

Supplementary Appendix for:
Now or later: Health impacts of delaying single-dose HPV vaccine implementation in a high-burden setting

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1. Supplementary material & methods

Appendix Table S1. Scenarios for ‘Analysis 1’ (non-inferior single-dose HPV vaccine) and ‘Analysis 2’ (inferior single-dose HPV vaccine)

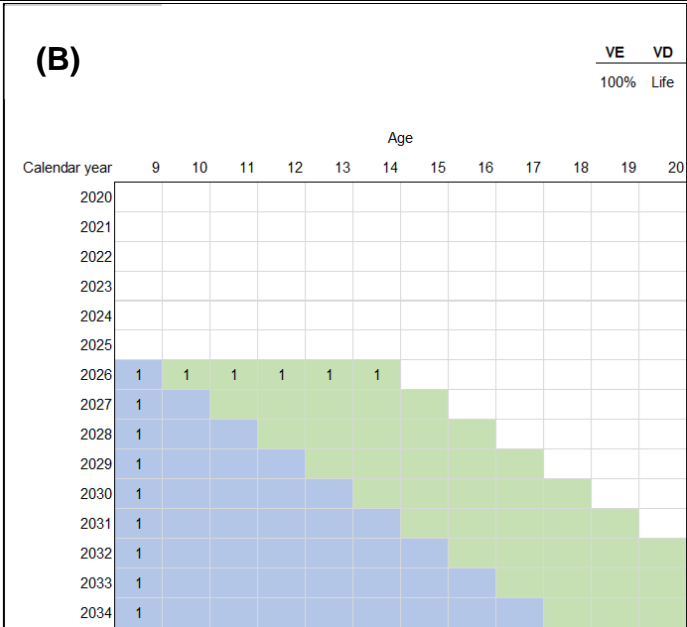
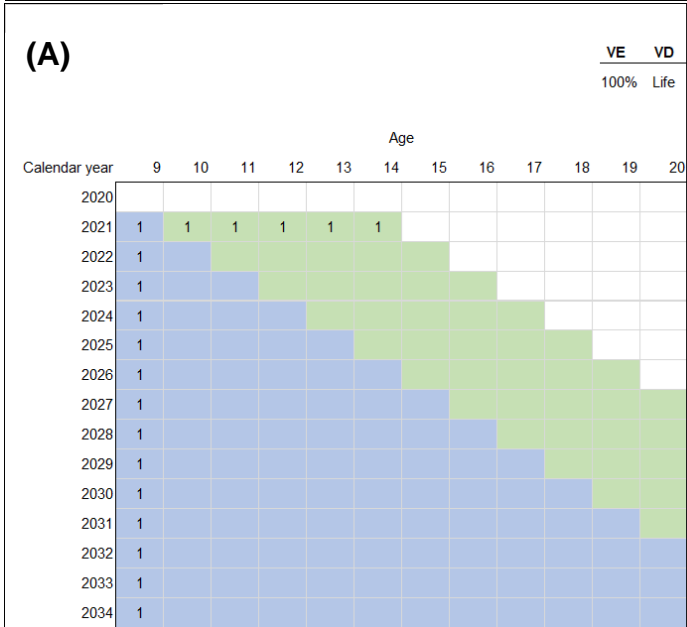
	Scenario	Dosage	Sex	First dose Coverage	Second dose coverage for revaccination for girls aged 10-14 (in 2026)	Second dose coverage for revaccination for girls aged 15-19 (in 2026)	Efficacy	Vaccine duration	Vaccination target ages year 1	Vaccination Start Year	Vaccination policy switch year**	Revaccination delivery approach
Natural history	0	0	-	0			-	-	-	-		-
Analysis I: Non-inferior 1D	1a	1	F	70%	-	-	100%	Lifelong	9, 10-14	2021	-	-
	1b	1	F	70%	-	-	100%	Lifelong	9, 10-14	2026	-	-
Analysis II: Inferior 1D	2	2	F	70%	-	-	100%	Lifelong	9, 10-14	2026	-	-
	2a	1	F	70%	100%	100%	80%	Lifelong	9, 10-14	2021	2026	Targeted
	2b	1	F	70%	0%	0%	80%	Lifelong	9, 10-14	2021	2026	--
	2c	1	F	70%	70%*	0%	80%	Lifelong	9, 10-14	2021	2026	Campaign
	2d	1	F	70%	100%	100%	80%	20	9, 10-14	2021	2026	Targeted
	2e	1	F	70%	0%	0%	80%	20	9, 10-14	2021	2026	--
	2f	1	F	70%	70%*	0%	80%	20	9, 10-14	2021	2026	Campaign

*70% coverage applied to both previously vaccinated and unvaccinated girls; **For routine program and previously vaccinated girls, if applicable

Appendix Figure S1. Single-dose implementation in 2021 with a non-inferior vaccine (A) and ‘delayed’ single-dose implementation in 2026 (B).

