

Assessing Policy Options Health Impacts

Three questions decision makers ask:

1. How big is the problem?

2. What can we do about it?

- What interventions do we have to address the problem?
- Which intervention has the most impact?

Models can help
estimate the
impact of
interventions

3. How much will it cost?

- What resources are required to address the problem?
- Do we have enough resources (ex: people, supplies, equipment, time)?

Review & Preview

- **Last lecture:**
 - How to frame an economic evaluation?
- **This lecture:**
 - Health impact of a program (or policy option): Does it have a meaningful health impact?
- **Next lecture:**
 - Can you afford the intervention (policy option)?

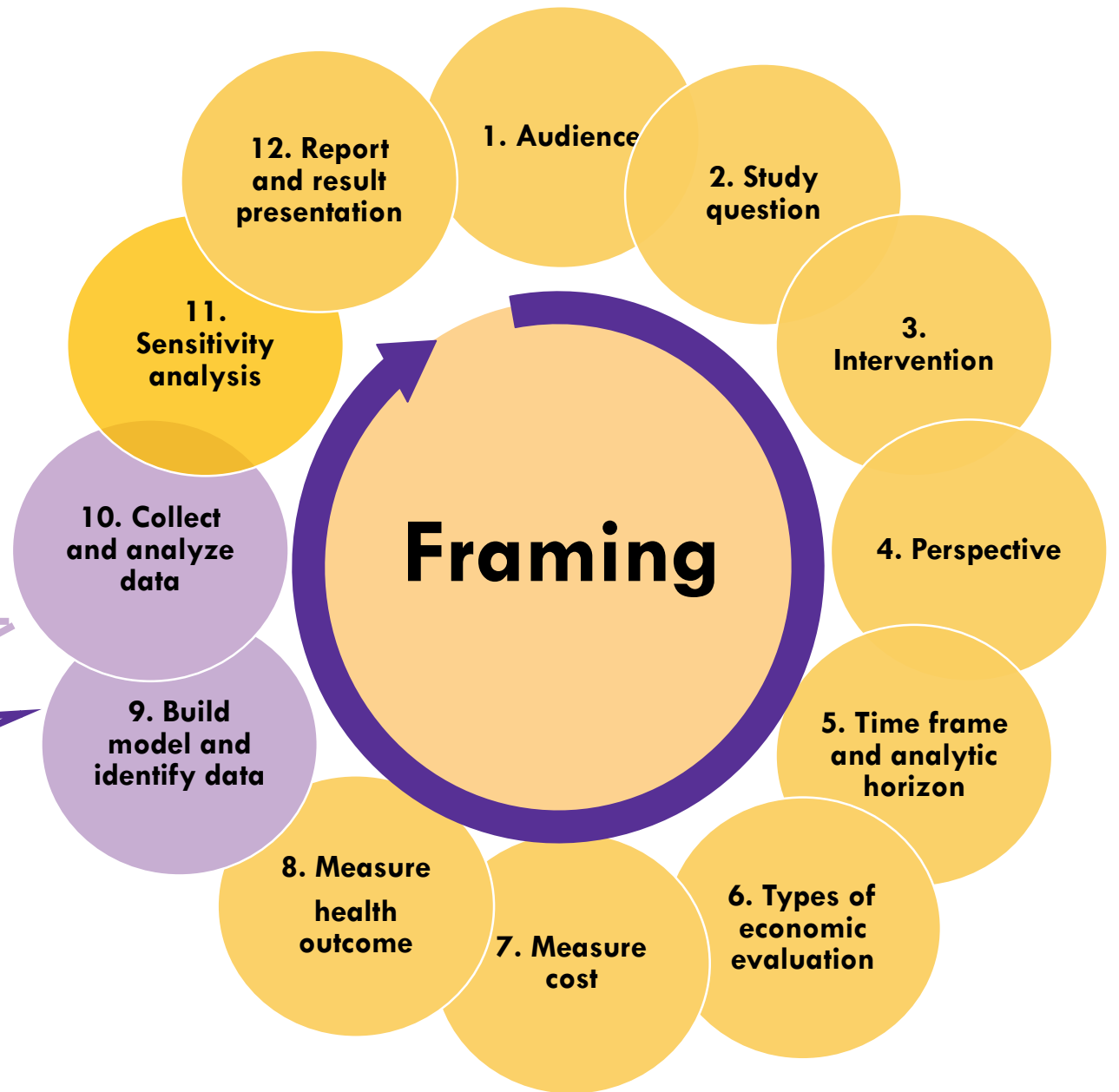
Learning objectives

At the end of this module, you will be able to:

- Model and estimate the health impact of a policy option
- Construct a decision tree
- Identify the information needed to use the model



Assess Health Impact



Why use models?

- **Models help (economic and health futures, etc.), when we:**
 - Have limited epidemiologic data and need to fill in gaps
 - Want to evaluate answers to “intuition” and “what if” analyses (such as new vaccine) before committing
- **Ebola example (2014, West Africa)**
 - Few data available early during epidemic
 - Modeling used to estimate that without interventions, 1.4M people would contract Ebola, while specific interventions could reduce ~10,000 cases
 - Led to ~\$2B in funding sent to region to intervene

Need data to support intervention proposal

- **Proposed intervention:** Screen and treat pregnant women for syphilis, in Philippines
 - How convincing is this proposed intervention?
- **Data supporting the effectiveness of this option:**
 - In the Philippines, 15% of pregnant women are infected with syphilis
 - Early antibiotic treatment for syphilis during pregnancy can prevent nearly all syphilis-associated adverse outcomes (including perinatal deaths)
- **Is this sufficient information to argue for screen and treat option?**
 - What about the effect of screen and treat option on perinatal deaths, the outcome of interest?
- **More data:**
 - Screen and treat program implementation is estimated to prevent 400 infant deaths each year
 - A similar program in Mozambique effectively prevented congenital syphilis at \$50 per case

Health impact estimation

Use data to project **changes in health outcomes** from a **proposed intervention**, based on the **specific situation** in which the intervention will be implemented.

Tools to evaluate proposed intervention

- Many tools exist to model and evaluate interventions
- Evaluation tool is chosen based on:
 - Available software
 - Data
 - Output
 - Potential use i.e. will others be able to use and access the tool as well?

Simple and accessible is often the right option - for broader use!

We primarily focus on decision trees, which require no special tech

What is a decision tree?

- **Systematic visual representation of decisions, processes, and outcomes**
 - Each decision point splits off until you reach the outcome
- **Compares expected outcomes of various intervention options**
 - Uses probabilities
 - Enables selection of most effective option
- **Decision tree components:**



Decision node



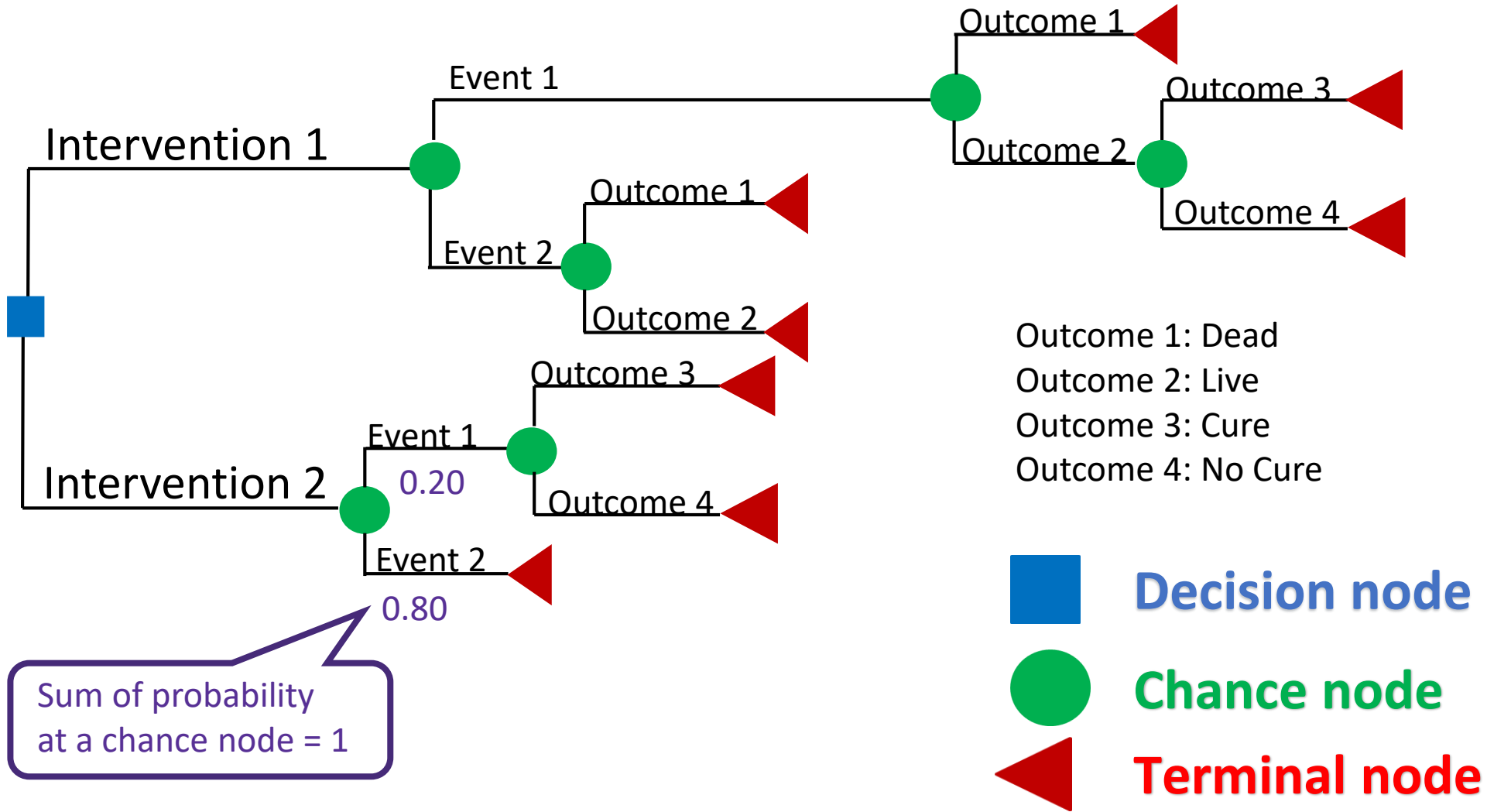
Chance node



Terminal node

What are the elements of a decision tree's structure?





Decision tree steps

1. Identify and describe decision problem
2. Identify interventions
3. Identify events/choices within each intervention
4. Fill in each node probability
5. Calculate expected value of intervention
6. Choose intervention with best expected value

THIS LECTURE

LECTURE 11

Syphilis Example Decision Tree

Syphilis intervention example

- In rural Philippines, syphilis in pregnant women accounts for many adverse pregnancy outcomes
- Group of antenatal clinics (**n=5**) in a high-burden rural area are trying to decide if they should screen and treat pregnant women for syphilis
 - Option 1. Not screen or treat pregnant women (status quo)
 - Option 2. To screen and treat and require \$3 from patient
 - Option 3. Treat without screening & require \$3 from patient
- Which option to choose?

