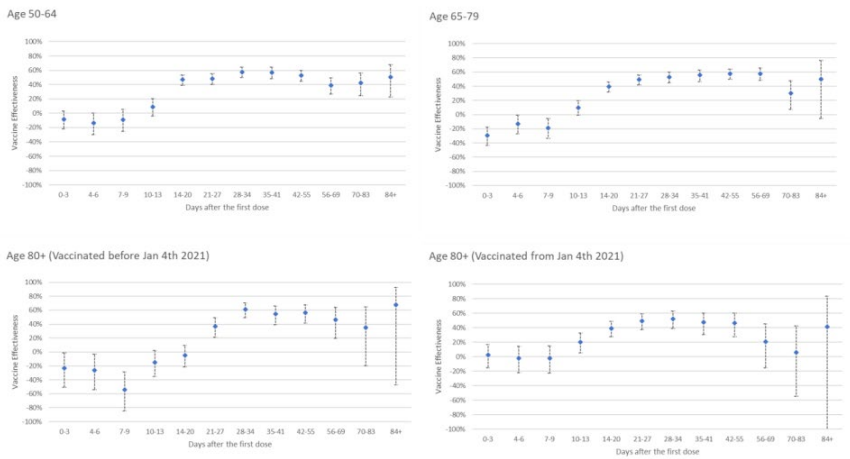
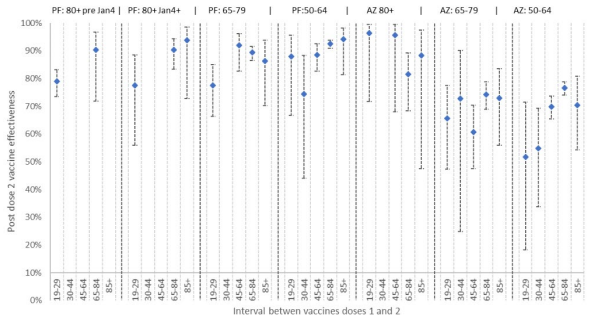
							(b) Pfizer  **Figure 4: Two dose vaccine effectiveness by age group, vaccine type and interval between doses** 
4	Public Health England Week 20 (May 20, 2021)	UK	65+ year old population	Alpha/Delta	BNT162b2 AZD1222	December-May 2021	This is a test-negative case control study linking surveillance and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

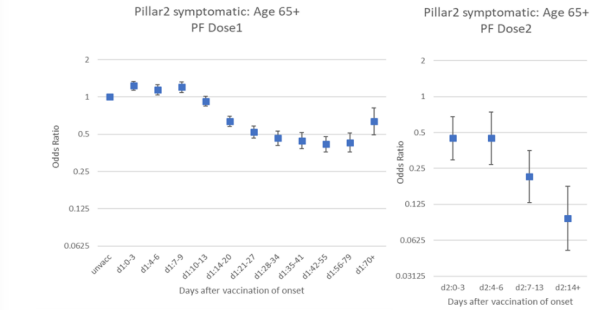
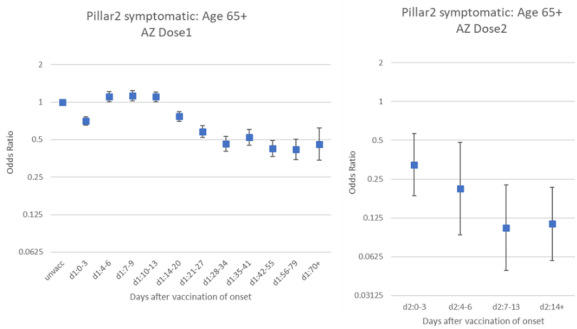
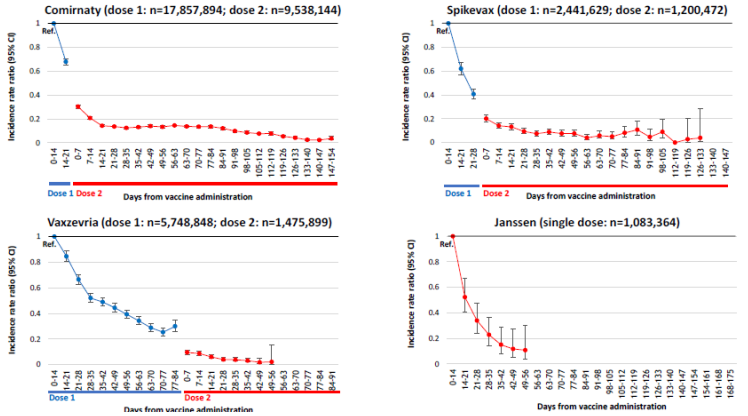
							Figure 1: Odds ratios for becoming a case by days after vaccination – Dose 1 and Dose 2 (Pfizer-BioNTech) among individuals aged 65 years and older  **Figure 2: Odds ratios for becoming a case by days after vaccination – Dose 1 and Dose 2 (AstraZeneca) among individuals aged 65 years and older** 
3	Italian 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
13	Clifford et al (November 24,2021)	UK	Prospective cohort	195 index cases and their 278 contacts	Alpha specifically ^	Unknown	BNT162b2	Transmission to contacts	26 (-11– 54)	21+	57 (5- 85)	7+	~31 weeks
							AZD1222		-7 (-60-29)		35 (-26-74)		
					Delta specifically^		BNT162b2		9 (-16– 49)		31 (-3- 61)		
							AZD1222		14 (-11-52)		42 (14- 69)		
12	Ng et al* (November 1, 2021)	Singapore	Retrospective cohort	301 index cases and 1204 household contacts	Delta index cases, specifically	Unknown	BNT162b2 & mRNA-1273	Documented infection of household contacts	38 (-69-78)	0+, including within 14 days of dose 2	27 (-40-62)	15+	~16.5 weeks
11	Singanayagam et al*(October 28,2021)	England	Prospective cohort	233 contacts (arising from 163 index notifications) and 19 index cases	Delta^	Included	BNT162b2 and AZD1222	Documented infection	—	—	34 (-15–60)	7+	~10.5 weeks
10	de Gier et al* (October 14, 2021)	Netherlands	Retrospective cohort	4921 index cases and 7771 household contacts (aged 12+)	Delta^	Unknown	BNT162b2, AZD1222, mRNA-1273, & Ad26.COV2.S	Transmission to unvaccinated household contacts	38 (-2-62)	14+	63 (46-75)	14+ (or 28+ after a single dose of Ad26.COV2.S)	~32 weeks
								Transmission to fully vaccinated household contacts	46 (22-63)		40 (20-54)		
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)		

#	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
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 BNT162b2 mRNA-1273 Ad26.COV2.S	Transmission to any household contacts (adjusted for contact vaccination status)	15 (4-26) 26 (12-37) 51 (8-74) 77 (6-94)	14+‡	58 (−12-84) 70 (61-77) 88 (50-97) —	7+	~15 weeks
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 (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	Infectiousness given Infection Transmission	—	—	41.3 (9.5-73.0) 88.5 (82.3-94.8)	10+	
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 BNT162b2	Documented infection	48(38-57) 46(38-53	>21 days after dose 1, including some with dose 2	—		
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

