

# THE LANCET

## Supplementary appendix

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## **Supplementary Appendix to:**

### **Risk of infection, hospitalisation, and death up to 9 months after a second dose of COVID-19 vaccine: a retrospective, total population cohort study in Sweden**

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**Supplemental Table 1. Definitions of comorbidities included. Diabetes and hypertension were defined based on prescribed medications or a diagnosis as specified below**

Variable	Definition	Code Type	Codes
<b>Comorbidities</b>			
Myocardial infarction		ICD-10-SE	I21
Stroke		ICD-10-SE	I60-I64
Hypertension	Hypertension Angiotensin-converting enzyme inhibitors/angiotensin II receptor blocker Calcium-receptor blocker Diuretic	ICD-10-SE ATC	I10 C09
Diabetes	Diabetes Antidiabetics	ICD-10-SE ATC	E10, E11 A10
Chronic obstructive pulmonary disease		ICD-10-SE	J40-J44
Asthma		ICD-10-SE	J45, J46
Cancer	Malignant neoplasm	ICD-10-SE	C
Renal failure/chronic kidney disease		ICD-10-SE	N17-N19
COVID-19		ICD-10-SE	U071

Abbreviations: ATC, Anatomical Therapeutic Chemical; ICD-10-SE, International Classification of Diseases, 10<sup>th</sup> Revision

**Supplemental Table 2. Type of SARS-CoV-2 genotypes based on whole genome sequencing week 5-40, 2021 in Sweden. Data was derived from the Public Health Agency of Sweden (<https://www.folkhalsomyndigheten.se/smittskydd-beredskap/utbrott/aktuella-utbrott/covid-19/statistik-och-analyser/sars-cov-2-virusvarianter-av-sarskild-betydelse/>)**

Week number, 2021	Type of SARS-CoV-2 variant				Total number of genomes sequenced‡	Genomes sequenced of total number of cases (%)
	Alfa (B.1.1.7) Number of cases (% of total)*	Beta (B.1.351) Number of cases (% of total)	Gamma (P.1) Number of cases (% of total)	Delta (B.1.617.2) Number of cases (% of total) †		
5	1121 (31.0)	90 (2.5)	6 (0.2)		3620	18
6	2338 (45.2)	175 (3.5)	5 (0.1)		4956	23
7	3319 (56.1)	223 (3.8)	10 (0.2)		5921	25
8	4458 (63.5)	216 (3.1)	10 (0.1)		7023	26
9	4716 (70.2)	157 (2.3)	6 (<0.1)		6718	24
10	6161 (76.4)	248 (3.1)	6 (<0.1)		8061	28
11	5631 (73.0)	287 (3.7)	9 (0.1)		7713	23
12	6723 (78.9)	333 (3.9)	15 (0.2)		8522	22
13	3693 (69.6)	270 (5.1)	6 (0.1)	18 (0.3)	5309	14
14	3999 (76.5)	140 (2.7)	3 (<0.1)	19 (0.4)	5229	13
15	3734 (76.6)	92 (1.9)	7 (0.1)	26 (0.5)	4874	12
16	3509 (79.7)	115 (2.6)	4 (<0.1)	27 (0.6)	4404	12
17	3516 (77.5)	68 (1.5)	0	20 (0.4)	4537	13
18	4059 (89.5)	78 (1.7)	5 (0.1)	21 (0.5)	4533	13
19	3276 (90.8)	64 (1.8)	13 (0.4)	29 (0.8)	3607	14
20	3383 (90.1)	71 (1.9)	9 (0.2)	40 (1.1)	3753	21
21	1943 (87.6)	39 (1.8)	13 (0.6)	60 (2.7)	2219	28
22	1746 (76.1)	15 (0.7)	31 (1.4)	248 (10.8)	2293	25
23	1509 (64.1)	8 (0.3)	14 (0.6)	576 (24.4)	2356	54
24	1232 (64.2)	8 (0.4)	10 (0.5)	560 (29.1)	1919	67
25	828 (57.2)	7 (0.5)	10 (0.7)	483 (33.4)	1447	73
26	522 (38.1)	2 (0.2)	5 (0.4)	757 (55.3)	1370	73
27	263 (22.7)	1 (<0.1)	3 (0.2)	841 (72.7)	1157	76
28	102 (7.6)	0	3 (0.2)	1213 (90.1)	1341	71
29	57 (3.2)	1 (<0.1)	1 (<0.1)	1692 (96.2)	1758	66
30	36 (1.8)	0	0	2005 (97.4)	2058	59
31	20 (0.8)	1 (<0.1)	0	2601 (98.7)	2636	57
32	9 (0.3)	0	0	3372 (97.9)	3444	59
33	5 (0.2)	0	1 (<0.1)	3324 (96.3)	3452	53
34	4 (0.1)	0	0	3210 (97.7)	3286	49
35	1 (<0.1)	0	1 (<0.1)	3089 (97.7)	3162	44
36	0	0	0	2925 (87.0)	3016	38
37	0	0	0	2528 (97.9)	2579	41
38	0	0	0	1865 (97.4)	1915	44
39	1 (<0.1)	0	0	2033 (97.5)	2085	49
40	0	0	0	2112 (97.6)	2165	52