Option 2 v. Option 1

Proposed screen & treat program information

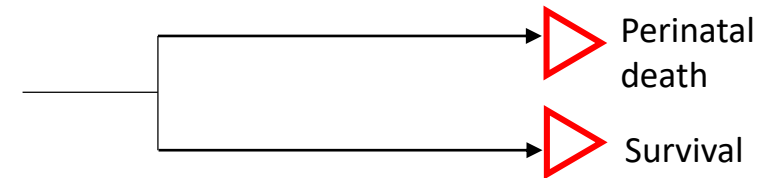
- 90% of pregnant women in catchment area receive prenatal care at least once during their pregnancies from the ANC clinics proposing the program
- **Proposed program:**
 - Participating clinics offer waiting room educational materials on congenital syphilis and benefits of treatment
 - At first antenatal care visit, women can opt to receive screening and treatment for \$3 from patient
 - Those who opt in will receive point-of-care testing
 - Women testing positive receive immediate treatment, counseling, and take-home treatment for one partner

Step 1: Describe decision problem

- **What is the population (and size) targeted by the intervention?**
 - Pregnant women in catchment area who use the clinics
- **What health outcome will we be evaluating?**
 - Perinatal mortality (fetal loss, stillbirth, neonatal mortality)
 - ~37% of pregnancies in mothers with untreated syphilis
- **What are the program priorities?**
 - Minimize cost
 - Maximize benefit (i.e., minimize perinatal deaths)
 - A combination of both

Put population and outcomes in decision tree

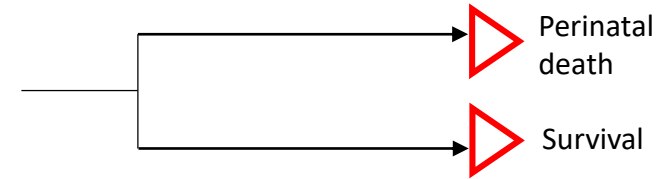
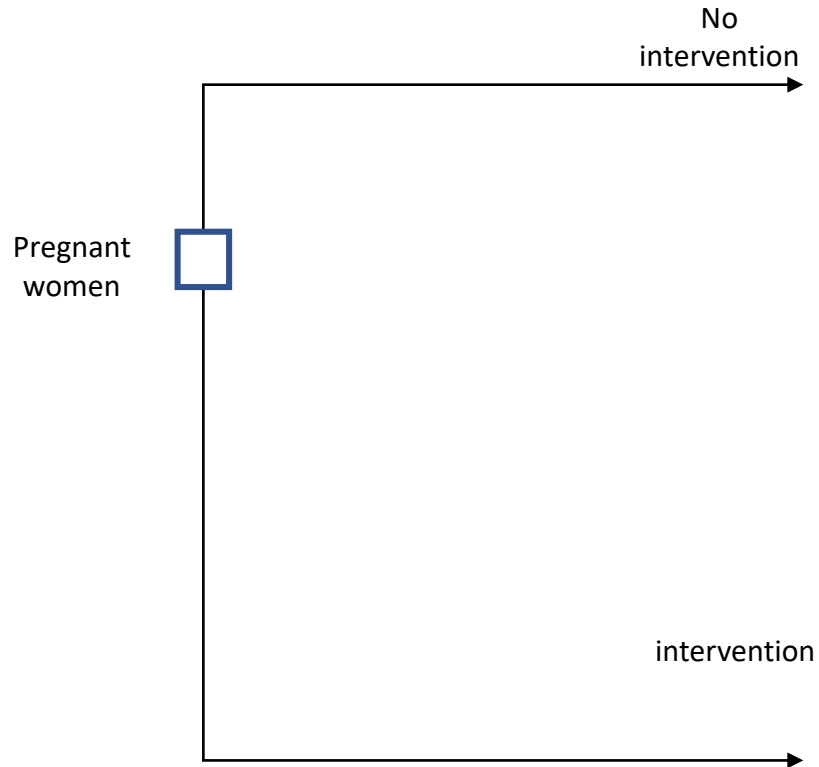
- **Population** – all pregnant women served by clinics
- **Health outcomes (terminal nodes)**
 - Perinatal death
 - Survival



Step 2: Identify the interventions

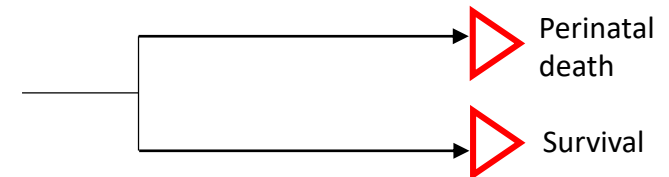
- List main intervention (or policy options) being compared
- At least two options, here:
 - Option 1: Not screen or treat pregnant women (status quo)
 - Option 2: To screen and treat and require \$3 from patient

Put interventions in decision tree



- Two options:

- No intervention (status quo)
- Screen + treat + \$3 from patient

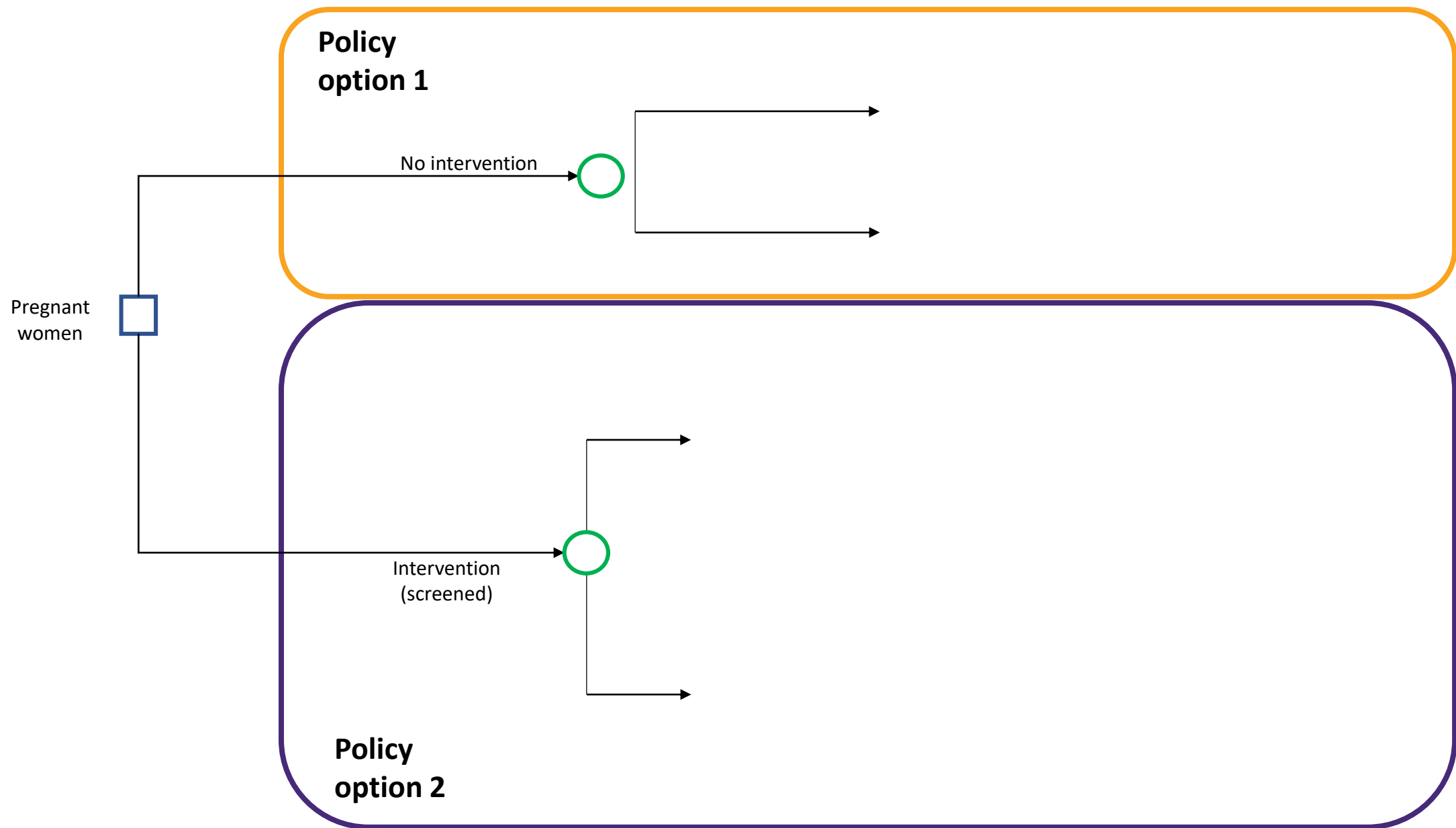


Step 3: Identify choices within each intervention

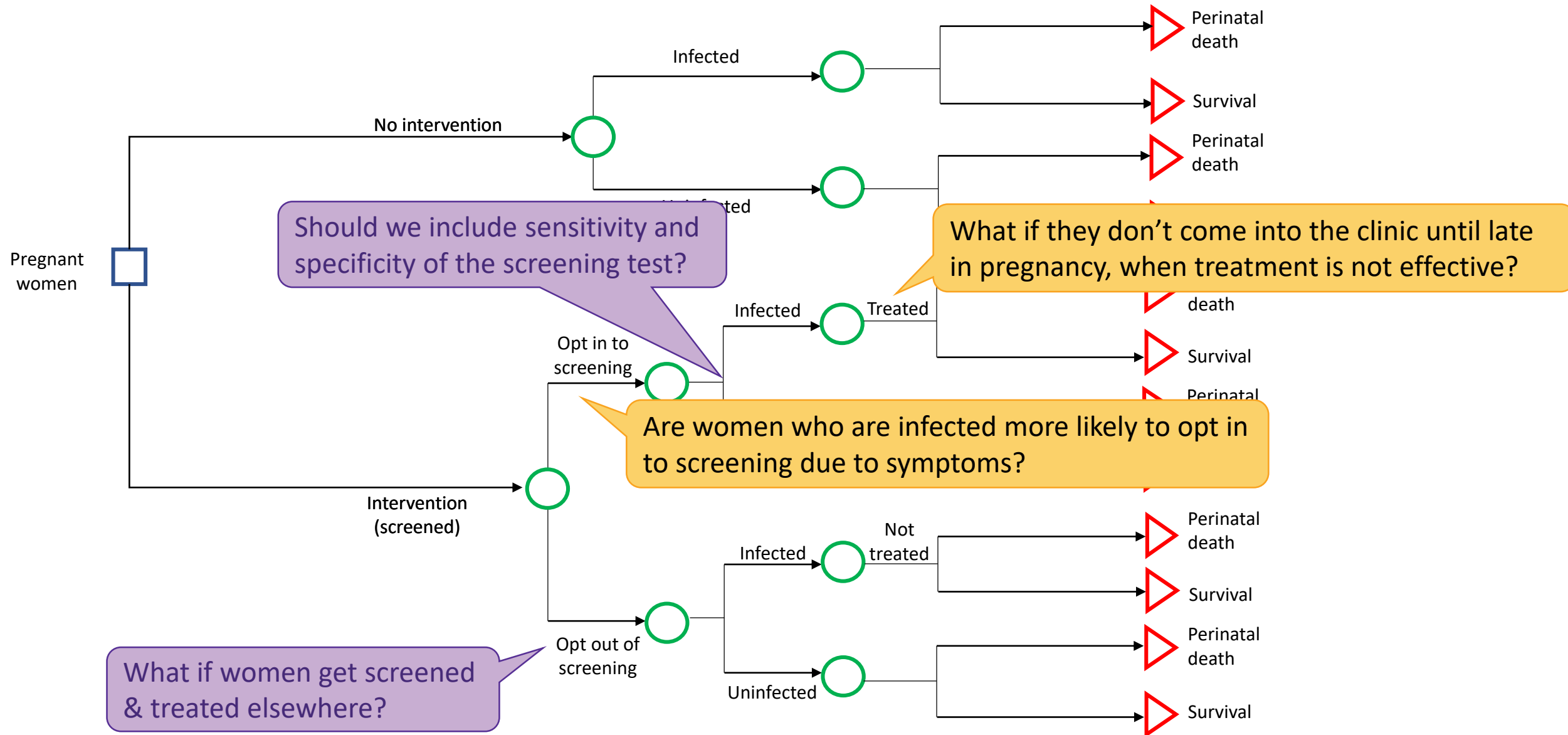
- What are the steps in ***each intervention*** after the decision node?
 - Consider each intervention option separately
 - Likely to be different steps after each option!

