

## Supplemental Tables and Figures

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**Figure S6:** Scenario analysis using a dynamic transmission model under optimistic coverage assumptions to estimate the impact of indirect effects on COVID-19 booster vaccination strategies in four age groups and two immunocompromised groups.

**Table S1: Number of non-severe COVID-19 cases, risk, and number needed to treat to avert non-severe COVID-19 in six risk groups with different frequencies of COVID-19 booster vaccination.**

	Total non-severe COVID-19 cases <sup>a</sup>	Absolute annual risk of non-severe COVID-19 (cases per 100,000; UI)	Annual risk reduction of non-severe COVID-19		NNT to avert non-severe COVID-19 case <sup>a</sup>
			Absolute risk averted (cases per 100,000)	Relative risk averted (%)	
<b>One-time booster<sup>b</sup></b>					
18-49 years	439,365	21,968 (15,896-29,893)	--	--	--
50-64 years	355,734	17,787 (12,572-25,166)	--	--	--
65-74 years	265,239	13,262 (9,139-17,272)	--	--	--
75+ years	303,767	15,188 (10,530-19,719)	--	--	--
Immunocompromised (Mild)	358,657	17,933 (12,797-24,261)	--	--	--
Immunocompromised (Moderate/Severe)	363,323	18,166 (12,858-24,605)	--	--	--
<b>Annual booster</b>					
18-49 years	367,029	18,351 (13,220-24,656)	3,617	16%	14
50-64 years	300,898	15,045 (10,768-20,798)	2,742	15%	19
65-74 years	217,293	10,865 (7,906-14,030)	2,397	18%	21
75+ years	250,000	12,500 (9,116-16,127)	2,688	18%	19
Immunocompromised (Mild)	313,786	15,689 (11,257-20,898)	2,244	13%	23
Immunocompromised (Moderate/Severe)	313,923	15,696 (11,274-20,822)	2,470	14%	21
<b>Semiannual booster (every 6 months)</b>					
18-49 years	301,214	15,061 (10,764-20,129)	6,908	31%	8
50-64 years	246,275	12,314 (8,849-17,085)	5,473	31%	10
65-74 years	176,486	8,824 (6,426-11,413)	4,438	33%	12
75+ years	203,741	10,187 (7,443-13,170)	5,001	33%	10
Immunocompromised (Mild)	270,767	13,538 (9,684-18,073)	4,395	25%	12
Immunocompromised (Moderate/Severe)	268,496	13,425 (9,569-17,736)	4,741	26%	11

<sup>a</sup>Estimated over 2-year simulation period in population of 1 million persons.

<sup>b</sup>One-time booster is the baseline intervention for risk reduction calculations.

**Table S2: Number of severe COVID-19 cases, risk, and number needed to treat to avert severe COVID-19 in four age groups among the mild immunocompromised population with different frequencies of COVID-19 booster vaccination.**

	Total severe COVID- 19 cases <sup>a</sup>	Absolute annual risk of severe COVID-19  (cases per 100,000; 95% UI)	Annual risk reduction of severe COVID-19		% Averted severe COVID-19		NNT to avert severe COVID-19 case <sup>a</sup>
			Absolute risk averted (cases per 100,000)	Relative risk averted (%)	No Prior Infection	Prior Infection	
<b>One-time booster<sup>b</sup></b>							
18-49 years	5,851	293 (267-339)	--	--	--	--	--
50-64 years	11,746	587 (539-668)	--	--	--	--	--
65-74 years	30,065	1,503 (1,411-1,612)	--	--	--	--	--
75+ years	80,148	4,007 (3,763-4,296)	--	--	--	--	--
<b>Annual booster</b>							
18-49 years	5,441	272 (243-322)	21	7%	48%	52%	2,440
50-64 years	10,863	543 (490-627)	44	8%	73%	27%	1,133
65-74 years	27,311	1,377 (1,270-1,492)	138	9%	83%	17%	364
75+ years	73,147	3,657 (3,391-4,033)	350	9%	82%	18%	143
<b>Semiannual booster (every 6 months)</b>							
18-49 years	5,173	258 (224-309)	34	12%	49%	51%	1,475
50-64 years	10,070	504 (445-602)	84	14%	71%	29%	597
65-74 years	25,180	1,259 (1,148-1,421)	244	16%	83%	17%	205
75+ years	67,745	3,387 (3,076-3,841)	620	15%	82%	18%	81

<sup>a</sup>Estimated over 2-year simulation period in population of 1 million persons.

<sup>b</sup>One-time booster is the baseline intervention for risk reduction calculations.