\* Also includes B.1.1.7 with the mutation E484K. † Also includes subgroups to B.1.617.2 with designations beginning with AY. ‡ The total number of fully sequenced cases also includes those where sequencing has been performed but where genetic group could not be determined.

**Supplemental Table 3. Vaccine effectiveness against COVID-19 hospitalisation or death up to 9 months after full vaccination (>14 days after the second dose) by number of days after the second dose.**

	Vaccinated		Unvaccinated		Vaccine effectiveness, % (95% CI)	
	No. of events	IR/100,000 person-days	No. of events	IR/100,000 person-days	Adjusted for age and baseline date	Fully adjusted*
15-30 days (N=1,685,948)	22	0·09	136	0·56	86 (78-91)	89 (82-93)
31-60 days (N=1,549,267)	65	0·13	354	0·89	88 (85-91)	91 (88-93)
61-120 days (N=1,341,255)	102	0·12	308	0·60	87 (85-90)	90 (88-92)
>120 days (N=575,432)	88	0·11	27	0·12	62 (43-75)	64 (44-77)

\*Adjusted for age, baseline date, sex, homemaker service, place of birth, education, and comorbidities according to Table 1.

**Supplemental Table 4. Baseline characteristics of the second matched cohort (N=3,966,630) at second dose of vaccine**

	Vaccinated N=1,983,315	Unvaccinated N=1,983,315
<b>Baseline date, mean</b>	19 May 2021	19 May 2021
<b>Age, mean ± SD</b>	59·4±17·2	56·8±20·2
<b>Female sex, N (%)</b>	1,119,761 (56·5)	1,022,813 (51·6)
<b>Homemaker service, N (%)</b>	167,481 (8·4)	97,297 (4·9)
<b>Born in Sweden, N (%)</b>	1,682,511 (84·8)	1,320,344 (66·6)
<b>Education, N (%)</b>		
Elementary school < 9yrs	171,954 (8·7)	228,702 (11·5)
Elementary school 9yrs	184,453 (9·3)	249,703 (12·6)
Secondary school, 2 yrs	507,517 (25·6)	490,785 (24·7)
Secondary school, >2 yrs	341,513 (17·2)	311,037 (15·7)
University education	743,795 (37·5)	517,708 (26·1)
Unknown	34,083 (1·7)	186,010 (9·4)
<b>Diagnoses at baseline, N (%)</b>		
Myocardial infarction	65,950 (3·3)	57,839 (2·9)
Stroke	68,991 (3·5)	52,203 (2·6)
Diabetes	231,561 (11·7)	184,588 (9·3)
Hypertension	770,155 (38·8)	592,423 (29·9)
Kidney failure	44,177 (2·2)	30,497 (1·5)
Chronic obstructive pulmonary disease	44,187 (2·2)	41,708 (2·1)
Asthma	101,710 (5·1)	89,472 (4·5)
Cancer	137,929 (7·0)	101,158 (5·1)
SARS-CoV-2 infection	0	0

**Supplemental Table 5. Vaccine effectiveness against SARS-CoV-2 infection of any severity up to 9 months after full vaccination (>14 days after the second dose) in the second matched cohort (N=3,966,630) by number of days after the second dose, according to sex, age, homemaker service, and any comorbidity at baseline**

