Dynamics of HPV - the Impact of Vaccinating Females at Different Age

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Introduction

• human papillomavirus, or HPV, is a sexually transmittable virus infection, which is not only the main, but also necessary risk factor for developing cervical cancer;
•about 70 percent of the sexually active population have acquired a virus of this type at some point of their lives;
•among the oncogenic HPVs, the most severe one is type 16, present in about half of all cervical cancer cases.

Problem statement (scenarios)

a) no vaccination or

vaccination of:

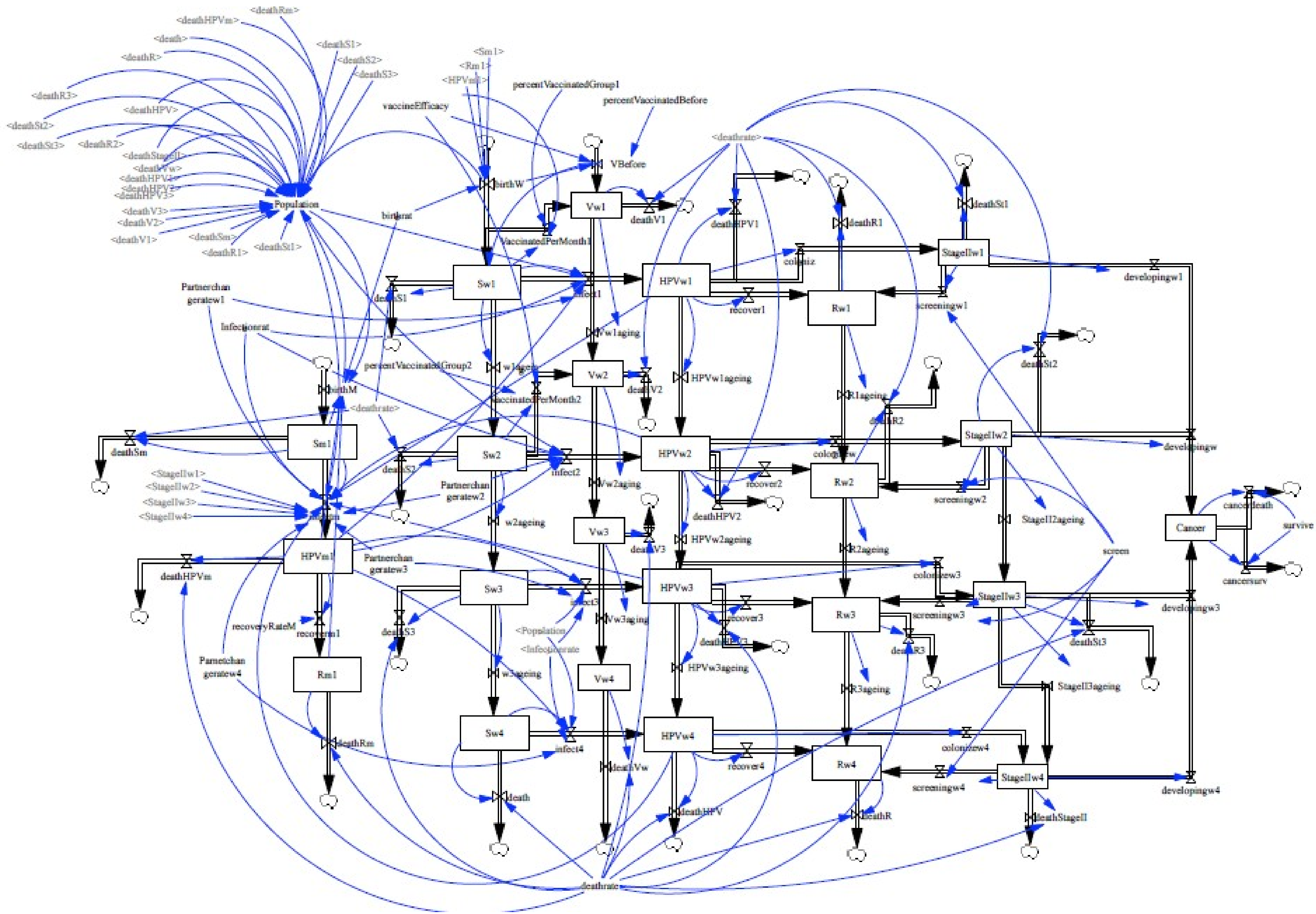
- 14 years old girls (before sexual debut),

- girls at age 15-19;

- girls at age 20-24;

b) with 75% or 90% of vaccination coverage;

c) for effective screening frequencies for testing for having cell pathology every 4 or 6 years.



