Using MOST to advance prevention interventions

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"…re-engineer EBIs based on their most robust features in order to reach more people in less time and at lower cost. (Rotheram-Borus, Swendeman, & Chorpita, 2012)

"Examining mechanism may improve intervention efficacy by identifying which intervention ingredients are effective and which should be abandoned." (Reid & Carey, 2015)

"The effects of the intervention on adherence were most pronounced for participants who were not viral suppressed at baseline. Although the intervention effect for unsuppressed individuals is clear and consistent, it is not optimized." "Dose determination trials are needed for behavior interventions aimed to improve TasP outcomes." (Kalichman et al., 2018)

"Although the ease of incorporating ACT activities into day-to-day routines was described as a strength, participants also expressed a need for external support to increase motivation for regular use of ACT skills. The phone and web-based ACT interventions described previously (cites) may be a novel and feasible way to use technology to address this need for support." (Woolf-King et al., 2018)

"The fact that KIU! significantly reduced selfreported and biological outcomes among YMSM with a brief, efficient, eHealth intervention suggests that KIU! is ideally suited for scale-up implementation research on how the KIU! intervention might be most effectively implemented, kept current, and integrated with new prevention options, such as PrEP." (Mustanski et al., 2018)

Outline

- Definitions
- What's wrong with business as usual?
- What is optimization?
- OK, how do you do this?
- Take home messages for HIV researchers

What is the multiphase optimization strategy (MOST)?

- An engineering-inspired framework for development, optimization, and evaluation of multi-component behavioral, biobehavioral, and biomedical interventions (BBIs)
- Using MOST it is possible to engineer an intervention to meet a specific criterion

What is a multi-component BBI?

- A program with the objective of
  - Preventing or treating HIV
  - Improving or maintaining ART adherence
- May use a strategy that, at least in part, aims to modify attitudes, cognitions, behaviors, contexts
- May be aimed at individuals, partners, networks, clinics, organizations, or communities

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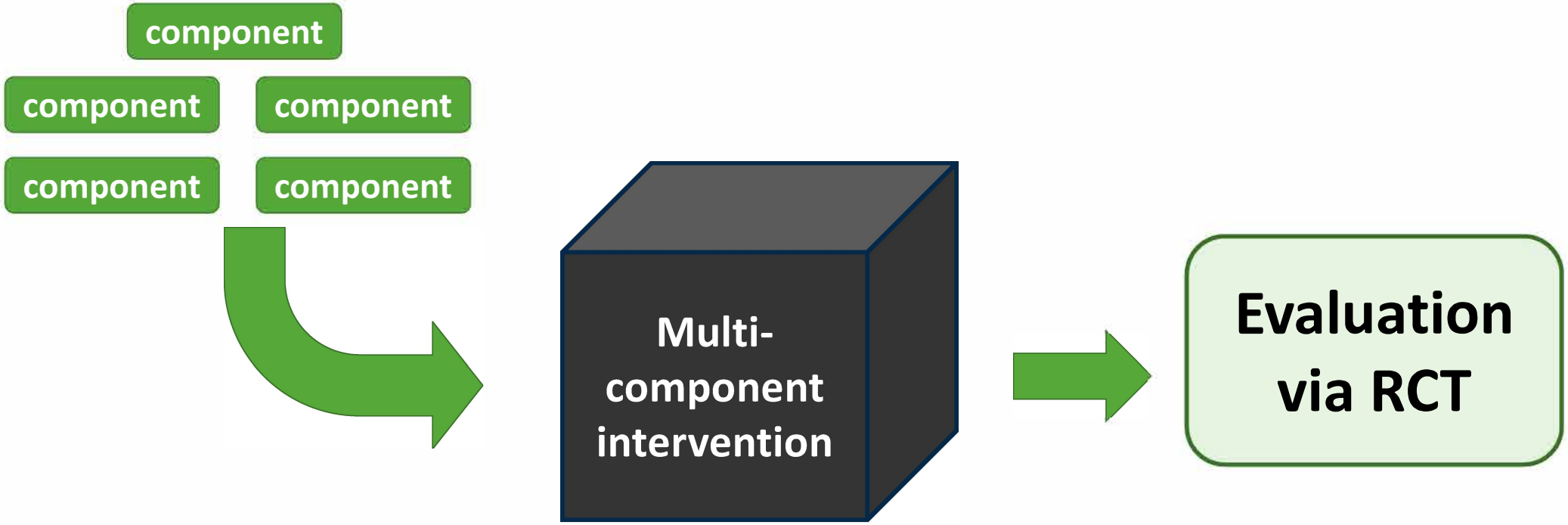
How multi-component inventions are typically developed and evaluated