#	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
								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
110	Percio et al (December 8,2021)	Brazil	Ecological	All adults	Alpha, Gamma and Delta^	BNT162b2, AZD1222, Ad26.COV2.S and Sinopharm	his ecological study assessed mortality and morbidity trends from COVID-19 in two subgroups of Brazilian adults- 18 to 59 years and >60 years. The primary objective of the study was to compare pre and post-vaccination periods in Brazil and assess the impact of the COVID-19 vaccination program. The study observed that hospitalization rates increased in the pre-vaccination period and declined in the vaccination period. COVID-19 vaccination coverage was inversely associated with the weekly incidence of hospitalizations for the disease in individuals aged 60 years and over (IRR: 0.97). Similarly, there was a mortality increase trend in the pre-vaccination period and declined in the post-vaccination period. The study showed that the indirect impact of vaccination was more intense in reducing indicators of morbidity and mortality trends for individuals aged 60 years and over compared to those aged 18 to 59 years, and for the latter group, vaccination coverage was lower in the period evaluated, as COVID-19 vaccination for this group started in immunocompromised individuals.
109	Reischig et al* (December 3, 2021)	Czechia	Retrospective cohort	420 adult kidney transplant recipients	Non-VOC, Alpha^	BNT162b2	Among other outcomes, this study assessed the impact of vaccination on COVID-19 disease severity, mortality, and the course of disease. Adult kidney transplant recipients from Charles University Teaching Hospital, Pilsen who were vaccinated in January 2021 (2 doses at 4-week intervals) were followed until June 2021, and were compared to unvaccinated patients during the previous COVID-19 wave (September-December 2020). The study found no significant difference between the vaccinated and unvaccinated groups in terms of what symptoms were present, treatments required, development of pneumonia, need for hospitalization, or death.
108	Raham (December 3, 2021)	16 countries/ territories	Ecological	Populations of the 16 countries/ territories (Israel, Chile, Jersey, UK, Guernsey, Bahrain, United States, Serbia, Qatar, Switzerland, Canada, Saudi Arabia,	Unknown	Multiple products	This study assessed the impact of vaccination on COVID-19 case fatality rates (CFR, calculated as cumulative deaths/cumulative cases since vaccine introduction x100) using data from 16 countries and territories that had been vaccinating people for at least 100 days as of April 3, 2021. The CFR on the day of vaccine introduction in each country was compared

#	Reference (date)	Country	Design	Population	Dominant Variants	Vaccine Product	Descriptive Findings
				China, Russia, Costa Rica, Mexico)			to the CFR on April 3, and results were stratified by level of vaccination coverage on April 3: >18 doses/100 people vs. ≤18 doses/100 people. The mean CFR in countries with higher coverage decreased to a greater extent than in countries with lower coverage: from 1.875 to 1.449 in countries with >18 doses/100 people versus from 3.315 to 3.283 in countries with ≤18 doses/100 people. This difference in reduction of CFR by dose coverage was found to be significant (p=0.033).
107	Borges et al (November 29, 2021)	Brazil	Stepped-wedge randomized trial	Adults (aged 18+) in Serrana, Brazil	Gamma^	CoronaVac	In this stepped-wedge randomized trial, the Serrana municipality of Sao Paolo, Brazil was divided into 25 subareas by land use, then the subareas were assigned to a color-coded group (Green, Yellow, Gray, or Blue), resulting in four groups of approximately equal population with no contiguous subareas in the same group. The intervention (COVID-19 vaccination with CoronaVac) was made available to each group at one-week intervals in a randomized order, and the study period covered epidemiological weeks 6-19 in 2021 (February-May). In addition to estimating vaccine effectiveness, the study investigated the impact of vaccination on incidence of infection in the entire urban population (pre and post vaccination) and on protection of unvaccinated persons. Incidence of symptomatic cases was reduced by 48.1% (95% CI 39.2-55.7) in the intervention period compared to the control period (6 weeks after the initial dose in each group, when full vaccination of participants is expected, versus before vaccination). Incidence of COVID-19 related hospitalization and death was also reduced by 48.1% when comparing these time periods (95% CI 13.2-69.0). The study also found that there was a significant indirect protective effect in unvaccinated persons when 52% of adults were fully vaccinated. Finally, the cumulative incidence of COVID-19 related hospitalization and death in Serrana was similar to other nearby cities from epidemiological weeks 6-13, but slowed relative to other cities beginning in week 13 (when most groups had received dose 2) and fell below all others by week 16 (when most were fully protected).

#	Reference (date)	Country	Design	Population	Dominant Variants	Vaccine Product	Descriptive Findings
106	Cerio et al* (September 29, 2021)	USA	Ecological	Population of New York State	Non-VOC††	BNT162b2, mRNA-1273, Ad26.COV2.S	This ecological study evaluated the relationship between vaccination rates and population adjusted SARS-CoV-2 case counts across all 62 counties in New York State at a cross-sectional single point in time (March 31, 2021). On March 31, the mean vaccination coverage by county was 31% (range: 21.8-57.4%) for at least one dose and 18% (range: 12.3-41.8%) for full vaccination. In bivariate testing, one and two dose vaccination coverage rates were negatively correlated with cases per 100,000 population, though the relationship was not significant, while population size was found to be strongly correlated with cases per 100,000 population ($r=0.715$, $p<0.001$). After controlling for county population in linear regression, the two-dose vaccination rate was significantly negatively associated with cases per 100,000 population, with each increase in percentage point of complete vaccination corresponding to a decrease of nearly one case per 100,000 people each day (correlation coefficient $\beta= -0.866$, $p=0.031$).
105	Gul et al* (July 2021)	Pakistan	Retrospective cohort	170 COVID-19 patients aged 20-80	Non-VOC, Alpha, Beta^	Not specified	This retrospective study assessed the impact of vaccination on disease severity among 170 COVID-19 patients at the Lady Reading Hospital, Peshawar and DHQ Category A Hospital, Batkhela between December 2020 and May 2021. Of the participants, 70 patients were vaccinated with at least one dose (40 had received the second dose). Frequency of adverse outcomes were substantially higher among unvaccinated patients compared to those vaccinated with at least one dose: Hospitalization occurred in 10% versus 4.3%, ICU admission in 14% versus 2.9%, and mortality in 40% versus 14.3% respectively.
104	Mattiuzzi et al (November 30, 2021)	Europe	Ecological	Adults in the WHO European Region	Alpha and Delta^	BNT162b2, mRNA-1273, AZD1222, Ad26.COV2.S	This ecological study built on the analysis of Meslé et al to assess the relationship between COVID-19 vaccine uptake and deaths averted in European countries between December 2020 and November 2021 using univariate and multiple linear regression. The study found a significant linear association between the percentage of vaccine uptake and the corresponding percentage of averted deaths among older people across European countries ($r=0.872$, $p<0.001$). The fit was improved further using an exponential curve ($r=0.881$, $p<0.001$), indicating an