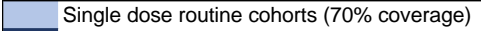
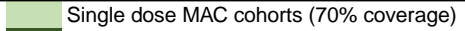

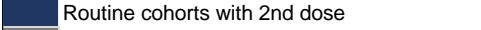
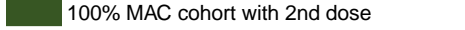

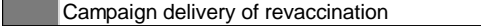

LEGEND:

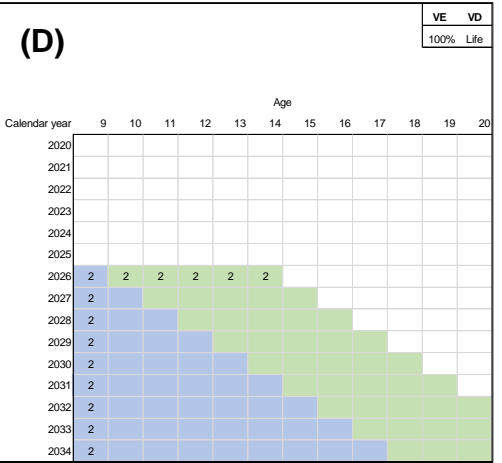
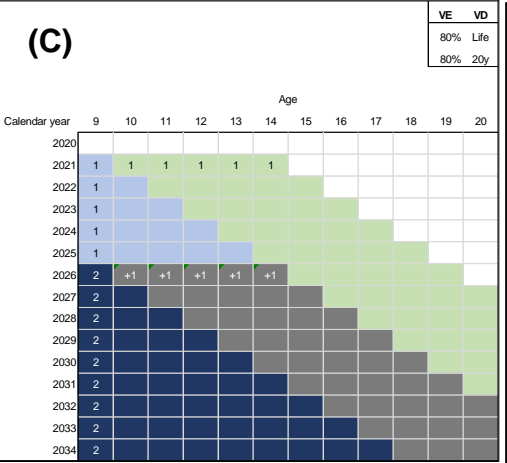
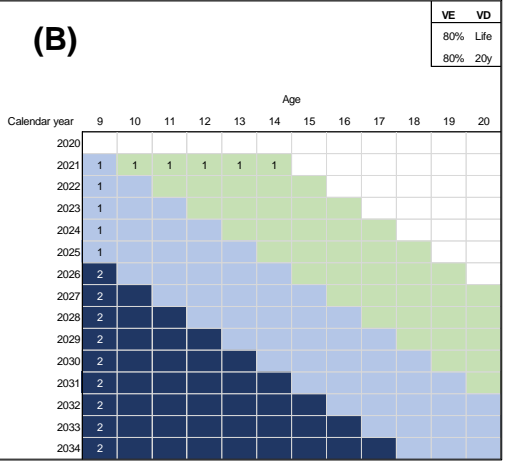
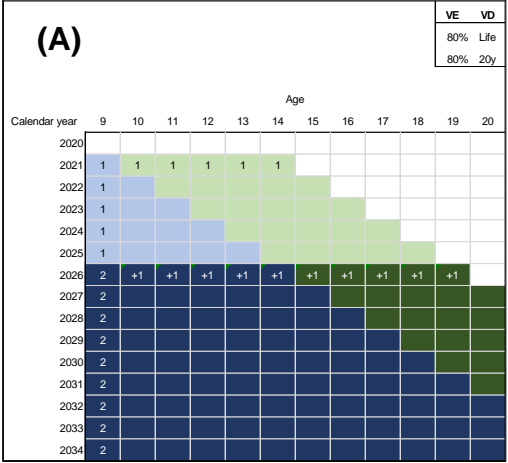
Single dose routine cohorts (70% coverage)	Single dose MAC cohorts (70% coverage)	1	Cohorts get 1 dose
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Appendix Figure S2. Single-dose implementation in 2021 with an inferior vaccine assuming 100% re-vaccination in 2026 (A), 0% revaccination in 2026 (B), campaign delivery revaccination in 2026 (C) and 2-dose delayed vaccination in 2026 (D).

