



Presented by  
**Daniel Almirall, PhD**

# Pilot Studies in Adaptive Interventions Research

Including Pilot SMARTs

**Module 6**

 60 min





# Outline

Situating Pilot Studies as  
Preparation for Success

Specific Goals of a Pilot Study &  
What are Some Tools to Reach For

Example Pilot SMART in Autism

Q&As





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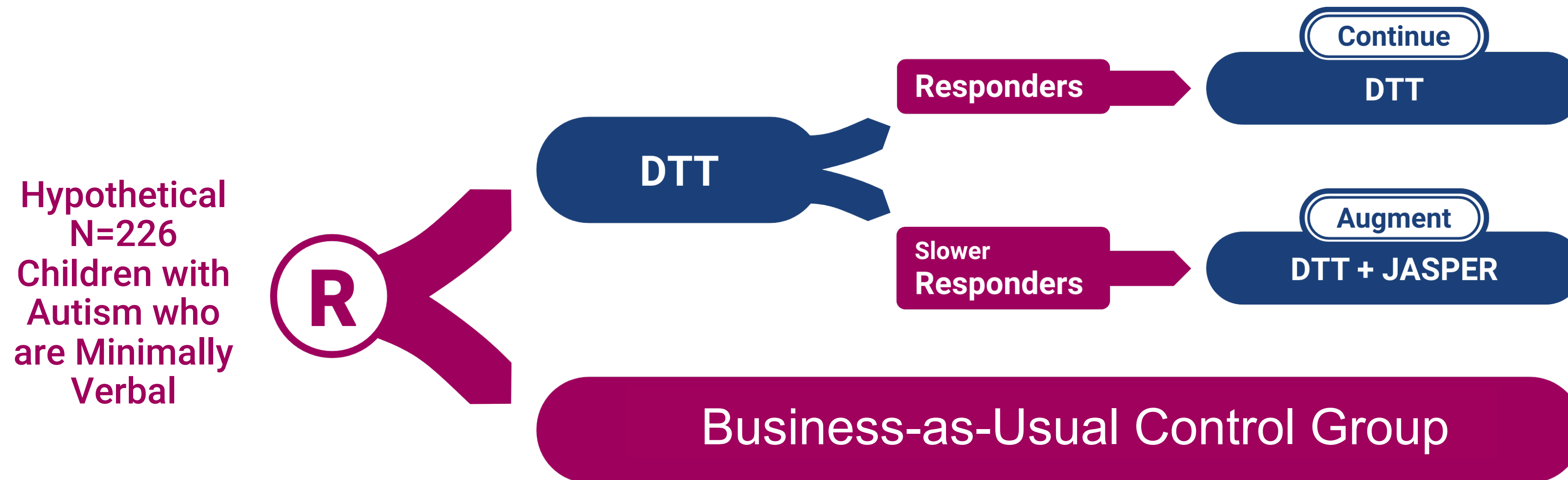
Q&As





