Effectiveness of BNT162b2 booster doses in England: a observational study in OpenSAFELY-TPP: Materials

Boosted	Aged 18+ and recieved booster dose between 16 September and 1 December 2021 inclusive	5,763,28
-	with homologous primary vaccination course of BNT162b2 or ChAdOx1-S	5,746,53
-	and not a HSC worker	5,373,97
-	and not a care/nursing home resident, end-of-life or housebound	5,129,99
Eligible (people)	with no missing demographic information	4,764,09
-	and no evidence of SARS-CoV-2 infection within 90 days of boosting	4,666,76
-	and not in hospital when boosted	4,264,38
Eligible (context)	and not boosted at an unusual time given region, priority group, and second dose date	3,998,66
Matched	and successfully matched to an unboosted control	3,426,96
-	and also selected as a control in an earlier trial	1,390,76

Table 0: Inclusion criteria

Table 1: Participant characteristics Participant characteristics as on the day of recruitment into the treatment or control group.

Characteristic	Boosted, ineligible	Boosted, eligible, unmatched	Boosted, eligible, matched
Total N	765,433	571,704	3,426,960
Primary vaccine course			
BNT162b2-BNT162b2	446,883 (58%)	345,700 (60%)	1,476,131 (43%)
ChAdOx1-ChAdOx1	318,550 (42%)	226,004 (40%)	1,950,829 (57%)
Age			
18-39	58,497 (7.6%)	1,174 (0.2%)	184,832 (5.4%)
40-49	62,987 (8.2%)	3,521 (0.6%)	221,668 (6.5%)
50-59	110,447 (14%)	24,398 (4.3%)	628,035 (18%)
60-69	133,034 (17%)	80,393 (14%)	939,494 (27%)
70-79	175,086 (23%)	307,114 (54%)	1,039,938 (30%)
80-89	195,805 (26%)	132,942 (23%)	364,261 (11%)
90+	29,577 (3.9%)	22,162 (3.9%)	48,732 (1.4%)
Sex			
Female	431,160 (56%)	320,042 (56%)	1,860,622 (54%)
Male	334,273 (44%)	251,662 (44%)	1,566,338 (46%)
Ethnicity			
White	697,216 (91%)	549,859 (96%)	3,218,953 (94%)
Black	10,010 (1.3%)	3,769 (0.7%)	31,058 (0.9%)
South Asian	42,951 (5.6%)	12,941 (2.3%)	126,998 (3.7%)
Mixed	5,018 (0.7%)	1,742 (0.3%)	18,073 (0.5%)
Other	10,238 (1.3%)	3,393 (0.6%)	31,878 (0.9%)
IMD			
1 most deprived	122,596 (16%)	71,605 (13%)	469,397 (14%)
2	146,615 (19%)	97,825 (17%)	586,546 (17%)
3	169,530 (22%)	137,070 (24%)	763,813 (22%)
4	168,784 (22%)	137,490 (24%)	799,431 (23%)
5 least deprived	157,908 (21%)	127,714 (22%)	807,773 (24%)
Region			
North East and Yorkshire	186,077 (24%)	82,274 (14%)	616,628 (18%)
Midlands	117,643 (15%)	136,134 (24%)	774,777 (23%)
North West	111,821 (15%)	42,956 (7.5%)	285,853 (8.3%)