#	Reference (date)	Country	Design	Population	Dominant Variants	Vaccine Product	Descriptive Findings
							almost exponential relationship between vaccine uptake and averted deaths of older people. In multiple linear regression, the percentage of deaths averted was independently associated with vaccine uptake (p<0.001), but not with the type of vaccine (p=0.264).
103	Zhao et al (November 27,2021)	England	Ecological	UK adults	Delta^	BNT162b2, mRNA-1273, AZD1222, Ad26.COV2.S	This ecological study used the nation-wide COVID-19 surveillance data of cases and deaths and SARS-CoV-2 genetic sequences from April to July 2021 to compare the relationships between vaccine coverage and case fatality ratios(CFRs) of Delta or non-Delta variants. The CFR associated with non-Delta variant depicted a gradual decline from 0.57% to 0.20% with IQR of (0.39%-0.23%), whereas the CFR of Delta remained relatively stable. The vaccine coverage increased to 52.4% in July 15, 2021 and the CFR of non-Delta was negatively associated with a lagged vaccine coverage. In addition, the negative association of CFR for Delta variant appeared weak and there was no statistical significance. This study is limited due to the ecological design, as heterogeneities in fatality rates and vaccination distribution for different subgroups of population cannot be adjusted.
102	Padovani et al (November 26, 2021)	Italy	Retrospective cohort	284 patients hospitalized with COVID-19 in Brescia, Italy	Alpha and Delta††	BNT162b2, mRNA-1273, AZD1222, Ad26.COV2	This observational study compared disease progression and outcomes by vaccination status in 284 consecutive patients hospitalized for COVID-19 at ASST Spedali Civili Hospital, Brescia between March 1-October 15, 2021. Fifty of the patients had received at least one dose of vaccine, and most received an mRNA vaccine. Disease progression was measured using the WHO COVID-19 clinical progression scale, and unvaccinated patients experienced worse disease progression (5.3+1.6 vs. 5.0+1.4; p<.03), as well as significantly greater needs for oxygen (p=0.048) and steroids (p=0.002). After controlling for comorbidities and severity at admission in multivariate regression, unvaccinated patients also had a higher risk of death (OR 3.3, 95% CI 1.05-10.7), particularly when considering unvaccinated vs. vaccinated ventilated patients (OR 54.8, 3.5-852).
101	Sacco et al (November 25, 2021)	Italy	Ecological	Italian residents aged 12 and above	Alpha and Delta††	BNT162b2, mRNA-1273, AZD1222, Ad26.COV2	This study evaluated the direct impact of the Italian vaccination programme on the number of cases, on hospitalisations, on admissions to intensive care units (ICU) and on deaths, by estimating the numbers of

#	Reference (date)	Country	Design	Population	Dominant Variants	Vaccine Product	Descriptive Findings
							these outcomes prevented (averted events) by COVID-19 vaccination between January (week 2/2021) and the end of September 2021 (week 38/2021) by age groups and geographical area. By the end of September, a major proportion of adults aged 60 above had received the recommended number of doses of vaccine. A total of 445,193 (range: 331,059–616,054) cases, 79,152 (range: 53,209–148,756) hospitalisations, 9,839 (range: 6,434–16,276) ICU admissions and 22,067 (range: 13,571–48,026) deaths were estimated to have been averted by the vaccination campaign, respectively. The study also estimated that 71% (69-79) of the overall detahs were averted for those aged 80 years and older.
100	Meslé et al (November 25, 2021)	33 countries in the WHO European Region	Ecological	Adults in the WHO European Region	Alpha and Delta^	BNT162b2, mRNA-1273, AZD1222, Ad26.COV2.S	This study analysed age-specific mortality counts and vaccination coverage data from The European Surveillance System(TESSy) until week 45 of 2021 to estimate the number of deaths averted in 33 countries in the age group of 60+ since the start of the vaccination program. By week 45, 80% of adults over the age of 60 years were fully vaccinated and 84% had received at least one dose of licensed vaccines. The study estimated that 51%(n=469,186) of total expected deaths were averted by vaccination over the study period ranging from 93% deaths averted in Iceland to 6% in Ukraine. The direct impact is more heterogenous as it is contingent on the speed and extent of the vaccination programme in these eligible groups in individual countries.
99	Saban et al* (November 17, 2021)	Israel	Ecological	Population of Israel	Non-VOC, Alpha,†† Delta^	BNT162b2	This study evaluated trends in COVID-19 incidence, morbidity, and mortality between February 27, 2020 and October 16, 2021 related to the rollout and coverage of vaccination and booster doses. Israel experienced three COVID waves between March 2020 and March 2021. Vaccination began in December 2020 and was available to all adults aged 16+ in February, and to children aged 12-15 in June. As a result, daily incidence of confirmed SARS-CoV-2 infection had dropped to less than 30 in May 2021. A fourth wave began in June with the rise of the Delta variant, by which time the majority of the population was fully vaccinated (66% as of July 6). Daily numbers of confirmed cases reached a higher peak in the

#	Reference (date)	Country	Design	Population	Dominant Variants	Vaccine Product	Descriptive Findings
							fourth wave compared to previous waves, but the rate of test positivity (proportion of positive tests out of all those tested) was lower than peaks of previous waves, as was the number of severe hospitalized cases. During the first three months after vaccination started, unvaccinated persons had substantially higher daily rates of documented infection, hospitalizations, and deaths compared to vaccinated persons. Four months after vaccination began, the gap between vaccinated and unvaccinated individuals narrowed, with low rates of infections and hospitalizations in both groups. Rates of infections, hospitalizations, and deaths rose in both groups at the start of the fourth wave with a relatively small gap but they diverged substantially in August and September after rollout of the booster dose of BNT162b2, with much higher rates among unvaccinated persons. The case fatality rate (CFR) was also substantially lower 2-3 months after booster shots began (September 20-October 20) (0.052%) compared to the CFR for the whole study period (0.052% vs. 0.61%).
98	Li et al (November 15,2021)	187 countries	Ecological	All adults eligible for vaccination	Non-VOC, Alpha, Beta, Gamma††	Multiple products	This ecological study estimated the relationship between daily vaccine coverage, the total number of new cases and deaths using data from Our World In Data website. The study reported that the daily new cases of COVID-19 would be reduced by 24.43% [95% CI: 18.89, 29.59] and 7.50% [95% CI: 6.18, 8.80] with 10,000 people per day becoming fully vaccinated and 10,000 people per day with at least one dose of vaccine. Similarly, the relationship between COVID-19 vaccines and deaths showed a decline of 13.2% [95% CI: 3.81, 21.89] and 2.02% [95% CI: 0.18, 4.16] with 10,000 people per day becoming fully vaccinated and 10,000 people per day with at least one dose of vaccine. For the analysis restricted to the United States, the study estimated that 10,000 fully vaccinated people per day and 10,000 people per day with at least one dose of vaccine would reduce the new COVID-19 cases by 4.84% [95% CI: 4.66, 5.02] and 2.02% [95% CI: 1.96, 2.07].