# A Pilot Study does not include a...

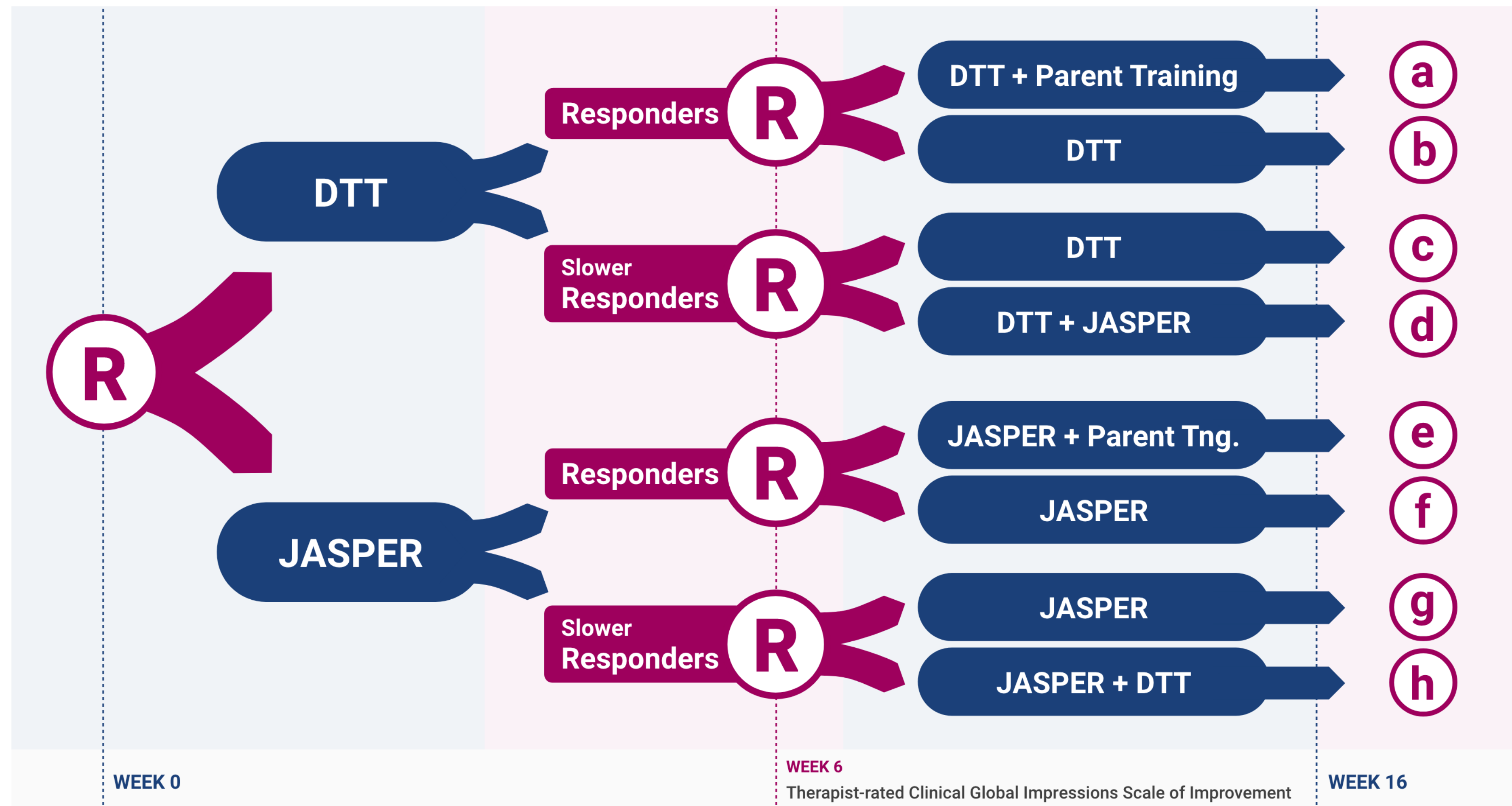
- Full-scale evaluation/confirmatory randomized trial, such as:



Primary Aim: To test if an adaptive intervention that (i) starts with DTT, (ii) continues with DTT for responders, and (iii) augments with JASPER for slower responders differs from business-as-usual (control) on average change in socially communicative utterances over 16wks.

# A Pilot Study does not include a...

- Full-scale optimization randomized trial, such as a SMART



# What does success look like at the end of a Pilot Study?

## A successful Pilot Study is

- Being better prepared to justify the significance/design of the proposed randomized trial
- Having AIs that are well-operationalized and manualized
- Having AIs that are acceptable and feasible to key stakeholders (e.g., students, parents, teachers, or clinicians, etc.)
- Ability to justify that the proposed trial design is feasible (i.e., the research staff can conduct the trial)



