Presented by

Dr. Inbal Billie Nahum-Shani

Adaptive Interventions

Introductory Review

Module 1 55 min

Outline

Defining Adaptive Interventions

Example Adaptive Intervention + Components

Different Types of Adaptive Interventions

Q&A about Adaptive Interventions

Definition of an Adaptive Intervention

- An intervention design ≠ an experimental design

Definition of an Adaptive Intervention

- A family of intervention designs ≠ experimental designs

The approach used to deliver an intervention in practice

Definition of an Adaptive Intervention

- A family of intervention designs ≠ experimental designs

The approach used to manipulate independent variables to answer scientific questions.

Definition of an Adaptive Intervention

- A family of intervention designs ≠ experimental designs
- …that guide how dynamic information about the unit of interest should be used in practice to decide whether and how to intervene.
- The unit of interest can be the individual, dyad, family, clinic etc.

Adaptive Intervention Example

Weight loss in overweight & obese adults

NIH/NIDDK R01DK108678; Spring & Nahum-Shani

FSU | FLORIDA STATE UNIVERSITY

CENTER FOR TRANSLATIONAL BEHAVIORAL SCIENCE

Bonnie Spring, Ph.D., ABPP

Krafft Professor of Behavioral Sciences and Social Medicine

Director, Blue Cross Center for Rural Health Research and Policy

Bonnie Spring, PhD, is a Krafft Professor in the Department of Behavioral Sciences and Social Medicine at the Florida State University College of Medicine. Dr. Spring is the Director of the Blue Cross Center for Rural Health Research and Policy.

JAMA | Original Investigation

An Adaptive Behavioral Intervention for Weight Loss Management
A Randomized Clinical Trial

Bonnie Spring, PhD; Angela F. Pfammatter, PhD; Laura Scanlan, BA; Elyse Daly, BA; Jean Reading, PhD; Sam Battalio, MS; H. Gene McFadden, BA; Don Hedeker, PhD; Juned Siddique, PhD; Inbal Nahum-Shani, PhD

IMPORTANCE Lifestyle interventions for weight loss are difficult to implement in clinical practice. Self-managed mobile health implementations without or with added support after unsuccessful weight loss attempts could offer effective population-level obesity management.

OBJECTIVE To test whether a wireless feedback system (WFS) yields noninferior weight loss vs WFS plus telephone coaching and whether participants who do not respond to initial treatment achieve greater weight loss with more vs less vigorous step-up interventions.

