

MSBI 32300- Homework 1

Totally 150 points (=15% of overall grade).

Please complete the following questions and upload to Canvas.

Question 1 – Diagnosing a Disease

Cyberchondria is a (fake) disorder induced by over-exposure to sensational news on social media. It has reached epidemic proportions, affecting approximately 20% of the population in your area of the country. It manifests with symptoms such as paranoia, anxiety, irritability, insomnia, and carpal-tunnel. Thankfully, a helpful test has been developed to assist physicians in diagnosing it. In a prior research study, the test performed as follows:

	Disease+	Disease-
Test+	256	79
Test-	27	438

1. What are the following values for this test? (30 points)
 - Sensitivity: 0.904 or 90.4%
 - Specificity: 0.847 or 84.7%
 - Positive Predictive Value: 0.764 or 76.4%
 - Negative Predictive Value: 0.942 or 94.2%
 - Positive Likelihood Ratio: 5.92
 - Negative Likelihood Ratio: 0.11
2. For a randomly chosen patient, what are the following values, given a positive test? (20 points)
 - Pre-test Probability: 20%
 - Pre-test Odds: 0.25
 - Post-test Odds: 1.48
 - Post-test Probability: 59.7%
3. Alternately, a patient presents with symptoms of Cyberchondria that lead you to believe there is a 70% chance they have the disease. You would like to confirm this diagnosis. What are the following values, given a positive test? (20 points)
 - Pre-test Probability: 70%
 - Pre-test Odds: 2.33
 - Post-test Odds: 13.8
 - Post-test Probability: 93.2%
4. Given your results in #3, would you diagnose this patient with Cyberchondria? What if the test came back negative? (10 points)

The post-test probability shows as 93.2% likelihood of the disease, so yes, I would diagnose the patients with Cyberchondria. The chances of the test coming back negative are so low (below 7%) that if the test was negative, I would re-do it to make sure and if it came back negative again, then they very likely do not have the disease.

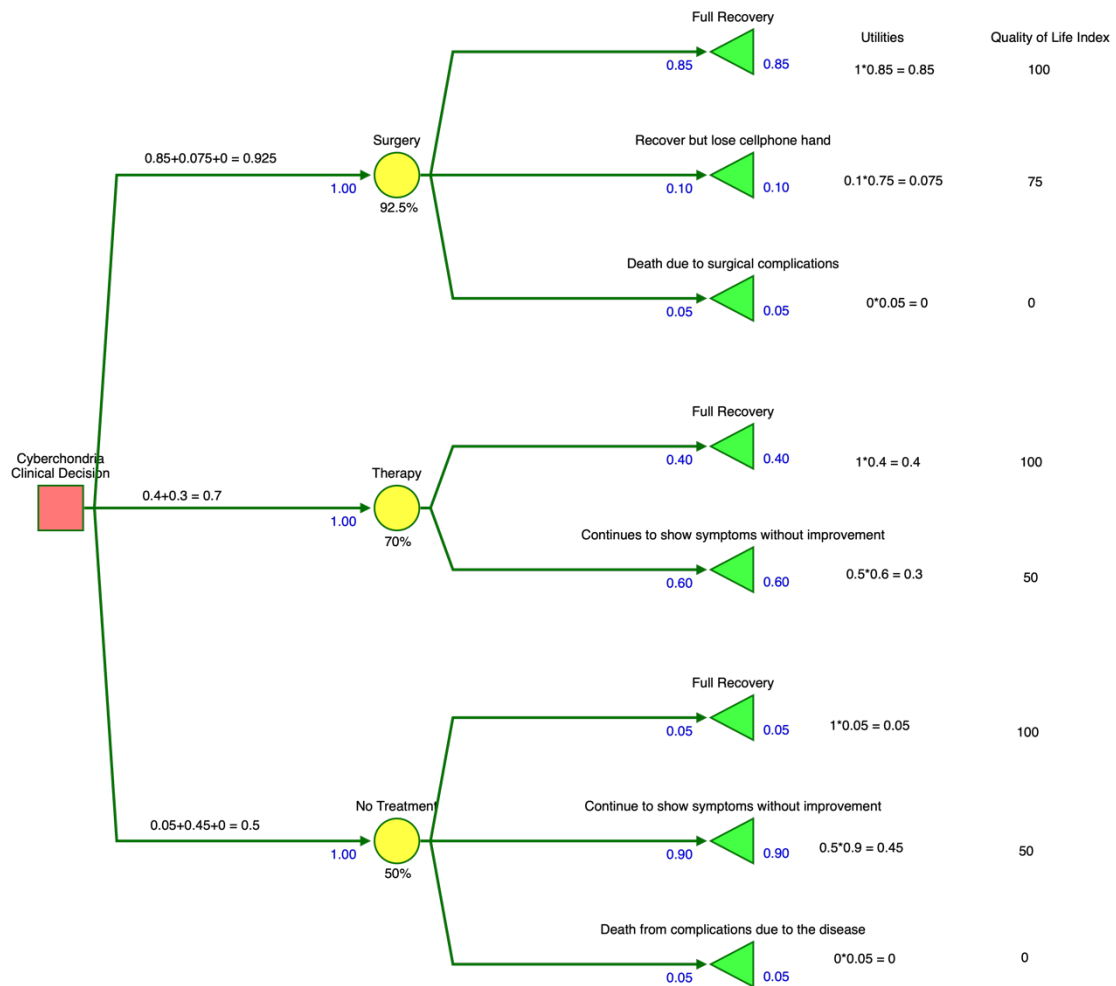
Question 2 – Treating a Disease

After testing your patient, you have diagnosed them with Cyberchondria and must decide how to proceed in treating them. Unfortunately, treatment can often be invasive, involving a difficult procedure to surgically remove cellphones that have become grafted to the patient's hand over the course of several years of addiction and overuse. However, some patients fully recover after an intense Internet-detoxification therapy program. A very small number recover fully without treatment. A detailed breakdown follows:

- For patients that elect surgery:
 - 85% recover fully (Quality of Life index: 100%)
 - 10% recover, but lose the use of their cellphone hand (Quality of Life index: 75%)
 - 5% die from surgical complications (Quality of Life index: 0)
- For patients that elect therapy:
 - 40% recover fully (Quality of Life index: 100%)
 - 60% continue to show symptoms, without improvement (Quality of Life index: 50%)
- For patients that elect no treatment:
 - 5% recover fully (Quality of Life index: 100%)
 - 90% continue to show symptoms, without improvement (Quality of Life index: 50%)
 - 5% die from complications of the disease (Quality of Life index: 0%)

1. Construct a decision tree to represent this information. Show all choice nodes, chance nodes, terminal nodes, probabilities, and utility values. You can either use the free online tree builder at <http://silverdecisions.pl/> or draw it yourself. Paste your diagram in the space below. (50 points)

The decision tree is on the next page. Just a few notes. There was no way to remove the probabilities between the decision and choice nodes (each was 1.00) in the software so I had to leave it even though we did not learn to add them in class. Also, the probabilities at the terminal nodes are represented twice for some reason (numbers in blue text), and I couldn't find a way to remove the redundancy in the settings. The two columns of black numbers are the utility values and Quality of Life indices.



2. What is the optimal treatment choice in this scenario? What is the expected Quality of Life index of that choice? (20 points)

The optimal treatment choice is surgery as it offers the highest chance of full recovery given the probabilities of full recovery (0.85) across all three potential choices. Also, the utility of the surgery choice arm is 92.5% which is the highest of all three options as well. The quality of life index is 100% of that choice.