- Intervention components are chosen based on scientific theory, clinical experience, etc.
- Combined into a package
- Package is evaluated via a randomized controlled trial (RCT)
- Let's call this the *classical approach*

Classical approach



What is wrong with evaluating a multicomponent BBI via an RCT?

Absolutely nothing!

The RCT **is** the gold standard for determining whether an intervention as a treatment package performs better than a control or comparison group

The RCT is the gold standard, but it cannot answer certain questions

If an RCT that finds a significant effect DOES NOT tell us:

- Which components are making positive contributions to overall effect
- Whether the inclusion of one component has an impact on the effect of another
- Whether a component's contribution offsets its cost
- How to make the intervention more effective, efficient, and scalable

The RCT is the gold standard, but it cannot answer certain questions

If an RCT that finds a non-significant effect DOES NOT tell us:

- Whether any components are worth retaining
- Whether one component had a negative effect that offset the positive effect of others
- Specifically what went wrong and how to do it better the next time

What's the alternative?

- When engineers build products they take an approach that is:
  - Systematic
  - Efficient
  - Focused on the clear objective of optimizing the product
- MOST integrates methodological perspectives from the behavioral sciences, statistics, and engineering…
- … to build optimized BBIs

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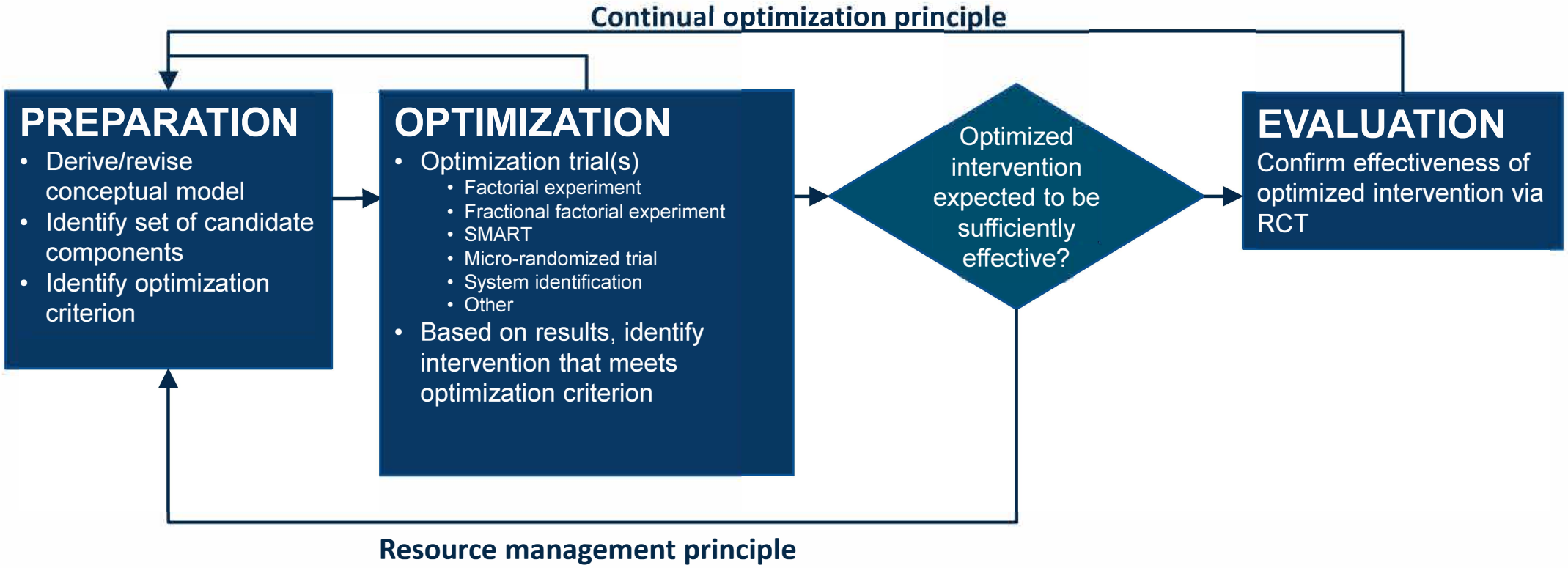
Definition of optimization of an intervention