#	Reference (date)	Country	Design	Population	Dominant Variants	Vaccine Product	Descriptive Findings
97	Linsenmeyer et al (November 10,2021)	USA	Prospective cohort	1973 Health care workers	Alpha^	BNT162b2, mRNA-1273 and Ad26.COV2.S	This cohort study was included HCPs from two health institutes in Boston to assess the association of vaccination with detection of SARS-CoV-2 asymptomatic infections. Lower case rates were detected in vaccinated vs unvaccinated staff during each monthly period. The detection rate declined toward zero in both groups in parallel with a drop in community transmission.
96	Desai et al (October 20,2021)	India	Retrospective cohort	569 patients admitted in a tertiary care centre	Delta††	AZD1222	The primary aim of this retrospective cohort study was to establish the association of partial vaccination with the ChAdOx1 nCoV-19 vaccine with clinical outcomes, such as comorbidity, ICU requirement, length of stay, and mortality in hospitalized COVID-19 patients. The study reported that the overall hospital stay for vaccinated patients was significantly lower than that for non-vaccinated patients. The vaccinated patients in the study showed a mean stay of 6.21 days in the ward, compared with 5.56 days for non-vaccinated patients, highlighting the impact of vaccines in preventing severe or critical outcomes in infected patients. The study also reported a mortality rate of 21.9% in the unvaccinated cohort compared to 2.9% in the vaccinated cohort. Overall, the requirement for mechanical ventilation was substantially lower in vaccinated patients compared to unvaccinated (42.85% vs 82.06%, respectively).
95	Safdar et al* (September 2021)	Pakistan	Prospective cohort	110 COVID-19 patients from two medical centers	Unknown	Sinopharm, Coronavac, Ad5-nCoV (CanSino), AZD1222	This prospective observational study assessed the impact of vaccination on disease severity, length of hospital stay, and mortality using Chi-square tests. The study was conducted from December 2020 to May 2021 among 45 vaccinated (receipt of at least one dose) and 65 unvaccinated COVID-19 patients at Fauji Foundation Hospital Rawalpindi and Pak International Medical College Hayatabad Peshwar. Unvaccinated patients were significantly more likely to experience severe disease compared to vaccinated patients (61.4% vs. 22.22%, p=0.0164), and also had significantly longer hospital stays than vaccinated patients (18.24 ±4.46 vs. 10.44±2.52 days, p=0.001). The mortality rate was also higher among unvaccinated (12.31%) compared to vaccinated patients (2.22%, p<0.05).

#	Reference (date)	Country	Design	Population	Dominant Variants	Vaccine Product	Descriptive Findings
94	Strum et al (November 21, 2021)	USA	Prospective cohort	952 SARS-CoV-2 positive healthcare workers from an academic campus in Southern California	Non-VOC, Alpha††	BNT162b2	This study was conducted between December 2020 and July 2021. Healthcare workers (HCW) from a Southern California academic campus (2 large hospitals, outpatient clinics, and other facilities) who tested positive for SARS-CoV-2 during the study period were followed for two main outcomes by vaccination status: days until they returned to work and symptoms. Fully vaccinated was defined as >13 days post dose 2, and partially vaccinated as >3 days post dose 1 through 13 days post dose 2. The adjusted mean days until returning to work was significantly shorter among fully vaccinated compared to partially vaccinated HCWs (10.9 vs. 15.5 days), and the time among partially vaccinated HCWs was significantly shorter than among unvaccinated HCWs (15.5 vs. 18 days). Fully vaccinated HCWs were most commonly asymptomatic (32%) or experienced nasal symptoms (28%), while partially vaccinated and unvaccinated HCWs experienced a wider variety and less mild symptoms.
93	Naleway et al (November 19, 2021)	USA	Retrospective cohort	482,464 participants (12+ years) enrolled in a Pacific Northwest health plan	Delta^	BNT162b2, mRNA-1273, Ad26.COV2.S	This study evaluated SARS-CoV-2 outcomes and severity in fully vaccinated versus unvaccinated members (aged 12+) of a large healthcare delivery plan (Kaiser Permanente Northwest) in Oregon and Washington from July-September 2021. Incidence of SARS-CoV-2 infection in fully vaccinated versus unvaccinated persons was 30.1 and 8.7 per 1000 people respectively (IRR 3.5). Unvaccinated persons were also more likely to visit an emergency department or be hospitalized (18.5% and 9%) compared to vaccinated persons (8.1% and 3.9%). Among those hospitalized for COVID-19, vaccinated persons had a shorter mean length of stay (7.4 days, SD 5.7) compared to unvaccinated persons (9.5 days, SD 9.6), and were less likely to be admitted to the ICU (15% vs. 27%), require intubation (8% vs. 16.1%), or require mechanical ventilation (<=5% vs. 8.6%). The crude mortality rate was also lower in fully vaccinated compared to unvaccinated persons (0.06 vs. 0.43 per 1000).
92	Salvatore et al (November 19, 2021)	USA	Outbreak investigation	95 incarcerated persons in a federal prison in Texas	Delta^	BNT162b2, mRNA-1273, Ad26.COV2.S	In this investigation of a Delta outbreak among incarcerated persons at a federal prison in Texas in July 2021, nasal specimens of a subset of infected people

#	Reference (date)	Country	Design	Population	Dominant Variants	Vaccine Product	Descriptive Findings
							were used to assess the impact of vaccination on transmission potential, indicated by duration of PCR positivity, viral load (Ct value), and viral culture positivity. The study compared fully vaccinated persons (14+ days after completing recommended primary vaccine series) to those not fully vaccinated (including completely unvaccinated and partially vaccinated). The cumulative incidence of infection was 70% and 93% among those fully vaccinated and not, respectively. There was no significant difference in duration of PCR positivity between fully vaccinated and not fully vaccinated persons (medians: 13 days in each group, p=0.5), nor in duration of viral culture positivity (medians: 5 days in each, p=0.29) or Ct values. Among fully vaccinated persons, median duration of PCR positivity among mRNA-1273 recipients (10 days) was slightly lower, though not significantly, than among BNT162b2 and Ad26.COV2.S recipients (13 days each; p=0.39). Median duration of positivity was also slightly lower among those who were fully vaccinated within 120 days before the outbreak compared to those fully vaccinated more than 120 days, but again this difference was not significant (11 vs. 13 days, p=0.32).
91	Simon et al (November 18, 2021)	USA	Retrospective cohort	240,648 COVID-19 infected persons	Non-VOC, Alpha††	BNT162b2, mRNA-1273, Ad26.COV2.S	This study investigated the relationship between the development of long-COVID and vaccination, along with other factors, using logistic and general linear regression among people in the Arcadia Data Research dataset from February 2020-May 2021. The vaccinated groups were anyone who received a first dose prior to being diagnosed with COVID-19, 0-4 weeks after diagnosis, 4-8 weeks after diagnosis, and 8-12 weeks post diagnosis. Long-COVID cases were those where the participant had one or more COVID-related symptoms between 12-20 weeks after the initial diagnosis. Results showed that, compared to unvaccinated persons with COVID-19, people who received at least one dose of any vaccine before diagnosis were 7-10 times less likely to report 2 or more long-COVID symptoms; those who received the first dose 0-4 weeks after diagnosis were 4-6 times less likely to report 2 or more long-COVID symptoms; and those who received the dose 4-8 weeks after diagnosis were 3 times less likely to report multiple long-COVID