East of England	110,699 (14%)	131,819 (23%)	825,941 (24%)
London	84,553 (11%)	10,213 (1.8%)	109,498 (3.2%)
South East	45,434 (5.9%)	56,128 (9.8%)	261,876 (7.6%)
South West	109,206 (14%)	112,180 (20%)	552,387 (16%)
Clinically extremely vulnerable	166,588 (22%)	83,765 (15%)	470,981 (14%)
Body Mass Index > 40 kg/mˆ2	37,479 (4.9%)	16,207 (2.8%)	156,646 (4.6%)
Chronic heart disease	224,769 (29%)	152,670 (27%)	665,488 (19%)
Chronic kidney disease	109,820 (14%)	89,342 (16%)	316,348 (9.2%)
Diabetes	139,416 (18%)	96,961 (17%)	532,340 (16%)
Chronic liver disease	28,129 (3.7%)	15,117 (2.6%)	115,145 (3.4%)
Chronic respiratory disease	75,031 (9.8%)	51,726 (9.0%)	249,441 (7.3%)
Asthma	6,883 (0.9%)	3,010 (0.5%)	25,437 (0.7%)
Chronic neurological disease	82,351 (11%)	57,137 (10.0%)	274,335 (8.0%)
Immunosuppressed	40,896 (5.3%)	20,199 (3.5%)	154,260 (4.5%)
Asplenia or poor spleen function	8,788 (1.1%)	4,823 (0.8%)	40,134 (1.2%)
Learning disabilities	3,019 (0.4%)	1,061 (0.2%)	21,039 (0.6%)
Serious mental illness	6,865 (0.9%)	3,820 (0.7%)	31,996 (0.9%)
Number of SARS-CoV-2 tests			
0	425,657 (56%)	412,696 (72%)	2,092,836 (61%)
1	124,172 (16%)	68,069 (12%)	486,362 (14%)
2	56,554 (7.4%)	26,571 (4.6%)	206,142 (6.0%)
3+	159,050 (21%)	64,368 (11%)	641,620 (19%)
Prior documented SARS-CoV-2 infection	122,122 (16%)	15,974 (2.8%)	202,432 (5.9%)
In hospital (planned admission)	3,700 (0.5%)	7,479 (1.3%)	46,478 (1.4%)

Table 2: Follow-up and outcomes Total follow-up and incidence rates for each outcome, by treatment group. The cumulative incidence of each outcome is provided in Supplementary Figure S2.

	Boosted		Unboosted	
Outcome	Events / person-years	Incidence rate	Events / person-years	Incidenc
3,998,664 eligible, 3,426,960 matched (85.7%).				
Positive SARS-CoV-2 test	17,089 /198,731	0.086	32,795 /171,492	
COVID-19 hospitalisation	454 /199,457	0.002	1,929 /173,359	
COVID-19 death	54 /199,477	<0.001	400 /173,489	

Table 3b: Estimated booster effectiveness (5 period)