LEGEND:

 Single dose routine cohorts (70% coverage)	 Single dose MAC cohorts (70% coverage)	 1	Cohorts get 1 dose
 Routine cohorts with 2nd dose	 100% MAC cohort with 2nd dose	 +1	Cohorts get 2nd dose
 Campaign delivery of revaccination		 2	Cohorts get 2 doses



Appendix Table S2. Standardized 1 million population in 2021 with growth (to 2120) used to estimate cases averted (see methods)

Age	Year		
	2021	...	2120
0	37046.04	...	58027.94
1	36073.72	...	58492.39
2	35008.35	...	58923.59
3	33991.76	...	59321.71
4	33019.85	...	59222.75
5	32088.49	...	59647.95
6	31193.15	...	60050.73
7	30329.38	...	60433.2
8	29494.91	...	60795.89
9	28686.4	...	61140.99
10	27898.58	...	61469.13
11	27129.68	...	61780.96
12	26380.21	...	62078.1
13	25622.92	...	62363.74
14	24844.01	...	62620.94
15	24052.92	...	62848.72
16	23277.28	...	63167.45
17	22517.05	...	63520.03
18	21745.67	...	63806.56
19	20954.49	...	63978.72
20	20156.86	...	64156.02
21	19372.1	...	64293.31
22	18593.23	...	64402.49
23	17856.23	...	64527.31
24	17179.97	...	64679.75
25	16547.41	...	64804.78
26	15925.2	...	64954.02
27	15322.9	...	65115.32
28	14719.78	...	65248.48
29	14103.12	...	65335.04
30	13485.41	...	65419.6
31	12889.93	...	65448.12
32	12309.71	...	65444.13
33	11763.98	...	65456.33
34	11264.01	...	65516.14
35	10799.02	...	65560.78
36	10345.94	...	65556.78
37	9908.016	...	65518
38	9483.341	...	65467.09
39	9068.152	...	65412.59

Age	Year		
	2021	...	2120
40	8663.06	...	65332.82
41	8272.971	...	65307.35
42	7897.395	...	65316.44
43	7526.602	...	65289.57
44	7156.423	...	65164.14
45	6790.331	...	65012.2
46	6437.158	...	64928.73
47	6096.209	...	64839.15
48	5763.845	...	64659.07
49	5439.452	...	64379.93
50	5125.075	...	64107.37
51	4823.29	...	63655.17
52	4533.647	...	63113.86
53	4261.214	...	62645.42
54	4008.772	...	62358.01
55	3774.523	...	62037.76
56	3552.047	...	61534.34
57	3340.283	...	60984.02
58	3149.817	...	60525.25
59	2984.493	...	60235.57
60	2838.629	...	59930.73
61	2701.023	...	59468.75
62	2571.879	...	58899.88
63	2450.257	...	58318.15
64	2333.95	...	57752.27
65	2221.609	...	57094.72
66	2115.685	...	56791.12
67	2017.448	...	56627.86
68	1909.44	...	56213.27
69	1783.852	...	55219.46
70	1648.249	...	54147.8
71	1517.675	...	53579.62
72	1388.572	...	53135.51
73	1268.994	...	52310.87
74	1164.338	...	50690.68
75	1070.107	...	48958.18
76	977.8381	...	47852.56
77	890.6385	...	46828.05
78	801.2312	...	45219.27
79	705.6509	...	42475.67

Age	Year		
	2021	...	2120
80	608.5989	...	39537.62
81	517.6381	...	37761.14
82	429.9888	...	36416.8
83	356.8523	...	34372.88
84	304.0746	...	31079.05
85	265.9324	...	27997.55
86	230.4066	...	23737.25
87	201.2583	...	19269.98
88	172.437	...	15854.5
89	140.0182	...	18705.49
90	106.373	...	5714.664
91	74.19943	...	4749.786
92	51.87828	...	4058.975
93	41.8215	...	3215.104
94	30.33387	...	2218.215
95	17.4154	...	1608.635
96	10.95617	...	1387.836
97	8.462414	...	1125.624
98	5.723372	...	822.0398
99	2.779924	...	477.0839
Sum	1000000	...	5179058