**Table S3: Number of severe COVID-19 cases, risk, and number needed to treat to avert severe COVID-19 in four age groups among the moderate/severe immunocompromised population with different frequencies of COVID-19 booster vaccination.**

	Total severe COVID- 19 cases <sup>a</sup>	Absolute annual risk of severe COVID-19  (cases per 100,000; 95% UI)	Annual risk reduction of severe COVID-19		% Averted severe COVID-19		NNT to avert severe COVID-19 case <sup>a</sup>
			Absolute risk averted (cases per 100,000)	Relative risk averted (%)	No Prior Infection	Prior Infection	
<b>One-time booster<sup>b</sup></b>							
18-49 years	6,153	308 (278-353)	--	--	--	--	--
50-64 years	12,498	625 (570-715)	--	--	--	--	--
65-74 years	31,891	1,595 (1,488-1,724)	--	--	--	--	--
75+ years	84,909	4,245 (3,947-4,624)	--	--	--	--	--
<b>Annual booster</b>							
18-49 years	5,353	268 (243-308)	40	13%	31%	69%	1,250
50-64 years	10,829	541 (491-622)	83	13%	51%	49%	600
65-74 years	27,471	1,374 (1,276-1,489)	221	14%	69%	31%	227
75+ years	73,542	3,677 (3,402-4,024)	568	13%	68%	32%	88
<b>Semiannual booster (every 6 months)</b>							
18-49 years	4,842	242 (215-280)	66	21%	32%	68%	763
50-64 years	9,649	482 (435-565)	142	23%	52%	48%	352
65-74 years	24,382	1,219 (1,124-1,345)	375	24%	71%	29%	134
75+ years	65,716	3,286 (3,017-3,642)	960	23%	69%	31%	53

<sup>a</sup>Estimated over 2-year simulation period in population of 1 million persons.

<sup>b</sup>One-time booster is the baseline intervention for risk reduction calculations.

**Table S4: Number of severe COVID-19 cases and risk in six risk groups with no additional COVID-19 booster vaccination.**

	Total severe COVID-19 cases <sup>a</sup>	Absolute annual risk of severe COVID-19
		(cases per 100,000; UI)
No booster given during simulation <sup>b</sup>		
18-49 years	2,249	113 (99-144)
50-64 years	4,620	231 (209-273)
65-74 years	12,062	603 (569-651)
75+ years	31,967	1,598 (1,504-1,730)
Immunocompromised (Mild)	28,094	1,405 (1,312-1,504)
Immunocompromised (Moderate/Severe)	31,276	1,564 (1,461-1,704)

<sup>a</sup>Estimated over 2-year simulation period in population of 1 million persons.

<sup>b</sup>No boosters given during simulation, although persons have received at least one monovalent booster dose prior to the initiation of the simulation.

**Table S5: Sensitivity analysis of pessimistic waning on the number of severe COVID-19 cases, risk, and number needed to treat to avert severe COVID-19 in six risk groups with different frequencies of COVID-19 booster vaccination.**

	Total severe COVID-19 cases <sup>a</sup>	Absolute annual risk of severe COVID-19  (cases per 100,000; UI)	Annual risk reduction of severe COVID-19		NNT to avert severe COVID-19 case <sup>a</sup>
			Absolute risk averted (cases per 100,000)	Relative risk averted (%)	
<b>One-time booster<sup>b</sup></b>					
18-49 years	2,124	106 (91-140)	--	--	--
50-64 years	4,433	222 (197-284)	--	--	--
65-74 years	11,423	571 (528-656)	--	--	--
75+ years	30,451	1,523 (1,409-1,764)	--	--	--
Immunocompromised (Mild)	27,086	1,354 (1,256-1,489)	--	--	--
Immunocompromised (Moderate/Severe)	28,422	1,421 (1,300-1,577)	--	--	--
<b>Annual booster</b>					
18-49 years	1,692	85 (72-104)	22	20%	2,315
50-64 years	3,504	175 (158-210)	46	21%	1,077
65-74 years	9,057	453 (429-491)	118	21%	423
75+ years	24,390	1,220 (1,150-1,328)	303	20%	165
Immunocompromised (Mild)	23,667	1,183 (1,089-1,311)	171	13%	293
Immunocompromised (Moderate/Severe)	23,711	1,186 (1,091-1,307)	236	17%	213
<b>Semiannual booster (every 6 months)</b>					
18-49 years	1,351	68 (58-81)	39	36%	1,294
50-64 years	2,871	144 (132-164)	78	35%	641
65-74 years	7,463	373 (349-395)	198	35%	253
75+ years	20,104	1,005 (951-1,061)	517	34%	97
Immunocompromised (Mild)	21,261	1,063 (968-1,197)	291	22%	172
Immunocompromised (Moderate/Severe)	20,656	1,033 (948-1,140)	388	27%	129

<sup>a</sup>Estimated over 2-year simulation period in population of 1 million persons.

