The Comparison of ACI and MCB Methods for Choosing a Set that Contains the Optimal Dynamic Treatment Regime

Rong Zhou

Joint work with Tianshuang Wu

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Outline

Organization of this presentation

- About the project
- Simulation

Goal of our project

Goal

The goal of this project is to apply simulation (and clinical data) to find out the probabilities that the two proposed methods will provide a set that includes the optimal DTR(s) in different scenarios, and to assess how good they are performing in excluding other DTRs. The two methods are:

- Adaptive Confidence Intervals (ACI) by Laber et al.
- Multiple Comparisons with the Best (MCB) by Ertefaie et al.

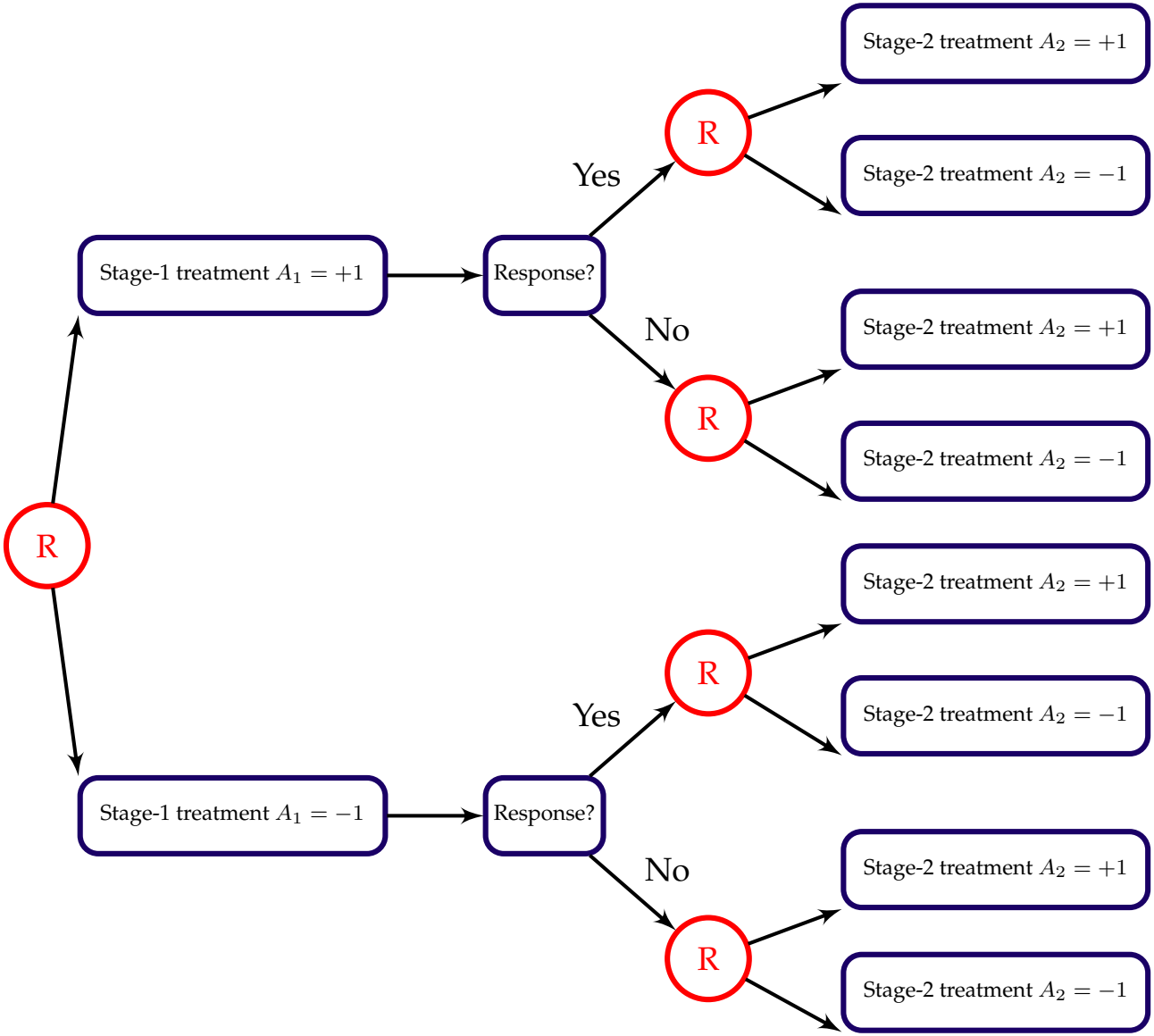
Goal of our project

Method

The way to determine whether ACI or MCB is a better method in different scenarios is by comparing:

- The probabilities that the best DTRs are included into the constructed set, and
- The average set size from each method, which is the sum of probabilities of all DTRs within each method.