#	Reference (date)	Country	Design	Population	Dominant Variants	Vaccine Product	Descriptive Findings
							symptoms. The protective effect of one vaccine dose against long-COVID persisted even if it was received up to 12 weeks after COVID-19 diagnosis.
90	Giddings et al(November 18,2021)	England	Prospective cohort	330 LTCF staff and residents	Alpha and Delta††	BNT162b2, mRNA-1273, AZD1222, Ad26.COV2.S	This prospective cohort study aimed to characterize COVID-19 outbreaks including outbreak duration and severity in 330 LTCFs across England during different time periods corresponding to the vaccination roll-out and pandemic waves. The study reported that the median vaccination rates among residents was consistently higher compared to the staff. Over 50% of the LTCF experienced a COVID-19 outbreak during the period when the uptake of first dose of the vaccine was low. A declining trend was noted in the number of outbreaks in the subsequent time periods which was attributed to the rising proportion of staff and residents getting vaccinated. Outbreak severity decreased as LTCF vaccination coverage increased, with an 80.6% reduction in the number of infected cases per outbreak and a 45.9% reduction in outbreak duration when comparing outbreaks between November and December 2020 with outbreak between May and June 2021. The proportion of residents who died of COVID-19 or were infected with SARS-CoV-2 during an outbreak decreased over the study period; less than 5% of residents died of COVID-19 in LTCF experiencing outbreaks after March 2021. There were no large outbreaks from March 2021 to the end of the study period. The findings from this study provide evidence of the impact of vaccination on the risk of LTCF outbreaks.
89	Fang et al (November 17,2021)	USA	Ecological study	3,070 counties across 49 states	Delta^	BNT162b2, mRNA-1273,Ad26.COV2.S	This ecological study was undertaken to estimate the population-level impact of SARS-CoV-2 vaccination on community-wide COVID-19 cases and mortality rates during the period of Delta variant transmission. The study used negative binomial models to estimate the associations between county-level vaccination rates and county-wide COVID-19 incidence and mortality from April 23rd to September 30th 2021 and presented the rates adjusted for potential confounders. Overall, each percentage increase in a county's total population vaccination rate between April 23rd and September 30th was associated with a 0.9% reduction in county-wide COVID-19 cases (relative risk (RR)

#	Reference (date)	Country	Design	Population	Dominant Variants	Vaccine Product	Descriptive Findings
							0.9910 (95% CI: 0.9869, 0.9952)) and a 1.9% reduction in county-wide COVID-19 mortality (RR 0.9807 (95% CI: 0.9745, 0.9823)). County population vaccination was associated with greater protection against COVID-19 infection, RR of 0.9895 (95% CI: 0.9851, 0.9940), and mortality, RR 0.9742 (95% CI: 0.9670, 0.9804), when the analysis was limited to July 3rd to September 30th, corresponding to when Delta became the predominant SARS-CoV-2 176 variant in the U.S.
88	Magalis et al(November 11,2021)	USA	Retrospective cohort	4,439 SARS-CoV-2 samples from patients in Florida	Delta^	BNT162b2, mRNA-1273,Ad26.COV2.S	This study analyzed data generated as part of the SARS-CoV-2 genomic epidemiology surveillance program in Florida from October 2020 to August 2021. Multivariable linear regression analysis performed to evaluate associations between patient characteristics and either viral load or RT-PCR cycle threshold (CT) levels. The study reported that unvaccinated individuals infected with the Delta variant exhibited the highest viral load compared to vaccinated Delta or non-Delta breakthrough infections. The study also reported that Delta-infected breakthrough cases had a statistically significant 38% reduction in viral load compared to unvaccinated Delta cases, and 34% compared to unvaccinated non-Delta cases. Particularly, the majority of vaccine breakthrough cases infected with the Delta variant (58.5%) exhibited a VL above the required threshold for potential transmission. There was also no correlation between distribution of VL over time elapsed since full vaccination, defined as the time interval between two weeks after 2nd vaccination dose.
87	Whittaker et al (November 9, 2021)	Norway	Retrospective cohort	2361 adults aged 18+ hospitalized for COVID-19	Alpha^	BNT162b2 and mRNA-1273	This cohort study used logistic regression of national surveillance data to assess the impact of mRNA vaccination on length of hospital stay (LoS), ICU admission, and mortality among 2361 patients (18+) hospitalized for COVID-19 from February through September 2021. Full vaccination was defined as 7+ days after dose 2 or 7+ days after dose 1 if diagnosed with a prior SARS-CoV-2 infection 21+ days before vaccination; partial vaccination was defined as 21+ days after dose 1 up to <7 days after dose 2. After adjusted for potential confounder, fully vaccinated patients had a significantly shorter LoS compared to unvaccinated patients (aHR for discharge 1.40, 95% CI

#	Reference (date)	Country	Design	Population	Dominant Variants	Vaccine Product	Descriptive Findings
							1.14-1.71) and 40% lower likelihood of ICU admission (aOR: 0.60, 95% CI 0.39-0.91), though the relationships varied by age strata. Results were similar when including partially vaccinated patients in the exposed group. The odds of dying in hospital were also reduced among vaccinated versus unvaccinated patients, though the difference was not statistically significant.
86	Maltezou et al* (October 30, 2021)	Greece	Prospective cohort	7445 healthcare workers (HCW) from 5 hospitals	Non-VOC, Alpha††	BNT162b2	This prospective study investigated the impact of BNT162b2 vaccination on morbidity and absenteeism among HCW from 5 hospitals in Greece between November 15, 2020-April 18, 2021. After vaccinations began (January 4, 2021), instances and duration of absenteeism were significantly higher among unvaccinated HCW compared to those who received at least one dose (11.8 vs 4.7 instances of absenteeism per 100 HCW, p<0.001; mean duration 11.9 vs. 6.9 days, p<0.001). Vaccination prevented an estimated 163 COVID-19 cases, 177 cases of SARS-CoV-2 infection, and 342 instances of absenteesim among HCW. Respiratory infections, influenza-like illness, and COVID-19 disease were significantly more common among unvaccinated HCW than those who received at least one dose (p<0.001 in each case), though there was no significant difference in the incidence of febrile episode or asymptomatic SARS-CoV-2.
85	Arbel et al (October 28, 2021)	Israel	Ecological	Adults aged 70+	Alpha^	BNT162b2	This study evaluated the impact of mass vaccination with BNT162b2 on mortality among older adults (70+ years) from COVID-19 in Israel from March 15 through June 26, 2021 by comparing the expected number of deaths in the absence of vaccination and based on vaccine efficacy data to the actual number of deaths. During the study period, at least 90% of adults over 70 were vaccinated, and there were 370 COVID-19 related deaths in this group. This was lower than the expected number of deaths based on vaccine efficacy alone (408), even with loosening non-pharmaceutical restrictions, indicating a possible herd immunity type effect. Actual recorded deaths were also much lower than the expected number of deaths in the absence of vaccination (370 versus 5120).
84	Rivasi et al* (October 13, 2021)	Italy	Ecological	3730 residents of nursing homes in Florence, Italy	Non-VOC, Alpha††	BNT162b2	This study assessed the impact of the BNT162b2 vaccine on the SARS-CoV-2 epidemic in nursing homes in the Florence Health District by comparing pre-