<sup>b</sup>One-time booster is the baseline intervention for risk reduction calculations.

**Table S6: Sensitivity analysis of optimistic waning on the number of severe COVID-19 cases, risk, and number needed to treat to avert severe COVID-19 in six risk groups with different frequencies of COVID-19 booster vaccination.**

	Total severe COVID-19 cases <sup>a</sup>	Absolute annual risk of severe COVID-19  (cases per 100,000; UI)	Annual risk reduction of severe COVID-19		NNT to avert severe COVID-19 case <sup>a</sup>
			Absolute risk averted (cases per 100,000)	Relative risk averted (%)	
<b>One-time booster<sup>b</sup></b>					
18-49 years	1,776	88 (74-120)	--	--	--
50-64 years	3,620	181 (162-212)	--	--	--
65-74 years	9,688	484 (436-527)	--	--	--
75+ years	25,779	1,289 (1,155-1,402)	--	--	--
Immunocompromised (Mild)	24,724	1,236 (1,149-1,351)	--	--	--
Immunocompromised (Moderate/Severe)	26,058	1,303 (1,217-1,420)	--	--	--
<b>Annual booster</b>					
18-49 years	1,657	83 (71-120)	6	7%	8,404
50-64 years	3,305	165 (153-201)	16	9%	3,175
65-74 years	8,734	437 (411-472)	48	10%	1,049
75+ years	23,393	1,170 (1,102-1,255)	119	9%	420
Immunocompromised (Mild)	23,642	1,182 (1,084-1,330)	54	4%	925
Immunocompromised (Moderate/Severe)	23,612	1,181 (1,088-1,318)	122	9%	409
<b>Semiannual booster (every 6 months)</b>					
18-49 years	1,544	78 (65-119)	12	13%	4,311
50-64 years	3,023	151 (140-188)	30	16%	1,676
65-74 years	7,853	393 (372-428)	92	19%	545
75+ years	21,114	1,056 (1,005-1,142)	233	18%	215
Immunocompromised (Mild)	22,571	1,129 (1,010-1,311)	108	9%	465
Immunocompromised (Moderate/Severe)	21,748	1,087 (985-1,245)	216	17%	233

<sup>a</sup>Estimated over 2-year simulation period in population of 1 million persons.

<sup>b</sup>One-time booster is the baseline intervention for risk reduction calculations.



**Table S7: Sensitivity analysis of pessimistic vaccine effectiveness on the number of severe COVID-19 cases, risk, and number needed to treat to avert severe COVID-19 in six risk groups with different frequencies of COVID-19 booster vaccination.**

	Total severe COVID-19 cases <sup>a</sup>	Absolute annual risk of severe COVID-19  (cases per 100,000; UI)	Annual risk reduction of severe COVID-19		NNT to avert severe COVID-19 case <sup>a</sup>
			Absolute risk averted (cases per 100,000)	Relative risk averted (%)	
<b>One-time booster<sup>b</sup></b>					
18-49 years	2,081	104 (90-124)	--	--	--
50-64 years	4,179	209 (189-243)	--	--	--
65-74 years	10,752	538 (503-583)	--	--	--
75+ years	29,029	1,451 (1,356-1,562)	--	--	--
Immunocompromised (Mild)	26,226	1,311 (1,217-1,413)	--	--	--
Immunocompromised (Moderate/Severe)	27,384	1,369 (1,268-1,482)	--	--	--
<b>Annual booster</b>					
18-49 years	1,929	96 (83-116)	8	7%	6,579
50-64 years	3,792	190 (170-226)	19	9%	2,584
65-74 years	9,672	484 (448-533)	54	10%	926
75+ years	26,199	1,310 (1,216-1,443)	142	10%	354
Immunocompromised (Mild)	24,530	1,227 (1,122-1,352)	85	6%	590
Immunocompromised (Moderate/Severe)	24,464	1,223 (1,124-1,342)	146	11%	343
<b>Semiannual booster (every 6 months)</b>					
18-49 years	1,798	90 (76-112)	14	14%	3,534
50-64 years	3,494	175 (153-214)	34	16%	1,460
65-74 years	8,832	442 (402-500)	96	18%	521
75+ years	23,952	1,198 (1,092-1,360)	254	17%	197
Immunocompromised (Mild)	23,164	1,158 (1,039-1,311)	153	12%	327
Immunocompromised (Moderate/Severe)	22,471	1,124 (1,016-1,254)	246	18%	204

<sup>a</sup>Estimated over 2-year simulation period in population of 1 million persons.

