Handout for Class Exercise on Friday March 6, 2020 and Homework 6, Which Is Due Wednesday March 18, 2020

1. If you have not already done so, update your version of TreeAge to the latest version (TreeAge Pro Healthcare Version 2020 R1.1), which was released in January 2020, by clicking on Help/Update. Grey highlighting indicates that the command sequence starts at the top left of your screen in the row immediately under "TreeAge Pro Healthcare 2020." In the next row down, the icons on the left are shortcuts to commands, and the options on the right provide help and support.

2. The material that follows will help you use TreeAge to create a decision tree for analyzing the decision about taking prophylaxis after a needle-stick injury that involves a needle from a patient who is HIV positive. Your tree does not have to be the same tree we reviewed in class.

Build and analyze a simple tree with utilities for outcomes.

3. Set preferences for the tree. Click on Edit /Tree Preferences.
   - Under Calculation click on Calculation Method, and then
     - Click on Simple for Calculation Method/Active Method
     - Click on High for Optimal path
     - Select 1 for Active payoff (If you have trouble selecting 1, click Cost-effectiveness and then click Simple.)
   - Under Calculation click on Numeric Formatting and then
     - Select 2 for Decimal places
     - Unselect Add trailing zeros
     - Select Use thousands separators
     - Select Exactly for Show numbers
     - Select Custom suffix for Units, and type "utiles" for the Suffix
   - Expand Numeric Formatting, click Probabilities
     - Select "6" in the box for Decimal places, then click Apply and Close

4. Build the tree. Start with a screen that is blank except for a single square decision node. If the node is not, present, click File/New Decision Tree. When the box appears asking if you want to use the Model Setup Wizard, click No. Click above the line before the square node where it reads *Enter Label*, type "Choose" in the box that appears, and then press Enter on your keyboard.
   - Use Node/Add Branch, Node/Change Type, Subtree/Select Subtree, Edit/Copy, Edit/Paste, and other options to build the tree. Note that right-clicking the location where you want to execute a command often will provide the command you want, for example, right-clicking on a node brings up Add Branch and Change Type.
   - Label each branch by clicking above the branch and typing the label in the box

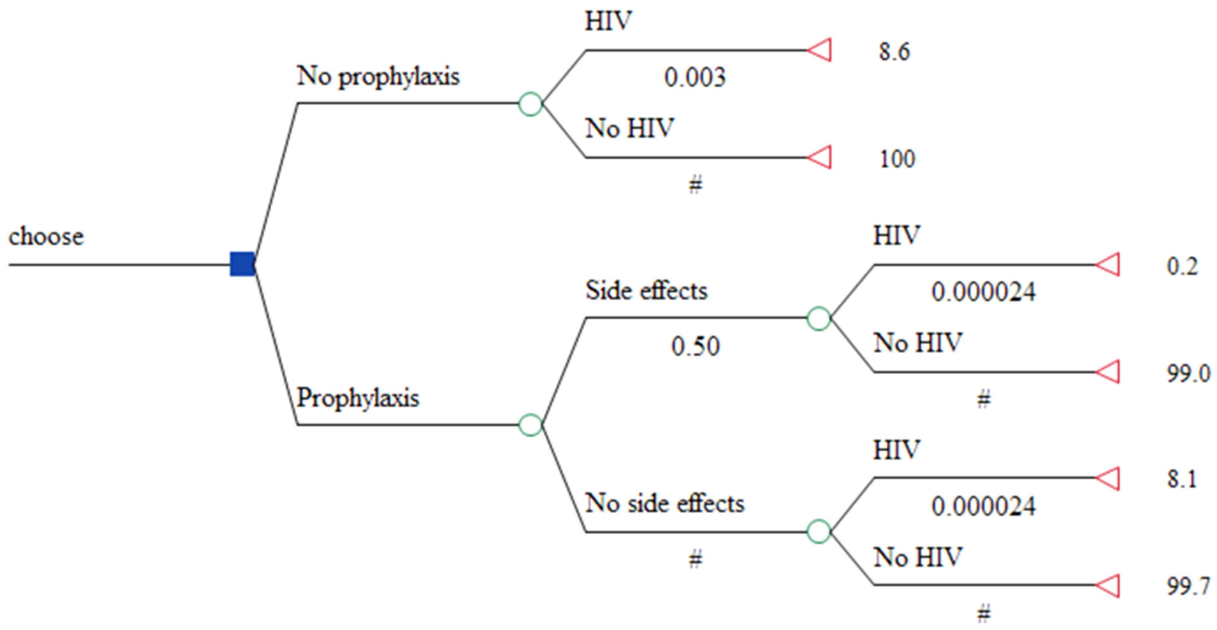
- When you create a chance node that does not follow the square decision node, the program indicates that you can enter a probability for each branch. Item 5 below explains how to do this.
- When you create a terminal node, the program will ask you to enter a payoff value. Item 6 below explains how to do this.