# What does success look like at the end of a Pilot Study?

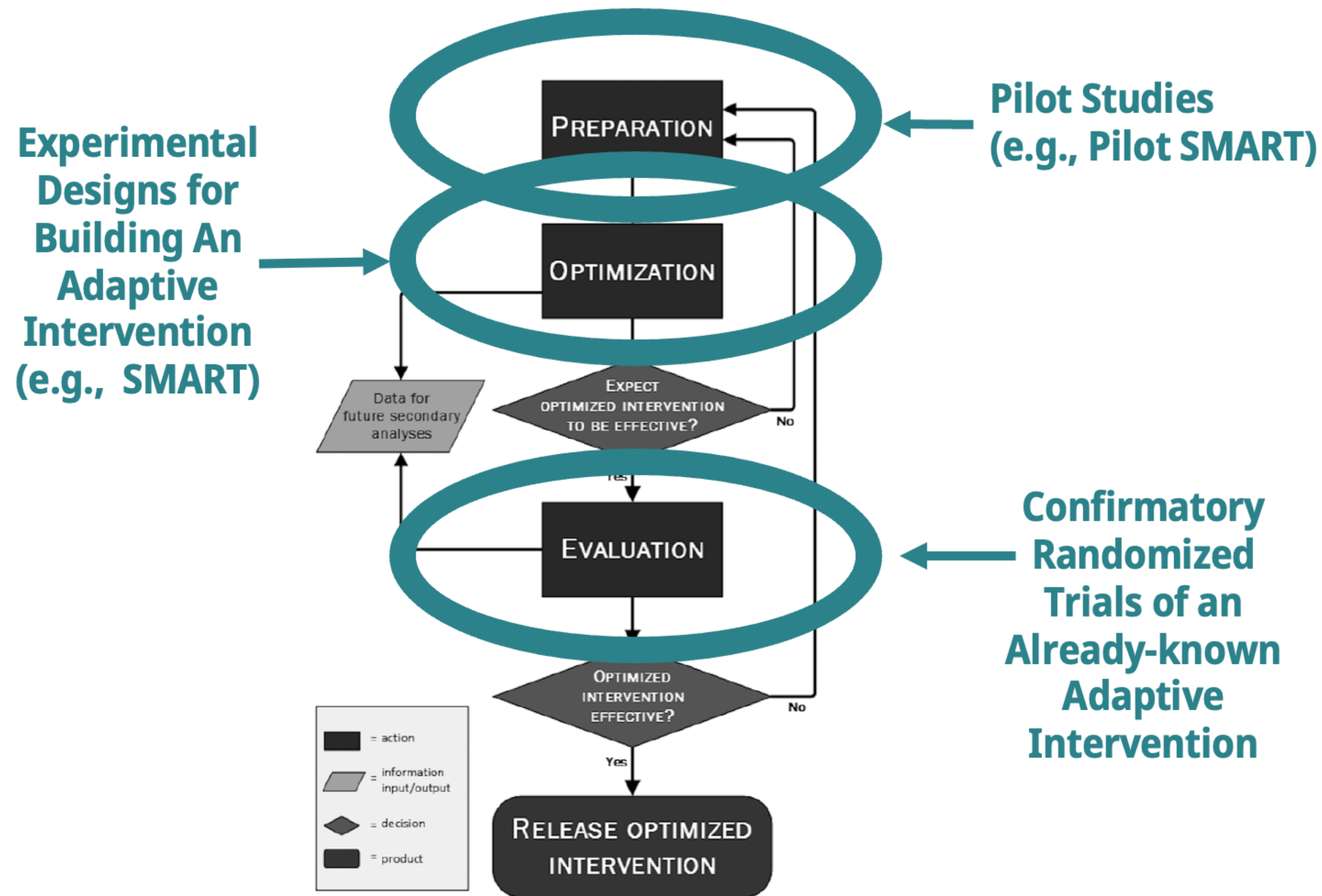
## A successful Pilot Study is

- Found a **clinically significant difference** between intervention A vs intervention B
- Found a large effect size between intervention A vs intervention B
- Found a **statistically significant difference** between intervention A vs intervention B
- Use it to select the effect size for the full-scale randomized trial

Pilot studies are a  
key part of  
**preparing** for a  
successful future,  
full-scale  
randomized trial  
(evaluation or  
optimization)



# One Way to View an Intervention's Life-course



# References

Collins, L. M. (2018). Optimization of behavioral, biobehavioral, and biomedical interventions. *Springer*. These are 2 back-to-back books.

Almirall, D., Nahum-Shani, I., Wang, L., & Kasari, C. (2018). Experimental designs for research on adaptive interventions: Singly and sequentially randomized trials. *Optimization of behavioral, biobehavioral, and biomedical interventions: Advanced topics*, 89-120. Part of Collins' second book.

Collins, L. M., Nahum-Shani, I., & Almirall, D. (2014). Optimization of behavioral dynamic treatment regimens based on the sequential, multiple assignment, randomized trial (SMART). *Clinical Trials*, 11(4), 426-434.