<sup>b</sup>One-time booster is the baseline intervention for risk reduction calculations.

**Table S8: Sensitivity analysis of optimistic vaccine effectiveness on the number of severe COVID-19 cases, risk, and number needed to treat to avert severe COVID-19 in six risk groups with different frequencies of COVID-19 booster vaccination.**

	Total severe COVID-19 cases <sup>a</sup>	Absolute annual risk of severe COVID-19  (cases per 100,000; UI)	Annual risk reduction of severe COVID-19  Absolute risk averted (cases per 100,000)		Relative risk averted (%)	NNT to avert severe COVID-19 case <sup>a</sup>
One-time booster <sup>b</sup>						
18-49 years	1,500	75 (0-223)	--	--	--	--
50-64 years	3,567	178 (138-238)	--	--	--	--
65-74 years	10,049	502 (427-593)	--	--	--	--
75+ years	26,374	1,319 (1,092-1,574)	--	--	--	--
Immunocompromised (Mild)	25,023	1,251 (1,176-1,377)	--	--	--	--
Immunocompromised (Moderate/Severe)	27,299	1,365 (1,257-1,565)	--	--	--	--
Annual booster						
18-49 years	1,233	62 (0-84)	13	18%		3,746
50-64 years	2,858	143 (109-164)	35	20%		1,411
65-74 years	7,931	397 (328-442)	106	21%		473
75+ years	21,056	1,053 (857-1,171)	266	20%		189
Immunocompromised (Mild)	21,896	1,095 (1,028-1,222)	156	12%		320
Immunocompromised (Moderate/Severe)	22,228	1,111 (1,036-1,233)	254	19%		198
Semiannual booster (every 6 months)						
18-49 years	991	50 (0-57)	25	34%		1,965
50-64 years	2,294	115 (81-131)	64	36%		786
65-74 years	6,181	309 (225-346)	193	38%		259
75+ years	16,462	823 (599-925)	496	38%		101
Immunocompromised (Mild)	19,388	969 (900-1,105)	282	23%		178
Immunocompromised (Moderate/Severe)	18,702	935 (879-1,019)	430	31%		117

<sup>a</sup>Estimated over 2-year simulation period in population of 1 million persons.

<sup>b</sup>One-time booster is the baseline intervention for risk reduction calculations.

**Table S9: Sensitivity analysis of higher severe COVID-19 incidence on the number of severe COVID-19 cases, risk, and number needed to treat to avert severe COVID-19 in six risk groups with different frequencies of COVID-19 booster vaccination.**

	Total severe COVID-19 cases <sup>a</sup>	Absolute annual risk of severe COVID-19  (cases per 100,000; UI)	Annual risk reduction of severe COVID-19		NNT to avert severe COVID-19 case <sup>a</sup>
			Absolute risk averted (cases per 100,000)	Relative risk averted (%)	
<b>One-time booster<sup>b</sup></b>					
18-49 years	3,331	167 (140-236)	--	--	--
50-64 years	6,878	344 (308-434)	--	--	--
65-74 years	18,438	922 (860-1,025)	--	--	--
75+ years	48,108	2,405 (2,234-2,660)	--	--	--
Immunocompromised (Mild)	46,441	2,322 (2,124-2,612)	--	--	--
Immunocompromised (Moderate/Severe)	49,311	2,466 (2,223-2,800)	--	--	--
<b>Annual booster</b>					
18-49 years	2,973	149 (126-204)	18	11%	2,794
50-64 years	6,044	302 (273-376)	42	12%	1,200
65-74 years	16,134	807 (753-879)	115	12%	435
75+ years	42,292	2,115 (1,986-2,308)	291	13%	172
Immunocompromised (Mild)	43,384	2,169 (1,948-2,497)	153	7%	328
Immunocompromised (Moderate/Severe)	43,681	2,184 (1,962-2,485)	282	11%	178
<b>Semiannual booster (every 6 months)</b>					
18-49 years	2,591	130 (112-177)	37	22%	1,352
50-64 years	5,302	265 (241-325)	79	23%	635
65-74 years	14,058	703 (661-759)	219	24%	229
75+ years	37,158	1,858 (1,753-2,008)	548	23%	92
Immunocompromised (Mild)	40,764	2,038 (1,799-2,407)	284	12%	177
Immunocompromised (Moderate/Severe)	39,606	1,980 (1,765-2,270)	485	20%	104

<sup>a</sup>Estimated over 2-year simulation period in population of 1 million persons.