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deathR
deathStageII
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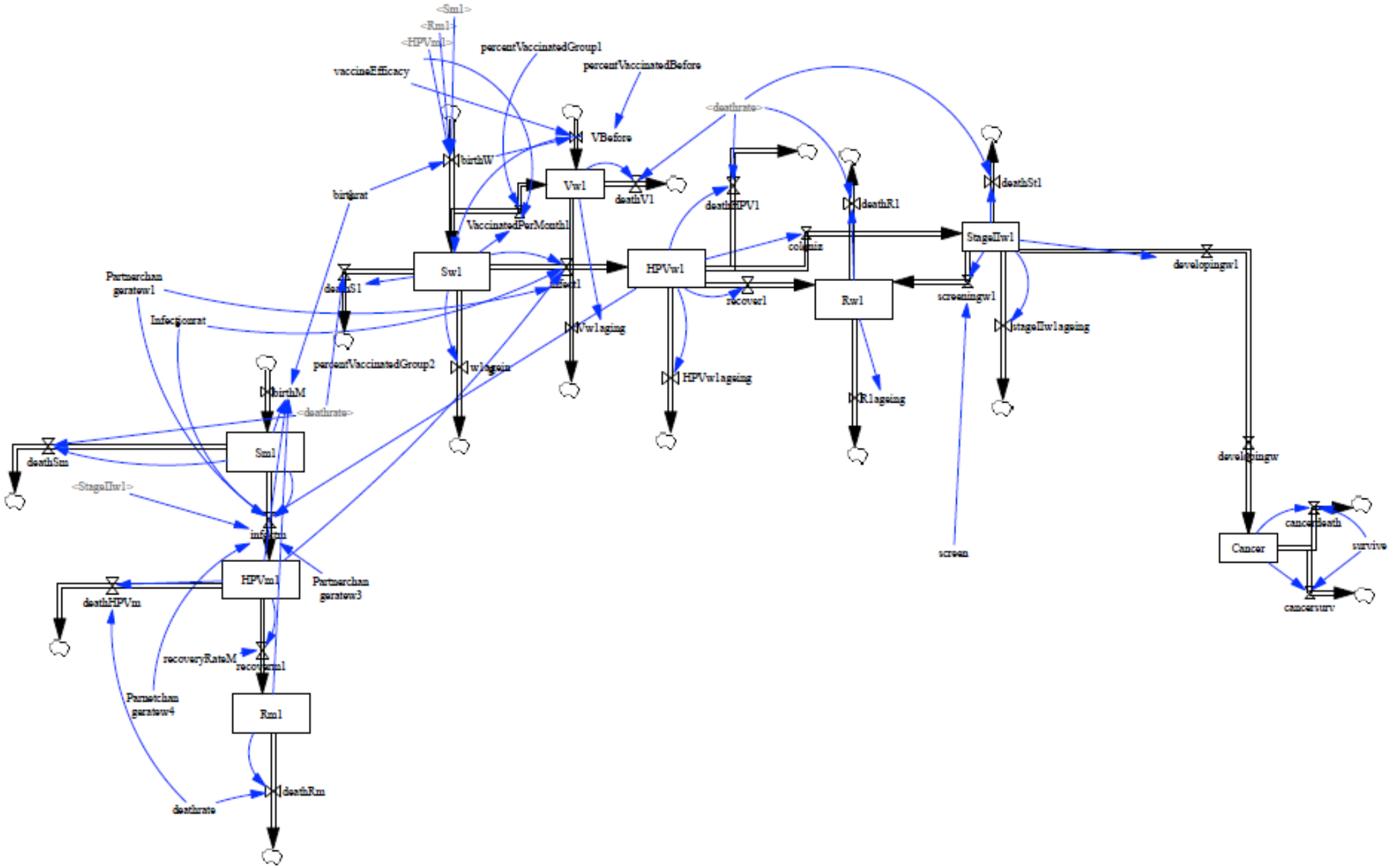
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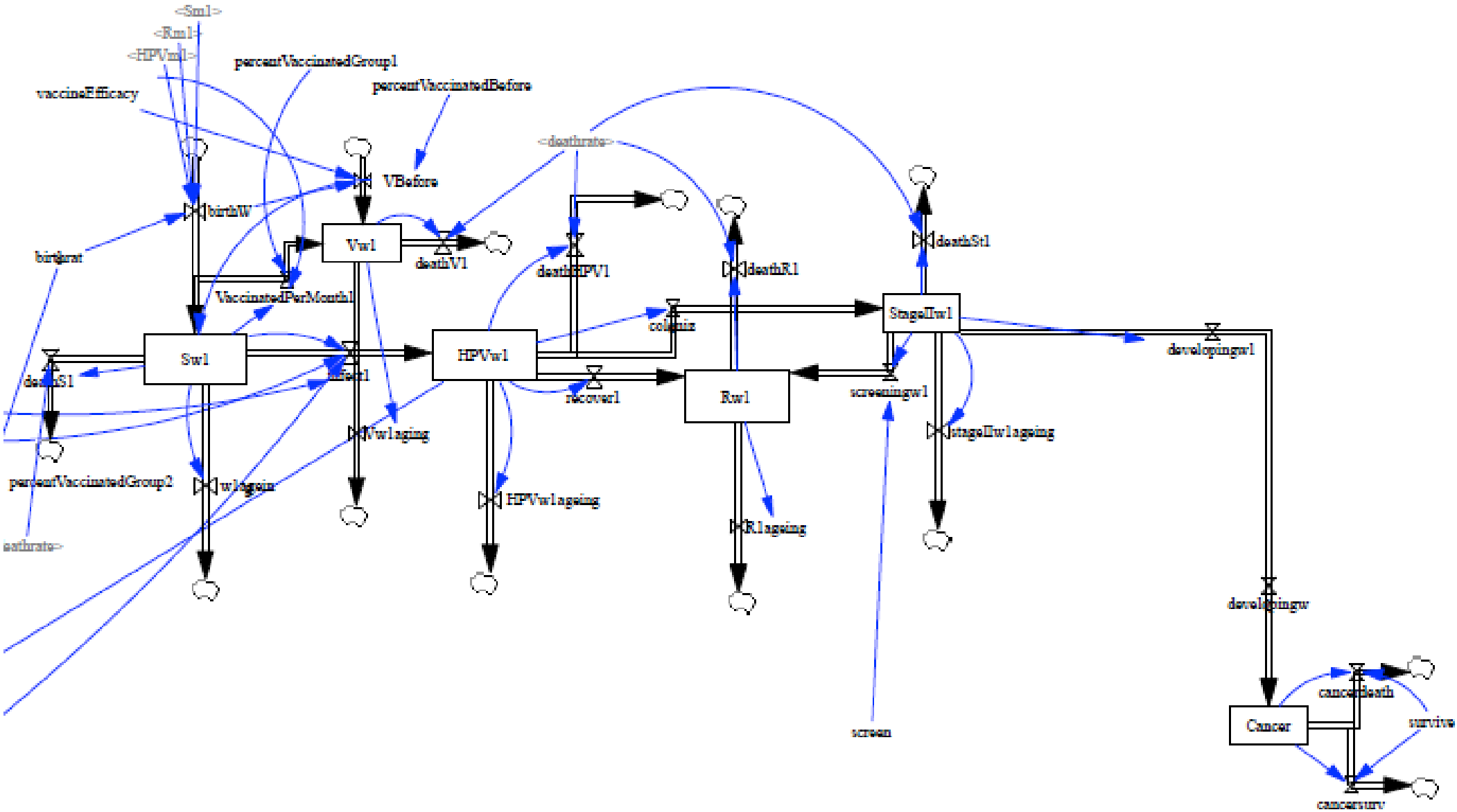
Rm1
deathRm
deathrate