Syphilis examples, choices for each intervention

- Opt in to screening (v. opting out)
- Infected with syphilis (v. uninfected)
- Perinatal death (v. survival), given infection status



Simple vs. Complex

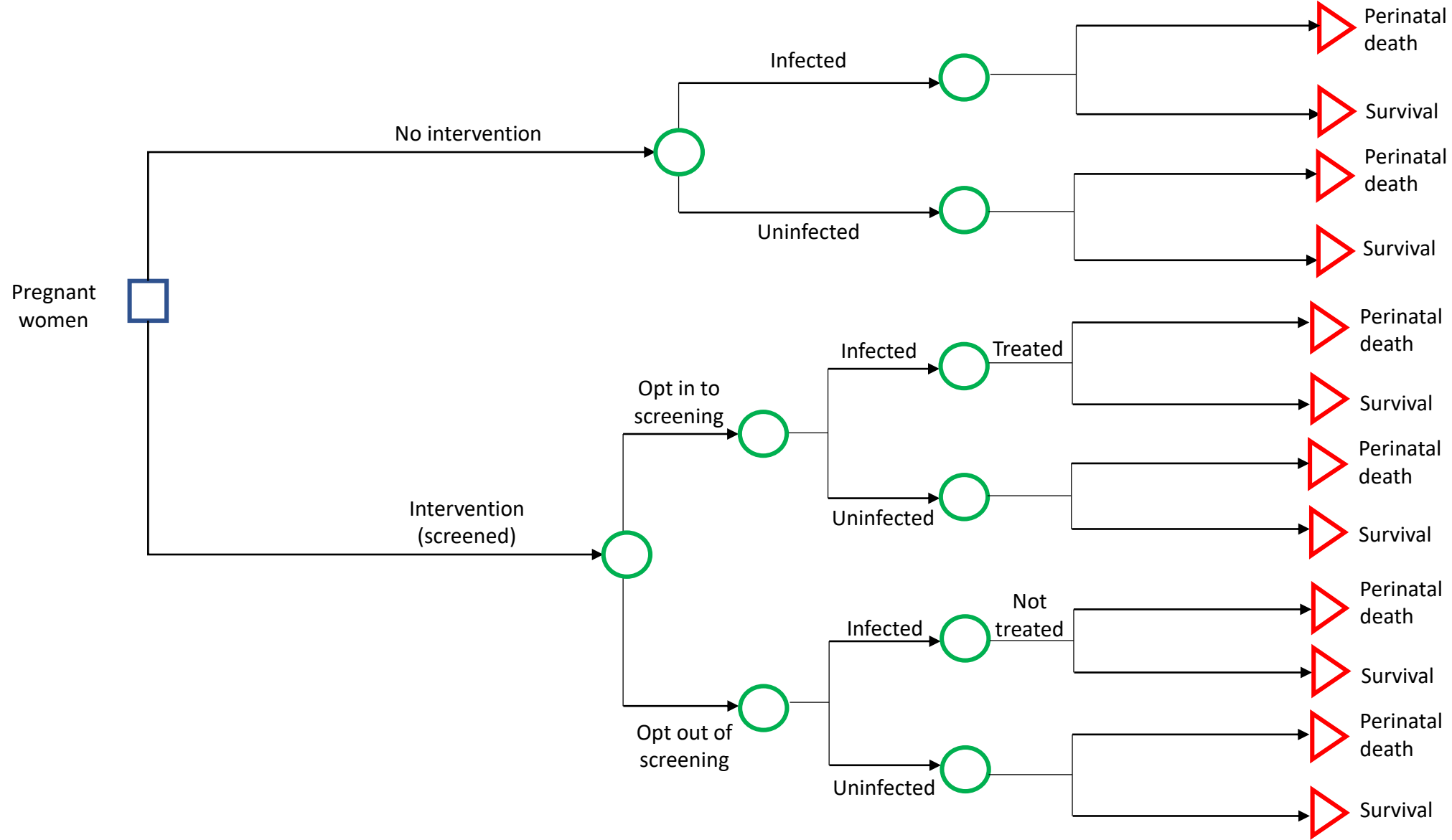


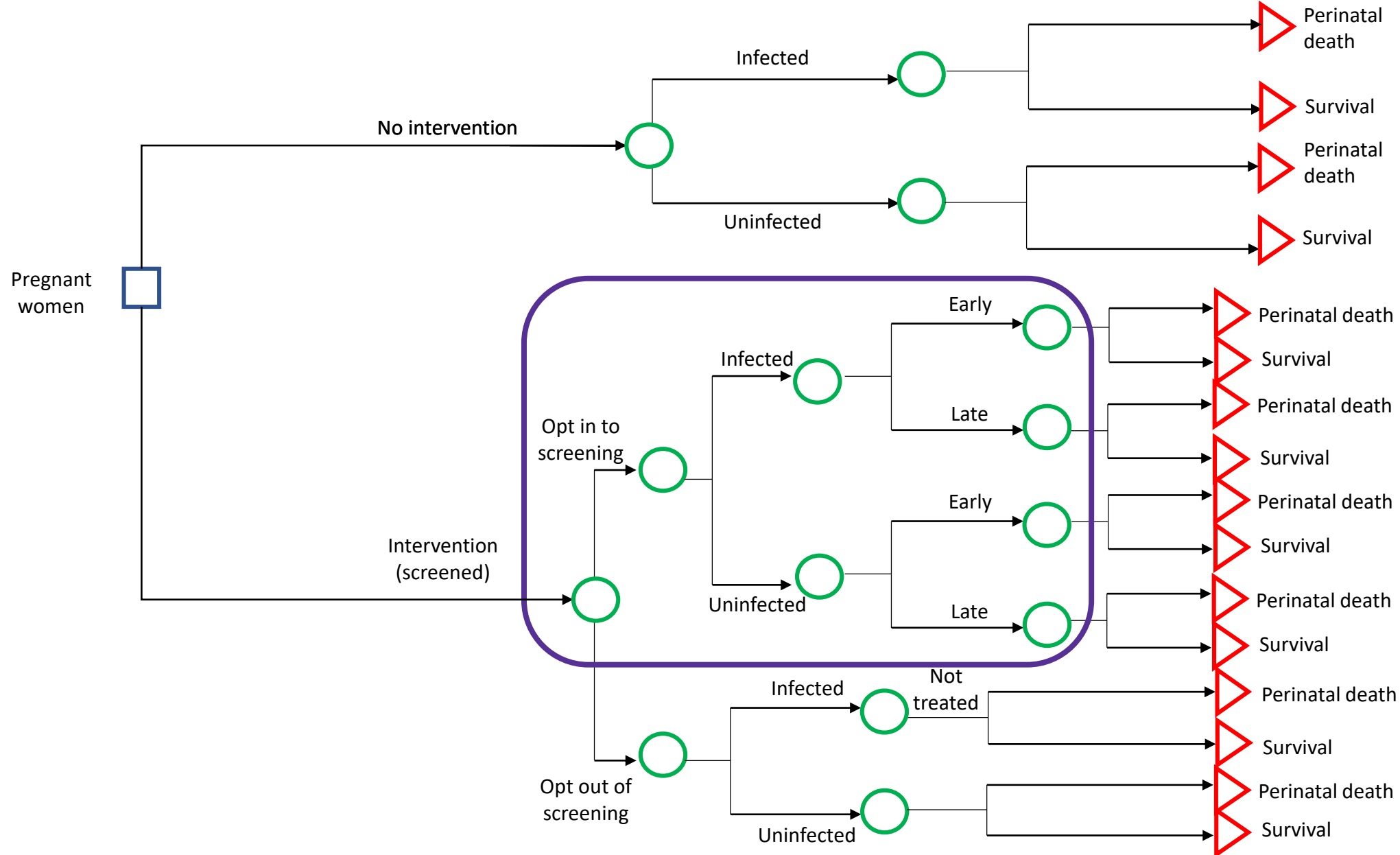
No model is perfect: state assumptions upfront

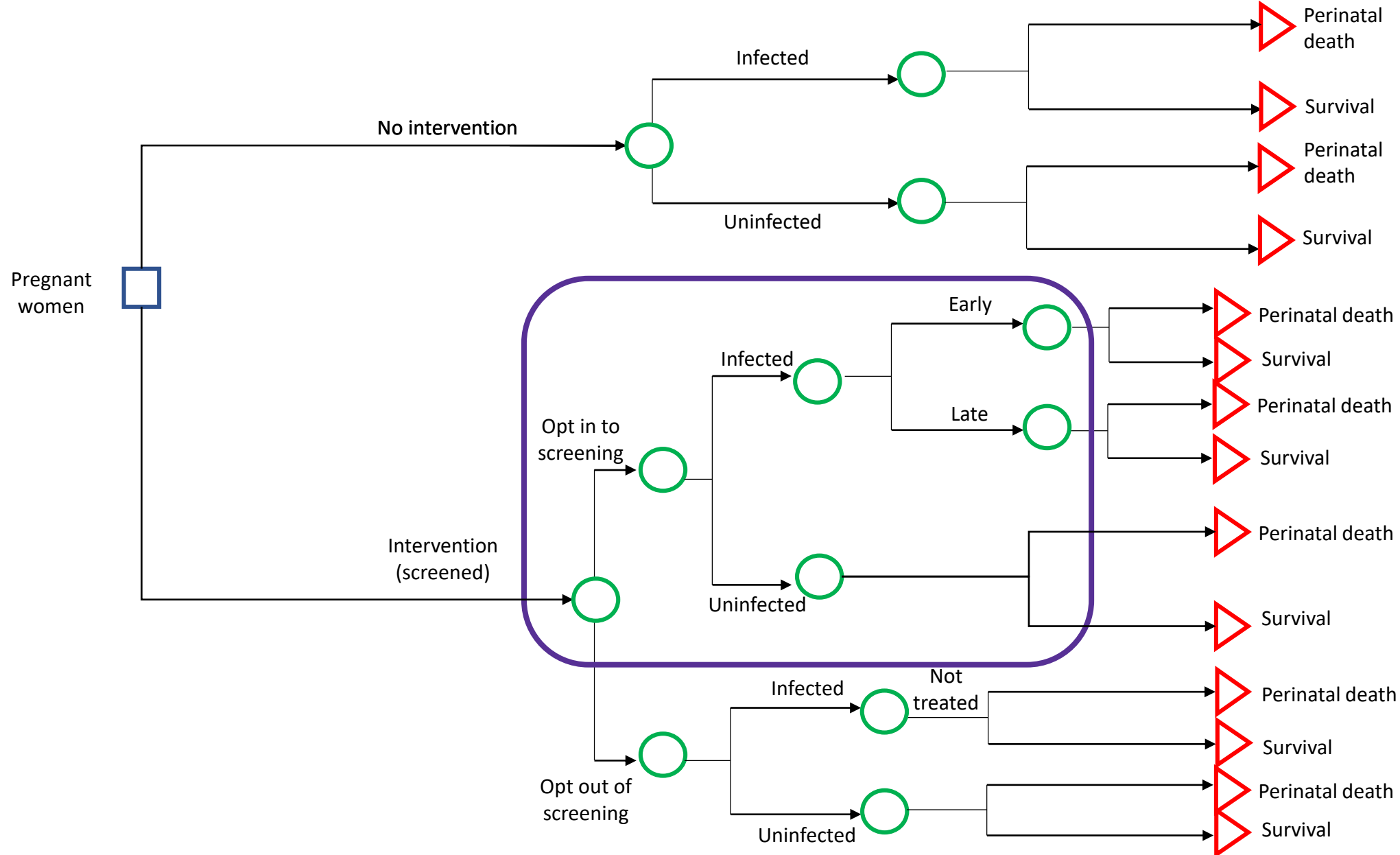
- If women are not screened and treated at these clinics, they won't be screened or treated elsewhere
- All women will present early enough during their pregnancy for perinatal death to be avoided **Probably Not!**
- Sensitivity and specificity of the test are high enough to not include in model (Best rapid syphilis tests have sensitivity & specificity > 90%)