2. Supplementary results

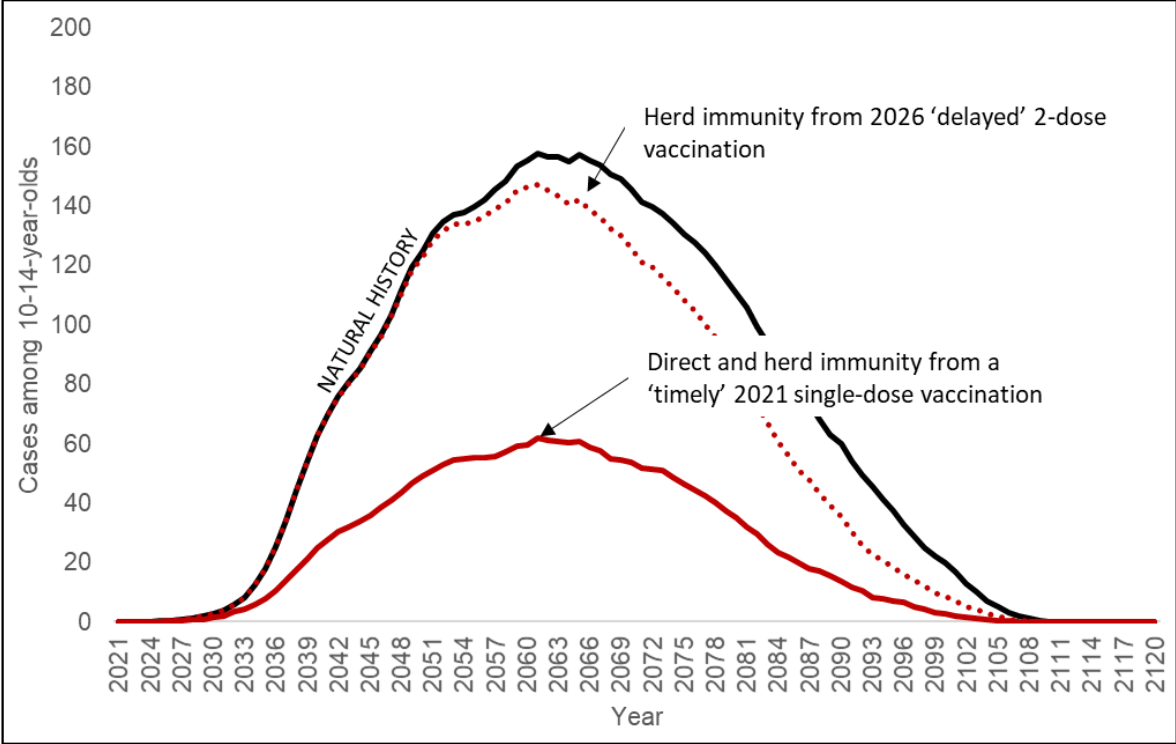
Appendix Table S3. Cumulative number of cases over 2021-2120 by scenario (See Appendix Table S1) for the Harvard model

	Scenario	Cases	Averted vs S0	Averted vs S1b	% increase in averted (immediate vs delay)	Averted vs S2	% increase in averted (immediate vs delay)
Natural history	0	167344					
Analysis I: Non-inferior 1D	1a	50144	117200	5308	9.6%		
	1b	55452	111893				
Analysis II: Inferior 1D	2	55452	111893	--			
	2a	50199	117146			5253	9.5%
	2b	53131	114213			2321	4.2%
	2c	50730	116615			4722	8.5%
	2d	50253	117092			5199	9.4%
	2e	60417	106927			-4965	-9.0%
	2f	56565	110779			-1113	-2.0%

Appendix Table S4. Cumulative number of cases over 2021-2120 by scenario (See Appendix Table S1) for the HPV-ADVISE model

	Scenario	Cases	Averted vs S0	Averted vs S1b	% increase in averted (immediate vs delay)	Averted vs S2	% increase in averted (immediate vs delay)
Natural history	0	192920					
Analysis I: Non-inferior 1D	1a	76745	116174	5933	7.2%		
	1b	82679	110241				
Analysis II: Inferior 1D	2	82679	110241	--			
	2a	76624	116295			6054	7.3%
	2b	79408	113511			3270	4.0%
	2c	76988	115932			5691	6.9%
	2d	76675	116244			6003	7.3%
	2e	79277	113643			3402	4.1%
	2f	76921	115999			5758	7.0%

Appendix Figure S3. Cervical cancer cases among the 10-14 years-old in 2021 assuming a non-inferior single-dose HPV vaccination program was implemented in 2021 or delayed until 2026, i.e., ‘Analysis 1’ (for the Harvard model only). Cases are estimated for a starting cohort of 1 million women alive in 2021 over 2021-2120 (inclusive). For the 2026 ‘delay’ scenario, these girls were age-ineligible for vaccination by 2026; therefore, health benefits are indirect only, i.e., herd immunity. The cohort size for the 10-14-year-old 2021 starting cohort is approximately 132,000.



Appendix Figure S4. Age-standardized incidence per 100,000 women over time by revaccination approach for an inferior (80% efficacy with a 20-year duration (5-year standard deviation)) single dose human papillomavirus (HPV) vaccination program implemented in 2021 with a switch to a 2-dose program in 2026 compared with a delayed 2-dose program implemented in 2026 for the A) Harvard and B) HPV-ADVISE simulation models. Cases averted are compared with a 2-dose vaccination program implemented in 2026 and are estimated for a starting cohort of 1 million women alive in 2021 over 2021-2120 (inclusive). Stochastic noise in HPV-ADVISE leads to a small increase in the number of cases averted for the 100% revaccination scenario compared with the cases averted shown in main manuscript Figure 1.