5. Add a probability number to each branch after a chance node. For example, to enter a value for the probability of HIV after choosing no prophylaxis, left click on the space below the branch, type "0.003" and then press Enter on your keyboard. To have the program automatically calculate the probability of No HIV, type "#"in the other branch instead of a number or a mathematical expression.
6. Add an outcome value after each terminal node. **We prefer that you use your personal utility values for outcome values instead of the utilities that are used in this example. You wrote your personal utility values down in class on Wednesday March 4. If you don't have your personal utility values, list the 6 outcomes vertically on a sheet of paper, rank them in order so the best outcome has the rank 1 and the worst outcome has the rank 6. Assign 100 to the best outcome, assign zero to the worst outcome, and assign values between zero and 100 to the 4 other outcomes.** When you create a terminal node, you can enter a payoff value, or you can exit without entering a a value. To enter values later, click a terminal node and then click Node/Edit Payoffs, or right-click the node and select Edit Payoffs. When the box labeled Edit Payoff – HIV opens, enter your utility value in the row labeled Active Payoff immediately under the label Value at Node, and then click OK. Repeat this process until you have entered utility values for all the outcomes. If you need to change a utility value, right-click the node and select Edit Payoffs.

   If your tree is too compact or too spread out horizontally, change it by going to the top of the box containing the tree. There you will find a horizontal scale that measures the distance from the left margin. Click on any icon in the scale (icons look like tiny triangles or pentagons pointing down and there is an icon for each node or each vertical set of nodes). Drag the icon right or left to the desired position.

   If you want to change other things about the way your tree looks, click on Edit /Tree Preferences, expand Display, and then click Tree Editing/Layout. For example, select Align endnodes, select Branch lines at right angles, and then click Apply and Close.

   Your tree should now look something like the tree that follows.



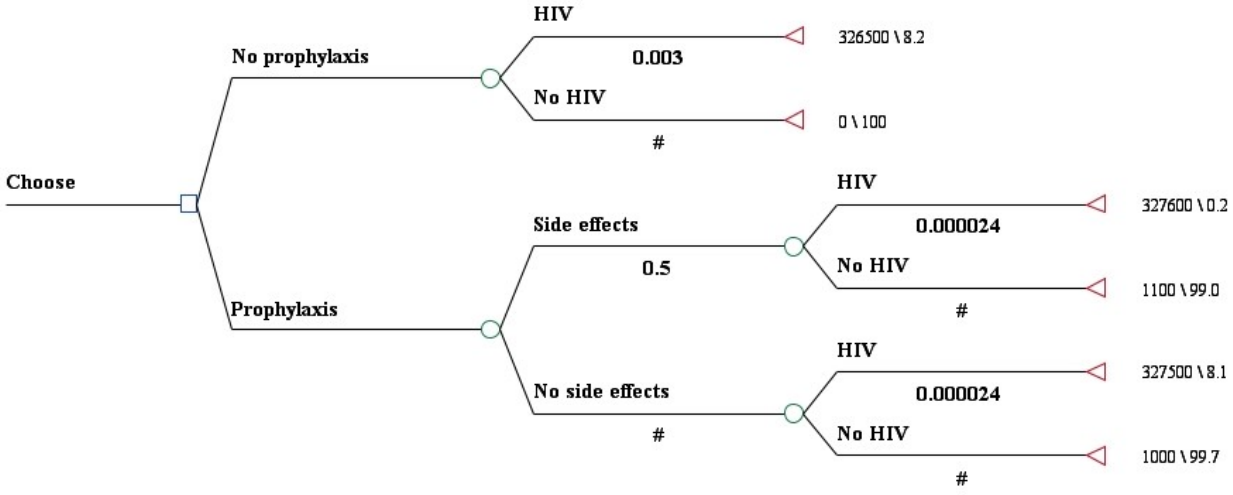
7. Save this tree (File/Save) with the name "HIV tree" in the .trex format in case you need it to recover from a future error.
   - Calculate the expected value of each choice (Select the Choose node, and then click Analysis/Roll Back).
   - Save the tree with its expected values (click File/ Save Image/All nodes) as a JPEG file. Name it with your family name followed by the number 1, for example, "Williams1.jpeg"
   - Turn off Roll Back (click Analysis/Roll Back).