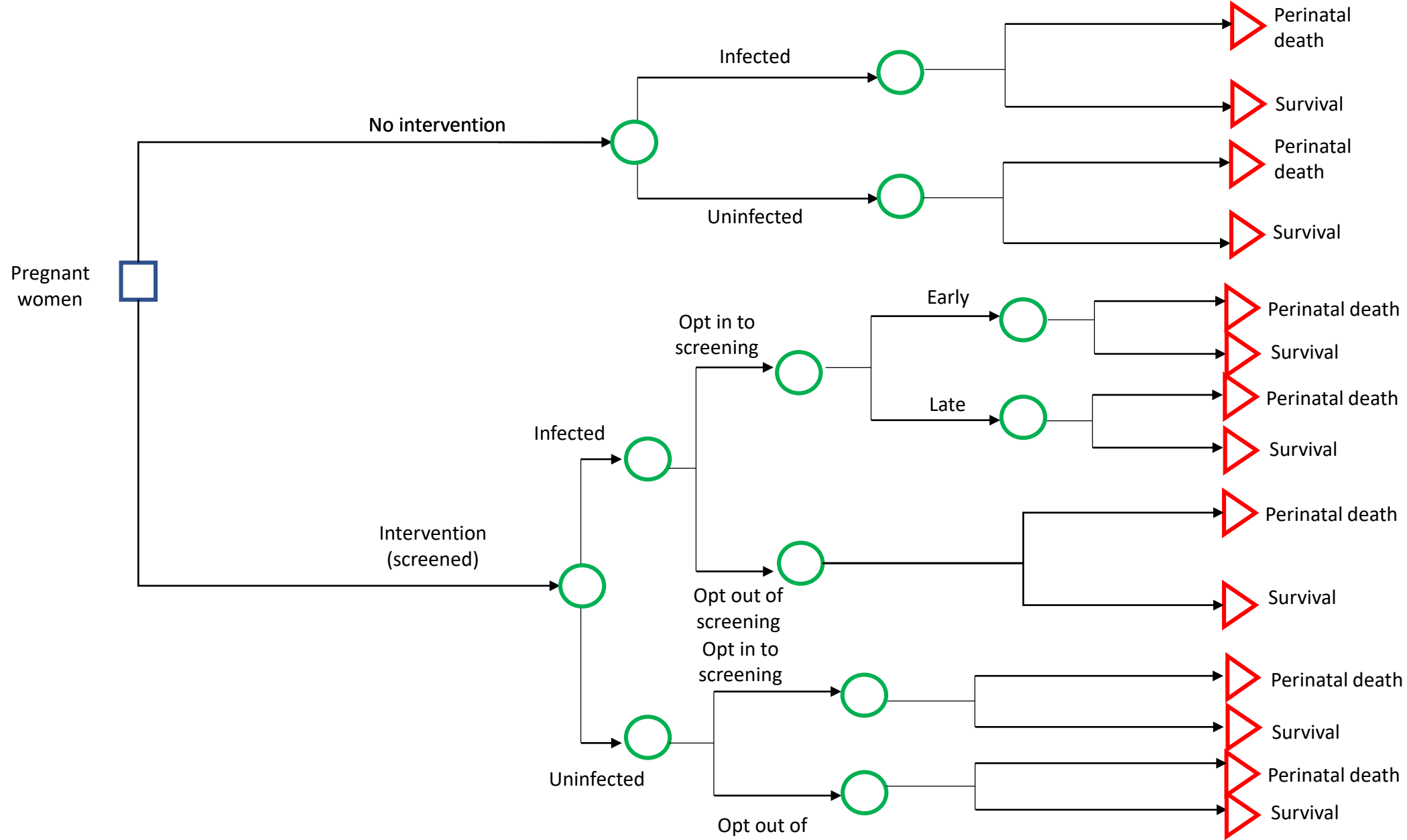
Even likely wrong assumptions SHOULD BE INCLUDED as decision tree branches.

Assumptions are not made to make model easy – Assumptions are realistic ideas.









Step 3: Identify choices within each intervention

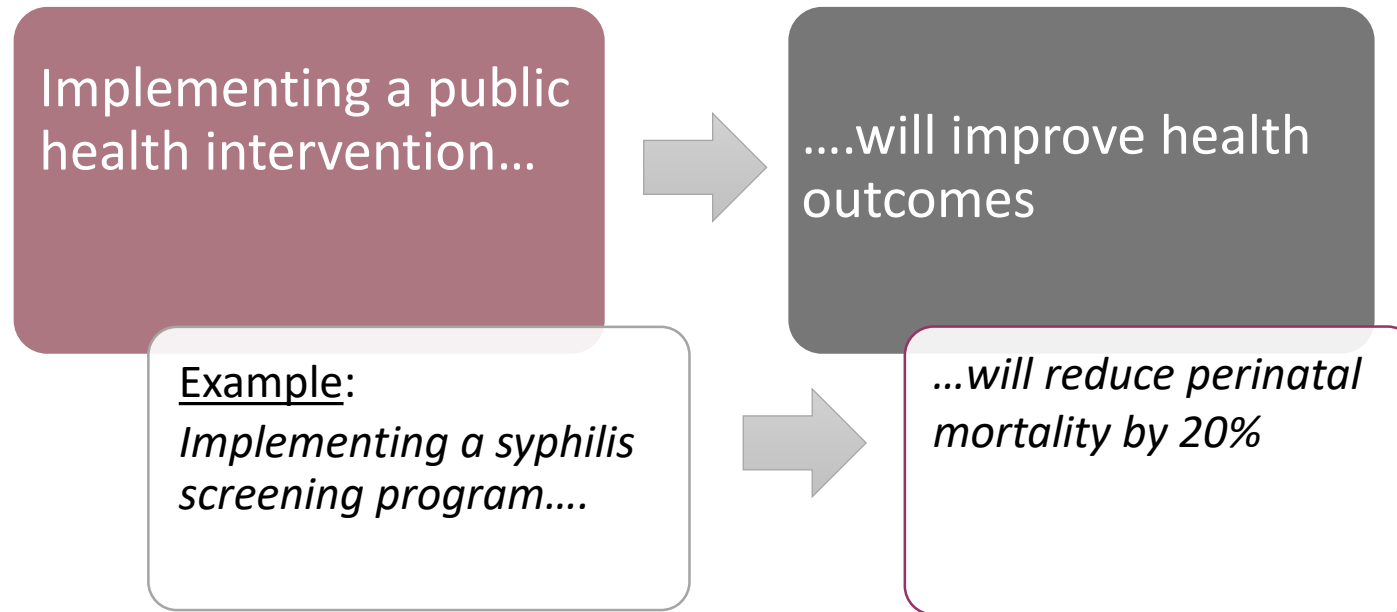
- **There is usually more than one way to build a tree**
 - Complexity
 - Outcomes
 - Available data
 - The way you think
- **Usually won't get it “right” the first time!**

Decision tree steps

1. Identify and describe decision problem
2. Identify interventions
3. Identify events/choices within each intervention
4. Fill in each node probability
5. Calculate expected value of intervention
6. Choose intervention with best expected value

Completed so far

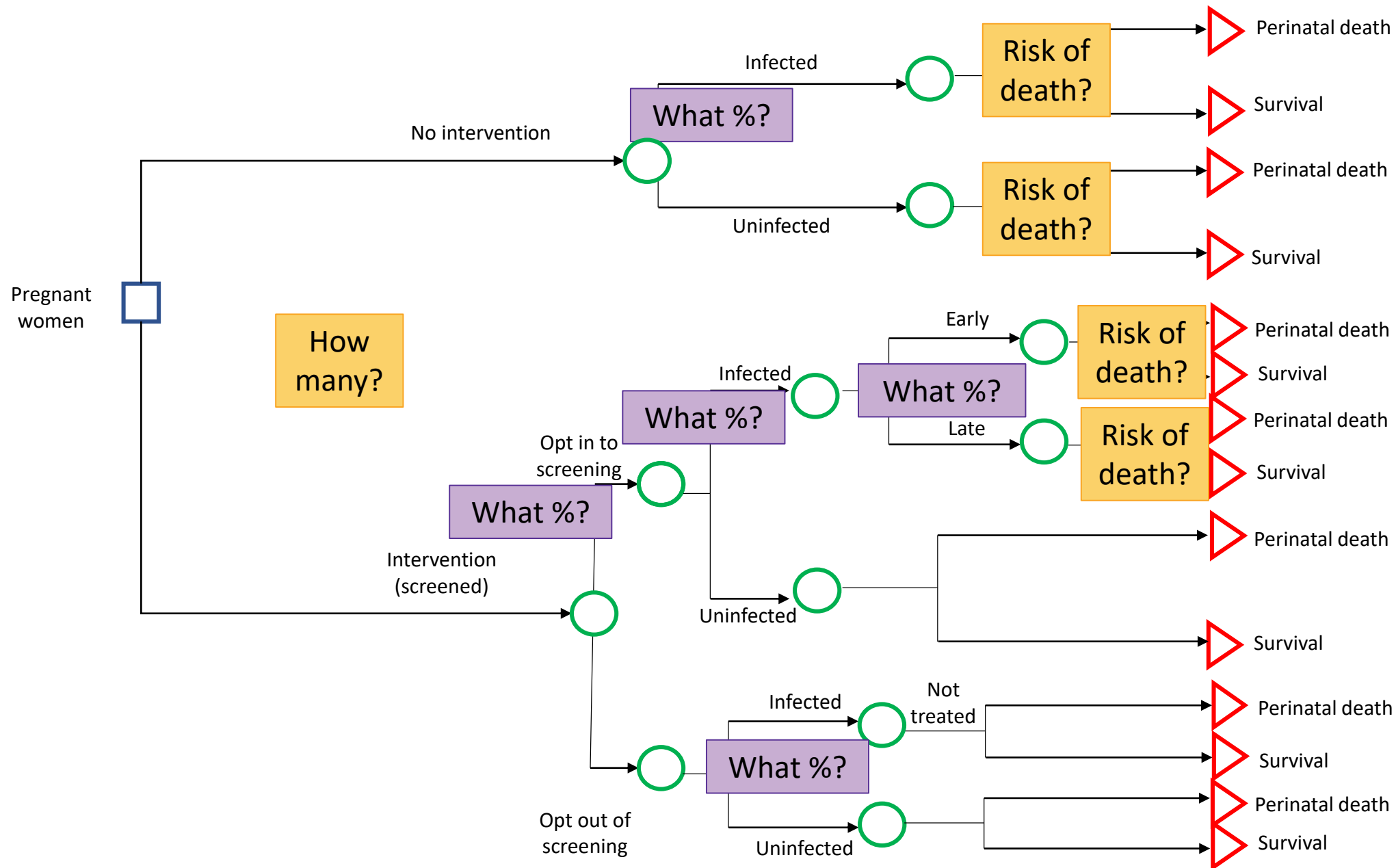
All models are wrong, but some models are useful – George Box



