Using TreeAge Pro to Model Chlamydia Prophylaxis

The material that follows is designed to help you use the TreeAge software to create a
decision tree that includes the important elements for the decision about women taking
prophylaxis for Chlamydia when they seek an induced abortion.

Step 1, Build the tree

1. Start with a screen that is blank except for a single square decision node. Place your
cursor on the square. When you see a wishbone, double click. Two branches should
appear (alternatively, left click above the decision node and use \Options\Add Branches).
The actual number of branches that are added is set under the option:
\edit\preferences\tree layout\default branches per node (the default is 2)

Label each branch by clicking above the branch and typing in the name (e.g., .No
prophylaxis and Prophylaxis)

2. Place your cursor on the No Prophylaxis chance node and repeat (labeling the resulting
Chlamydia and No Chlamydia branches). Add the PID and No PID branches to the
Chlamydia chance node. Add the Symptomatic and Asymptomatic branches to the PID
node.

3. Right click above the Symptomatic PID branch (you should see a box appear as well as a
series of options). Select Change Node Type (alternatively, left click above the
Symptomatic PID branch and use \Options\Change Node Type). Change the node type to
a terminal node. You will be offered a number of payoffs, but for the moment simply click
okay. Repeat for the Asymptomatic PID, No PID, and No Chlamydia branches.

4. You may note that the tree does not look like the tree we have already developed in class.
The branches do not come off the nodes at right angles, and they don’t all line up, one
under the other. These features are also selected by use of the \edit\preferences\tree layout
option. Check Align endnodes and Branch lines at right angles. The tree in the lecture
notes and your tree will now look similar.

5. Save the tree, making sure that you save it in the appropriate directory:
\File\Save [Chlamydia]

Step 2, Identify the probabilities

<table>
<thead>
<tr>
<th>Condition</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlamydia:</td>
<td>0.048</td>
</tr>
<tr>
<td>PID:</td>
<td>0.63</td>
</tr>
<tr>
<td>Symptomatic PID:</td>
<td>0.40</td>
</tr>
</tbody>
</table>
Azithromycin cure rate: 0.96

6. Left click below Chlamydia and a box should appear. Inside the box, type 0.048. Left click below No Chlamydia. Inside the box that appears, type # (alternatively, type 0.952). TreeAge uses the pound sign to represent the difference between the sum of the other probabilities for the chance node (in this case, 0.048) and 1.0.

7. Left click below PID and type 0.63; left click below No PID and type #; left click below Symptomatic and type 0.4; and left click below Asymptomatic and type #.

8. Resave the tree

Step 3. Identify the outcomes

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Cost</th>
<th>PID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlamydia and symptomatic PID:</td>
<td>1455</td>
<td>0</td>
</tr>
<tr>
<td>Chlamydia and asymptomatic PID:</td>
<td>630</td>
<td>0</td>
</tr>
<tr>
<td>Chlamydia, no PID:</td>
<td>42</td>
<td>1</td>
</tr>
<tr>
<td>No Chlamydia:</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Azithromycin prophylaxis:</td>
<td>40</td>
<td>--</td>
</tr>
</tbody>
</table>

9. Before proceeding to enter these data in the tree, let’s be sure that they are formatted the way we want. The format for the different outcomes is set under the option:

\edit\preferences\calculation method

Be sure that “Method” is set to “Simple (single payoff”). Use Payoff 1 to represent cost. Set “Optimal Path” to “Low,” (because all else equal low cost is better than high cost). Click on Numeric Format. Show 0 decimal points; give the Units a Custom suffix; make the suffix “RMB”, and give Probabilities 4 decimal points. Click OK.

Next, use Payoff 2 to represent effectiveness (PID). Set “Optimal Path” to “High,” (because all else equal high effectiveness is better than low). Click on Numeric Format. Show 4 decimal points; give the Units a Custom suffix; make the suffix “PID Avoided”, and give Probabilities 4 decimal points. Click OK. Again click OK to exit preferences.

10. Right click above the Symptomatic PID branch (you should see a box appear as well as a series of options). Select Change Payoff (alternatively, left click above the Symptomatic PID branch and use \Options\Change Payoff). You will be offered a number of payoffs. Use Payoff 1 for cost (1455) and Payoff 2 for PID (0). Repeat for the Asymptomatic PID (630 for Payoff 1 and 0 for Payoff 2), No PID, and No Chlamydia branches.