Add cost outcomes to the tree and do a cost-effectiveness analysis

8. Click Edit/Tree Preferences. Select Calculation Method
   - Under Calculation Method
     - Click on Cost-effectiveness
     - Select 1 for Cost payoff
     - Select 2 for Effectiveness payoff
   - Click on Numeric Formatting,
     - For cost, select 2 for Decimal places, unselect Add trailing zeros, select Use thousands separators, select Exactly for Show numbers, and select Currency for Units.
     - For effectiveness, select 2 for Decimal places, unselect Add trailing zeros, select Use thousands separators, select Exactly for Show numbers, select Custom suffix for Units, and type "utiles" for the Suffix

- For cost-effectiveness, select 2 for Decimal places, unselect Add trailing zeros, select Use thousands separators, select Exactly for Show numbers, and select custom suffix for Units, and type in "$/utile".
- Expand Numeric Formatting, click on Probabilities
  - Select 6 for Decimal places, then click Apply and Close.

9. Add to the tree the values for the cost of each outcome. Assume that the lifetime cost of treating HIV infection is $326,500, the cost of prophylaxis is $1,000, and the cost of a side effect is $100. For example, to enter the cost for the branch Choose/Prophylaxis/Side Effects/HIV, right click the triangle at the end of this branch, and click Edit Payoffs. When the box opens, locate the box for the cost value in the first row under the label Value at Node. Enter "327600," which is the sum of 1000+100+326500. When you enter the cost value, you will replace the existing number for effectiveness that already is in the first row, and you must retype or move the value for effectiveness to the second row. After you have entered the values for cost and effectiveness for this branch, then click OK and repeat the process for the other branches.
   - When finished, your tree should look something like the tree below.
   - Save the tree (click File/ Save Image/All nodes) as a JPEG file. Name it with your family name followed by the number 2, for example, "Williams2.jpeg"



10. Run a cost-effectiveness analysis.
   - Select the node Choose, click Analysis/Cost-effectiveness…
   - Ignore the graph that appears
   - If you see material titled Console, delete it
   - Click on Text Report
   - Concentrate on the set of values that are labeled All, ignore the columns NMB and C/E, and convince yourself that the remaining values make sense
   - Save this report. Go to the top of the report (not the top of the screen). On the left is the label Cost-Effectiveness Rankings. At the same level on the right are 4 icons. If you float the pointer over the last icon on the right, it will bring up a box that says, Open in

New Excel Spreadsheet. Click this icon. Save the spreadsheet that appears as an .xlsx file. Label the file you save with your family name followed by the number 3, for example, "Williams3.xlsx."