A simple model

Additional commonly needed data

- **Size of population of interest (target population for intervention)**
- **Baseline incidence or prevalence of condition (burden)**
- **Costs at baseline for treatment per prevention**
- **Conditional probabilities (relative risks, odds ratios) of outcomes given certain decision points**
 - e.g., chance of testing positive, given screening



Populate model with data

- **Sources of data**

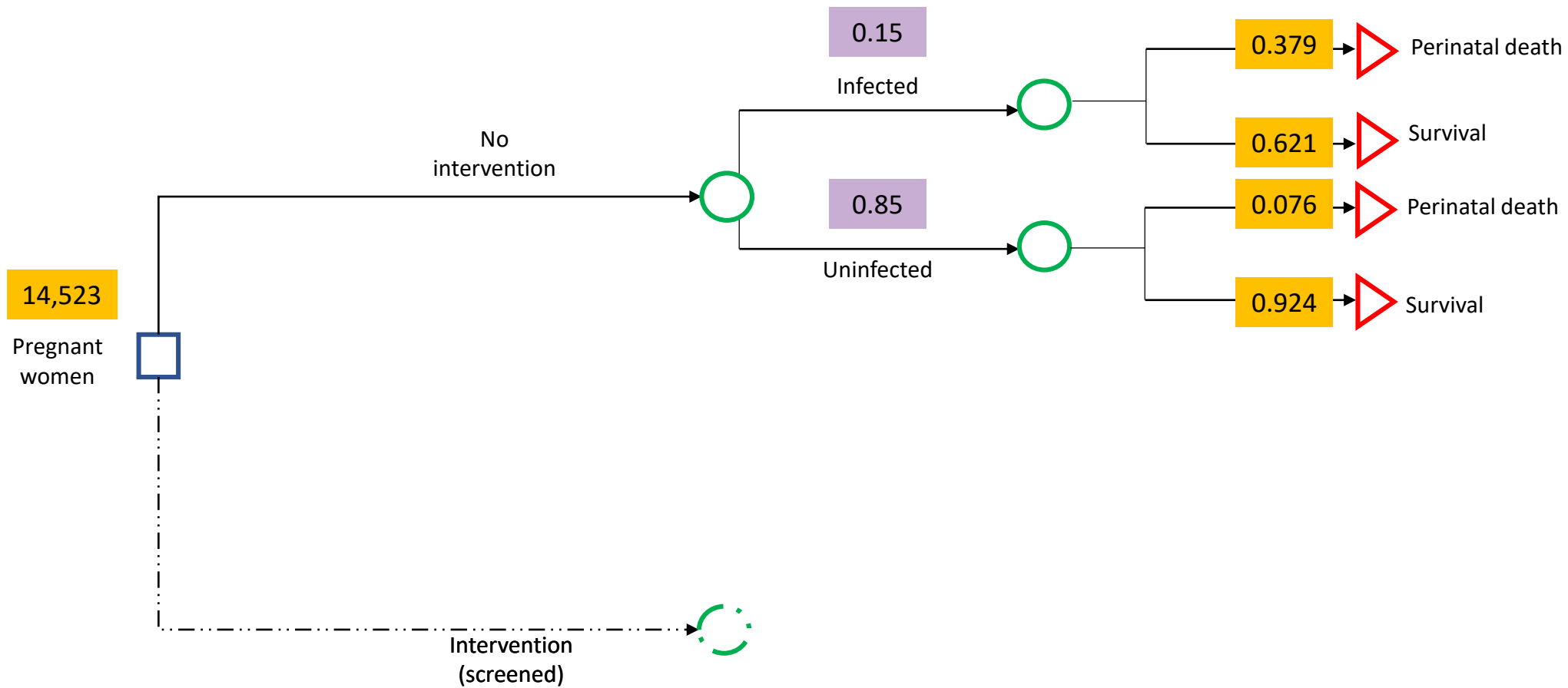
- Data from the literature
- Analyses from national or local data
- Expert opinions
- Your best guess!

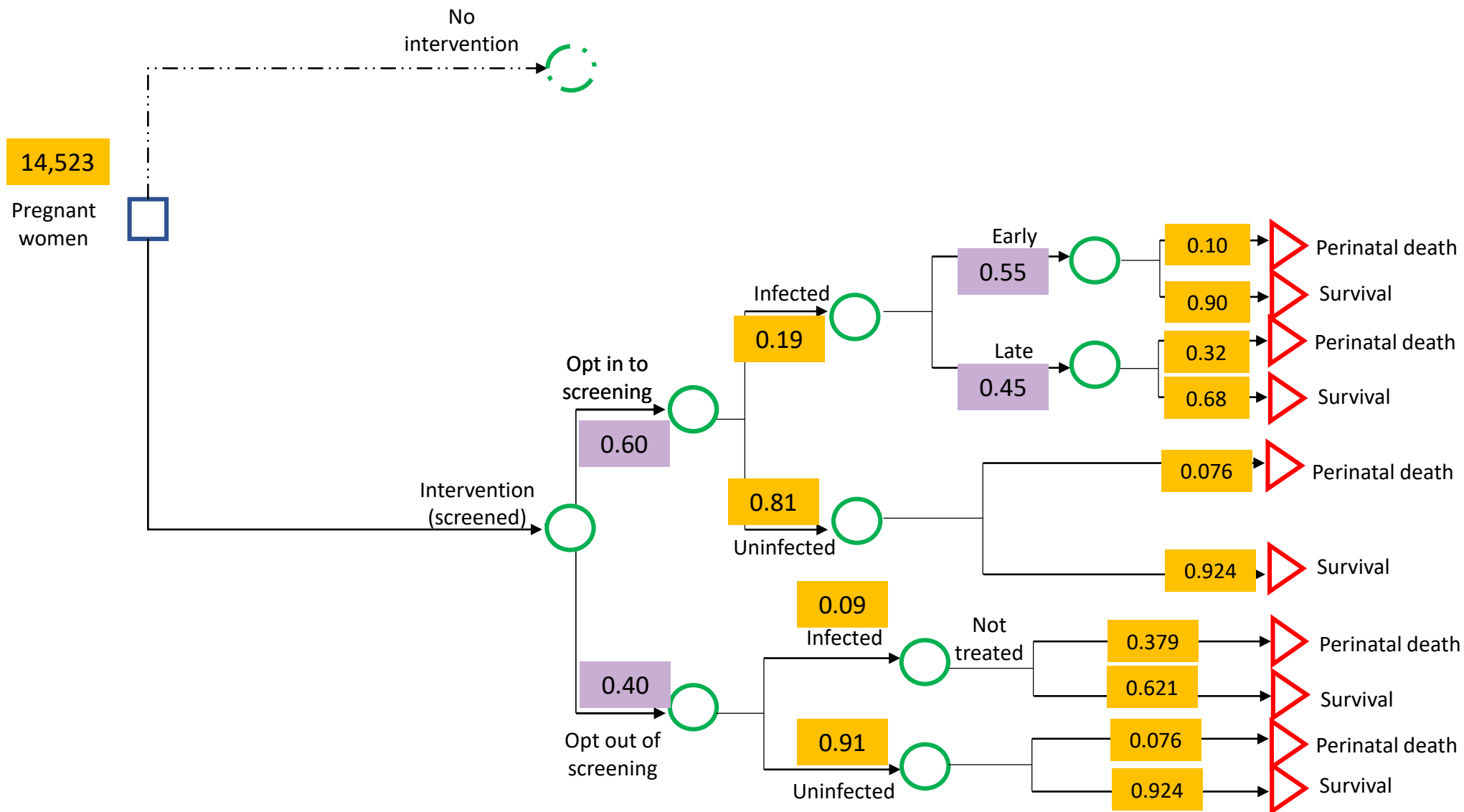
- **Levels of certainty**

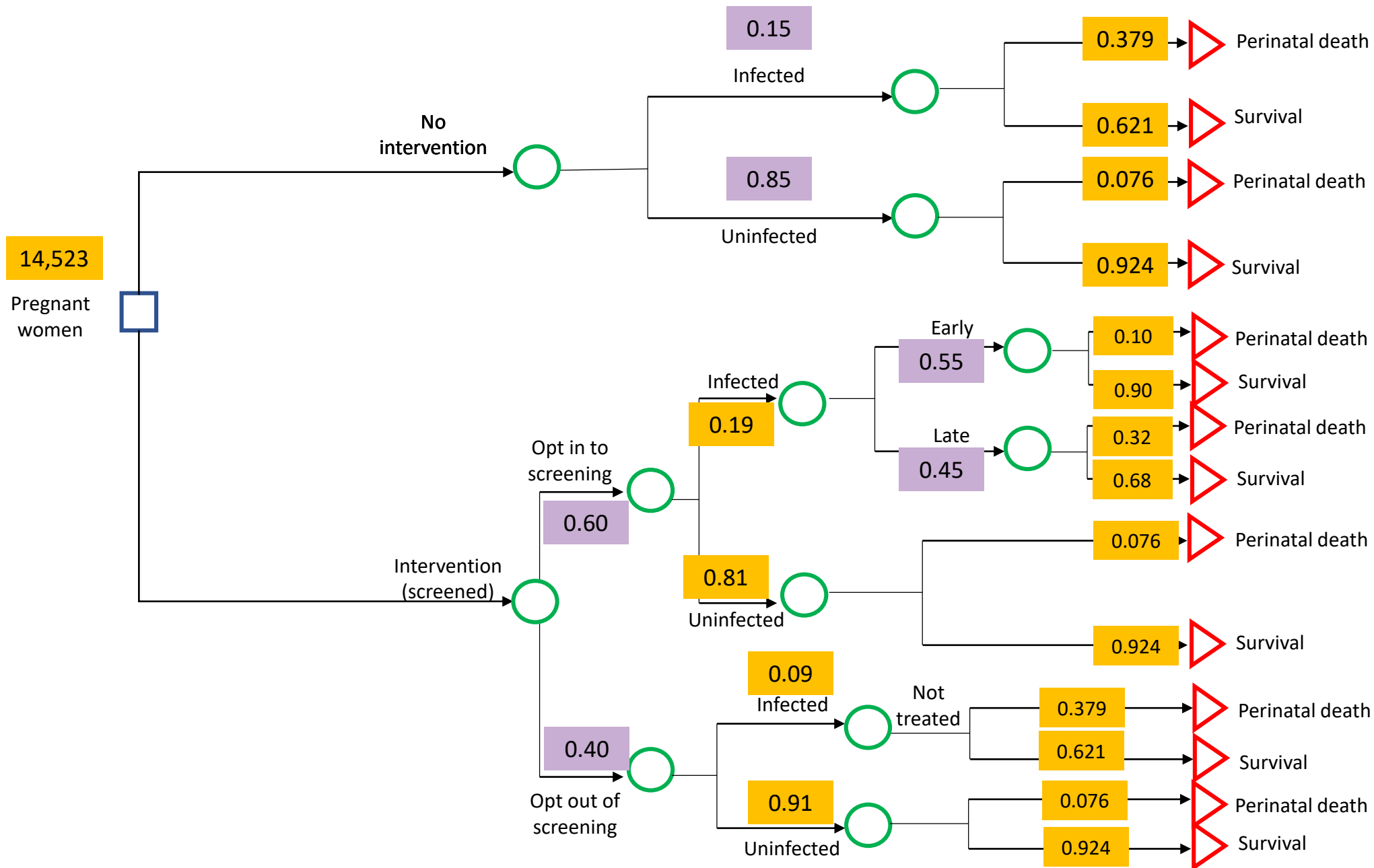
- You will not feel equally certain about each data point!
- Prioritize evidence-based estimates
- Don't be afraid to use your best guess if no data are available