Table Proportion in activity groups *Activity in the last group is the average of 5 year groups from 35 to 49 and extrapolated activity from 50 until 65 years.

Age (years)	Highest activity	Moderately high activity	Moderate activity	Lowest activity
15 – 19	0.015	0.03	0.135	0.82
20 – 24	0.015	0.025	0.34	0.62
25 – 34	0.01	0.02	0.21	0.76
35 – 65*	0.005	0.01	0.09	0.895

Mean rate of sexual partner change (new partners per year) for activity groups

Age (years)	Highest activity	Moderately high activity	Moderate activity	Lowest activity
15 – 19	15	3.50	1.34	0.48
20 – 24	17.5	0.96	0.38	0.14
25 – 34	15	0.67	0.21	0.08
35 – 65	7.5	0.45	0.08	0.04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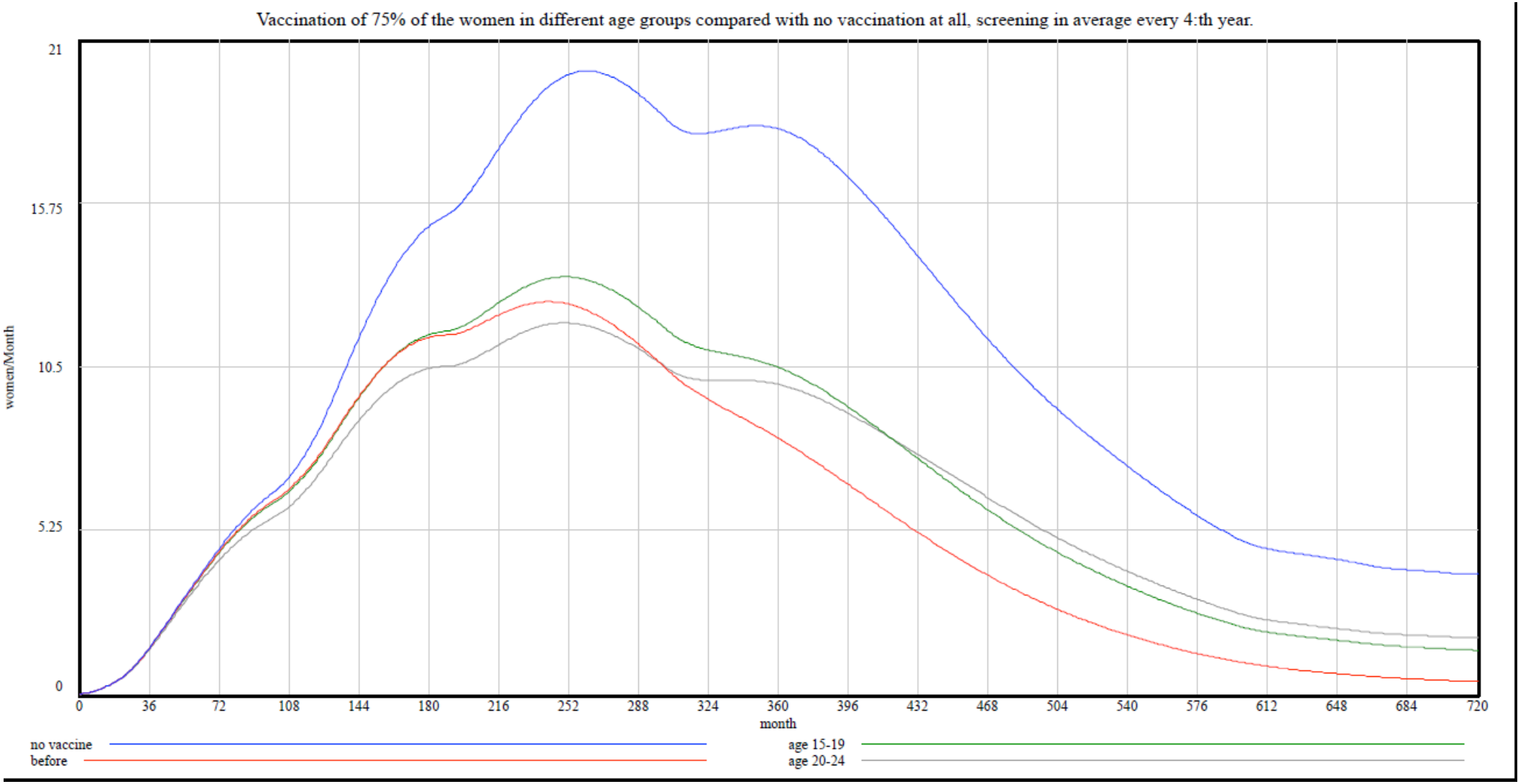
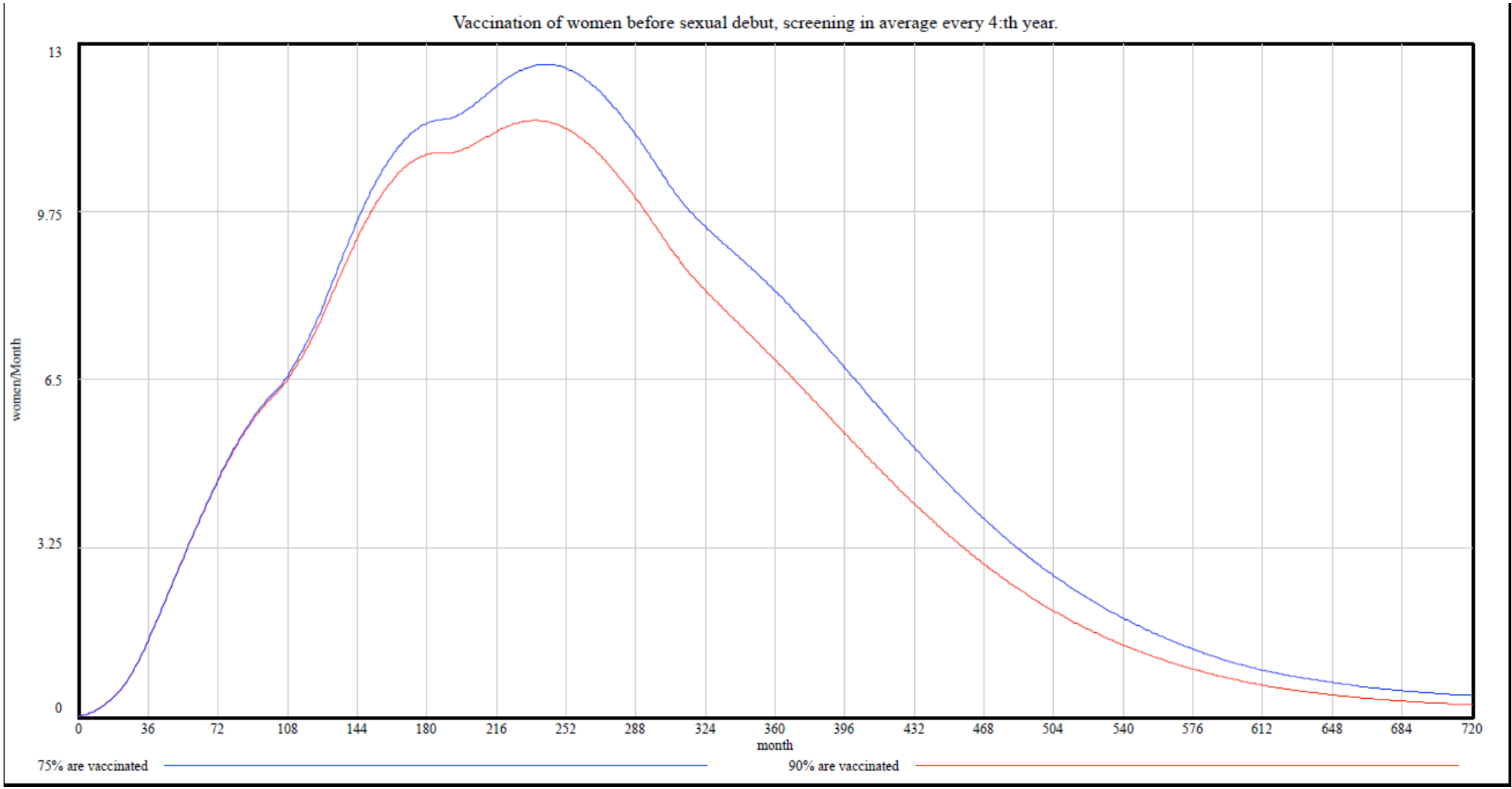
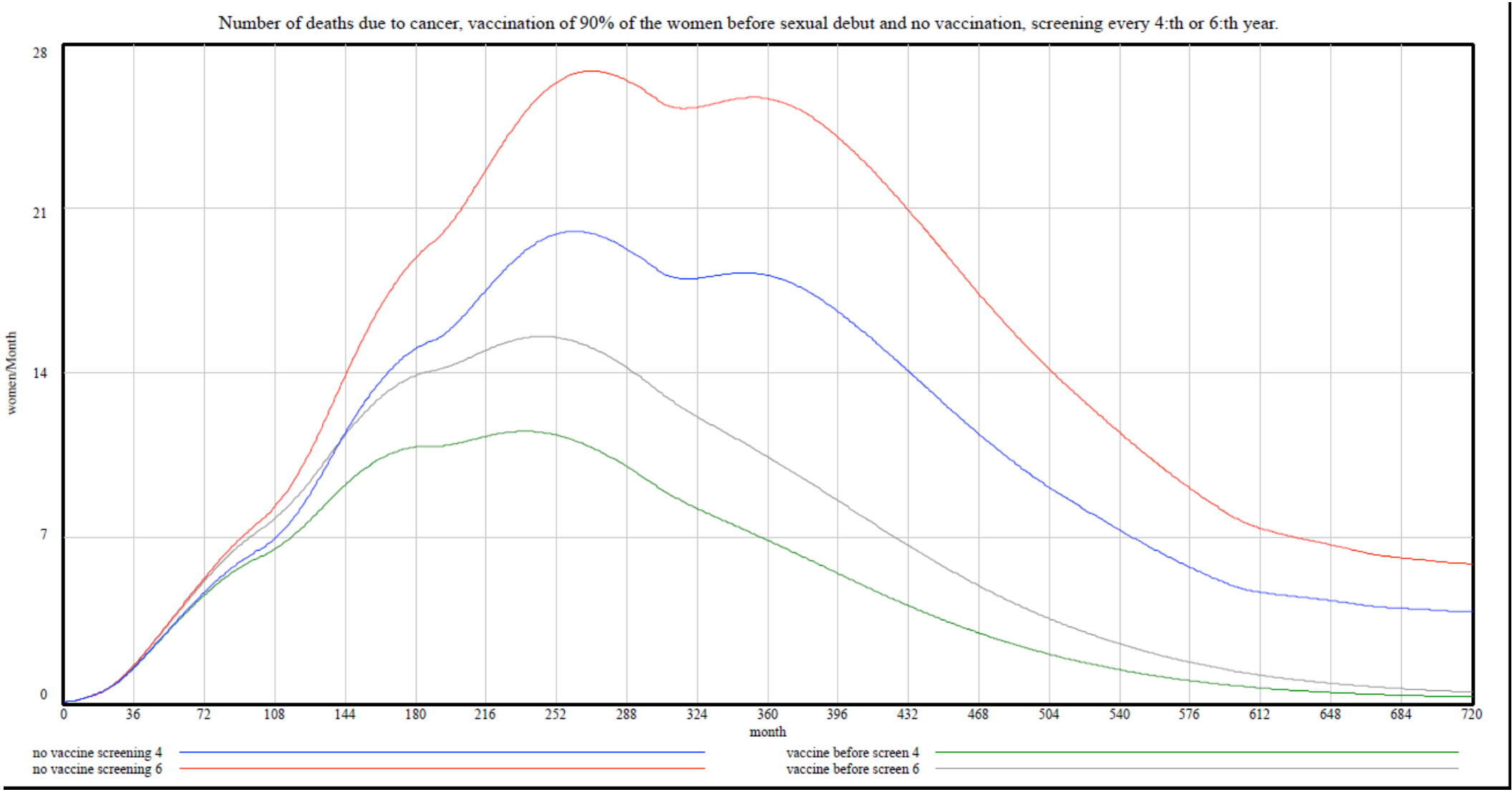