<sup>b</sup>One-time booster is the baseline intervention for risk reduction calculations.

**Table S10: Sensitivity analysis of lower severe COVID-19 incidence on the number of severe COVID-19 cases, risk, and number needed to treat to avert severe COVID-19 in six risk groups with different frequencies of COVID-19 booster vaccination.**

	Total severe COVID-19 cases <sup>a</sup>	Absolute annual risk of severe COVID-19  (cases per 100,000; UI)	Annual risk reduction of severe COVID-19		NNT to avert severe COVID-19 case <sup>a</sup>
			Absolute risk averted (cases per 100,000)	Relative risk averted (%)	
<b>One-time booster<sup>b</sup></b>					
18-49 years	1,052	53 (46-68)	--	--	--
50-64 years	2,198	110 (100-129)	--	--	--
65-74 years	5,598	280 (266-300)	--	--	--
75+ years	15,216	761 (727-805)	--	--	--
Immunocompromised (Mild)	13,697	685 (640-736)	--	--	--
Immunocompromised (Moderate/Severe)	14,495	725 (678-786)	--	--	--
<b>Annual booster</b>					
18-49 years	883	44 (39-56)	8	16%	5,918
50-64 years	1,823	91 (83-108)	19	17%	2,667
65-74 years	4,693	235 (223-251)	45	16%	1,105
75+ years	12,771	639 (610-676)	122	16%	409
Immunocompromised (Mild)	12,392	620 (575-683)	65	10%	767
Immunocompromised (Moderate/Severe)	12,369	618 (574-676)	106	15%	471
<b>Semiannual booster (every 6 months)</b>					
18-49 years	747	37 (33-48)	15	29%	3,279
50-64 years	1,551	78 (70-90)	32	29%	1,546
65-74 years	3,998	200 (188-213)	80	29%	625
75+ years	10,833	542 (519-574)	219	29%	229
Immunocompromised (Mild)	11,380	569 (518-646)	116	17%	432
Immunocompromised (Moderate/Severe)	10,983	549 (504-609)	176	24%	285

<sup>a</sup>Estimated over 2-year simulation period in population of 1 million persons.

<sup>b</sup>One-time booster is the baseline intervention for risk reduction calculations.

**Table S11: Sensitivity analysis of lower seroprevalence on the number of severe COVID-19 cases, risk, and number needed to treat to avert severe COVID-19 in six risk groups with different frequencies of COVID-19 booster vaccination.**

	Total severe COVID-19 cases <sup>a</sup>	Absolute annual risk of severe COVID-19  (cases per 100,000; UI)	Annual risk reduction of severe COVID-19  Absolute risk averted (cases per 100,000)      Relative risk averted (%)		NNT to avert severe COVID-19 case <sup>a</sup>
One-time booster <sup>b</sup>					
18-49 years	1,794	90 (82-101)	--	--	--
50-64 years	3,968	198 (181-217)	--	--	--
65-74 years	10,374	519 (490-547)	--	--	--
75+ years	27,692	1,385 (1,321-1,464)	--	--	--
Immunocompromised (Mild)	24,926	1,246 (1,188-1,315)	--	--	--
Immunocompromised (Moderate/Severe)	26,305	1,315 (1,248-1,388)	--	--	--
Annual booster					
18-49 years	1,560	78 (70-86)	12	13%	4,274
50-64 years	3,371	169 (156-183)	30	15%	1,676
65-74 years	8,774	439 (417-462)	80	15%	625
75+ years	23,603	1,180 (1,133-1,232)	204	15%	245
Immunocompromised (Mild)	22,637	1,132 (1,070-1,210)	114	9%	437
Immunocompromised (Moderate/Severe)	22,662	1,133 (1,072-1,202)	182	14%	275
Semiannual booster (every 6 months)					
18-49 years	1,336	67 (61-74)	23	26%	2,184
50-64 years	2,903	145 (134-157)	53	27%	939
65-74 years	7,494	375 (359-396)	144	28%	348
75+ years	20,242	1,012 (973-1,054)	373	27%	135
Immunocompromised (Mild)	20,803	1,040 (967-1,140)	206	17%	243
Immunocompromised (Moderate/Severe)	20,151	1,008 (947-1,082)	308	23%	163

<sup>a</sup>Estimated over 2-year simulation period in population of 1 million persons.