SMART Design



Scenarios for Data Simulation

Simulations are constructed based on a two-stage SMART and the generative model for final outcome Y is set as follows:

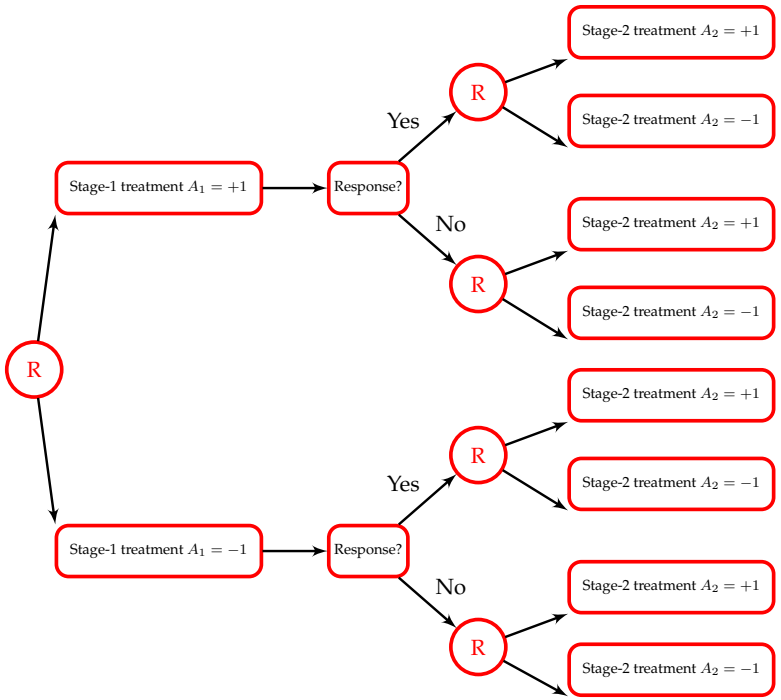
$$Y = \gamma_1 + \gamma_2 X_1 + \gamma_3 A_1 + \gamma_4 X_1 A_1 + \gamma_5 A_2 + \gamma_6 X_2 A_2 + \gamma_7 A_1 A_2 + \epsilon, \epsilon \sim N(0, 1)$$

Scenarios are constructed by setting different values of γ vector $(\gamma_1, \gamma_2, \gamma_3, \gamma_4, \gamma_5, \gamma_6, \gamma_7)$ and δ vector (δ_1, δ_2) that determines $X_2|X_1, A_1$ as $X_2|X_1, A_1 \sim$ Bernoulli(expit$(\delta_1 X_1 + \delta_2 A_1)$), expit(x) = $e^x/(1 + e^x)$

Scenarios for Data Simulation

Scenario One

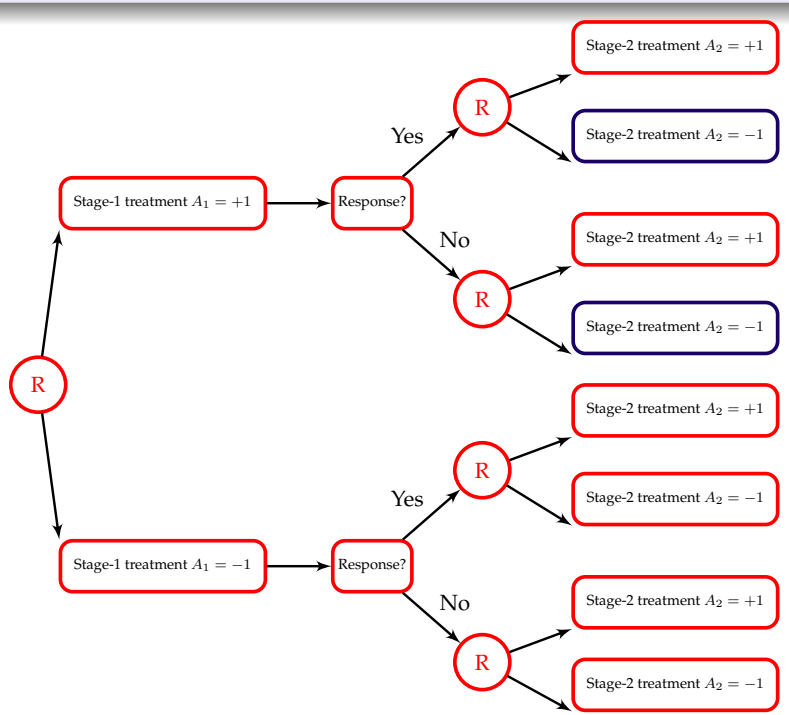
All eight DTRs are equally the optimal ones.
(γ = (0,0,0,0,0,0,0), δ = (0,0))
Result: MCB performs better than the ACI. (Average set size: 7.699(ACI), 7.5162(MCB))