Main and subgroup analyses

	Days since booster	HR (95% CI)	VE (95% CI)
Positive SARS-CoV-2 test			
All	1 - 7	0.79 (0.77-0.82)	20.6 (18.0-23.1)
	15 - 28	0.21 (0.20-0.21)	79.4 (78.5-80.2)
	29 - 42	0.23 (0.22-0.25)	76.9 (75.4-78.3)
	43 - 70	0.32 (0.30-0.34)	67.9 (65.6-70.1)
	8 - 14	0.47 (0.45-0.49)	53.1 (51.4-54.7)
BNT162b2-BNT162b2	1 - 7	0.79 (0.74-0.83)	21.4 (16.9-25.8)
	15 - 28	0.24 (0.23-0.26)	75.5 (73.8-77.1)
	29 - 42	0.28 (0.26-0.30)	72.2 (69.6-74.5)
	43 - 70	0.35 (0.32-0.39)	64.6 (61.4-67.6)
	8 - 14	0.48 (0.46-0.51)	51.5 (48.5-54.4)
ChAdOx1-ChAdOx1	1 - 7	0.80 (0.77-0.83)	20.3 (17.0-23.4)
	15 - 28	0.19 (0.18-0.20)	81.4 (80.4-82.3)
	29 - 42	0.20 (0.18-0.21)	80.4 (78.6-82.0)
	43 - 70	0.27 (0.24-0.30)	73.1 (69.6-76.3)
	8 - 14	0.46 (0.44-0.48)	53.9 (51.9-55.9)
Not Clinically Extremely Vulnerable	1 - 7	0.79 (0.76-0.82)	21.0 (18.2-23.7)
	15 - 28	0.20 (0.19-0.21)	80.4 (79.4-81.2)
	29 - 42	0.23 (0.21-0.24)	77.3 (75.6-78.8)
	43 - 70	0.33 (0.30-0.35)	67.4 (64.7-69.9)
	8 - 14	0.45 (0.44-0.47)	54.7 (53.0-56.4)
Clinically Extremely Vulnerable	1 - 7	0.82 (0.75-0.90)	17.8 (10.0-24.9)
	15 - 28	0.27 (0.24-0.30)	73.3 (70.5-75.9)
	29 - 42	0.25 (0.22-0.29)	74.9 (71.3-78.1)
	43 - 70	0.30 (0.26-0.36)	69.6 (64.1-74.2)
	8 - 14	0.58 (0.53-0.64)	41.8 (36.1-47.0)
Aged 18-64	1 - 7	0.82 (0.79-0.86)	17.6 (14.3-20.9)
	15 - 28	0.23 (0.22-0.24)	77.2 (76.1-78.3)
	29 - 42	0.27 (0.25-0.29)	73.2 (71.2-75.0)
	43 - 70	0.38 (0.35-0.41)	61.9 (58.8-64.9)
	8 - 14	0.45 (0.43-0.47)	55.1 (53.1-57.1)
Aged 65 and over	1 - 7	0.76 (0.72-0.81)	23.7 (19.3-27.8)
	15 - 28	0.17 (0.16-0.19)	82.8 (81.3-84.2)
	29 - 42	0.20 (0.18-0.22)	80.1 (77.6-82.3)
	43 - 70	0.24 (0.20-0.28)	76.2 (72.3-79.6)
	8 - 14	0.53 (0.50-0.57)	46.7 (43.4-49.8)
COVID-19 hospitalisation			
All	1 - 7	0.31 (0.25-0.39)	69.1 (61.2-75.4)
	15 - 28	0.16 (0.13-0.19)	84.4 (81.0-87.1)
	29 - 42	0.10 (0.07-0.14)	89.9 (86.1-92.7)
	43 - 70	0.17 (0.12-0.24)	83.0 (76.3-87.9)
	8 - 14	0.32 (0.27-0.39)	68.0 (61.5-73.5)
BNT162b2-BNT162b2	1 - 7	0.34 (0.24-0.49)	65.8 (50.8-76.2)
	15 - 28	0.20 (0.15-0.26)	80.2 (73.5-85.2)
	29 - 42	0.13 (0.08-0.20)	87.4 (80.2-92.0)
	43 - 70	0.15 (0.09-0.24)	85.3 (76.5-90.8)
	8 - 14	0.34 (0.25-0.46)	65.7 (53.7-74.5)