<sup>b</sup>One-time booster is the baseline intervention for risk reduction calculations.

**Table S12: Sensitivity analysis of higher seroprevalence on the number of severe COVID-19 cases, risk, and number needed to treat to avert severe COVID-19 in six risk groups with different frequencies of COVID-19 booster vaccination.**

	Total severe COVID-19 cases <sup>a</sup>	Absolute annual risk of severe COVID-19  (cases per 100,000; UI)	Annual risk reduction of severe COVID-19  Absolute risk averted (cases per 100,000)      Relative risk averted (%)		NNT to avert severe COVID-19 case <sup>a</sup>
One-time booster <sup>b</sup>					
18-49 years	2,391	120 (97-128)	--	--	--
50-64 years	4,254	213 (189-271)	--	--	--
65-74 years	10,449	522 (497-616)	--	--	--
75+ years	27,791	1,390 (1,331-1,646)	--	--	--
Immunocompromised (Mild)	25,970	1,299 (1,235-1,491)	--	--	--
Immunocompromised (Moderate/Severe)	27,635	1,382 (1,306-1,600)	--	--	--
Annual booster					
18-49 years	2,032	102 (83-109)	18	15%	2,786
50-64 years	3,644	182 (163-230)	31	14%	1,640
65-74 years	8,874	444 (425-520)	79	15%	635
75+ years	23,783	1,189 (1,143-1,398)	200	14%	250
Immunocompromised (Mild)	24,019	1,201 (1,125-1,411)	98	8%	513
Immunocompromised (Moderate/Severe)	23,966	1,198 (1,130-1,396)	183	13%	273
Semiannual booster (every 6 months)					
18-49 years	1,745	87 (72-93)	32	27%	1,548
50-64 years	3,115	156 (141-194)	57	27%	878
65-74 years	7,599	380 (363-443)	143	27%	351
75+ years	20,494	1,025 (989-1,190)	365	26%	138
Immunocompromised (Mild)	22,416	1,121 (1,034-1,358)	178	14%	282
Immunocompromised (Moderate/Severe)	21,516	1,076 (1,005-1,268)	306	22%	164

<sup>a</sup>Estimated over 2-year simulation period in population of 1 million persons.

<sup>b</sup>One-time booster is the baseline intervention for risk reduction calculations.

**Table S13: Sensitivity analysis of 100% seroprevalence on the number of severe COVID-19 cases, risk, and number needed to treat to avert severe COVID-19 in six risk groups with different frequencies of COVID-19 booster vaccination.**

	Total severe COVID-19 cases <sup>a</sup>	Absolute annual risk of severe COVID-19  (cases per 100,000; UI)	Annual risk reduction of severe COVID-19		NNT to avert severe COVID-19 case <sup>a</sup>
			Absolute risk averted (cases per 100,000)	Relative risk averted (%)	
<b>One-time booster<sup>b</sup></b>					
18-49 years	2,403	120 (117-128)	--	--	--
50-64 years	5,203	260 (255-272)	--	--	--
65-74 years	13,558	678 (671-700)	--	--	--
75+ years	36,870	1,843 (1,839-1,893)	--	--	--
Immunocompromised (Mild)	29,996	1,500 (1,449-1,551)	--	--	--
Immunocompromised (Moderate/Severe)	32,739	1,637 (1,621-1,655)	--	--	--
<b>Annual booster</b>					
18-49 years	2,045	102 (99-109)	18	15%	2,794
50-64 years	4,433	222 (216-231)	39	15%	1,299
65-74 years	11,431	572 (562-592)	106	16%	471
75+ years	31,331	1,567 (1,553-1,594)	277	15%	181
Immunocompromised (Mild)	28,564	1,428 (1,410-1,454)	72	5%	699
Immunocompromised (Moderate/Severe)	28,432	1,422 (1,405-1,439)	215	13%	233
<b>Semiannual booster (every 6 months)</b>					
18-49 years	1,747	87 (82-92)	33	27%	1,525
50-64 years	3,718	186 (180-195)	74	29%	674
65-74 years	9,709	485 (473-496)	192	28%	260
75+ years	26,458	1,323 (1,303-1,346)	521	28%	97
Immunocompromised (Mild)	27,394	1,370 (1,334-1,375)	130	9%	385
Immunocompromised (Moderate/Severe)	25,521	1,276 (1,253-1,307)	361	22%	139

<sup>a</sup>Estimated over 2-year simulation period in population of 1 million persons.