- *Optimization of an intervention is*
  - *the process of identifying the intervention that provides the best expected outcome obtainable…*
  - *…within key constraints imposed by the need for efficiency, economy, and/or scalability.*

The Multiphase Optimization Strategy (MOST)



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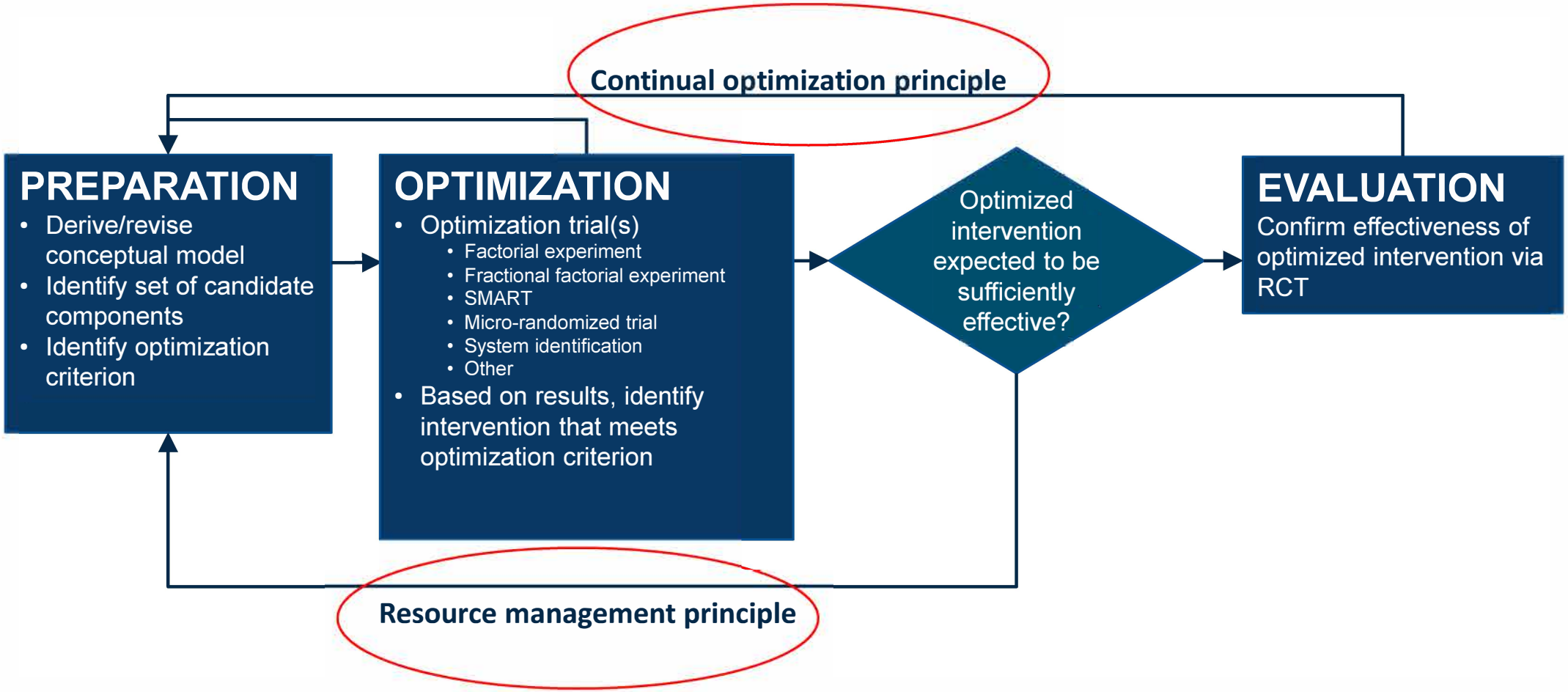