# Outline

Situating Pilot Randomized Trials  
as Preparation

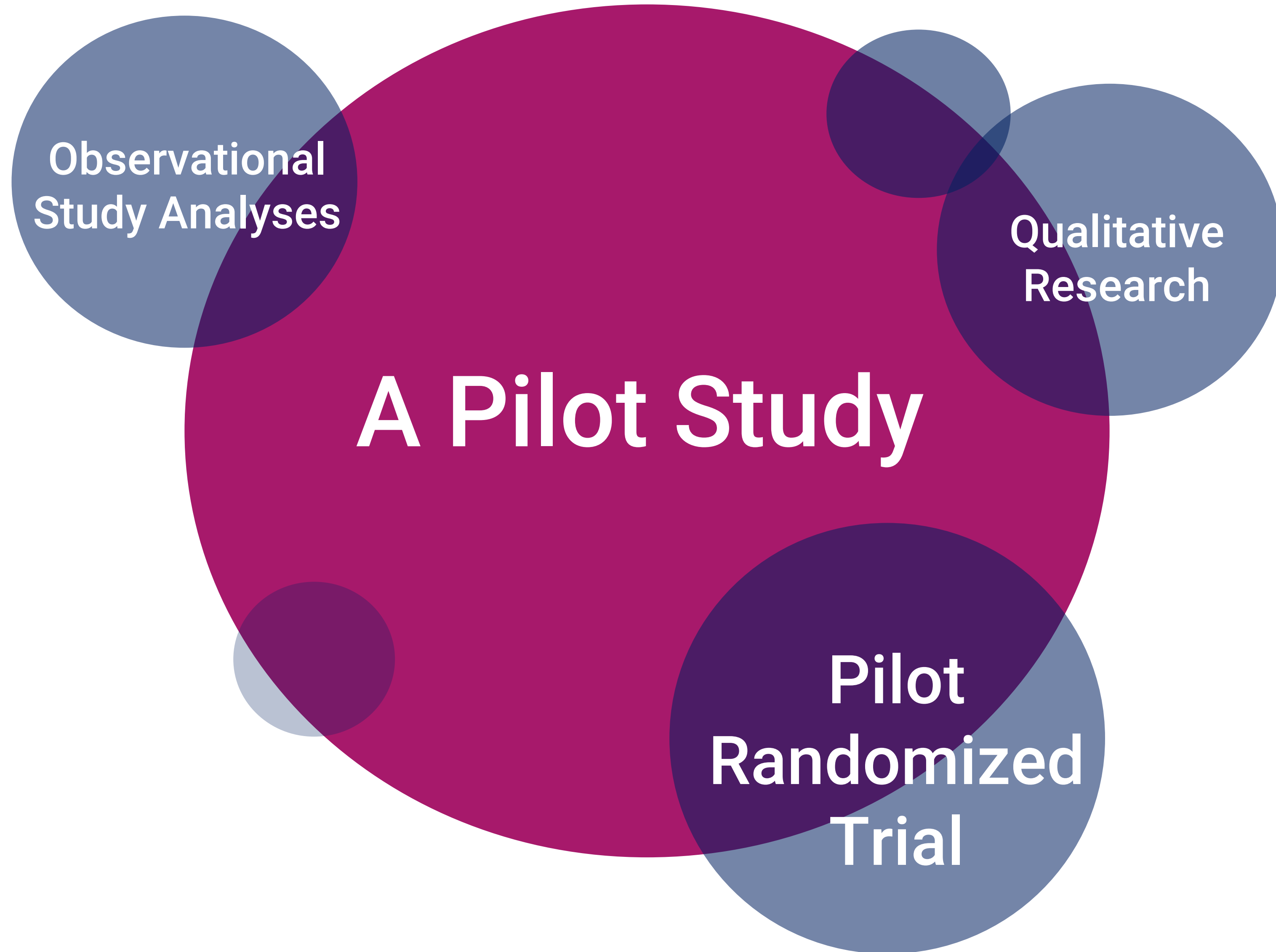
**Specific Goals of a Pilot Study &  
What are Some Tools to Reach For**

Example Pilot SMART in Autism  
PI: Connie Kasari, UCLA

Q&As









# Goals in a Pilot Study & Tools You Might Reach for

Goal of a Pilot Study	Tool (Method)		
	Preliminary Data Analysis	Qualitative, Iterative or Formative Research	Small-scale Proposed Trial (with focus groups)
Better justify significance/design of the proposed trial	✓✓	✓	✓
Manualized AI(s) and well-operationalized context		✓✓	✓
Acceptability and feasibility of the AI(s)	✓	✓	✓✓
Better justify feasibility of proposed trial	✓	✓	✓✓



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# Common Sources of Data for a Preliminary Analyses

- Previous randomized trials
- Previous pilot data
- School or school district administrative data
- Electronic medical record data
- Observational study data
- Pilot SMART

# Preliminary Data Analyses can be Used to

- Examine longitudinal treatment effects using previous data
- Analyses that quantify heterogeneity in treatment effects
- Analyses that shed light on early predictors of ultimate failure/success to a particular treatment (e.g., ROC analyses)
- Examine reliability, validity or utility of potential tailoring variables
- Potential usefulness of subsequent stage intervention options
- Analyses that help build/support a **dynamic theory of change** 



# Goals in a Pilot Study & Tools You Might Reach for

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Manualized AI(s) and well-operationalized context		✓✓	✓
Acceptability and feasibility of the AI(s)	✓	✓	✓✓
Better justify feasibility of proposed trial	✓	✓	✓✓