<sup>b</sup>One-time booster is the baseline intervention for risk reduction calculations.

**Table S14: Sensitivity analysis of five-year simulation period on the number of severe COVID-19 cases, risk, and number needed to treat to avert severe COVID-19 in six risk groups with different frequencies of COVID-19 booster vaccination.**

	Total severe COVID-19 cases <sup>a</sup>	Absolute annual risk of severe COVID-19  (cases per 100,000; UI)	Annual risk reduction of severe COVID-19		NNT to avert severe COVID-19 case <sup>a</sup>
			Absolute risk averted (cases per 100,000)	Relative risk averted (%)	
<b>One-time booster<sup>b</sup></b>					
18-49 years	4,693	94 (76-141)	--	--	--
50-64 years	9,488	190 (161-251)	--	--	--
65-74 years	24,828	497 (444-571)	--	--	--
75+ years	63,790	1,276 (1,142-1,473)	--	--	--
Immunocompromised (Mild)	61,048	1,221 (1,117-1,374)	--	--	--
Immunocompromised (Moderate/Severe)	70,131	1,403 (1,253-1,622)	--	--	--
<b>Annual booster</b>					
18-49 years	3,588	72 (59-106)	22	24%	905
50-64 years	7,219	144 (127-187)	45	24%	441
65-74 years	18,989	380 (352-424)	117	24%	172
75+ years	49,785	996 (927-1,109)	280	22%	72
Immunocompromised (Mild)	52,973	1,059 (941-1,242)	162	13%	124
Immunocompromised (Moderate/Severe)	53,646	1,073 (953-1,242)	330	24%	61
<b>Semiannual booster (every 6 months)</b>					
18-49 years	3,107	62 (51-89)	32	34%	631
50-64 years	6,280	126 (112-159)	64	34%	312
65-74 years	16,516	330 (307-364)	166	33%	121
75+ years	43,512	870 (816-956)	406	32%	50
Immunocompromised (Mild)	49,610	992 (864-1,191)	229	19%	88
Immunocompromised (Moderate/Severe)	48,090	962 (848-1,121)	441	31%	46

<sup>a</sup>Estimated over 5-year simulation period in population of 1 million persons.

<sup>b</sup>One-time booster is the baseline intervention for risk reduction calculations.



**Table S15: Sensitivity analysis of delayed vaccine administration on the number of severe COVID-19 cases, risk, and number needed to treat to avert severe COVID-19 in six risk groups with different frequencies of COVID-19 booster vaccination.**

	Total severe COVID-19 cases <sup>a</sup>	Absolute annual risk of severe COVID-19  (cases per 100,000; UI)	Annual risk reduction of severe COVID-19		NNT to avert severe COVID-19 case <sup>a</sup>
			Absolute risk averted (cases per 100,000)	Relative risk averted (%)	
<b>One-time booster<sup>b</sup></b>					
18-49 years	1,900	95 (83-125)	--	--	--
50-64 years	3,964	198 (180-236)	--	--	--
65-74 years	10,299	515 (487-557)	--	--	--
75+ years	27,598	1,380 (1,308-1,475)	--	--	--
Immunocompromised (Mild)	25,596	1,280 (1,194-1,394)	--	--	--
Immunocompromised (Moderate/Severe)	26,941	1,347 (1,246-1,481)	--	--	--
<b>Annual booster</b>					
18-49 years	1,669	83 (72-108)	12	12%	4,330
50-64 years	3,408	170 (156-204)	28	14%	1,799
65-74 years	8,900	445 (421-479)	70	14%	715
75+ years	23,892	1,195 (1,137-1,274)	185	13%	270
Immunocompromised (Mild)	23,608	1,180 (1,089-1,318)	99	8%	504
Immunocompromised (Moderate/Severe)	23,686	1,184 (1,090-1,310)	163	12%	308
<b>Semiannual booster (every 6 months)</b>					
18-49 years	1,447	72 (63-94)	23	24%	2,208
50-64 years	2,997	150 (137-176)	48	24%	1,035
65-74 years	7,752	388 (368-417)	127	25%	393
75+ years	21,026	1,051 (1,001-1,114)	329	24%	153
Immunocompromised (Mild)	22,100	1,105 (1,001-1,264)	175	14%	287
Immunocompromised (Moderate/Severe)	21,467	1,073 (982-1,199)	274	20%	183

<sup>a</sup>Estimated over 2-year simulation period in population of 1 million persons.

<sup>b</sup>One-time booster is the baseline intervention for risk reduction calculations.