ChAdOx1-ChAdOx1	1 - 7	0.29 (0.22-0.39)	70.9 (61.1-78.3)
	15 - 28	0.13 (0.10-0.17)	86.7 (82.7-89.8)
	29 - 42	0.08 (0.05-0.13)	91.5 (86.8-94.6)
	43 - 70	0.20 (0.12-0.32)	80.0 (67.6-87.6)
	8 - 14	0.31 (0.24-0.39)	69.4 (61.1-75.9)
Not Clinically Extremely Vulnerable	1 - 7	0.30 (0.23-0.41)	69.5 (59.0-77.4)
	15 - 28	0.10 (0.07-0.13)	90.4 (86.7-93.0)
	29 - 42	0.09 (0.05-0.14)	91.5 (86.1-94.8)
	43 - 70	0.09 (0.05-0.17)	90.6 (82.6-94.9)
	8 - 14	0.28 (0.22-0.36)	71.9 (63.7-78.3)
Clinically Extremely Vulnerable	1 - 7	0.32 (0.22-0.45)	68.3 (54.9-77.7)
	15 - 28	0.24 (0.19-0.31)	76.2 (69.5-81.4)
	29 - 42	0.12 (0.08-0.18)	88.0 (81.8-92.1)
	43 - 70	0.25 (0.17-0.37)	75.1 (62.5-83.4)
	8 - 14	0.38 (0.29-0.50)	62.2 (50.3-71.2)
Aged 18-64	1 - 7	0.31 (0.18-0.52)	69.2 (47.7-81.9)
	15 - 28	0.24 (0.17-0.35)	75.6 (64.7-83.1)
	29 - 42	0.10 (0.05-0.20)	90.4 (80.1-95.4)
	43 - 70	0.54 (0.31-0.95)	46.2 (5.3-69.4)
	8 - 14	0.32 (0.22-0.47)	67.8 (53.3-77.8)
Aged 65 and over	1 - 7	0.31 (0.24-0.39)	69.3 (60.6-76.2)
	15 - 28	0.13 (0.11-0.17)	86.6 (83.2-89.4)
	29 - 42	0.10 (0.07-0.15)	89.8 (85.4-92.8)
	43 - 70	0.10 (0.07-0.16)	89.5 (83.7-93.3)
	8 - 14	0.32 (0.26-0.40)	68.2 (60.5-74.3)
COVID-19 death			
All	1 - 7	0.16 (0.04-0.70)	84.2 (29.9-96.4)
	15 - 28	0.17 (0.11-0.25)	83.4 (74.6-89.1)
	29 - 42	0.07 (0.04-0.12)	93.2 (87.6-96.2)
	43 - 70	0.04 (0.02-0.11)	95.8 (89.4-98.3)
	8 - 14	0.19 (0.09-0.38)	81.3 (61.9-90.9)
BNT162b2-BNT162b2	1 - 7	0.00 (0.00-0.00)	100.0 (100.0-100.0)
	15 - 28	0.14 (0.07-0.30)	85.9 (70.3-93.3)
	29 - 42	0.08 (0.03-0.18)	92.0 (81.5-96.5)
	43 - 70	0.06 (0.02-0.16)	94.4 (84.3-98.0)
	8 - 14	0.13 (0.04-0.42)	87.5 (58.4-96.2)
ChAdOx1-ChAdOx1	1 - 7	0.27 (0.06-1.29)	73.1 (-28.8-94.4)
	15 - 28	0.18 (0.11-0.31)	81.7 (69.3-89.1)
	29 - 42	0.06 (0.03-0.14)	94.0 (85.9-97.4)
	43 - 70	0.02 (0.00-0.15)	97.9 (84.6-99.7)
	8 - 14	0.25 (0.10-0.61)	75.1 (38.6-89.9)
Not Clinically Extremely Vulnerable	1 - 7	0.00 (0.00-0.00)	100.0 (100.0-100.0)
	15 - 28	0.19 (0.10-0.35)	80.8 (64.6-89.6)
	29 - 42	0.00 (0.00-0.00)	100.0 (100.0-100.0)
	43 - 70	0.04 (0.01-0.19)	95.6 (80.9-99.0)
	8 - 14	0.04 (0.01-0.33)	95.5 (66.8-99.4)
Clinically Extremely Vulnerable	1 - 7	0.90 (0.13-6.36)	9.9 (-535.9-87.2)
	15 - 28	0.15 (0.08-0.27)	84.9 (72.8-91.6)
	29 - 42	0.15 (0.08-0.28)	85.1 (72.2-92.0)
	43 - 70	0.04 (0.01-0.13)	95.9 (86.9-98.7)
	8 - 14	0.31 (0.14-0.68)	69.2 (31.7-86.1)
Aged 18-64	1 - 7	0.32 (0.03-3.20)	68.1 (-219.8-96.8)
	15 - 28	0.27 (0.07-0.99)	73.2 (0.7-92.8)