Data for syphilis model

Variables	Value	Source
Population attending antenatal clinics in one year	14,523	Annual clinic data
Proportion who opt in to screening with \$3 copay	60%	Similar policies, other places
Overall prevalence of infection in pregnant women	15%	MOH data
Prevalence of infection among women who opt in to screening	19%	Based on programs in other countries
Prevalence of infection among women who opt out of screening	9%	Based on programs in other countries
Proportion of women who present early	55%	Annual clinic data
Perinatal mortality in uninfected women	7.6%	Literature
Perinatal mortality in infected, untreated women	37.9%	Literature
Perinatal mortality in infected, treated women who present early	8.6%	Literature
Perinatal mortality in infected, treated women who present late	29.6%	Literature

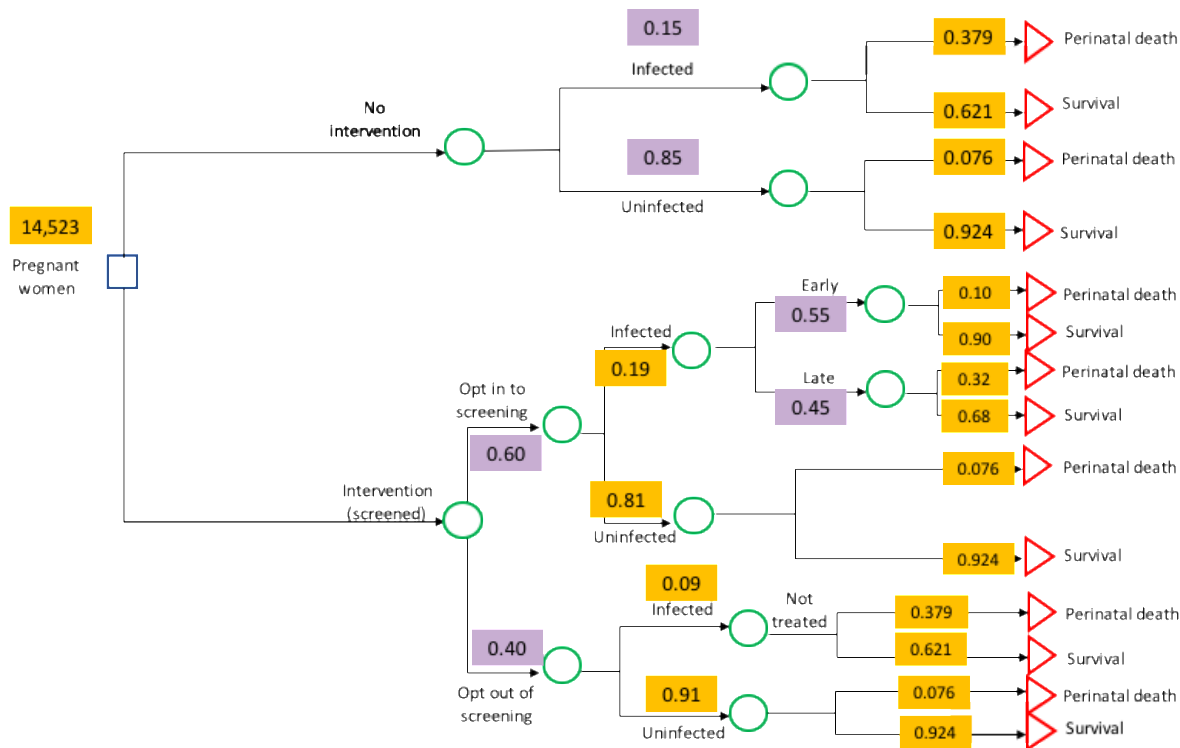




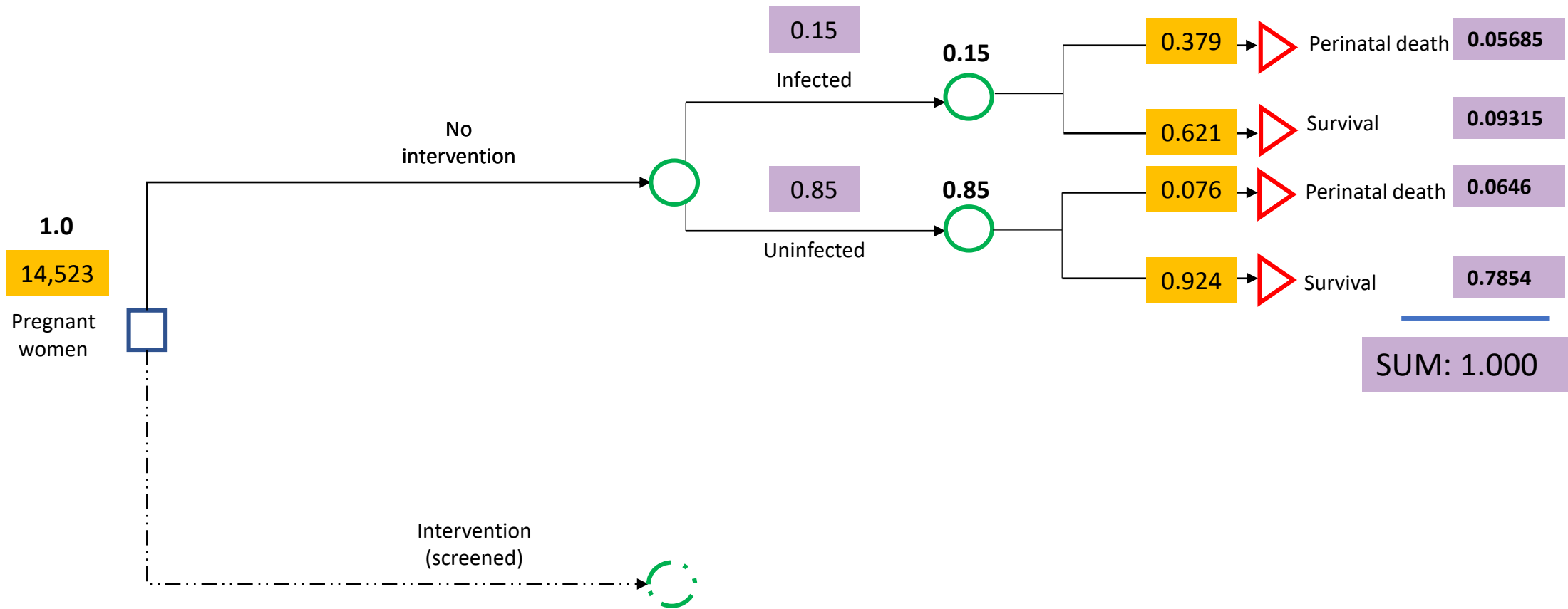


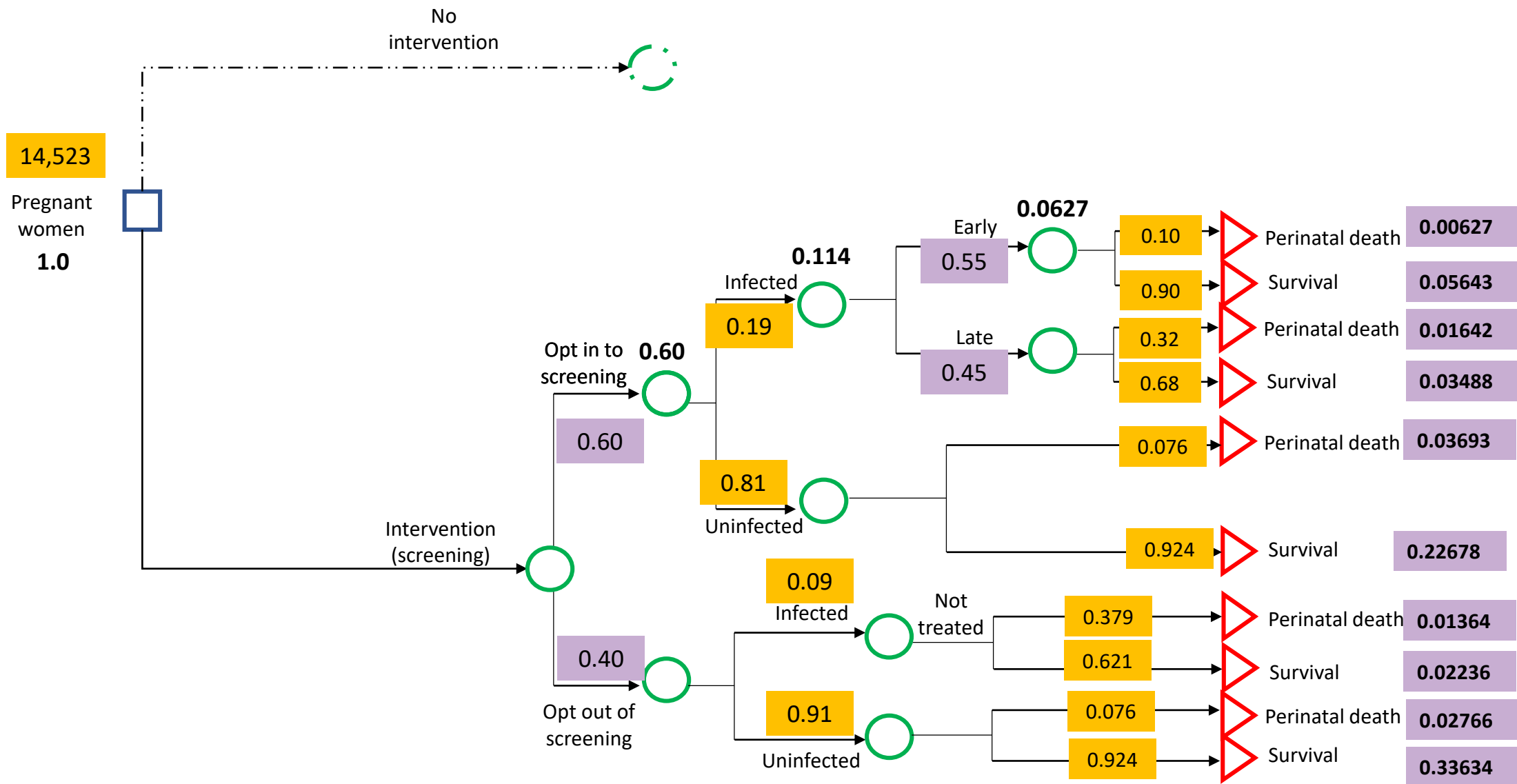
Running the model

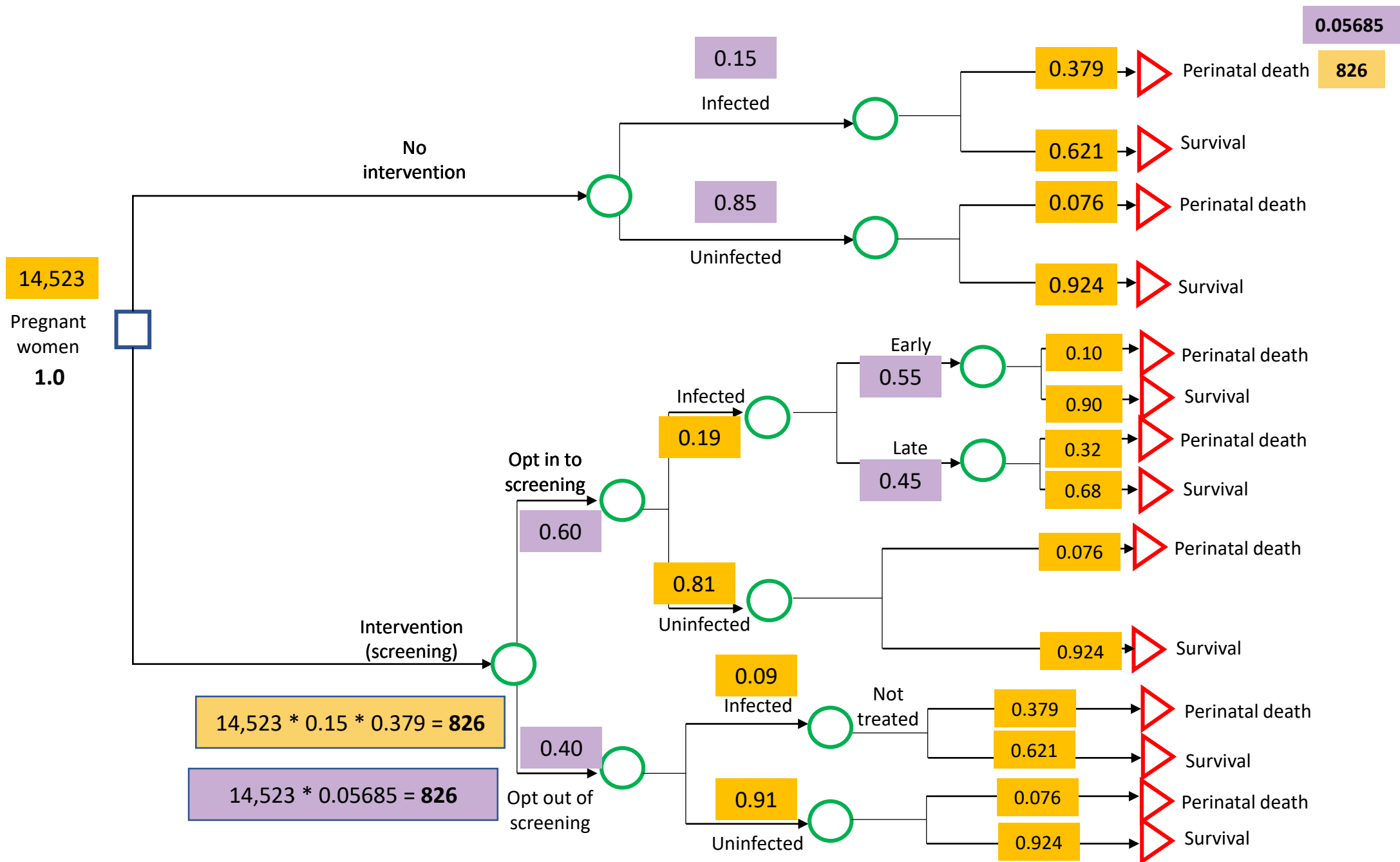
- Refers to determining the final proportion or count of persons in each group on the far-right of the tree

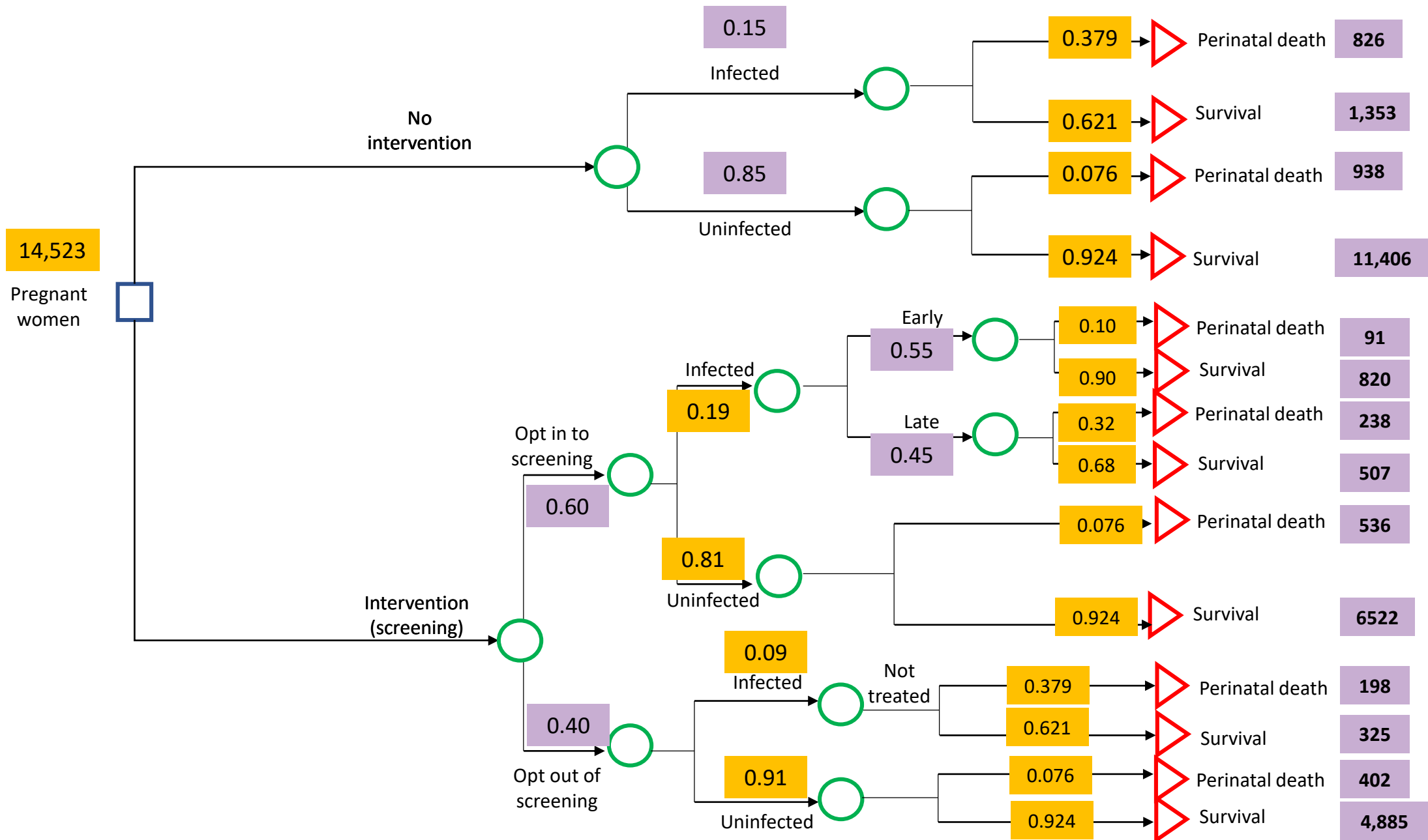


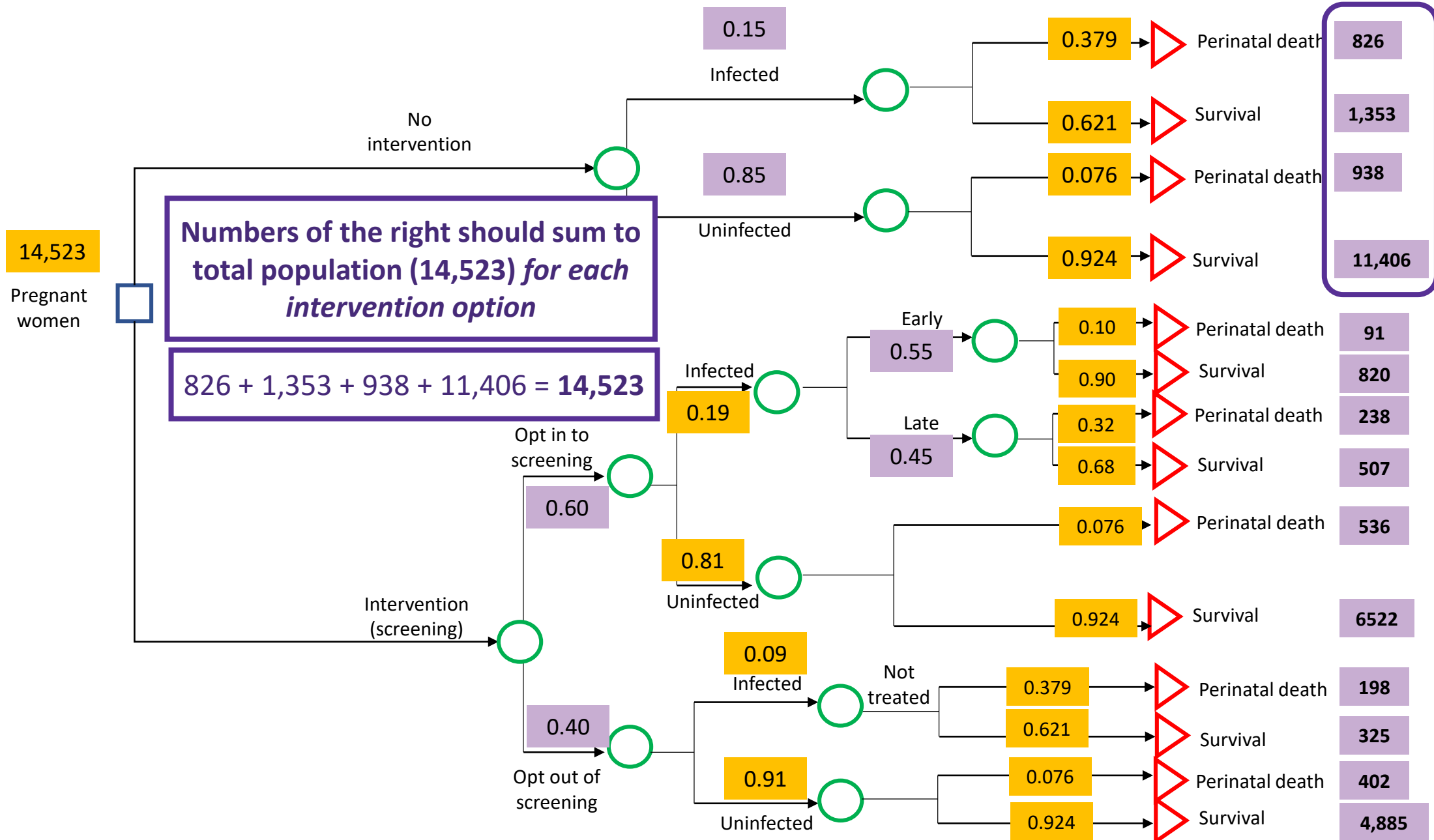
Of total population affected by the intervention,
what % or # have each outcome?