Continual optimization principle

- MOST presents the opportunity to keep making an intervention better and better in an incremental fashion
- Suppose you build the most effective intervention that can be delivered for <$500
- Next time, you might set out to build an intervention that, e.g.,
  - Is just as effective but costs less
  - Is just as effective, costs no more, and takes less time
  - Costs the same, is more effective
- This is a long-range perspective!

Resource management principle

- An investigator using MOST must strive to make the best and most efficient use of available resources when obtaining scientific information in the optimization phase
- ANY experimental design can be used for the optimization phase, as long as it is the most efficient one

Phases of MOST: Preparation, optimization, evaluation

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Phases of MOST: **Preparation**, optimization, evaluation

Preparation

- Purpose: to lay groundwork for optimization
  - Review prior research, take stock of clinical experience, conduct secondary analyses, etc.
  - Derive conceptual model
  - Select intervention components to examine
  - Conduct pilot/feasibility work
  - Identify clearly operationalized optimization criterion

Selecting an optimization criterion

- Optimization always involves a clearly stated *optimization criterion*
- This is the goal you want to achieve…subject to constraints
- Once achieved, it is a bar that sets a standard for subsequent efforts (continual optimization principle)

Possible optimization criteria

- Key constraint: no “dead wood”
  - Select set of components that represents most effective intervention that includes only “active” intervention components
- Key constraint: Money
  - Select set of components…that can be delivered for ≤$500/person
- Key constraint: Time
  - Select set of components…that can be delivered in ≤ 90 minutes

Phases of MOST: Preparation, **optimization**, evaluation

Optimization

- Objective: To form a treatment package that meets the optimization criterion
  - Collect and analyze empirical data on performance of individual intervention components relying on efficient randomized experimentation
  - Based on information gathered, select components and levels that meet optimization criterion

Phases of MOST: Preparation, optimization, **evaluation**

Evaluation

- Objective: To establish whether the optimized intervention has a statistically significant effect compared to a control or alternative intervention
  - Conduct an RCT

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- OK, how do you do this?
- Summary of differences in perspective between the classical approach and MOST