	Vaccinated		Unvaccinated		Vaccine effectiveness, % (95% CI)	
	No. of events	Incidence rate/100000 person-days	No. of events	Incidence rate/100000 person-days	Adjusted for age and baseline date	Fully adjusted*
<b>Total study cohort (any vaccine)</b>						
<b>15-30 days (N=3,966,630)</b>						
Men (N=1,824,056)	235	0·9	3,502	12·6	89 (88-91)	90 (89-91)
Women N=2,142,574)	420	1·3	3,411	11·6	90 (88-91)	90 (89-91)
<50 years (N=1,129,195)	255	1·5	4,600	28·2	94 (93-95)	94 (93-95)
50-64 years (N=1,306,783)	186	1·0	1,370	7·1	87 (85-89)	87 (85-89)
65-79 years (N=1,072,599)	83	0·5	499	3·3	84 (79-87)	85 (81-88)
≥80 years (N=458,053)	131	1·9	444	7·2	77 (72-81)	78 (74-82)
Any comorbidity (N=1,700,258)	326	1·1	1,692	7·9	85 (83-86)	86 (84-87)
Homemaker service (N=264,778)	136	2·7	207	7·5	78 (72-83)	77 (71-82)
<b>31-60 days (N=3,667,937)</b>						
Men (N=1,683,085)	681	1·3	6,400	13·6	85 (84-86)	86 (85-87)
Women (N=1,984,852)	1,383	2·1	6,589	13·3	85 (84-86)	86 (85-86)
<50 years (N=1,044,921)	913	2·7	8,780	31·9	90 (90-91)	90 (90-91)
50-64 years (N=1,237,496)	646	1·7	3,165	9·2	83 (81-84)	82 (80-83)
65-79 years (N=997,293)	254	0·8	663	2·5	71 (66-75)	73 (68-77)
≥80 years (N=388,227)	251	1·8	381	4·5	72 (68-76)	75 (70-79)
Any comorbidity (N=1,561,378)	835	1·5	2,813	8·1	81 (80-83)	82 (80-83)
Homemaker service (N=244,561)	284	2·9	208	4·7	74 (67-79)	72 (65-78)
<b>61-120 days (N=3,353,855)</b>						
Men (N=1,533,402)	1,417	1·5	6,259	9·0	79 (78-80)	79 (78-80)
Women (N=1,820,453)	2,672	2·2	6,639	9·1	79 (78-80)	79 (78-80)
<50 years (N=936,779)	1,939	3·4	8,100	21·8	83 (82-84)	83 (82-83)
50-64 years (N=1,163,704)	1,226	1·8	3,606	6·9	78 (76-79)	76 (74-78)
65-79 years (N=919,304)	541	0·9	1,011	2·5	69 (65-72)	63 (59-67)
≥80 years (N=334,068)	383	1·4	181	1·6	55 (47-62)	55 (45-63)
Any comorbidity (N=1,429,758)	1,685	1·6	2,911	5·7	76 (74-77)	74 (72-75)
Homemaker service (N=228,320)	437	2·3	194	2·7	57 (47-64)	52 (41-61)
<b>121-180 days (N=1,438,433)</b>						
Men (N=582,945)	420	0·7	363	1·2	45 (36-52)	49 (40-56)
Women (N=855,488)	771	0·8	461	1·3	52 (46-58)	48 (40-54)
<50 years (N=320,382)	536	1·6	367	2·5	50 (43-57)	49 (41-56)
50-64 years (N=280,596)	243	0·8	91	0·8	44 (28-57)	33 (10-50)
65-79 years (N=533,415)	212	0·4	145	0·6	52 (39-61)	43 (27-56)
≥80 years (N=304,040)	200	0·5	221	1·6	65 (57-71)	60 (50-67)
Any comorbidity (N=755,262)	524	0·6	345	1·2	60 (54-66)	56 (48-62)
Homemaker service (N=194,230)	145	0·5	125	1·9	69 (58-77)	64 (51-73)
<b>&gt;180 days (N=504,501)</b>						
Men (N=170,689)	442	1·5	145	2·2	28 (13-41)	26 (8-40)
Women (N=333,812)	1,104	1·7	189	2·2	37 (26-46)	30 (17-41)
<80 years (N=319,194)	1,109	1·8	261	3·0	27 (16-37)	26 (14-37)
≥80 years (N=185,307)	437	1·3	73	1·1	42 (28-54)	35 (17-50)
Any comorbidity (N=292,863)	759	1·3	105	1·6	44 (32-54)	33 (17-46)
Homemaker service (N=146,546)	485	1·6	36	1·5	45 (23-61)	39 (15-56)

\*Adjusted for age, baseline date, sex, homemaker service, place of birth, education, and comorbidities at baseline.

