Building a decision tree model of antenatal HIV transmission

Foundation Course Exercise 2

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Overview

Imagine that you have been asked to advise local decision-makers on the cost-effectiveness of antenatal HIV testing (i.e. testing pregnant women for the HIV virus). You undertake a Medline search to identify published economic evaluations - but find nothing to help you in your analysis. You quickly realise that you will have to undertake a decision analysis of your own using data from available data sources.

Data

From a Medline search you identify publications that provide you with the following information:

- If a woman has HIV and her infection remains undetected during pregnancy, the probability that she will transmit the infection to her child is 26%.
- If a woman's infection is known during pregnancy, however, it is possible to use risk-reduction interventions such as caesarean section, zidovudine antiretroviral therapy and bottle-feeding. These interventions cost £800 more than a normal delivery and reduce the probability of transmission to the child to 7%, but only 95% of infected women accept the interventions.
- Discussion with midwifery staff indicates that offering the test to women could be achieved at negligible additional cost, but your pathology labs suggest that each blood test will cost £10; they also indicate that the tests are 100% accurate (i.e. there are no false negatives or false positives).
- A published paper suggests that the prevalence of undetected HIV in the antenatal population in your area is 5%.

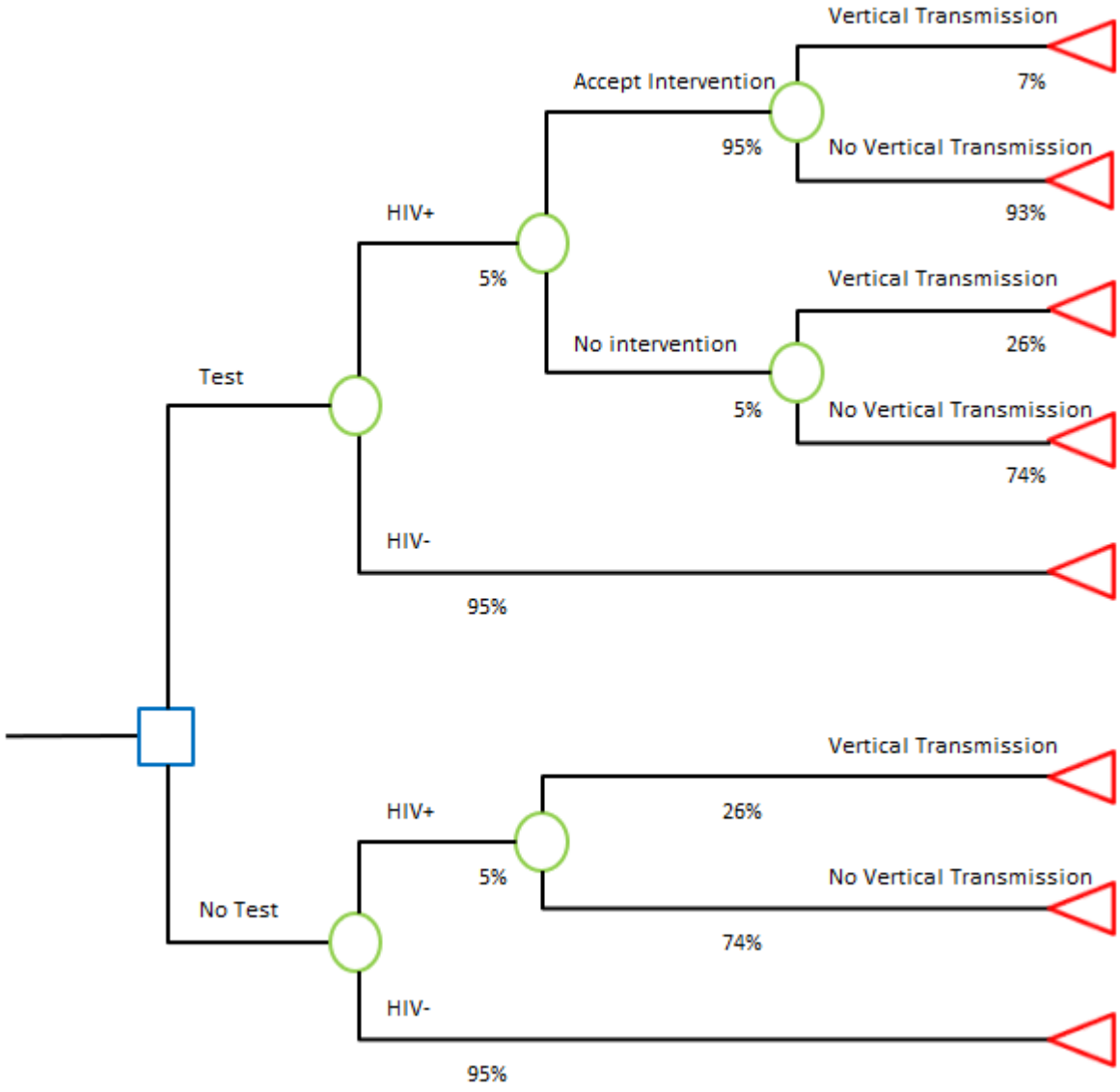
Assumptions

Discussions with professional staff indicate that the following assumptions can be justified:

- No women will select to terminate on discovering she has HIV infection.
- All women who are tested positive will be offered risk-reduction interventions.

Decision Tree Figure

To help visualise the decision tree model structure, we have provided the decision tree and conditional probabilities for each branch below:



Tasks

i) First, assign the appropriate values to each parameter, using the data derived from the literature review, given above.

ii) Create each of the five pathways for the testing arm of the decision tree, estimating the pathway probabilities, costs, and cases (HIV births due to vertical transmission) for each pathway. *(Hint: we have provided a naming convention, working through pathways 1 to 5 for the testing arm and have completed the first one for you).*

iii) Once you have estimated the probabilities, costs and cases for each pathway, multiply the probability of each pathway with its expected payoffs (costs and cases). Then evaluate the entire testing pathway to calcualte the estimated costs and cases associated with testing. *(Hint: Create vectors of the pathway probabilities and payoffs, and then multiply these vectors together. Once you have done this you can use the* `sum()` *function to get the total for the testing arm).*
Once you have estimated the total costs and cases for the testing arm, the results should look like this:

```
testing.results
```

```
##     costs     cases
## 48.000000  0.003975
```

iv) Now that you have estimated the total costs and cases associated with testing, do the same for the no testing arm, following the steps outlined in ii) and iii) to help you.

v) Once you have the costs and cases associated with the testing arm and no testing arm of the decision tree, use these to calculate the incremental costs and the cases avoided, and calcualte the expected cost per HIV infected child avoided.

What do your results show? You should have an estimated **£5318.56** per HIV-infected child avoided. If not, then make sure that you have used the correct parameters in calculating the incremental results.

Now that we have finished the practical component of the exercise, consider some of the other aspects of this analysis:

vi) What are likely to be the key sensitivity analyses to undertake?

vii) What are the weaknesses of the analysis?