Example: An online STI preventive intervention targeting college students

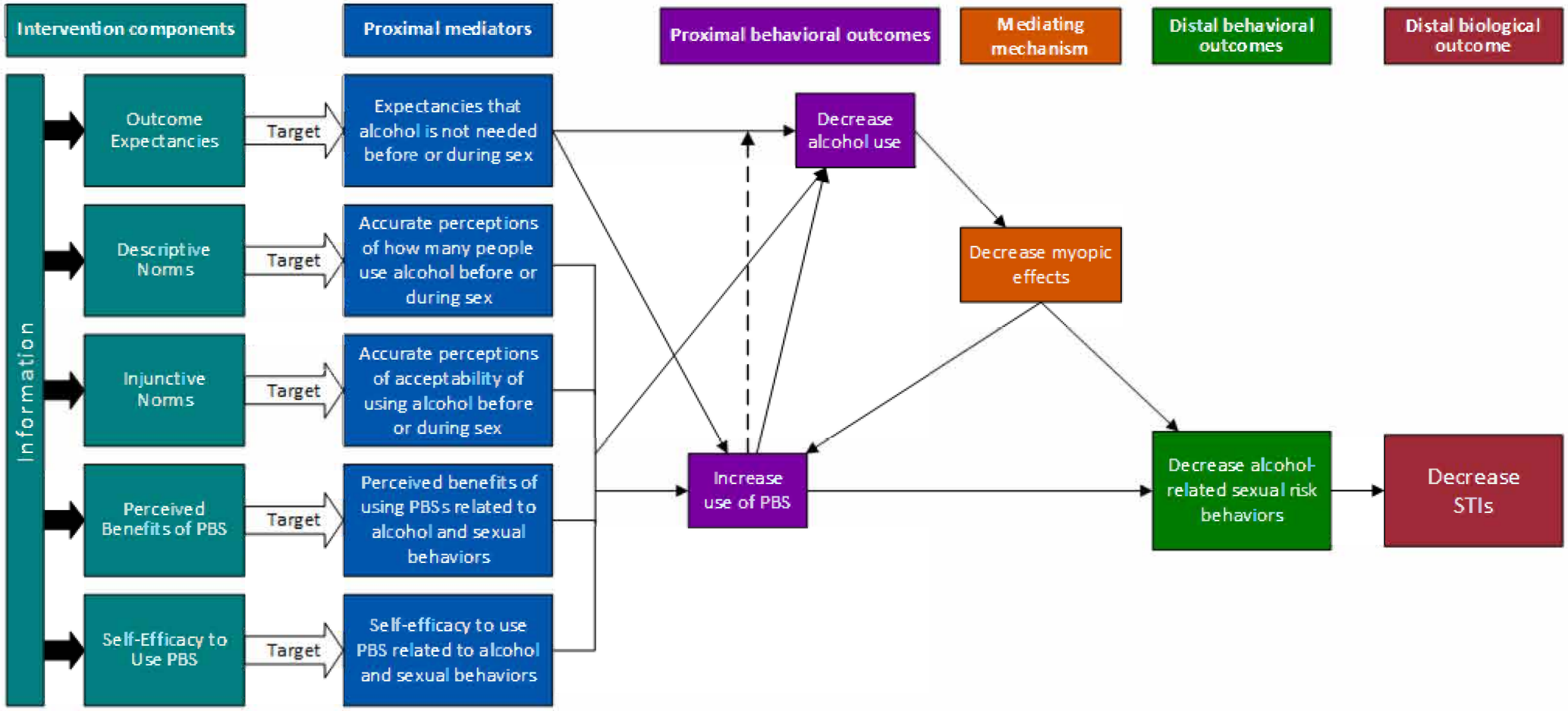
X

R01 AA022931 (PI: Collins)

Preparation phase

- Develop conceptual model
- Optimization criterion: Select components that represents most effective intervention with only “active” components