#	Reference (date)	Country	Design	Population	Dominant Variants	Vaccine Product	Descriptive Findings
							vaccination) and post-vaccination periods (1 October-26 December 2020 vs. 27 December 2020-31 March 2021). The authors also analyzed symptoms, hospitalization, and mortality among cases by vaccination status in the post-vaccine period. In the pre-vaccination period, weekly infection rates ranged from 1.8% to 6.5%. Weekly infection rates fell progressively during the post-vaccination period, from 4.5% at the start to zero by late February, and remained at zero through the end of the study period. At the same time, infection rates among the general population of Tuscany (the region where Florence is located) were gradually rising. During the post-vaccination period, most fully vaccinated SARS-CoV-2 cases were asymptomatic (86%) or had mild symptoms, whereas symptoms were reported in 70% and 78% of partially vaccinated and unvaccinated cases respectively ($p<0.001$). Hospitalization and mortality rates were also significantly higher among unvaccinated than partially and fully vaccinated cases.
83	Stock et al (November 9,2021)	Scotland	Prospective cohort	16,229 pregnant women	Delta^	BNT162b2, mRNA-1273, AZD1222, Ad26.COV2.S	This study used data from a national prospective dynamic cohort which included all women who were pregnant on, or became pregnant after March 1st 2020. The primary outcome of the study was to evaluate SARS-CoV-2 infection and severe COVID-19 outcomes in vaccinated and unvaccinated pregnant women. The study estimated that a 81.7% of COVID-19 cases, 93% of COVID-19 cases associated with hospital admissions and 98.9% of COVID-19 cases associated with critical care admissions occurred in women who were unvaccinated at the time of COVID-19 in pregnancy. The study also reported that complications known to be associated with COVID-19 in pregnancy (critical care admission, perinatal mortality) were far more common in women who were unvaccinated at the time of SARS-CoV-2 diagnosis than in vaccinated pregnant women. Although COVID-19 rates were similar across all trimesters of pregnancy, and mirrored those in the general female population of reproductive age, associated hospital admissions and critical care admissions were higher in pregnant women than in the general female population of reproductive age, and highest in the third trimester.

#	Reference (date)	Country	Design	Population	Dominant Variants	Vaccine Product	Descriptive Findings
82	Lim et al (November 8, 2021)	Malaysia	Ecological	Populations of 16 states of Malaysia	Delta††	BNT162b2, AZD1222, CoronaVac, Ad5-nCoV (CanSino)	This study aimed to assess the impact of COVID-19 vaccination on COVID-19 mortality rates using data from 16 states in Malaysia between February 24 (first day of vaccination in Malaysia) to October 2, 2021. The authors used an Autoregressive integrated Moving Average (ARIMA) model to evaluate differences in COVID-related mortality trends in each state among unvaccinated, partially vaccinated (one dose of BNT612b2, AZD1222 or CoronaVac), and fully vaccinated persons (14+ days after 2 doses of BNT162b2, AZD1222, or CoronaVac, or 28+ days after single dose of Ad5-nCoV). Compared to the unvaccinated populations, COVID-19 mortality rates of fully vaccinated persons were statistically significantly lower in all states. Mortality among partially vaccinated persons was also lower in 15 of 16 states, but the relationship was only statistically significant in 7 states.
81	Matos et al* (November 5, 2021)	Portugal	Prospective cohort	4617 patients with stage 5 chronic kidney disease (CKD-5D) in Portugal	Non-VOC††	BNT162b2	This prospective study investigated SARS-CoV-2 infection and mortality rates in patients with stage 5 chronic kidney disease undergoing dialysis (CKD-5D) at 38 NephroCare clinics (prioritized in phase 1 of vaccinations) compared to rates in the general population in the time periods before vaccination (3 Feb 2020-13 Feb 2021), during vaccination (24-27 Feb 2021), and after vaccination (28 Feb-15 Mar 2021). In the pre-vaccination period, the incidence of infection was significantly higher among the CKD-5D cohort than in the general population (14.9% vs. 7.9%, p<0.001). In the period starting 16 days after the first dose to 7 days after the second dose (during vaccination), there was no significant difference in the average daily incidence of infection between the CKD-5D cohort and the general population (13.68 vs. 14.09 per 100,000, p=0.541). Starting the 8th day after dose 2 (full/post-vaccination), the average daily incidence rate in the CKD-5D cohort was significantly reduced compared to the general population (1.33 vs. 6.65 per 100,000, p<0.001). COVID-19 related mortality, on the other hand, remained significantly higher in the CKD-5D cohort.

#	Reference (date)	Country	Design	Population	Dominant Variants	Vaccine Product	Descriptive Findings
80	McNamara et al*(November 3, 2021)	USA	Ecological	Adults aged 50+	Non-VOC, Alpha††	BNT162b2, mRNA-1273, Ad26.COV2.S	This national study aimed to assess the impact of COVID-19 vaccination on COVID-19 infections, emergency department visits, hospital admissions, and deaths by comparing the pre-vaccination period to the early post-roll-out period (November 1, 2020-April 10, 2021). Incidence rates for COVID-related outcomes among adults aged 65+ (who were among the groups initially prioritized for vaccination) were compared to those among adults aged 50-64 in the pre- and post-vaccination periods. Relative to those aged 50-64 and accounting for pre-vaccination differences, the incidence of infection during the post-vaccination period was reduced by 53% (95% CI 50-55) among those aged 65-74 and 62% (59-64) among those 75+, while emergency department visits were reduced by 61% (52-68) and 77% (71-81) respectively. Relative to adults aged 50-59, hospital admissions were reduced by 39% (29-48), 60% (54-66), and 68% (62-73) for adults aged 60-69, 70-79, and 80+ respectively. Deaths were reduced by 41% and 40% for adults aged 65-74 and 75+ respectively, though these results were not significant (95% CI -14-69 and -47-66 respectively).
79	Bouanane et al (November 2,2021)	France	Ecological	All adults	Delta††	BNT162b2, mRNA-1273, AZD1222, Ad26.COV2.S	This study used data from Santé France to estimate the correlation between vaccination rates and hospitalizations, ICU admissions, and COVID-19 related deaths per 100,000 people across 100 territories. While the study reports a strong relationship between decreasing incidence and increasing vaccination rates averaged across the entire country during the month of September, authors reported a weak decreasing relationship between the incidence of COVID-19 and vaccination rate when accounting for varying vaccination levels by territory. Weak relationships with vaccination rates were also found for hospitalizations and ICU admissions, while no association was found between COVID-19 mortality and vaccination rates across the 100 territories. When stratifying the analysis by most and least vaccinated territories, authors found no association between incidence and vaccination levels among the most vaccinated territories and a moderate decreasing association among the least vaccinated territories. Factors that the authors surmise may play a role in the results are: 1) gradual decline of