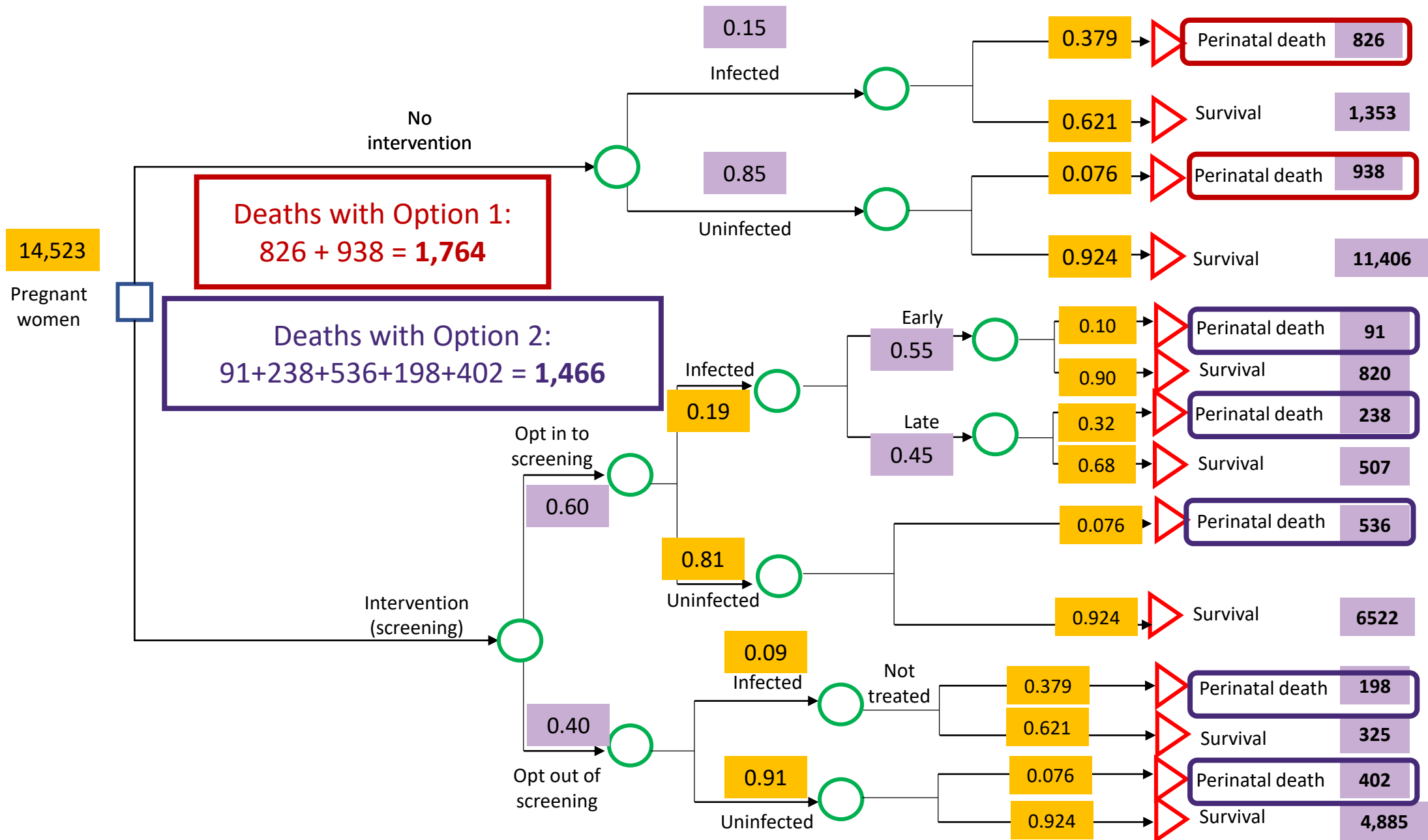






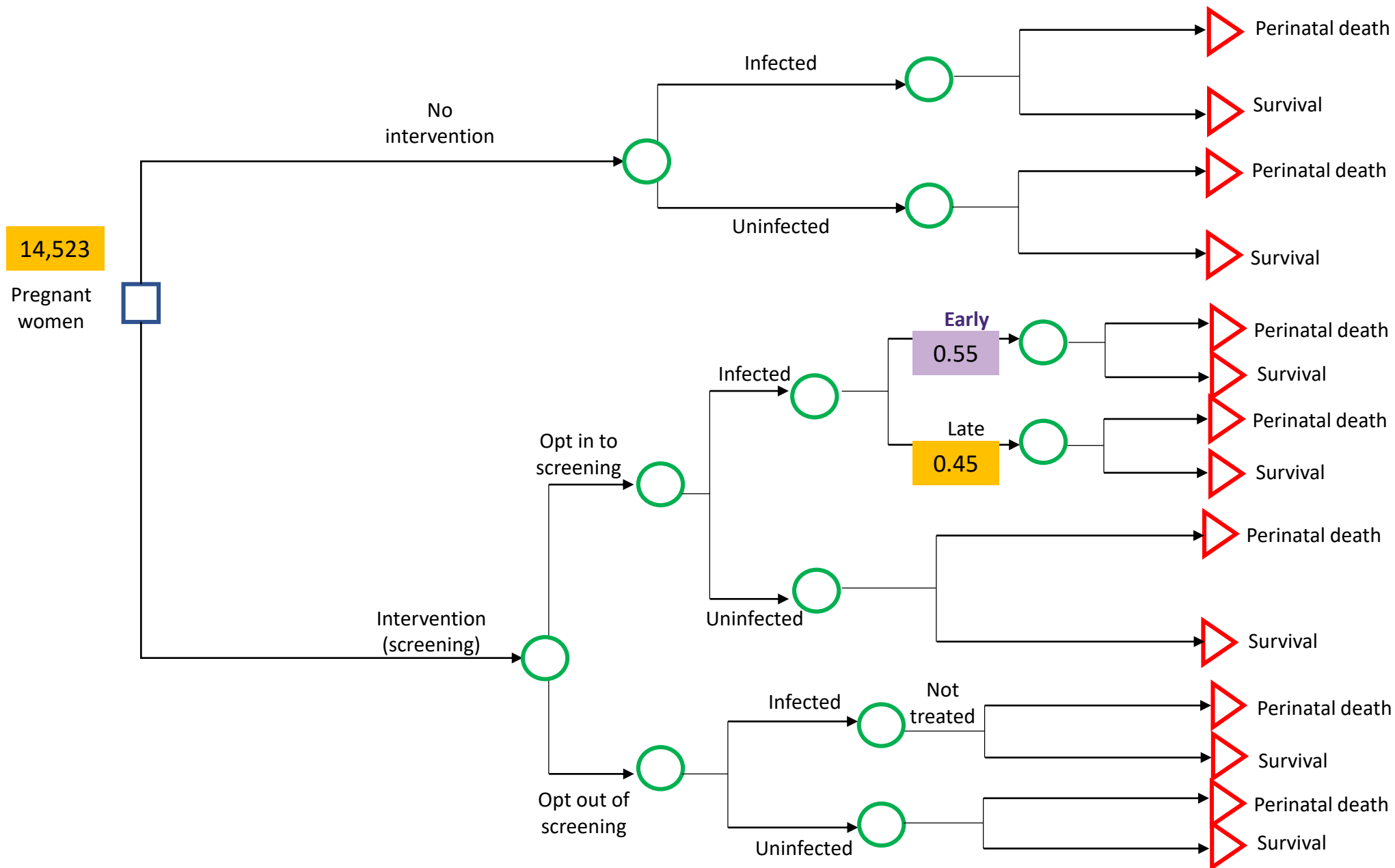






Syphilis screen & treat results

- **Perinatal deaths**
 - No intervention: 1,764
 - Intervention (screen & treat): 1,466
- **Infant deaths prevented with intervention**
 - $1,764 - 1,466 = 298$



Review of syphilis program policy options

- In rural Philippines, syphilis in pregnant women accounts for many adverse pregnancy outcomes
- Group of antenatal clinics (ANCs) in a high-burden rural area are trying to decide if they should screen and treat pregnant women for syphilis
 - Option 1. Not screen or treat pregnant women (status quo)
 - Option 2. To screen and treat and require \$3 from patient
 - Option 3. Treat without screening & require \$3 from patient
- Which option to choose?

Using Excel as a Decision Tree Tool

Why use Excel for decision trees?

- Easy way to do analyses
- Can perform quick economic evaluations
- Worksheets may be saved, formatted, or printed
- Allows users to perform calculations using their own data
- Can conduct sensitivity analyses easily
- Everyone has a copy
- May not have sophisticated software (TreeAge)

Excel-based model components

- Population
- Probabilities
- Cost of cases & intervention

Inputs	
Pregnant women served per year at clinics OR Full pop proportion	14,523
Opt in to screening	0.60
Prevalence of infection	0.15
Prevalence of infection among women who opt in to screening	0.19
Prevalence of infection among women who opt out of screening	0.09
Proportion of women who present early (first half of pregnancy)	0.55
Perinatal death among untreated infected women	0.379
Perinatal death among uninfected women	0.076
Perinatal death among treated infected women, early pregnancy	0.10
Perinatal death among treated infected women, late pregnancy	0.32
Copay	(\$3.00)
Costs	
Fixed costs per year	\$60,000
Cost to screen, per person	\$ 3.65
Cost to treat, per person	\$ 2.00
Per-person fixed cost	\$ 4.13
Outputs	
Death with no intervention	1,763.8
Death with intervention	1,465.8
Lives saved	298.0
Use 1 for Death and 69 for YLL	1
Expected cost per pregnant woman	\$ 4.75
CEA (cost to avert 1 perinatal death)	(231.45)
CEA (cost to gain 1 year of life)	
Expected cost for the program	\$ 68,975.21

Excel-based syphilis program model

Syphilis program example Excel sheet

[illegible]

Making an Excel sheet for your model

- Review the Excel decision tree models in your flash drive
 - Modify the inputs and see how it affects the model outputs
- Make your first decision tree by hand before transferring it to Excel
- Your mentor can help you!

RESEARCH ARTICLE

Rapid Syphilis Testing Is Cost-Effective Even in Low-Prevalence Settings: The CISNE-PERU Experience

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Abstract

Studies have addressed cost-effectiveness of syphilis testing of pregnant women in high-prevalence settings. This study compares costs of rapid syphilis testing (RST) with laboratory-based rapid plasma reagin (RPR) tests in low-prevalence settings in Peru. The RST was introduced in a tertiary-level maternity hospital and in the Ventanilla Network of primary health centers, where syphilis prevalence is approximately 1%. The costs per woman tested and treated with RST at the hospital were \$2.70 and \$369 respectively compared with \$3.60 and \$740 for RPR. For the Ventanilla Network the costs per woman tested and treated with RST were \$3.19 and \$295 respectively compared with \$5.55 and \$1454 for RPR. The cost per DALY averted using RST was \$46 vs. \$109 for RPR. RST showed lower costs compared to the WHO standard costs per DALY (\$64). Findings suggest syphilis screening with RST is cost-effective in low-prevalence settings.

Introduction

Syphilis remains an important global health issue. The World Health Organization (WHO) estimates that every year 1.5 million pregnant women are infected with syphilis [1]. At least half of untreated infected pregnant women will have serious adverse events associated with syphilis, including stillbirths, neonatal or early infant deaths, and infants with clinical signs of the disease [1]. Penicillin is the treatment of choice and can prevent complications and congenital syphilis if pregnant women are treated early in pregnancy, ideally before 20 weeks of gestation [2]. Although almost every country in the world has policies or guidelines related to syphilis screening in antenatal care (ANC) implementation is still a problem in many settings; women are often not screened, results are not always available and infected women fail to undergo treatment [3].

Rapid syphilis tests (RSTs) are now available for use at the point of care. Since results are available in 15–20 minutes, they allow for same-day testing and treatment. Most currently available RSTs are treponemal tests, which detect antibodies to treponemal antigens and have

Mallma P *et al.* Rapid Syphilis Testing is Cost-Effective Even in Low-Prevalence Settings: The CISNE-PERU Experience. PLoS ONE, 7 March 2016.
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