# Common Sources of Data for Qualitative, Formative, Iterative Research

- Qualitative concerns raised by experts/stakeholders (e.g., students, parents, teachers, other researchers) from a previous trial
- Experts/stakeholder elicitation surveys with questions related to
  - the ideal components to include in an adaptive intervention
  - the feasibility of adaptive intervention components
  - the acceptability of adaptive intervention components
- Pilot SMART





# Goals in a Pilot Study & Tools You Might Reach for

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Manualized AI(s) and well-operationalized context		✓✓	✓
Acceptability and feasibility of the AI(s)	✓	✓	✓✓
Better justify feasibility of proposed trial	✓	✓	✓✓



# What do you have going into a Pilot Randomized Trial

- A clear set of scientific questions related to evaluation or optimization, including a compelling rationale for them
- A proposed, full-scale randomized trial design to answer these questions, such as the ones shown on the previous slides
- A clear acknowledgement that
  - the intervention components have not all been tested for their acceptability or feasibility
  - the research team is not fully prepared to conduct or analyze a successful full-scale trial

# Considerations for a Pilot Randomized Trial

## We Recommend the Scholar Make Two lists

Acceptability and feasibility of the AI(s)	<ul style="list-style-type: none"><li>• Burden of the embedded tailoring variable</li><li>• Plan for common contingencies (e.g., missing value on a tailoring variable)</li><li>• Transitions between stages of treatment</li><li>• Concerns from clinical staff (e.g., interventionists insists on classifying student as non-responder)</li><li>• Concerns from students or parents</li></ul>
Better justify feasibility of proposed trial	<ul style="list-style-type: none"><li>• Estimate of the response/non-response rate in a prototypical trial</li><li>• Collecting additional, candidate tailoring variables</li><li>• Distinction between research assessments and intervention assessments (tailoring variables)</li><li>• Fidelity to AI components</li><li>• Sequential randomization procedure</li></ul>



# References

**Schoenfeld, D. (1980). Statistical considerations for pilot studies. *International Journal of Radiation Oncology*, 6(3), 371-374.**

Lancaster GA, et al. (2004). Design and analysis of pilot studies: recommendations for good practice. *Journal of Evaluation in Clinical Practice*.

**Kraemer HC et al. (2006). Caution regarding the use of pilot studies to guide power calculations for study proposals. *Arch Gen Psychiatry*.**

Thabane L, Ma J, et al. (2010). A tutorial on pilot studies: the what, why, and how. *BMC Medical Research Methodology*.

**Leon AC, Davis LL, Kraemer HC. (2011) The role and interpretation of pilot studies in clinical research. *Journal of Psychiatry Research*.**

Westlund, E., & Stuart, E. A. (2017). The nonuse, misuse, and proper use of pilot studies in experimental evaluation research. *American Journal of Evaluation*, 38(2), 246-261.