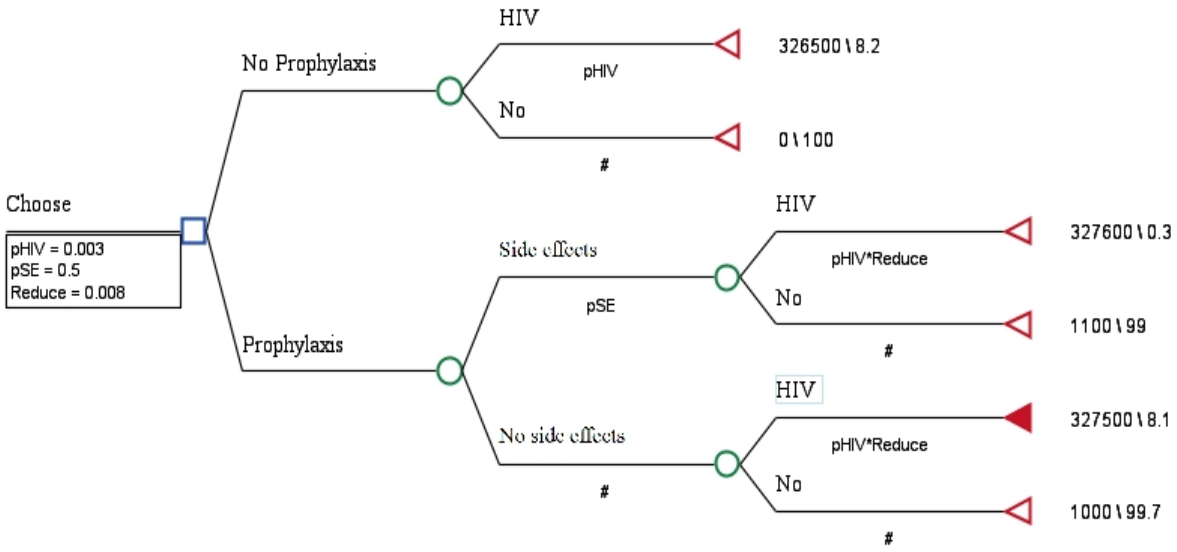
- Close all the open material except for the tree. Save this tree (File/Save As…) with the name "HIV CE tree" in the .trex format in case you need it to recover from a future error.

Change the numbers in the tree to variables, and run a deterministic (as opposed to a probabilistic) sensitivity analysis

11. Replace the probability numbers in your tree with symbolic expressions for probabilities.

    - For example, to enter a value for the probability of HIV after choosing no prophylaxis, click on the space below the branch, type "pHIV," and press Enter on your keyboard
    - In the box that appears, in the Description box, type "Probability of HIV without prophylaxis"
    - Find Create definition at, and select Root node
    - In the section for Root Definition, in the white box underneath Build Expression, type "0.003"
    - Scroll down to the very bottom of the box until you can see Show definitions in tree and select this option
    - Click Apply and Close.
    - Use similar steps to change other probabilities to variables. (Reduce had a value of 0.008 in the example used in class.)
    - Click on the Choose node, click Values/Variable Definitions View, and confirm that all the numbers are listed under the Choose node in the window that appears.

12. If your tree does not have a box underneath the Choose node that lists the names and the values of the variables you have just created, turn on this feature
    - Go to Edit/Tree Preferences and expand Display
    - Click on Variables/Markov Info, select Show Definitions, and click Apply and Close
    - Your tree should look something like the tree that follows



13. Replace the utility numbers in your tree with symbolic expressions for utilities. To do this, you need to make three assumptions. One assumption is that your utilities can be converted into disutilities, which are reductions from the optimal health state. For example, if your utility for the branch No Prophylaxis, HIV is 8.6, then your disutility for that outcome is 100 - 8.6 or 91.4 (see the table that follows).