Vaccination of 75% of the women in different age groups compared with no vaccination at all, screening in average every 4:th year.
21
15.75
10.5
5.25
0
women/Month
0
36
72
108
144
180
216
252
288
324
360
396
432
468
504
540
576
612
648
684
720
month
no vaccine
before
age 15-19
age 20-24


Vaccination of women before sexual debut, screening in average every 4:th year.
13
9.75
6.5
3.25
0
women/Month
0
36
72
108
144
180
216
252
288
324
360
396
432
468
504
540
576
612
648
684
720
month
75% are vaccinated
90% are vaccinated


Number of deaths due to cancer, vaccination of 90% of the women before sexual debut and no vaccination, screening every 4:th or 6:th year.
28
21
14
7
0
women/Month
0
36
72
108
144
180
216
252
288
324
360
396
432
468
504
540
576
612
648
684
720
month
no vaccine screening 4
no vaccine screening 6
vaccine before screen 4
vaccine before screen 6

Results - table of cervical cancer death incidences

Scerario	First month of year 20	First month of year 50	total (60 years)
No vaccine, screen 6	25.36	7.82	10624
No vaccine, screen 4	19.36	4.90	7630
Vaccine age $15-19$, 75%, screen 6	17.74	3.72	6754
Vaccine age $20-24$, 75%, screen 6	15.82	4.27	6485
Vaccine age $15-19$, 90%, screen 6	16.88	3.30	6333
Vaccine age $20-24$, 90%, screen 6	15.78	4.26	6468
Vaccine before, 75%, screen 6	16.88	1.85	5608
Vaccine before, 90%, screen 6	15.51	1.30	4961
Vaccine age $15-19$, 75%, screen 4	13.29	2.14	4782
Vaccine age $20-24$, 75%, screen 4	11.83	2.54	4594
Vaccine age $15-19$, 90%, screen 4	11.80	2.53	4582
Vaccine age $20-24$, 90%, screen 4	12.61	1.87	4482
Vaccine before, 75%, screen 4	12.58	1.00	4003
Vaccine before, 90%, screen 4	11.50	0.68	3552

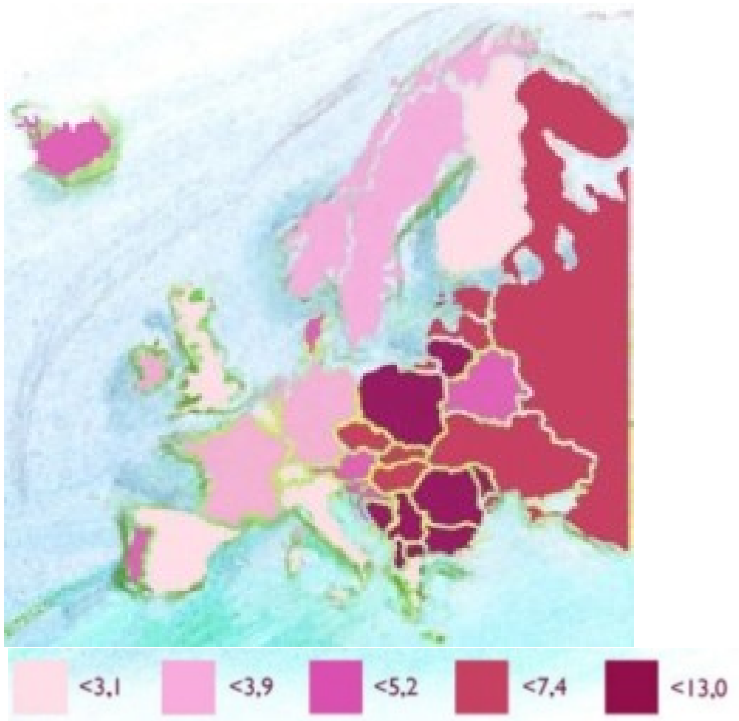
Conclusions

- The best strategy, in the long run and with respect to the total number of cervical cancer deaths, is to vaccinate girls before starting the sexual life.
- It is necessary to stay with short screening intervals, because it also has a big impact on results.
- Vaccination coverage is not as important.
- The intervention seems to be needed...

Limits

- In order to imitate multistrain reality, we needed to increase the amount of infection, so we multiplied the partner change rates by 2.75, to get a reasonable number of cancer incidents in Sweden.
- We assume that both natural and vaccine acquired immunity are lifelong.

Against HPV!!!



Deaths on 100000 woman

[source] www.pzh.gov.pl

Thank you for attention