11. When you finish these last entries, you will see that the tree shows the cost outcome, but does not show the effect outcome. The outcomes that are displayed are set under the
To show both outcomes, change “Method” from “Simple (single payoff)” to “Cost-Effectiveness.” Be sure that you “Use payoff: 1 for ‘Cost’” and “Use payoff: 2 for ‘Effectiveness.’” Optional: You can click Numeric Format, select Cost/Eff, and add a custom suffix to the ratio if you want (e.g., RMB/PID Avoided). You can also set the decimals for the ratio (0) and the decimals for probability (4).

12. Resave the tree.

You have now finished construction of the No Prophylaxis “arm” of the tree.

To construct the Prophylaxis arm of the tree you could repeat the steps above. To avoid all of that work:

13. Right click above the No Prophylaxis branch (you should see a box appear as well as a series of options). Choose Select Subtree (alternatively, left click above the No Prophylaxis branch and use \\Options\\Select Subtree). The circles and triangles to the right of No Prophylaxis will change from being unfilled to filled. Right click \\Options\\Copy Subtree (alternatively, use \\Edit\\Copy Subtree). Either way, your subtree will be copied. Finally, right click above the Prophylaxis branch, and “Paste Node(s)” (alternatively, left click above the Prophylaxis branch and use \\Edit\\Paste… You will be asked if you want to paste a Subtree or Text. Paste the subtree). You should see the No Prophylaxis branches now appended to the Prophylaxis branch.

There are two important differences between the No Prophylaxis and Prophylaxis arms of the tree. The probability of Chlamydia is lower in the Prophylaxis branch than it is in the No Prophylaxis branch. In addition, everyone who takes Prophylaxis experiences the cost of prophylaxis.

14. The probability of Chlamydia is 0.048 in the No Prophylaxis arm. In the Prophylaxis arm, it equals ((1-cure rate) * 0.048) or (1-0.96) * 0.048. To enter this probability, left click below Chlamydia and a box should appear. Left click on the grey box with three periods; by doing so, you will open a text editing window for the entry of probabilities. Enter (1-0.96) * 0.048 (alternatively 0.04*0.048). Click OK. Because you used the # sign in step 6 above, you do not need to adjust the probability in the No Chlamydia branch.

15. The cost of each terminal node in the Prophylaxis arm is 40 RMB higher than the cost of the equivalent terminal node in the No Prophylaxis arm. To make this adjustment, right click above each of the terminal nodes in the Prophylaxis arm of the tree and select Change Payoff. Add 40 to payoff 1 for cost (e.g., for Symptomatic PID, payoff 1 equals 1455+40).
16. Resave the tree.

You have now finished construction of the Prophylaxis “arm” of the tree.

Step 4. Calculate the expected values

We can calculate the expected values for cost alone, for effectiveness alone, or for both cost and effectiveness simultaneously. We use the Rollback feature when we calculate the expected values for one outcome only; we use the Cost-Effectiveness feature when we calculate them for 2 outcomes simultaneously.

17. Roll back cost. Go to \Edit\Preferences\Calculation Method; select Method: Simple; use payoff: 1; click OK. Click on the colored “beach ball” to the right of the tool bar at the top of the screen (alternatively, use \Analysis\Roll Back). You will see the roll back values for each of the chance nodes for the cost of No Prophylaxis and Prophylaxis as well as a box by the decision (root) node indicating the option that is preferred in terms of cost (in this case, lowest). The average cost for No prophylaxis is 30; it is 41 for Prophylaxis. If you want, you can use the \Edit\Numeric Formatting option to see more decimals. When you are through inspecting the costs, again click on the colored beach ball to turn off the roll back function.

18. Roll back effect. Go to \Edit\Preferences\Calculation Method; select Method: Simple; use payoff: 2; click OK. Click on the colored “beach ball” to the right of the tool bar at the top of the screen. The probability of avoiding PID is 0.9698 for No prophylaxis; it is 0.9988 for Prophylaxis. If you want, you can use the \Edit\Numeric Formatting option to see more decimals. When you are through inspecting the effects, again click on the colored beach ball to turn off the roll back function.

19. Roll back cost and effect simultaneously and analyze incremental cost-effectiveness. Go to \Edit\Preferences\Calculation Method; select Method: Cost-Effectiveness; use payoff: 1 for cost and payoff 2 for effect. Click OK.