	29 - 42	0.28 (0.07-1.10)	72.4 (-10.1-93.1)
	43 - 70	0.11 (0.01-0.94)	89.4 (5.5-98.8)
	8 - 14	0.23 (0.05-1.07)	77.2 (-7.2-95.2)
Aged 65 and over	1 - 7	0.11 (0.01-0.84)	89.4 (15.9-98.7)
	15 - 28	0.16 (0.10-0.25)	84.4 (75.5-90.1)
	29 - 42	0.05 (0.03-0.11)	94.6 (89.3-97.3)
	43 - 70	0.04 (0.01-0.10)	96.3 (89.7-98.7)
	8 - 14	0.18 (0.08-0.40)	82.3 (60.3-92.1)
Non-COVID-19 death			
All	1 - 7	0.08 (0.07-0.10)	91.8 (90.3-93.0)
	15 - 28	0.21 (0.19-0.24)	79.0 (76.4-81.3)
	29 - 42	0.16 (0.14-0.19)	83.7 (81.2-85.8)
	43 - 70	0.17 (0.15-0.20)	82.6 (79.7-85.1)
	8 - 14	0.26 (0.22-0.30)	74.4 (70.3-77.9)
BNT162b2-BNT162b2	1 - 7	0.06 (0.05-0.08)	93.8 (92.1-95.2)
	15 - 28	0.20 (0.17-0.24)	80.1 (76.3-83.3)
	29 - 42	0.15 (0.12-0.18)	85.4 (82.0-88.1)
	43 - 70	0.16 (0.13-0.19)	84.2 (80.7-87.1)
	8 - 14	0.21 (0.17-0.26)	79.1 (73.9-83.2)
ChAdOx1-ChAdOx1	1 - 7	0.11 (0.09-0.13)	89.2 (86.6-91.3)
	15 - 28	0.22 (0.19-0.26)	78.0 (74.2-81.2)
	29 - 42	0.18 (0.15-0.22)	81.8 (77.8-85.0)
	43 - 70	0.20 (0.16-0.25)	79.9 (74.6-84.2)
	8 - 14	0.31 (0.25-0.38)	69.0 (62.2-74.6)
Not Clinically Extremely Vulnerable	1 - 7	0.09 (0.08-0.12)	90.5 (88.3-92.3)
	15 - 28	0.20 (0.17-0.23)	80.4 (76.9-83.3)
	29 - 42	0.15 (0.13-0.19)	84.6 (81.2-87.3)
	43 - 70	0.15 (0.12-0.19)	84.9 (81.1-87.9)
	8 - 14	0.27 (0.22-0.33)	72.7 (66.8-77.5)
Clinically Extremely Vulnerable	1 - 7	0.07 (0.05-0.09)	93.2 (91.2-94.7)
	15 - 28	0.23 (0.20-0.27)	76.9 (72.7-80.5)
	29 - 42	0.18 (0.15-0.22)	82.2 (78.3-85.5)
	43 - 70	0.20 (0.16-0.24)	80.4 (75.8-84.1)
	8 - 14	0.24 (0.19-0.30)	76.0 (70.0-80.7)
Aged 18-64	1 - 7	0.10 (0.06-0.16)	90.1 (83.7-94.0)
	15 - 28	0.26 (0.19-0.36)	73.8 (64.1-80.9)
	29 - 42	0.33 (0.21-0.50)	67.2 (49.6-78.7)
	43 - 70	0.22 (0.13-0.39)	77.6 (60.5-87.3)
	8 - 14	0.35 (0.24-0.50)	65.1 (50.0-75.7)
Aged 65 and over	1 - 7	0.08 (0.07-0.09)	92.0 (90.5-93.3)
	15 - 28	0.20 (0.18-0.23)	80.0 (77.3-82.4)
	29 - 42	0.15 (0.13-0.17)	85.1 (82.7-87.2)
	43 - 70	0.17 (0.15-0.20)	82.9 (79.9-85.4)
	8 - 14	0.24 (0.20-0.28)	75.9 (71.7-79.5)

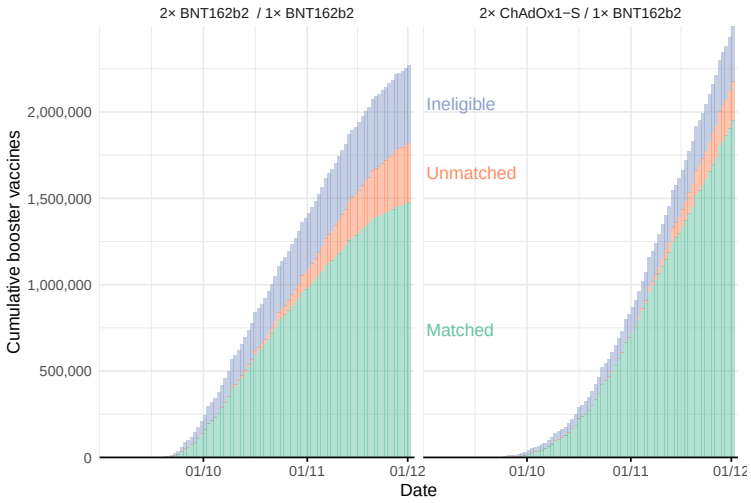
Table 3b: Estimated booster effectiveness (2 period)

