Mobile TB Care

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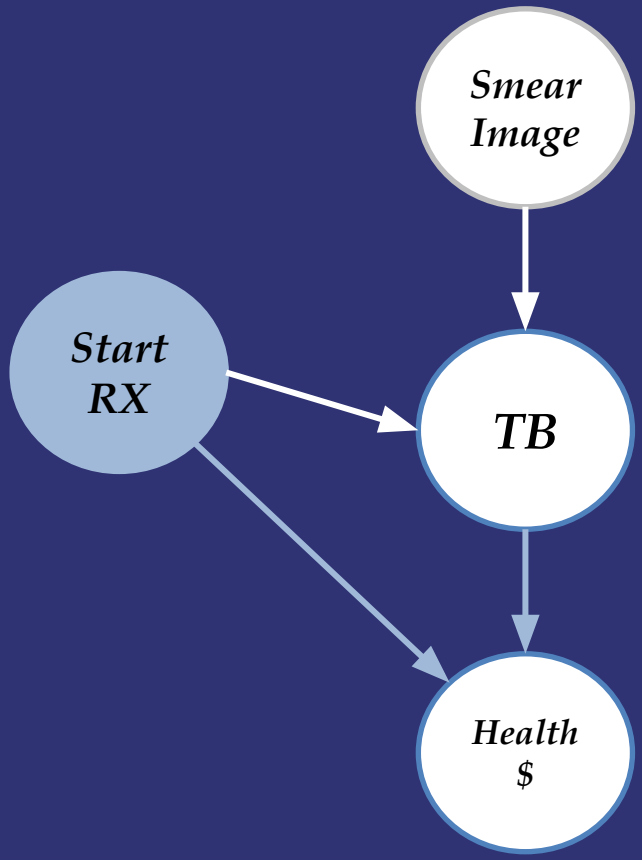
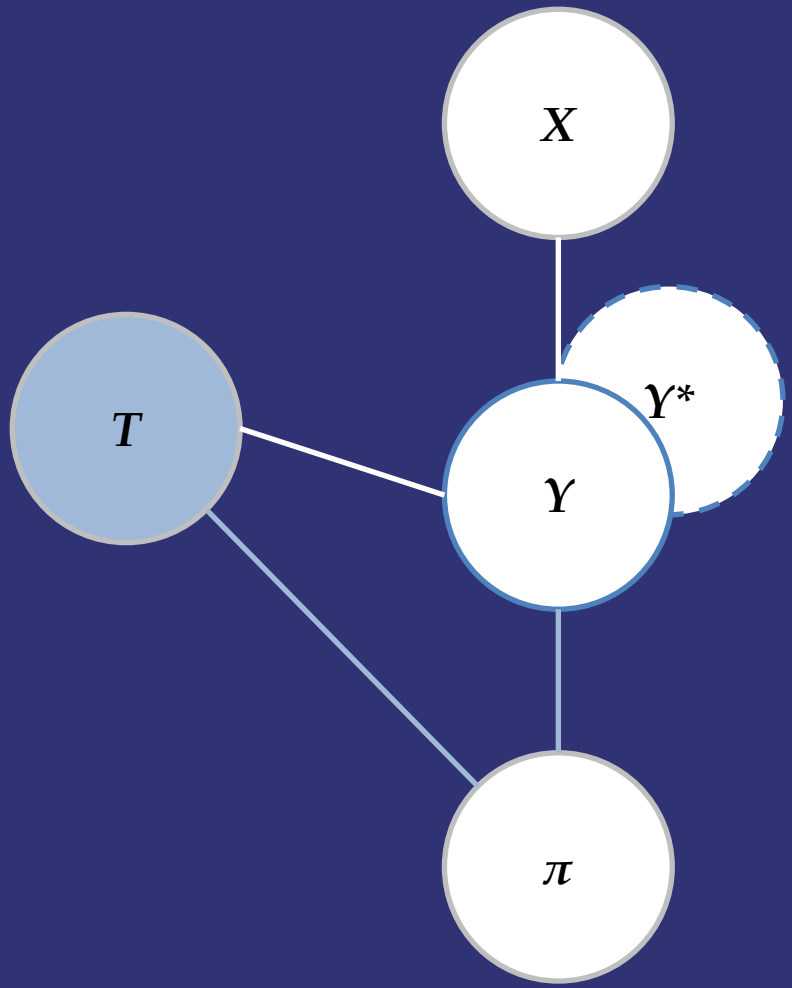
Prediction problem



- **What is the decision?**
  - The decision *T* that the algorithm improves is whether to initiate Active Tuberculosis (TB) treatment, by using smear image data to detect TB in a patient's sputum
  - The decision maker is the physician, who will decide whether to treat the patient given sputum analysis and algorithm results
  - The final decision is made once the physician runs the algorithm and analyzes its conclusion
- **What are we predicting?**
  - Based on the smear images, we can calculate probabilities that the patient has Active TB in their sputum
  - This prediction benefits the physician since the sputum analysis process is automated, allowing them to bypass chest x-rays and expand TB screening access by keeping services mobile

Prediction pitfalls



- **Do we have exactly the variable we want?**
  - Yes, the measured Y is the visual identification of Active TB or other indications of TB on the smear images, which is a direct proxy for our true goal of identifying TB (Y*).

- **Is there a causal link between the decision and the variable?**
  - No, there exists no causal link between the decision and the variable, rendering the algorithm a pure prediction problem
  - The algorithm utilizes the input variables X0 to directly predict the likelihood of a patient having TB, without modifying the underlying conditions that determine the presence or absence of TB in that patient.

Summary

- **Our high-level goal is to help the physician detect active TB in a patient, in order to provide them life-saving treatment immediately**
- **Our dataset includes key limitations:**
  - Of ~75,000 images in the Nightingale Open Science dataset, only 5.2% of them show positive TB smears. This can lead to a high accuracy algorithm by predicting negative for every sample
  - The images come from smears taken in Asia; this regional uniformity could introduce confounding variables in the algorithm
- **These limitations have implications for how we would deploy our algorithm**
  - In terms of how we adjust our algorithm, we might have to use other metrics of measuring algorithm performance such as precision and/or recall, as maximizing accuracy might not be the right course of action.
  - To enhance generalizability of the algorithm, we would also diversify the dataset by incorporating images from different geographical regions.