**Supplemental Table 6. Vaccine effectiveness against SARS-CoV-2 infection of any severity up to 9 months after full vaccination (>14 days after the second dose) in the second matched cohort (N=3,966,630) by number of days after the second dose for different vaccine schedules.**

	Vaccinated		Unvaccinated		Vaccine effectiveness, % (95% CI)	Fully adjusted*
	No. of events	IR/100,000 person-days	No. of events	IR/100,000 person-days	Adjusted for age and baseline date	
<b>Total study cohort (any vaccine) (N=3,966,630)</b>	9,545	3·5	33,958	19·3	80 (80-81)	81 (81-81)
15-30 days (N=3,966,630)	655	1·1	6,913	12·1	80 (79-80)	80 (80-81)
31-60 days (N=3,667,937)	2,064	1·7	12,989	13·4	85 (85-86)	86 (85-87)
61-120 days (N=3,353,855)	4,089	1·9	12,898	9·0	79 (78-80)	79 (78-80)
121-180 days (N=1,438,433)	1,191	0·76	824	1·3	50 (45-54)	48 (43-53)
181-210 days (N=504,501)	877	1·0	255	1·8	41 (32-49)	36 (25-45)
>210 days (N=317,272)	669	1·0	79	1·0	5 (-20-25)	1 (-26-22)
<b>BNT162b2 subcohort (N=2,978,586)</b>	7,786	3·7	29,192	22·1	81 (81-82)	82 (81-82)
15-30 days (N=2,978,586)	540	1·2	5,893	13·7	90 (89-91)	91 (90-91)
31-60 days (N=2,748,173)	1,766	2·0	11,412	15·8	86 (85-86)	86 (86-87)
61-120 days (N=2,507,054)	3,073	1·9	10,932	10·3	81 (80-82)	81 (80-82)
121-180 days (N=1,100,197)	904	0·74	641	1·3	53 (48-58)	52 (46-57)
181-210 days (N=463,310)	839	1·0	235	1·8	39 (29-48)	34 (23-44)
>210 days (N=305,797)	664	1·0	79	1·0	5 (-20-25)	3 (-24-24)
<b>mRNA-1273 subcohort (N=370,358)</b>	526	2·2	2,851	17·7	86 (85-87)	87 (86-88)
15-30 days (N=370,358)	41	0·74	765	14·4	94 (92-96)	94 (92-96)
31-60 days (N=339,240)	125	1·1	1,158	13·1	90 (88-92)	91 (89-92)
61-120 days (N=311,639)	210	1·1	802	6·2	82 (79-85)	83 (80-85)
121-180 days (N=134,587)	108	0·75	106	1·6	64 (53-72)	62 (49-72)
>180 days (N=40,223)	42	0·61	20	1·4	63 (35-79)	46 (1-71)
<b>ChAdOx1 nCoV-19 subcohort (N=445,076)</b>	773	3·0	1,180	5·7	51 (46-55)	46 (41-51)
15-30 days (N=445,076)	52	0·78	142	2·2	62 (48-72)	63 (48-74)
31-60 days (N=424,544)	113	0·85	280	2·4	63 (54-70)	57 (46-66)
61-120 days (N=398,819)	491	2·0	714	3·9	51 (45-57)	45 (37-51)
>120 days (N=116,128)	117	1·1	44	0·82	-24 (-76-12)	-33 (-101-12)
<b>ChAdOx1 nCoV-19 and an mRNA vaccine † subcohort (N=166,972)</b>	443	4·2	697	10·2	62 (57-67)	63 (58-68)
15-30 days (N=166,972)	20	0·80	105	4·4	80 (68-88)	79 (66-87)
31-60 days (N=150,907)	55	1·1	117	3·1	64 (49-74)	67 (52-77)
61-120 days (N=76,924)	309	3·2	444	8·4	63 (57-68)	62 (55-68)
>120 days (N=85,508)	59	0·74	31	0·89	16 (-30-46)	20 (-26-50)