Conceptual model

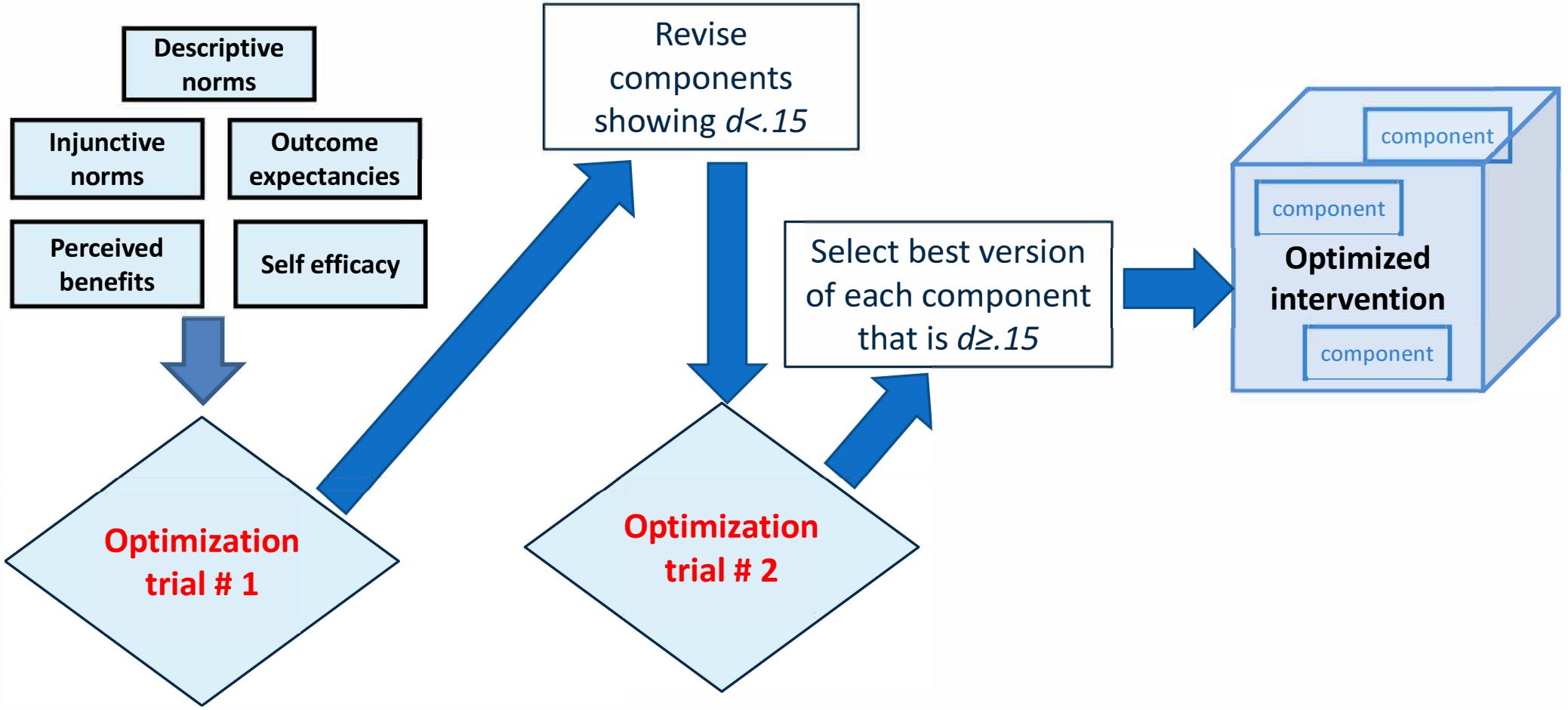


Kugler, K.C., et al. (2018). Using the Multiphase Optimization Strategy (MOST) to Develop an Optimized Online STI Preventive Intervention Aimed at College Students: Description of Conceptual Model and Iterative Approach to Optimization. In L. M. Collins & K. C. Kugler (Eds.), *Optimization of Multicomponent Behavioral, Biobehavioral, and Biomedical Interventions: Advanced Topics* (pp. 1-21). New York, NY: Springer.

Optimization phase

- Determine candidate components
- Determine most efficient experimental design to answer research question

Optimization phase



Optimization trial(s)

- Chose 2^5 full factorial experiment
  - 32 experimental conditions

Experimental conditions in a 2^4 factorial experiment

Experimental condition	Outcome Exp	Inj Norms	Desc Norms	Benefits
1	Off	Off	Off	Off
2	Off	Off	Off	On
3	Off	Off	On	Off
4	Off	Off	On	On
5	Off	On	Off	Off
6	Off	On	Off	On
7	Off	On	On	Off
8	Off	On	On	On
9	On	Off	Off	Off
10	On	Off	Off	On
11	On	Off	On	Off
12	On	Off	On	On
13	On	On	Off	Off
14	On	On	Off	On
15	On	On	On	Off
16	On	On	On	On

Using data from the experiment to optimize

- Conduct an analysis of variance, obtain estimates of effects of each of the components
- Use this information to select components
  - Discard components that do not perform adequately
  - Use size of effects in combination with other data (e.g., cost) or prediction model to select components that will make up optimized intervention
  - Developing ways of doing this is an active research area