Main and subgroup analyses

	Days since booster	HR (95% CI)	VE (95% CI)
Positive SARS-CoV-2 test			
All	1 - 28	0.47 (0.46-0.48)	52.5 (51.5-53.5)
	29 - 70	0.27 (0.25-0.28)	73.5 (72.2-74.7)
BNT162b2-BNT162b2	1 - 28	0.48 (0.47-0.50)	51.5 (49.8-53.2)
	29 - 70	0.31 (0.30-0.33)	68.6 (66.6-70.5)
ChAdOx1-ChAdOx1	1 - 28	0.47 (0.46-0.48)	53.1 (51.9-54.3)
	29 - 70	0.22 (0.20-0.23)	78.3 (76.7-79.8)
Not Clinically Extremely Vulnerable	1 - 28	0.47 (0.46-0.48)	53.3 (52.2-54.3)
	29 - 70	0.27 (0.25-0.28)	73.5 (72.1-74.8)
Clinically Extremely Vulnerable	1 - 28	0.53 (0.50-0.55)	47.5 (44.5-50.2)
	29 - 70	0.27 (0.24-0.30)	72.9 (69.9-75.6)
Aged 18-64	1 - 28	0.48 (0.46-0.49)	52.5 (51.3-53.6)
	29 - 70	0.31 (0.30-0.33)	68.7 (67.0-70.3)
Aged 65 and over	1 - 28	0.50 (0.48-0.52)	50.0 (48.1-51.8)
	29 - 70	0.21 (0.19-0.23)	78.7 (76.6-80.6)
COVID-19 hospitalisation			
All	1 - 28	0.25 (0.22-0.28)	75.4 (72.4-78.1)
	29 - 70	0.13 (0.10-0.16)	87.1 (83.7-89.7)
BNT162b2-BNT162b2	1 - 28	0.28 (0.23-0.33)	72.3 (66.8-76.9)
	29 - 70	0.14 (0.10-0.19)	86.4 (81.2-90.2)
ChAdOx1-ChAdOx1	1 - 28	0.23 (0.20-0.27)	77.2 (73.4-80.4)
	29 - 70	0.13 (0.09-0.18)	87.4 (82.5-90.9)
Not Clinically Extremely Vulnerable	1 - 28	0.22 (0.18-0.26)	78.4 (74.5-81.7)
	29 - 70	0.09 (0.06-0.13)	91.1 (87.0-93.9)
Clinically Extremely Vulnerable	1 - 28	0.30 (0.25-0.35)	70.2 (64.9-74.6)
	29 - 70	0.17 (0.13-0.23)	82.5 (76.6-87.0)
Aged 18-64	1 - 28	0.29 (0.23-0.36)	71.5 (63.9-77.5)
	29 - 70	0.28 (0.18-0.44)	71.8 (56.0-82.0)
Aged 65 and over	1 - 28	0.24 (0.21-0.27)	76.4 (73.1-79.4)
	29 - 70	0.10 (0.08-0.14)	89.7 (86.4-92.2)
COVID-19 death			
All	1 - 28	0.17 (0.12-0.24)	82.9 (75.7-88.0)
	29 - 70	0.06 (0.04-0.10)	94.1 (90.2-96.4)
BNT162b2-BNT162b2	1 - 28	0.00 (0.00-0.00)	99.9 (99.9-100.0)
	29 - 70	0.07 (0.04-0.13)	93.1 (86.7-96.4)
ChAdOx1-ChAdOx1	1 - 28	0.20 (0.13-0.31)	79.8 (68.8-86.9)
	29 - 70	0.05 (0.02-0.11)	94.9 (88.8-97.6)
Not Clinically Extremely Vulnerable	1 - 28	0.00 (0.00-0.00)	100.0 (100.0-100.0)
	29 - 70	0.00 (0.00-0.00)	100.0 (100.0-100.0)
Clinically Extremely Vulnerable	1 - 28	0.21 (0.13-0.34)	78.8 (66.5-86.6)
	29 - 70	0.11 (0.06-0.19)	88.8 (80.6-93.5)
Aged 18-64	1 - 28	0.26 (0.10-0.65)	74.0 (34.9-89.6)
	29 - 70	0.21 (0.07-0.68)	79.0 (32.4-93.5)
Aged 65 and over	1 - 28	0.16 (0.11-0.23)	84.1 (76.7-89.2)
	29 - 70	0.05 (0.03-0.08)	95.2 (91.6-97.3)