\*Adjusted for age, baseline date, sex, homemaker service, place of birth, education, and comorbidities at baseline. † The mRNA vaccine was either BNT162b2 or mRNA-1273

**Supplemental Table 7. Vaccine effectiveness against COVID-19 hospitalisation or death up to 9 months after full vaccination (>14 days after the second dose) in the second matched cohort (N=3,966,630) by number of days after the second dose, according to sex, age, homemaker service, and any comorbidity at baseline**

	Vaccinated		Unvaccinated		Vaccine effectiveness, % (95% CI)	
	No. of events	IR/100,000 days	No. of events	IR/100,000 days	Adjusted for age and baseline date	Fully adjusted*
<b>Total (2 doses of any vaccine)</b>						
<b>15-30 days (N=3,966,630)</b>	42	0·07	398	0·70	91 (88-94)	92 (89-94)
Men (N=1,824,056)	25	0·10	199	0·70	88 (81-92)	90 (84-93)
Women (N=2,142,574)	17	0·05	199	0·70	93 (89-96)	94 (90-96)
<80 years (N=3,508,577)	22	0·04	213	0·42	91 (85-94)	92 (87-95)
≥80 years (N=458,053)	20	0·28	185	3·00	92 (87-95)	92 (88-95)
Any comorbidity (N=1,700,258)	41	0·14	281	1·31	89 (85-92)	91 (87-93)
Homemaker service (N=264,778)	23	0·46	101	3·64	92 (88-95)	92 (87-95)
<b>31-60 days (N=3,675,040)</b>	128	0·11	750	0·77	90 (87-91)	90 (88-92)
Men (N=1,686,584)	66	0·13	368	0·78	86 (82-90)	88 (84-91)
Women (N=1,988,456)	62	0·09	382	0·77	91 (89-93)	91 (88-93)
<80 years (N=3,286,444)	53	0·05	487	0·55	92 (89-94)	92 (89-94)
≥80 years (N=388,596)	75	0·54	263	3·13	88 (84-91)	88 (84-91)
Any comorbidity (N=1,563,063)	123	0·22	478	1·37	87 (85-90)	87 (85-90)
Homemaker service (N=244,779)	76	0·76	120	2·69	89 (85-92)	89 (84-92)
<b>61-120 days (N=3,282,190)</b>	168	0·08	674	0·49	89 (87-91)	89 (86-90)
Men (N=1,499,366)	98	0·11	357	0·53	86 (83-89)	88 (84-90)
Women (N=1,782,824)	70	0·06	317	0·45	91 (89-93)	89 (86-92)
<80 years (N=2,947,640)	73	0·04	562	0·45	93 (91-95)	92 (90-94)
≥80 years (N=334,550)	95	0·35	112	0·96	83 (78-87)	84 (79-88)
Any comorbidity (N=1,421,723)	157	0·15	424	0·85	88 (86-90)	86 (83-88)
Homemaker service (N=228,434)	112	0·58	82	1·15	82 (75-88)	81 (72-87)
<b>&gt;120 days (N=1,194,976)</b>	141	0·09	118	0·21	80 (74-84)	78 (72-83)
Men (N=468,292)	72	0·14	42	0·17	69 (56-78)	68 (52-79)
Women (N=726,684)	69	0·07	76	0·25	85 (79-89)	83 (76-88)
<80 years (N=893,317)	46	0·04	39	0·09	86 (78-90)	86 (77-91)
≥80 years (N=301,659)	95	0·22	79	0·57	76 (68-82)	72 (63-80)
Any comorbidity (N=642,329)	123	0·14	91	0·38	82 (76-86)	79 (72-84)
Homemaker service (N=189,080)	99	0·31	47	0·78	77 (65-84)	71 (58-80)

\*Adjusted for age, baseline date, sex, homemaker service, place of birth, education, and comorbidities at baseline.

**Supplemental Figure 1. Vaccine effectiveness (any vaccine) against COVID-19 hospitalisation or death in 842,974 vaccinated individuals matched to equally number of unvaccinated individuals for up to 9 months of follow-up. The association was illustrated using proportional hazards models with 95% CIs (shaded areas) and restricted cubic splines. The model was adjusted for age, baseline date, sex, homemaker service, place of birth, education, and comorbidities at baseline.**