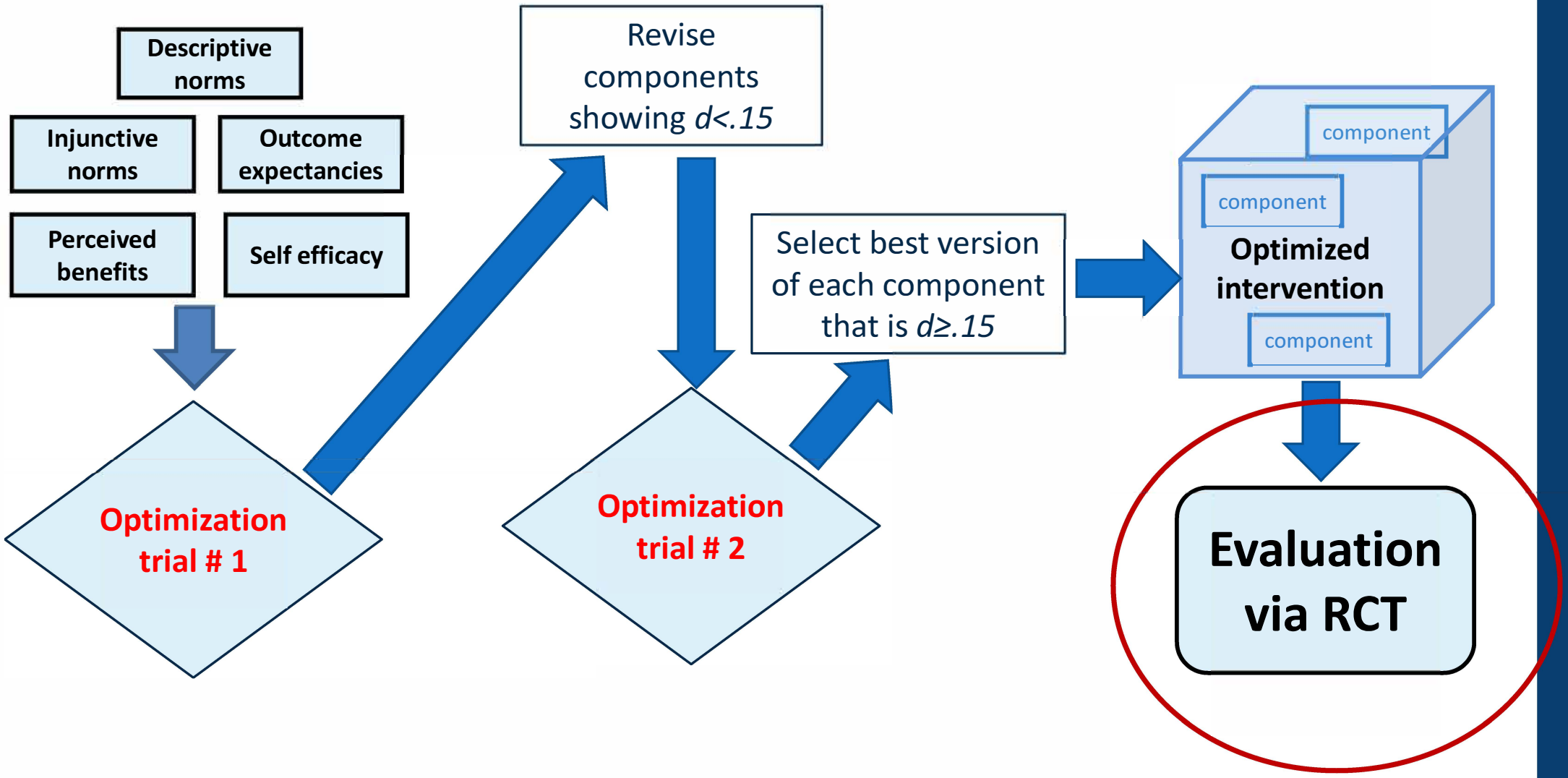
Using the data from the experiment to answer other questions

- Could conduct mediation analyses
- Could conduct moderation analyses
  - These could be secondary aims of a grant

Evaluation phase

- Conduct 2-arm RCT
  - One arm: Optimized STI preventive intervention
  - One arm: Delayed control

Evaluation phase



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Take home messages

- MOST is a framework for optimizing BBIs
- Principles guiding MOST stress efficiency and continuous optimization
  - Information gleaned can be used to refine theories and hypothesized mechanisms
  - Realignment of resources
- In the long-run, using MOST move science forward faster and ultimately “Getting to Zero”!

Once you go MOST…

… the over-stuffed multi-component intervention with inactive, ineffective, and/or counter-productive components is toast (Marya Gwadz)

Thank you!

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