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Preparation for Success

Specific Goals of a Pilot Study &  
What Tools to Reach For

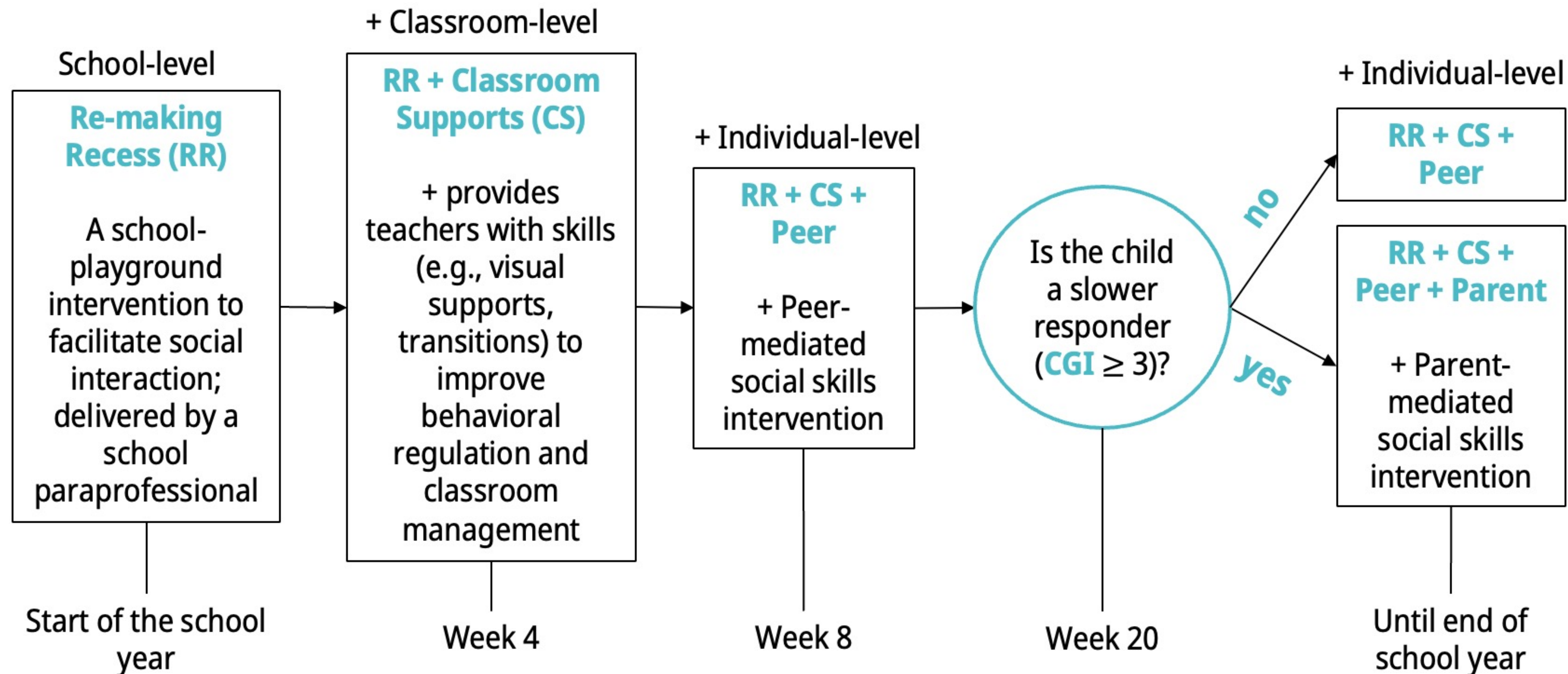
**Example Pilot SMART in Autism**

Q&As



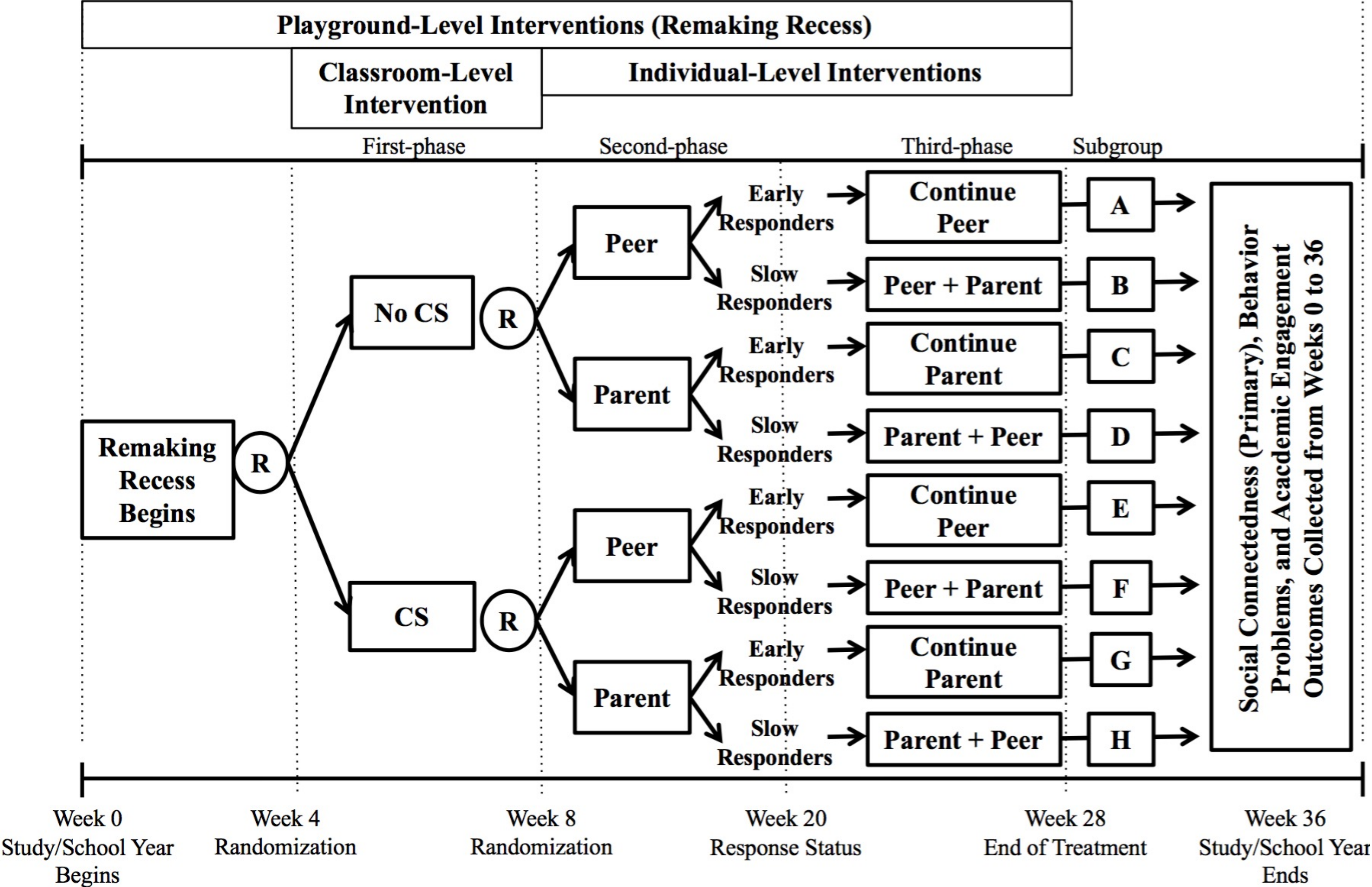


# Example: Is this Multilevel Adaptive Intervention feasible and acceptable?





# An Example Pilot SMART



# Primary Aim of this IES-funded Pilot SMART

## Concerns Related to Adaptive Interventions

- Identifying children as early vs slower responders by the paraprofessionals in the context of Remaking Recess
- Transitioning children to Parent or Peer at week 8
- Providing augmented Peer + Parent to slower responders at week 20
- Not providing augmented treatment to responders at week 20
- Satisfaction with treatment sequences by children, parents, teachers, paraprofessionals, and school champions
- Teacher-rated measures of child progress during CS for deciding parent vs peer at week 8





# Primary Aim of this IES-funded Pilot SMART

## Concerns Related to Conducting the Full-scale SMART

- Obtain good estimates of the recruitment rate
- Sequential randomizations, including approach to stratification
- Crafting two distinct retention and engagement protocols:
  - Intervention, goes in the Intervention Descriptions part of the grant
  - Research, goes in the Research Plan of the grant

# Sample Size for a Pilot SMART

## *Approach 1*

Ensure research team can implement and assess feasibility and acceptability of all aspects of the the SMART (and within each “treatment path”)