Scenarios for Data Simulation

Scenario Two

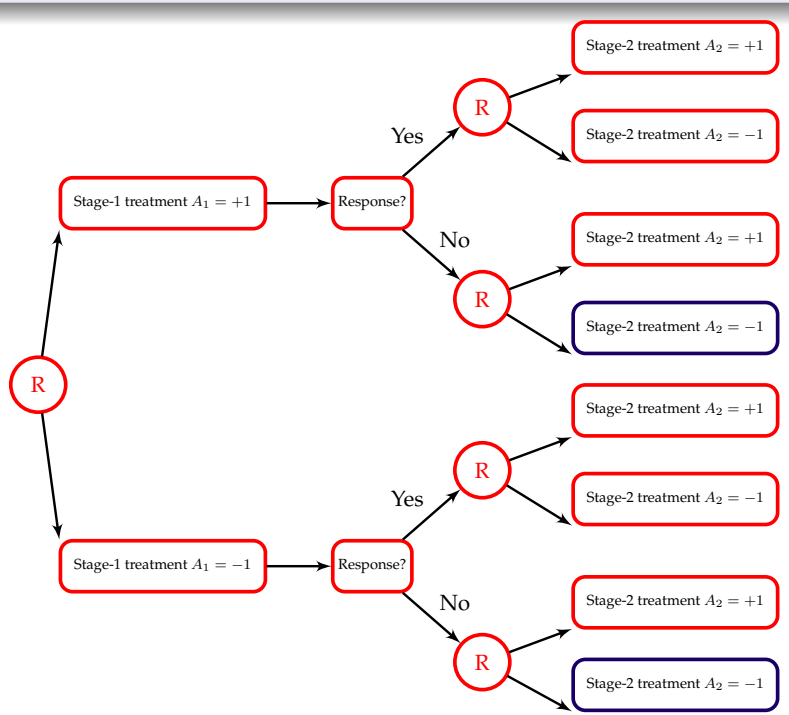
If a DTR starts with $A_1 = 1$, we will have a unique better A_2; if a DTR starts with A_1 = -1, the effect of two A_2s will be the same. In this way, we will obtain five equally best DTRs.
(γ = (0,0,-0.5,0,0.5,0,0.5), δ = (0,0))
Result: MCB performs better than the ACI. (Average set size: 4.8283(ACI), 4.8174(MCB))



Scenarios for Data Simulation

Scenario Three

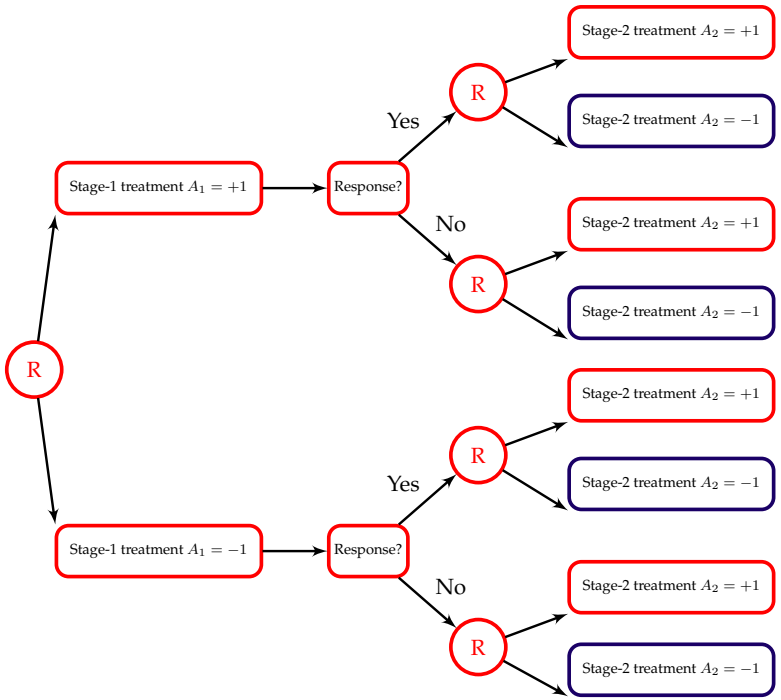
Final outcomes are based on response of the first stage treatment. Responders of the first stage have same final outcomes, but non-responders have different expected final outcomes based on A_2. We have four optimal DTRs. (γ = (0,0,0,0,0.5,-0.5,0), δ = (0,0)) Result: MCB performs better than the ACI. (Average set size: 3.8925(ACI), 3.8815(MCB))



Scenarios for Data Simulation

Scenario Four

Final outcomes are different based on A_1 and A_2 decisions, and only two optimal DTRs will be obtained.
(γ = (0,0,-1,0,-1,0,-0.5), δ = (0,0))
Result: ACI performs better than the MCB. (Average set size: 1.9585(ACI), 1.98(MCB))



Conclusion

Based on the simulation results in four different scenarios, we recommend MCB method. The reasons are:

- On average, MCB performs better than ACI.
- In real clinical trails, Scenario One is more likely to happen.

What's Next

We are focusing on real data analysis using the data from Extending Treatment Effectiveness of Naltrexone (EXTEND) study.

Thank you