#	Reference (date)	Country	Design	Population	Dominant Variants	Vaccine Product	Descriptive Findings
							vaccine efficacy 2) lower VE against newly emerging variants 3) improvement of medical care for COVID-19 patients and 4) probably a fairly significant development of natural immunity.
78	Evangelou et al (October 26,2021)	England	Retrospective cohort	41,208 patients in England with Multiple Sclerosis	Non VOC and Alpha††	BNT162b2, mRNA-1273, AZD1222, Ad26.COV2.S	This study was undertaken in England to assess the impact of mass vaccination on the entire population of people with Multiple Sclerosis(MS) taking Disease-Modifying treatment(DMTs) in England in preventing asymptomatic and symptomatic COVID-19 infection, and compares their risk of infection to the general population during two distinct waves of the pandemic before and after implementation of SARS-CoV-2 vaccinations. The incidence of SARS-CoV-2 infection for people taking ocrelizumab or fingolimod increased following the lifting of COVID-19restrictions despite mass vaccination and a reduction in infections among the general population. The IRR (95% CI) of SARS-CoV-2 infection for people on ocrelizumab compared to the general population significantly increased from1.13 (0.97 – 1.31) during the pre-vaccination period to 1.79 (1.57 – 2.03) during the post-vaccination period .The IRR (95% CI) of SARS-CoV-2infection for people on fingolimod compared to the general population also significantly increased from 0.87 (0.73 – 1.02) to 1.40 (1.20 – 1.63) during the same periods.
77	Gyeltshen et al (October 21,2021)	Bhutan	Ecological	Individuals aged 12 and above	Delta^	BNT162b2, mRNA-1273, Sinopharm, AZD1222	This study summarises the impact of COVID-19 vaccination program in Bhutan on the rates of new infection. The authors note that with the onset of the second vaccination campaign in July 20,2021, there were 2455 total cases recorded with 328 active cases as compared to 889 total cases with 18 active cases as of April 2,2021. After the second dose, the country observed a steady decline in the cases with 123 active cases by August 2, 2021. This study highlights the impact of vaccination on the overall population of Bhutan.
76	Levine-Tiefenbrun et al* (November 2, 2021)	Israel	Retrospective cohort	16,553 infected adults (aged 20+)	Delta^	BNT162b2	This study analyzed viral loads (cycle threshold/Ct) of 16,533 infected individuals, focusing on adults over 20 among patients of Maccabi Healthcare Services between June 28 and September 9, 2021. There were a total of 3100 infections among unvaccinated people, 12,934 infections among fully vaccinated people, and 519 infections among those who had

#	Reference (date)	Country	Design	Population	Dominant Variants	Vaccine Product	Descriptive Findings
							received a booster dose. The authors used multivariable linear regression, adjusting for relevant covariates. The study found that infections in people who recently became fully vaccinated (within 7-30 days) have lower viral loads (higher Ct values) than infections in unvaccinated people, but that the effect begins to wane 2 months after vaccination and disappears completely 6 months or more after vaccination. Receipt of a booster dose of BNT162b2 was found to restore the effect of lowering the viral load of infections.
75	Taylor et al* (October 29, 2021)	US	Retrospective cohort	87,879 COVID-19 hospitalizations among US adults	Delta^	mRNA-1273, BNT162b2 and Ad26.COV2.S	The study utilised data from COVID-NET- a population based surveillance for laboratory confirmed COVID-19 associated hospitalisations across 99 counties in 14 states from January to August-2021. The study compared the study outcomes across two different time periods- the periods before and the period during the Delta variant predominance. There was a decreasing trend of hospital admissions among all adult age groups in the pre-Delta period, but hospitalizations subsequently increased during the months of July-August(corresponding to the high Delta variant transmission). The study noted that approximately 71.8% of COVID-19–associated hospitalizations in the Delta period were in unvaccinated adults. Adults aged 18–49 years accounted for 43.6% (95% CI = 39.1%–48.2%) of all hospitalizations among unvaccinated adults during the Delta period.
74	Xu et al*(October 29,2021)	US	Retrospective cohort	6.4 million COVID-19 vaccinees and 4.6 million unvaccinated persons	Non-VOC, Alpha and Delta††	mRNA-1273, BNT162b2 and Ad26.COV2.S	This retrospective cohort study was conducted across seven different sites in the US from December 2020-July 2021 to assess mortality not associated with COVID-19 ie. Non COVID-19 related deaths. After age and sex standardization, this study observed that the adjusted RR of non-COVID-19 mortality are significantly lower in vaccinated individuals compared to unvaccinated across all the three vaccine groups. In children aged 12-17 years vaccinated with BNT162b2, mortality risk was similar after dose 1 and (aRR = 0.85; 95% CI = 0.38–1.90) and after dose 2 (aRR = 0.73; 95% CI = 0.33–1.64). Across vaccine type and dose, males and females had comparable aRRs. All vaccinated

#	Reference (date)	Country	Design	Population	Dominant Variants	Vaccine Product	Descriptive Findings
							racial and ethnic groups had lower mortality risks than did unvaccinated comparison groups.
73	Coccia et al(October 25, 2021)	Italy	Retrospective cohort	All adults	Non- VOC, Alpha and Delta††	mRNA-1273, BNT162b2, Ad26.COV2.S and AZD1222	This retrospective cohort study analyses the impact of COVID-19 in Italy between April-September 2020 (without vaccinations and with non-pharmaceutical interventions) and April-September 2021 (with pharmaceutical interventions based on vaccination programs) to study the dynamics and impact of COVID-19 pandemic in society. The study reported that confirmed cases in 2020 is about 2.1%, whereas in 2021 is 2.5%. Number of hospitalizations, ICUs in 2020 has a slightly higher level, whereas fatality rate is lower in 2021 compared to 2021, likely because of a higher number of swab tests in 2021.
72	Subramanian et al *(September 30,2021)	68 countries and 2947 US counties	Ecological	Adults	Delta^	All	This study analysed country-level immunization data from online platforms, 'Our World in Data,' to investigate the association between the percentage of population fully vaccinated and new COVID-19 cases across 68 countries. Similar methodology was applied for extracting county-level data for the US from the 'White House COVID-19 Team' for 2,947 counties. At the country-level, there appears to be no significant relationship between percentage of population fully vaccinated and new COVID-19 cases in the last 7 days. Across the US counties, too, the median new COVID-19 cases per 100,000 people in the last 7 days is largely similar across the categories of percent population fully vaccinated.
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

#	Reference (date)	Country	Design	Population	Dominant Variants	Vaccine Product	Descriptive Findings
							69.8% during the most recent reporting period- 30th May to June 2021, with utilisation numbers approaching pre-pandemic levels.
70	Singh et al* (October 11, 2021)	India	Case control	577 cases and 1144 controls aged 45+ among patients of AIIMS in Patna, Bihar	Delta^	AZD1222 (SII) & COVAXIN	This case control study was conducted at the All India Institute of Medical Sciences (AIIMS) in Patna, Bihar. In addition to estimating vaccine effectiveness against infection, the study assessed the impact of vaccination on the length of hospital stay (LOS) and disease severity. The median LOS among partially vaccinated patients (9 days, IQR 5-13) was significantly lower than among unvaccinated patients (12 days, IQR 6-16) according to a Bonferroni post hoc test (p=0.028). Fully vaccinated patients had a median hospital stay of 10 days (IQR 6-15). Fully vaccinated cases were also less likely to experience severe disease (30.3% of fully vaccinated cases) compared to partially vaccinated (51.3%) and unvaccinated cases (54.1%) based on Chi-square tests (p=0.035).
69	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.
68	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