Terminal Node	Utility Value	Disutility value
No Prophylaxis, HIV	8.6	91.4
No Prophylaxis, No HIV	100.0	0.0
Prophylaxis, Side Effects, HIV	0.2	99.8
Prophylaxis, Side Effects, No HIV	99.0	1.0
Prophylaxis, No Side Effects, HIV	8.1	91.9
Prophylaxis, No Side Effects, No HIV	99.7	0.3

The second assumption is that you can estimate the components that make up the 6 outcome utilities. For example, there are three estimates of the disutility for HIV in the values that are in the decision tree. One estimate is the difference between the disutility for No Prophylaxis, HIV (91.4) and the disutility for No Prophylaxis, No HIV (0.0), which is (91.4 - 0.0 = 91.4). The second estimate is the difference between the disutility for Prophylaxis, Side Effects, HIV (99.8) and the disutility for Prophylaxis, Side Effects, No HIV (1.0) or (99.8 - 1.0 = 98.8). The third estimate is the difference between the disutility for Prophylaxis, No Side Effects, HIV (91.9) and the disutility for Prophylaxis, No Side Effects, No HIV (0,3) or (91.9 - 0.3 = 91.6). **The estimate for the disutility of HIV, therefore, is 93.9**, which is the mean of these three numbers ((91.4 + 98.8 + 91.6) / 3 = 93.9).

Similarly, there are two estimates of the disutility of side effects. One estimate is the difference between the disutility of Prophylaxis, Side Effects, HIV (99.8) and the disutility of Prophylaxis, No Side Effects, HIV (91.9) or (99.8 - 91.9 = 7.9). The second estimate is the difference between the disutility of Prophylaxis, Side Effects, No HIV (1.0) and the disutility of Prophylaxis, No Side Effects, No HIV (0.3) or (1.0 - 0.3 = 0.7). **The estimate of the disutility of side effects, therefore, is 4.3**, which is the mean of these two numbers ((7.9 + 0.7) / 2 = 4.3).

In addition, there are two estimates of the disutility of taking drugs. One estimate is the difference between the disutility of Prophylaxis, No Side Effects, HIV (91.9) and the disutility of No Prophylaxis, HIV (91.4) or (91.9 - 91.4 = 0.5). The second estimate is the difference between the disutility of Prophylaxis, No Side Effects, No HIV (0.3) and the disutility of No Prophylaxis, No HIV (0.0) or (0.3 - 0.0 = 0.3). **The estimate for the disutility of taking drugs, therefore, is 0.4**, which is the mean of these two numbers ((0.5 + 0.3) / 2 = 0.4).

The third assumption is that the overall disutility for each outcome is the sum of the disutilities for the components that make up that outcome. For example, the disutility for Prophylaxis, Side Effects, HIV is equal to the disutility for taking drugs plus the disutility for having side effects plus the disutility for having HIV.

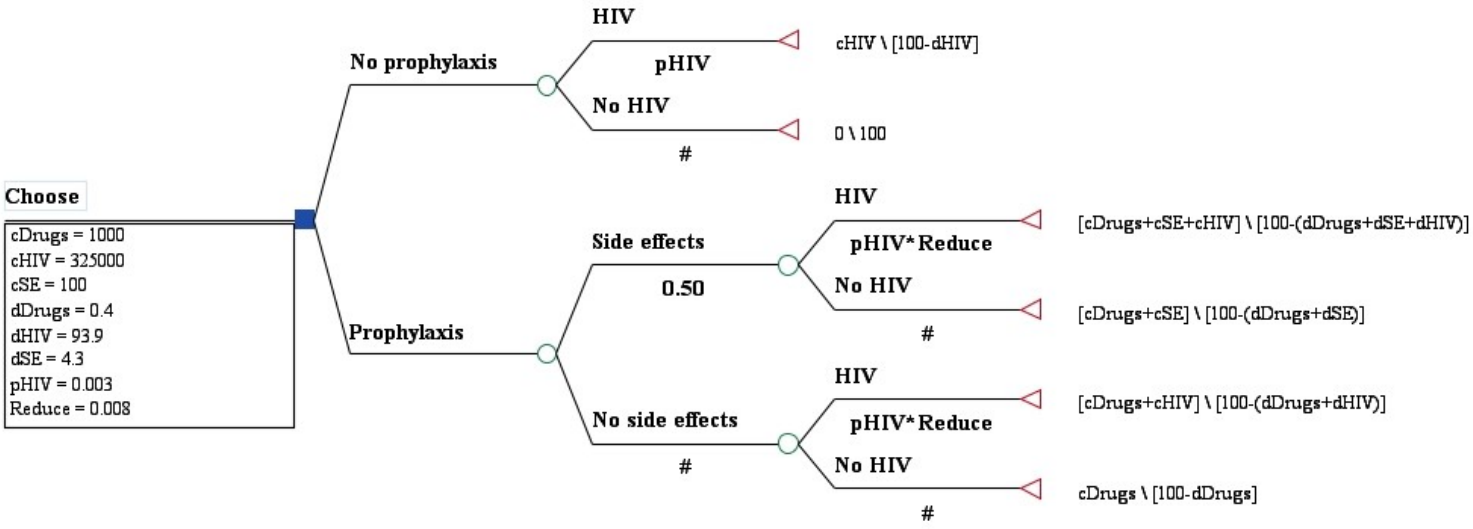
To put algebraic expressions for costs and utilities in your decision tree, enter the appropriate algebraic expressions in the appropriate positions. For example, to enter expressions for the branch No Prophylaxis, HIV