**Table S16: Sensitivity analysis of higher sub-clinical infection on the number of severe COVID-19 cases, risk, and number needed to treat to avert severe COVID-19 in six risk groups with different frequencies of COVID-19 booster vaccination.**

	Total severe COVID-19 cases <sup>a</sup>	Absolute annual risk of severe COVID-19  (cases per 100,000; UI)	Annual risk reduction of severe COVID-19  Absolute risk averted (cases per 100,000)		Relative risk averted (%)	NNT to avert severe COVID-19 case <sup>a</sup>
One-time booster <sup>b</sup>						
18-49 years	1,657	83 (69-119)	--	--	--	--
50-64 years	3,444	172 (151-220)	--	--	--	--
65-74 years	9,247	462 (430-515)	--	--	--	--
75+ years	24,326	1,216 (1,128-1,356)	--	--	--	--
Immunocompromised (Mild)	23,654	1,183 (1,081-1,328)	--	--	--	--
Immunocompromised (Moderate/Severe)	25,118	1,256 (1,133-1,423)	--	--	--	--
Annual booster						
18-49 years	1,481	74 (61-104)	9	11%		5,682
50-64 years	3,020	151 (135-190)	21	12%		2,359
65-74 years	8,065	403 (443-376)	59	13%		847
75+ years	21,400	1,070 (1,001-1,178)	146	12%		342
Immunocompromised (Mild)	22,022	1,101 (990-1,268)	82	7%		613
Immunocompromised (Moderate/Severe)	22,161	1,108 (997-1,262)	148	12%		339
Semiannual booster (every 6 months)						
18-49 years	1,288	64 (54-89)	18	22%		2,711
50-64 years	2,653	133 (119-164)	40	23%		1,265
65-74 years	7,030	352 (329-385)	111	24%		452
75+ years	18,752	938 (883-1,023)	279	23%		180
Immunocompromised (Mild)	20,657	1,033 (912-1,217)	150	13%		334
Immunocompromised (Moderate/Severe)	20,018	1,001 (896-1,147)	255	20%		197

<sup>a</sup>Estimated over 2-year simulation period in population of 1 million persons.

<sup>b</sup>One-time booster is the baseline intervention for risk reduction calculations.

**Table S17: Sensitivity analysis of lower vaccine effectiveness for subsequent doses after the first dose on the number of severe COVID-19 cases, risk, and number needed to treat to avert severe COVID-19 in six risk groups with different frequencies of COVID-19 booster vaccination.**

	Total severe COVID-19 cases <sup>a</sup>	Absolute annual risk of severe COVID-19  (cases per 100,000; UI)	Annual risk reduction of severe COVID-19		NNT to avert severe COVID-19 case <sup>a</sup>
			Absolute risk averted (cases per 100,000)	Relative risk averted (%)	
<b>One-time booster<sup>b</sup></b>					
18-49 years	1,949	97 (85-126)	--	--	--
50-64 years	4,041	202 (183-240)	--	--	--
65-74 years	10,422	521 (494-566)	--	--	--
75+ years	27,937	1,397 (1,329-1,504)	--	--	--
Immunocompromised (Mild)	25,797	1,290 (1,203-1,405)	--	--	--
Immunocompromised (Moderate/Severe)	27,340	1,367 (1,263-1,504)	--	--	--
<b>Annual booster</b>					
18-49 years	1,767	88 (77-116)	9	9%	5,495
50-64 years	3,587	179 (166-217)	23	11%	2,203
65-74 years	9,467	473 (448-509)	48	9%	1,048
75+ years	25,398	1,270 (1,210-1,358)	127	9%	394
Immunocompromised (Mild)	24,408	1,220 (1,131-1,347)	69	5%	720
Immunocompromised (Moderate/Severe)	24,832	1,242 (1,147-1,369)	125	9%	399
<b>Semiannual booster (every 6 months)</b>					
18-49 years	1,655	83 (72-108)	15	15%	3,402
50-64 years	3,378	169 (154-201)	33	16%	1,509
65-74 years	8,843	442 (417-472)	79	15%	634
75+ years	23,672	1,184 (1,126-1,261)	213	15%	235
Immunocompromised (Mild)	23,475	1,174 (1,078-1,314)	116	9%	431
Immunocompromised (Moderate/Severe)	23,306	1,165 (1,073-1,291)	202	15%	248

<sup>a</sup>Estimated over 2-year simulation period in population of 1 million persons.

<sup>b</sup>One-time booster is the baseline intervention for risk reduction calculations.