Problem Statement

Key Goal: Reduce patient waiting time by mixing chemotherapy drugs before patients arrive in the system or at earlier stages in the process.

Motivation
- Cancer
  - Second leading cause of death in the U.S.
  - ~1.7 million estimated cases in 2017
- More than half require chemotherapy treatment
- Infusion centers
  - Increased outpatient demand leads to undesirable outcomes such as:
    - Increased patient waiting times
    - Overworked staff

What is Pre-mix?

- Anytime you mix a drug before a patient is deemed ready to receive it
- Generally you don’t pre-mix drugs due to risk in wastage cost
- Consider the trade off between waste cost and reduced patient waiting time

Probability of Deferral

Suppose we have five patients scheduled to receive 100 mg of Taxotere on a given day.
If the first patient defers/no-shows we then can give their drug to the second and so on. Therefore to waste one dose, all patients must defer or not show.

Model

- Probability of wasting the second dose pre-mixed
- Probability of deferring the second dose pre-mixed

Prediction Model

We have developed a predictive model which utilizes patient specific data to determine the probability that a patient will not show for or defer treatment on a given day. This model is useful to help determine which drugs to pre-mix, to help schedule patients, and to improve work allocation.

We tested a wide range of predictive models including generalized linear models (GLM), tree-based methods, neural networks, and various ensemble models. This work serves as an initial step for building an optimization model to determine the superior set of drugs to make ahead in order to reduce patient waiting time in the cancer center.

- UMHS Data from 2015
- N=28,919
- 3,522 total patients in sample

Future Work

- Relax assumptions for drug hang-by time, preparation times, and that all patients are scheduled to receive one drug
- Determine the most appropriate prediction model for patient deferrals/no-shows
- Incorporate prediction model
- Use to justify the expected saved wait time by following recommendations taken from the static pre-mix model solution
- Test various policies for mixing chemotherapy drugs throughout the day

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Figure 1: To the left we illustrate the breakdowns of patients following each route depicted above. Note these percentages also include a small fraction of patients that are receiving non-chemotherapy related infusion. We also note that the route for patients scheduled to only visit the infusion is not depicted above.

Figure 2: Box plot representation of predictive AUC for 50 repeated hold out trials