- Right click the terminal node, and click Edit Payoffs
- Type "cHIV" in the Payoff Set for Cost, click OK, in the window that opens write a description of the variable, enter its baseline value (326500) in the big white box underneath Build Expression, select Show definitions in tree, and click Apply and Close
- Type “100 - dHIV” in the Payoff Set for Effectiveness, click OK, in the window that opens, write a description of the variable dHIV, and enter your disutility value for this payoff in the big white box underneath Build Expression, select Show definitions in tree, click Apply and Close, and click OK

- Use comparable methods to create other outcome variables, describe them, and assign numerical values to them

Note that you can do the same things by clicking Values/Value properties view. You can then enter new variables, describe them, assign numerical values to them, and indicate that they should appear in the tree with their values. This alternative feature is especially useful for editing properties once you have defined them. Another alternative is to click on Tree/Tree Properties. In the window that appears at the bottom of the screen, click Variables in the upper left part of the window.

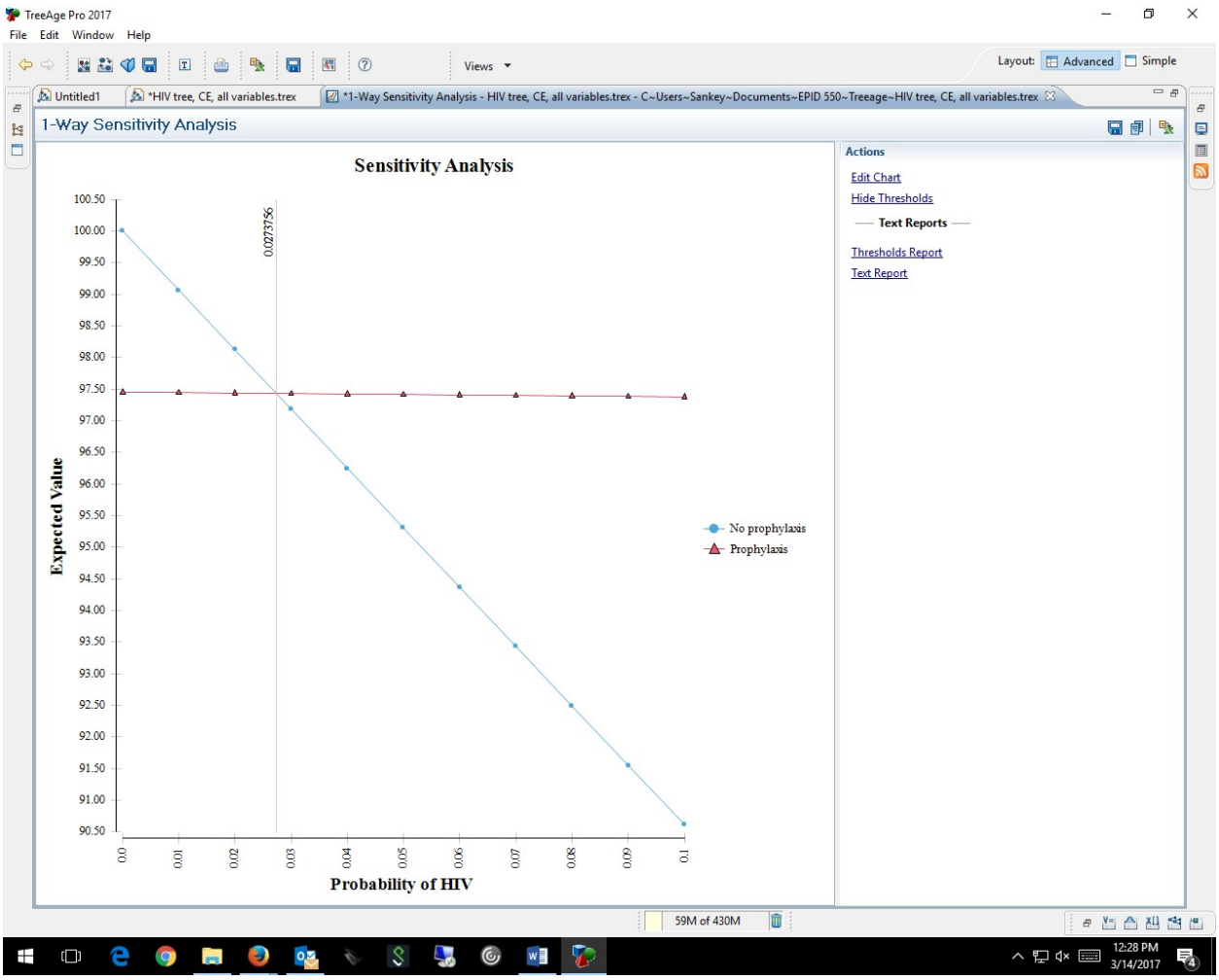
When you have finished adding variables, your tree should look something like the tree below.



Save your tree (click File/ Save Image/All nodes) as a JPEG file, labeled with your family name followed by the number 4, for example, "Williams4.jpeg."

14. Run a simple analysis for outcomes.
    - Click Edit/Tree Preference/Calculation/Calculation Method and select Simple
    - If the Active Payoff is not 2, select Payoff 2, then Apply and Close
    - Select the Choose node, and calculate the expected value of each choice (Analysis/Roll Back)