20. Left click above the decision node (you should see a box appear). Use \Analysis\Cost-Effectiveness; plot effectiveness on the X axis; click OK. You will see what Treeage refers to as the “Cost-Effectiveness” graph (it is usually relatively uninformative). Use \Actions\Text Report; set the baseline strategy to No Prophylaxis; and continue. You will see the cost-effectiveness table that I reproduced in the notes (Note: Table 2 is usually either redundant or useless). If you want to save the text so that you can include it in a report on the tree, use the “Export” command and either copy it to the clip board, export it to Excel, save it to a file, or open a text window (commonly to add identifying information, etc.)

You have finished calculating the expected values for the tree.
Step 5. Perform sensitivity analysis.

You can not perform sensitivity analysis on numbers in the tree. If you want to perform such analyses, you must replace the numbers with variables. In what follows, we perform sensitivity analyses on 3 variables, the probability of Chlamydia, the cure rate of azithromycin, and the cost of azithromycin (and we will thus create only 3 variables for the tree). If one wanted to, she could perform sensitivity analysis on all 4 probabilities and all 4 costs that are included in the tree (by defining 8 variables).

21. Use the Values\Variables and Tables option to create variables (alternatively, if you enter an undefined variable in the probability or outcome windows, TreeAge will immediately ask you to define the variable). An (empty) box which lists your variables opens. We will define 3 variables, pChlamydia, pProtect, and cAzith. Click New Variable. Name the variable pChlamydia; give it a Description of Probability of Chlamydia; Define it numerically (at the root) as equaling 0.048; and under Properties for Sensitivity Analysis, make its Low value 0 and its High value 0.1. Be sure Show in Tree is checked. Click OK.

22. Repeat to define pProtect (Azithromycin cure rate; point estimate = 0.96; Low Value = 0.9; High Value = 1.0) and cAzith (Cost of Azithromycin; point estimate = 40; Low Value = 20; High Value = 60). When you are finished, click OK to close the Variables and Table box.

23. You will note that the variable names appear below the decision (root) node, but they do not include the full definition (including their point estimate). How these variables are displayed is set under the option:

\Edit\Preferences\Variables/Markov Info

Check the box entitled Expand node to fit variables.

24. To add the variables to the tree, click where the numbers they represent appear in the tree and substitute the variable name for the number. For example, to substitute pChlamydia for 0.048, under the Chlamydia node of both the No Prophylaxis and Prophylaxis arms, enter pChlamydia for 0.048.

25. To determine how cost changes as the probability of Chlamydia changes, go to Edit\Preferences\Calculation Method; select Simple; and use Payoff 1. Use the \Analysis\Sensitivity Analysis\One Way option. Choose the variable you wish to use in the sensitivity analysis (pChlamydia). You’ve already provided a default value for the range of the sensitivity analysis. You can leave it unchanged, or change it if you wish. The number of intervals tells the program something about the number of different values of pChlamydia for which the results are recalculated. It may not be intuitive, but TreeAge calculated n+1 recalculations of the result (e.g., if you enter 4 intervals, it will calculate 5
estimates of the value of cost). Click ok.

You will see a plot of the cost for No Prophylaxis and Prophylaxis. You can export the graph (File\Export). You can also see the text report which indicates precise values of cost for each of the values of pChlamydia and you can export the data for use in other software packages. Exit the sensitivity analysis.

26. When you do a sensitivity analysis for a single payoff, you get the limited output described above. If you instead do a sensitivity analysis for cost-effectiveness, you get the same data on cost, but also can see the results of the sensitivity analysis on effect and on cost-effectiveness. Go to Edit\Preferences\Calculation Method; select Cost-Effectiveness. Use the Analysis\Sensitivity Analysis\One Way option. Click OK.

There are many ways to print out the results of this sensitivity analysis. The text report provides a version of the cost-effectiveness table, with individual sets of calculations for each of the values to pChlamydia that are used in the sensitivity analysis. It shows the cost, incremental cost, effect, incremental effect, (the inappropriate individual cost-effectiveness ratios), and the incremental cost-effectiveness ratio. For example, when the probability of Chlamydia is 0, Prophylaxis is dominated by No Prophylaxis; when the probability of Chlamydia is 0.1, No Prophylaxis is dominated.

Alternatively you can see a graph of cost, incremental cost, effect, incremental effect, (inappropriately, individual cost-effectiveness ratios), and incremental cost-effectiveness ratios. Note that Treeage has difficulty plotting the incremental cost-effectiveness ratio when the denominator of the ratio is 0 (in which case the ratio is undefined). Also note that the Animated Cost-Effectiveness feature is interesting.

27. Perform sensitivity analyses for pProtect and cAzith.

For our class, we have completed analyzing this tree.