Non-COVID-19 death			
All	1 - 28	0.18 (0.16-0.19)	82.2 (80.8-83.6)
	29 - 70	0.17 (0.15-0.19)	83.2 (81.4-84.8)
BNT162b2-BNT162b2	1 - 28	0.15 (0.14-0.17)	84.6 (82.6-86.3)
	29 - 70	0.15 (0.13-0.18)	84.8 (82.4-86.9)
ChAdOx1-ChAdOx1	1 - 28	0.20 (0.18-0.23)	79.7 (77.3-81.7)
	29 - 70	0.19 (0.16-0.22)	81.0 (78.0-83.7)
Not Clinically Extremely Vulnerable	1 - 28	0.18 (0.16-0.20)	82.1 (80.1-84.0)
	29 - 70	0.15 (0.13-0.18)	84.7 (82.3-86.8)
Clinically Extremely Vulnerable	1 - 28	0.18 (0.16-0.20)	81.9 (79.7-84.0)
	29 - 70	0.19 (0.16-0.22)	81.4 (78.5-83.9)
Aged 18-64	1 - 28	0.24 (0.20-0.30)	75.8 (70.0-80.5)
	29 - 70	0.28 (0.20-0.40)	71.5 (59.8-79.8)
Aged 65 and over	1 - 28	0.17 (0.15-0.18)	83.3 (81.8-84.7)
	29 - 70	0.16 (0.14-0.18)	84.1 (82.3-85.8)

Figure 1: Booster vaccination uptake, treatment group eligibility and matching success Cumulative booster vaccination over the duration of the study period, by matching eligibility and matching success. Separately by primary vaccination course.



Estimated booster effectiveness

Main analysis

Participants in the emulated trial experienced 49,884 documented infections, 2,383 COVID-19 hospital admissions, and 454 COVID-19 deaths across 372,967 person-years of follow-up (Table 2).

In the first 28 days of follow-up the estimated effectiveness (95% CI) comparing a BNT162b2 booster dose to two doses only, was 52.5% (51.5-53.5) for documented infection, 75.4% (72.4-78.1) for COVID-19 hospital admission, and 82.9% (75.7-88.0) for COVID-19 death (Figure 2).

For days 28-70, estimated effectiveness (95% CI) comparing a BNT162b2 booster dose to two doses only, was 73.5% (72.2-74.7) for documented infection, 87.1% (83.7-89.7) for COVID-19 hospital admission, and 94.1% (90.2-96.4) for COVID-19 death (Figure 2), suggesting a potential waning of booster effectiveness with time.

Subgroup analyses

In the first 28 days of follow-up the estimated effectiveness (95% CI) comparing a BNT162b2 booster dose to two doses only separately for 2× BNT162b2 and 2× ChAdOx1-S primary course recipients respectively were 51.5% (49.8-53.2) and 53.1% (51.9-54.3) for documented infection, 72.3% (66.8-76.9) and 77.2% (73.4-80.4) for COVID-19 hospital admission, and 99.9% (99.9-100.0) and 79.8% (68.8-86.9) for COVID-19 death (Figure 2).

For days 28-70, the estimated effectiveness (95% CI) comparing a BNT162b2 booster dose to two doses only separately for 2× BNT162b2 and 2× ChAdOx1-S primary course recipients respectively were 68.6% (66.6-70.5) and 78.3% (76.7-79.8) for documented infection, 86.4% (81.2-90.2) and 87.4% (82.5-90.9) for COVID-19 hospital admission, and 93.1% (86.7-96.4) and 94.9% (88.8-97.6) for COVID-19 death (Figure 2).

Figure 2a: Estimated booster effectiveness (5 period) For each outcome based on the fully adjusted model, the period-specific hazard ratios for boosting with BNT162b2 versus not boosting is shown, stratified by primary course.