#	Reference (date)	Country	Design	Population	Dominant Variants	Vaccine Product	Descriptive Findings
							unvaccinated individuals during a period of Beta 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.
67	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.
66	Samson et al (October 5, 2021)	USA	Retrospective cohort	25.3 million Medicare beneficiaries			This study was conducted from September 2020 to May 2021 to identify associations between COVID-19 infections, hospitalizations, and deaths among Medicare users and estimate the reduction in overall disease outcomes associated with the roll-out of vaccines in the US. The study reported that for the risk

#	Reference (date)	Country	Design	Population	Dominant Variants	Vaccine Product	Descriptive Findings
							of COVID-19 infection, a 10% increase in COVID-19 vaccination rate among those 65 and older was associated with an 11% decrease in the odds of COVID-19 infection, with an estimated reduction between 9 and 12%.For COVID-related hospitalizations and deaths, a 10% increase in COVID-19 vaccinations in those ages 18-64 was associated with approximately an 11% (OR=0.989, 95% CI 0.982-0.995) and 12% (OR=0.988, 95% CI 0.978-0.999) decrease in the odds of COVID-19 hospitalizations and deaths, respectively, among Medicare beneficiaries infected with COVID-19.
65	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 baseline to six months between vaccinated and unvaccinated participants.
64	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.
63	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

#	Reference (date)	Country	Design	Population	Dominant Variants	Vaccine Product	Descriptive Findings
							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.
62	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 infected with Gamma, Delta or Alpha variant increased the likelihood of hospitalization.
61	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).
60	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

#	Reference (date)	Country	Design	Population	Dominant Variants	Vaccine Product	Descriptive Findings
							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.
59	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 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.
58	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

#	Reference (date)	Country	Design	Population	Dominant Variants	Vaccine Product	Descriptive Findings
							unvaccinated and vaccinated patients were 8.7% and 4.3% respectively. Among 32 of the cases for which complete antibody information was available, there was no difference in antibody levels between vaccinated and unvaccinated patients.
57	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.
56	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

#	Reference (date)	Country	Design	Population	Dominant Variants	Vaccine Product	Descriptive Findings
							intensive care (ICU) than those who had received a dose within 14 days (p=0.03). Receipt of any vaccine 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.
55	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.
54	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.
53	Schwarzer et al (September 16, 2021)	Germany	Retrospective cohort	9 staff and 23 residents of a senior citizen home in Bremen, Germany	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)

#	Reference (date)	Country	Design	Population	Dominant Variants	Vaccine Product	Descriptive Findings
				with confirmed SARS-CoV-2 infection			while 10 were among unvaccinated persons (9 staff and 1 resident). The majority of cases among partially 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.
52	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.
51	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

#	Reference (date)	Country	Design	Population	Dominant Variants	Vaccine Product	Descriptive Findings
							versus 0.1, respectively). Higher hospitalization and death rates were observed in older age groups, regardless of vaccination status, resulting in a larger impact of age-standardization on overall incidence for these outcomes.
50	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).
49	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

#	Reference (date)	Country	Design	Population	Dominant Variants	Vaccine Product	Descriptive Findings
							group, and from 20 pre-vaccination (16-26) to 9 post-vaccination (5-18) in the 80+ cohort (808 deaths prevented).
48	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.
47	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.
46	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.

#	Reference (date)	Country	Design	Population	Dominant Variants	Vaccine Product	Descriptive Findings
							The time-series analysis, performed using non-linear 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.
45	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.
44	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.
43	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

#	Reference (date)	Country	Design	Population	Dominant Variants	Vaccine Product	Descriptive Findings
							Los Angeles County residents, the age-adjusted 7-day 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.
42	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).
41	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

#	Reference (date)	Country	Design	Population	Dominant Variants	Vaccine Product	Descriptive Findings
							hospitalizations, and a 16.6% decrease in hospitalizations per 100 cases.
40	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).
39	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.
38	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,

#	Reference (date)	Country	Design	Population	Dominant Variants	Vaccine Product	Descriptive Findings
				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)
37	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.
36	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

#	Reference (date)	Country	Design	Population	Dominant Variants	Vaccine Product	Descriptive Findings
							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.
35	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 ($p<0.05$).
34	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.
33	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%.
32	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.
31	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.
30	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).
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 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

#	Reference (date)	Country	Design	Population	Dominant Variants	Vaccine Product	Descriptive Findings
							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, Ad26.COV2.S available)	Ecologic study evaluating the relationship between the cumulative proportion of residents vaccinated and weekly incidence of COVID-19 by location in 115 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

#	Reference (date)	Country	Design	Population	Dominant Variants	Vaccine Product	Descriptive Findings
							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 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

#	Reference (date)	Country	Design	Population	Dominant Variants	Vaccine Product	Descriptive Findings
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]: 1.20–1.60). 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

#	Reference (date)	Country	Design	Population	Dominant Variants	Vaccine Product	Descriptive Findings
							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 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

#	Reference (date)	Country	Design	Population	Dominant Variants	Vaccine Product	Descriptive Findings
							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, 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-

#	Reference (date)	Country	Design	Population	Dominant Variants	Vaccine Product	Descriptive Findings
							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 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

#	Reference (date)	Country	Design	Population	Dominant Variants	Vaccine Product	Descriptive Findings
							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 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.

#	Reference (date)	Country	Design	Population	Dominant Variants	Vaccine Product	Descriptive Findings
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
16. https://www.medrxiv.org/content/10.1101/2021.07.18.21260732v2
17. https://www.medrxiv.org/content/10.1101/2021.10.04.21264542v1
18. https://www.eurosurveillance.org/content/10.2807/1560-7917.ES.2021.26.41.2100920
19. https://europepmc.org/article/MED/34676000
20. http://medrxiv.org/content/early/2021/11/03/2021.11.03.21265819.abstract
21. https://www.cambridge.org/core/journals/epidemiology-and-infection/article/sarscov2-variants-and-effectiveness-of-vaccines-a-review-of-current-evidence/39243FCC3CED73D5F1D94E497F8823D3
22. https://www.spandidos-publications.com/10.3892/etm.2021.10843
23. https://idpjournal.biomedcentral.com/articles/10.1186/s40249-021-00915-3
24. https://eymj.org/DOIx.php?id=10.3349/ymj.2021.62.11.961
25. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3961378
26. https://www.sciencedirect.com/science/article/pii/S1201971221008572?via%3Dihub#sec0002
27. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8524740/

28. https://www.mdpi.com/2076-393X/9/11/1305
29. https://www.researchsquare.com/article/rs-1130796/v1

Please direct any questions about content to:

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