    - Note that you will get expected values that are different from the answers you got when you used numbers for outcomes, because the values you used for outcomes in this tree are different
    - Save this tree with its expected values (click File/ Save Image/All nodes) as a JPEG file labeled with your family name followed by the number 5, for example, "Williams5.jpeg"
    - Turn off Roll Back (Analysis/Roll Back).
15. Select the Choose node, and run a one-way sensitivity analysis on the probability of getting HIV with no prophylaxis

- (Analysis/Sensitivity analysis/1 way)
- Select Variable = pHIV, type “0” for Low entry, type “0.1” for High entry, type “10” for Number of intervals, and click OK.



- If your graph does not look something like the figure above, click on Edit Chart to the right of the graph. When the box opens, look at the top of the box and make sure you are using the folder titled Select Chart Type. Find the box labeled Select Chart Type at the lower left and select Line for chart type. If that doesn’t work, explore other options. Click Finish when the graph looks the way you want it to. Note that you had to assign the description “Probability of HIV” to the variable pHIV for this label to appear on the graph.
- Save the graph in JPEG format (click File/ Save and select JPEG in the small box labeled Type just below the center of the large box that opens). Label the file you save with your family name followed by the number 6, for example, “Williams6.jpeg.”

16. Select the 6 files you have labeled with your family name and saved, and email them to sankey@wharton.upenn.edu. Expect an email message from me acknowledging receipt of your files. If you don't receive a message from me in a couple of days, check to make sure I received your files and a junk mail filter did not divert them.