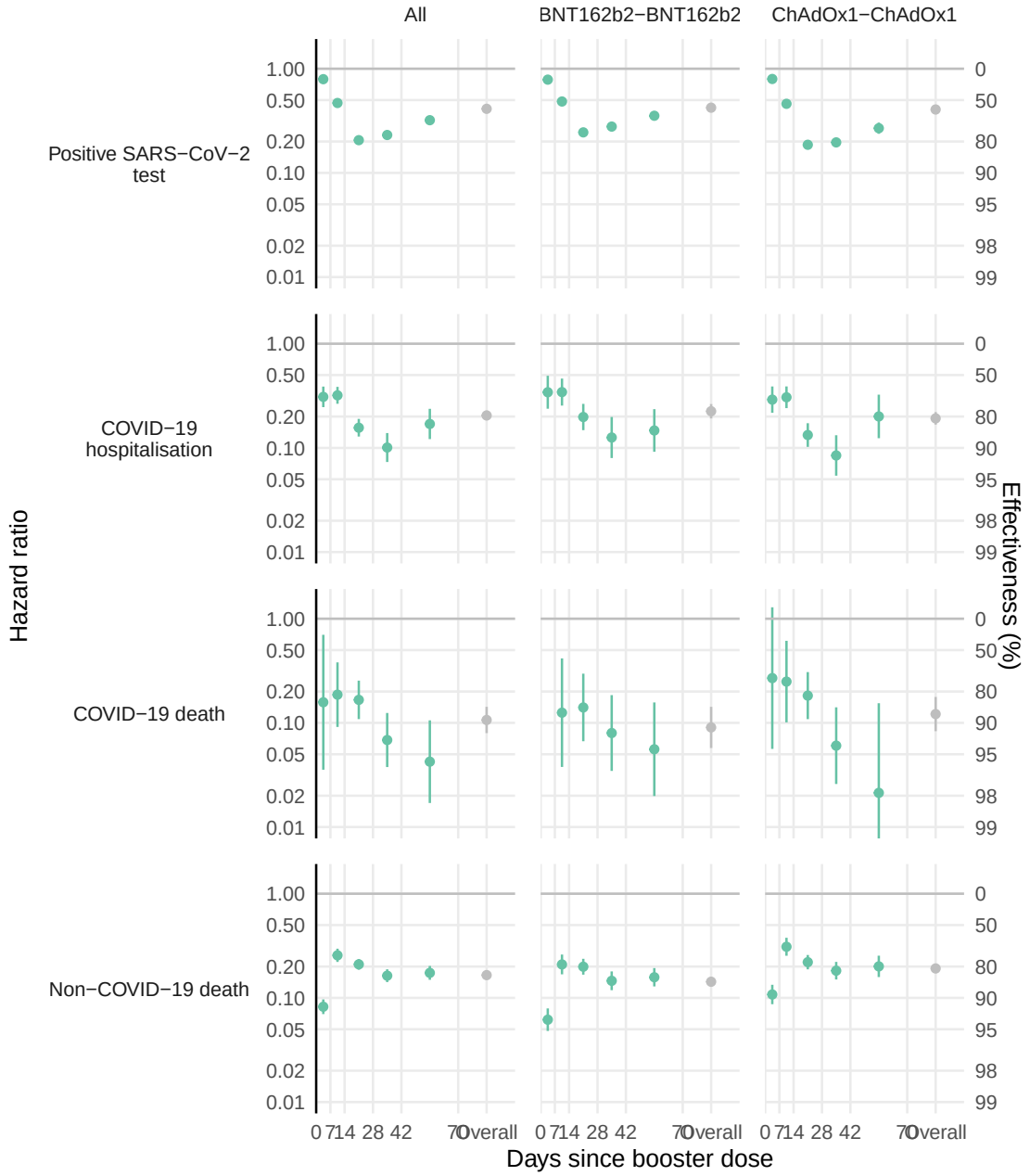


Figure 2b: Estimated booster effectiveness (2 period) For each outcome based on the fully adjusted model, the period-specific hazard ratios for boosting with BNT162b2 versus not boosting is shown, stratified by primary course.