Scientists chooses

$m$  = number of students in each treatment path

$k$  =  $\Pr(\text{actual number of students in each path} \geq m)$

$q$  = anticipated non-response rate

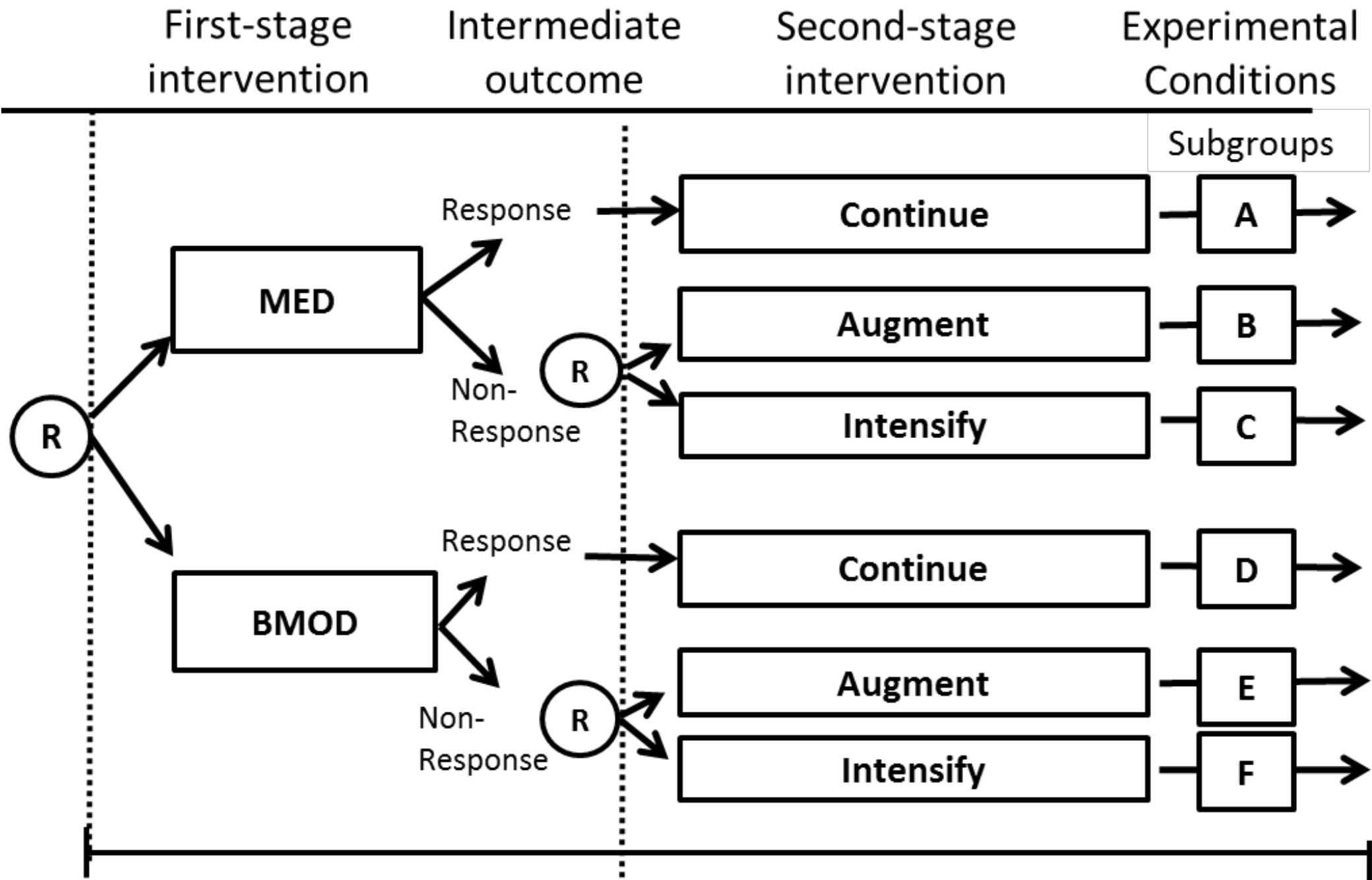
Method provides total sample size  $N$



# Sample Size for a Pilot SMART

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# Sample Size for a Pilot SMART

## Approach 1

Ensure research team can implement and assess feasibility and acceptability of all aspects of the the SMART (and within each “treatment path”)

N	q = anticipated non-response rate						
	0.35	0.40	0.45	0.50	0.55	0.60	0.65
k = 0.85							
m = 2	44	38	34	30	26	24	22
m = 3	58	50	44	40	36	32	28
m = 4	72	62	54	48	44	40	36
m = 5	86	74	66	58	52	48	42



# Sample Size for a Pilot SMART

## *Approach 2*

To obtain an estimate of overall non-response rate with a given margin of error (i.e., the goal is precision in the estimate)

Confidence interval method (point precision)

Use this if there is poor information about non-response rate

Scientists chooses

$moe$  = margin of error

$1 - \alpha$  = coverage probability for confidence interval

$q$  = anticipated non-response rate

Method provides total sample size  $N$

# Sample Size for a Pilot SMART

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$q$  = anticipated non-response rate

Method provides total sample size  $N$

32 Example:  $1 - \alpha = 95\%$ ,  $moe = 0.10$ ,  $q = 0.50$ , requires  $N = 100$





# Sample Size for a Pilot SMART

## *Approach 3*

- Rare, but becoming more common: You could use hypothesis tests that are not related to treatment effects but that might be related to some other metric of “success”
- For example: You could select the sample size to target a “go-no-go” decision which tells us whether to “graduate” an adaptive intervention (or set of them) to a full-scale trial
  - Example: No harm done. Select  $N$  such that you have 80% power to detect whether there is any improvement in academic outcomes, on average, from baseline to month 9.
- Many scholars call these “proof of concept” pilot randomized trials



# References and Resources

- Almirall D, Compton SN, Gunlicks-Stoessel M, Duan N, Murphy SA (2012). Designing a Pilot SMART for Developing an Adaptive Treatment Strategy. *Statistics in Medicine*
- Kim, H. & Almirall, D. (2016). *A sample size calculator for SMART pilot studies*, *SIAM Undergraduate Research Journal*, Vol. 9 (Undergraduate honors thesis).

Updated formulae (and for a variety of SMART designs)

<https://d3c.isr.umich.edu/> > Softwar

**Calculate the minimum sample size for a Pilot SMART**

[View Resources and More Information](#)

# Q&A



10 min