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Supplemental content

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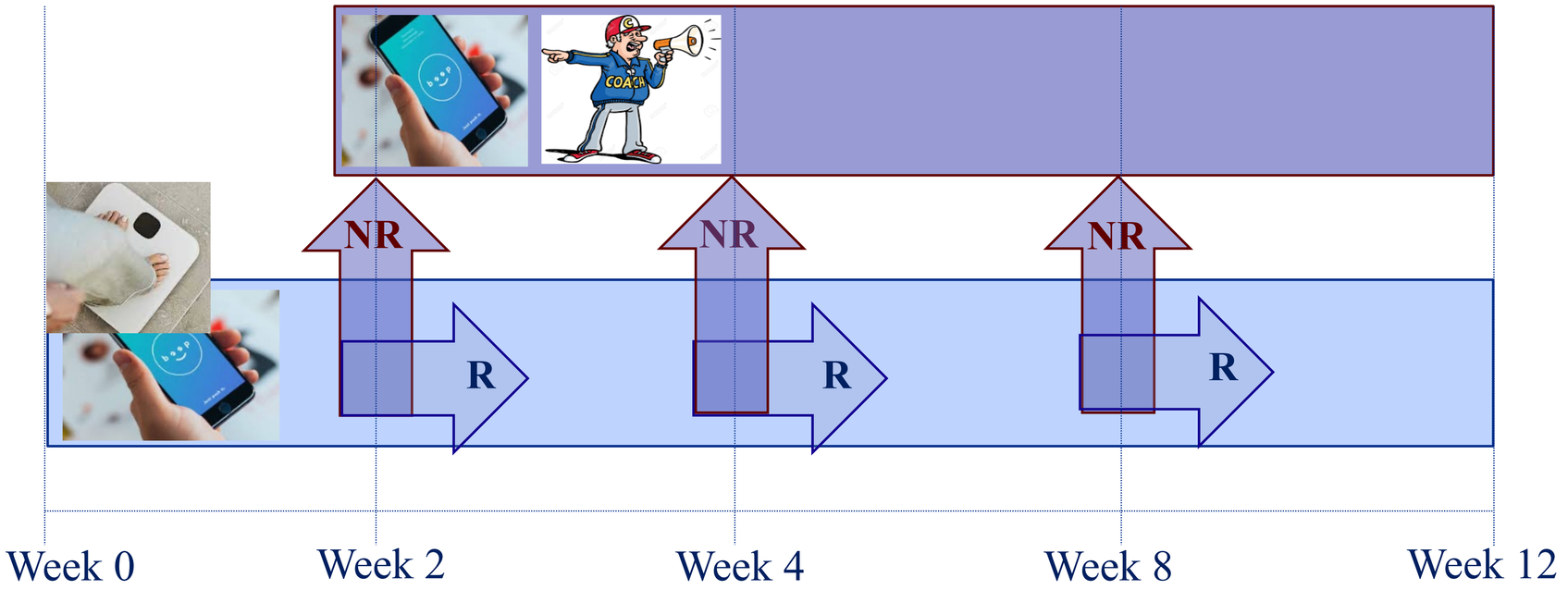
Weight loss in overweight & obese adults



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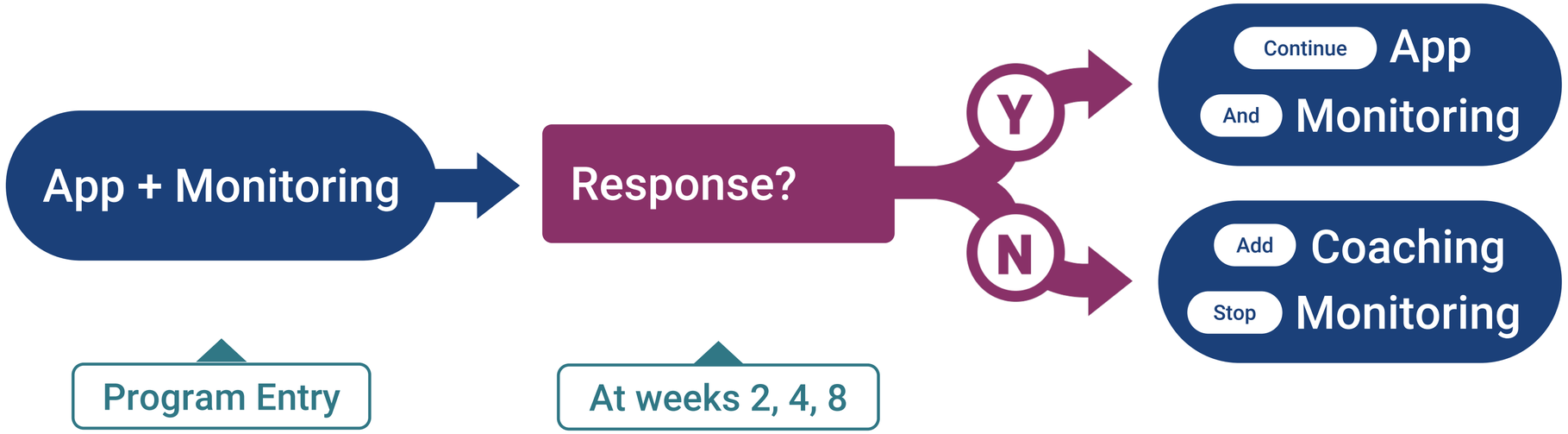
Weight loss in overweight & obese adults



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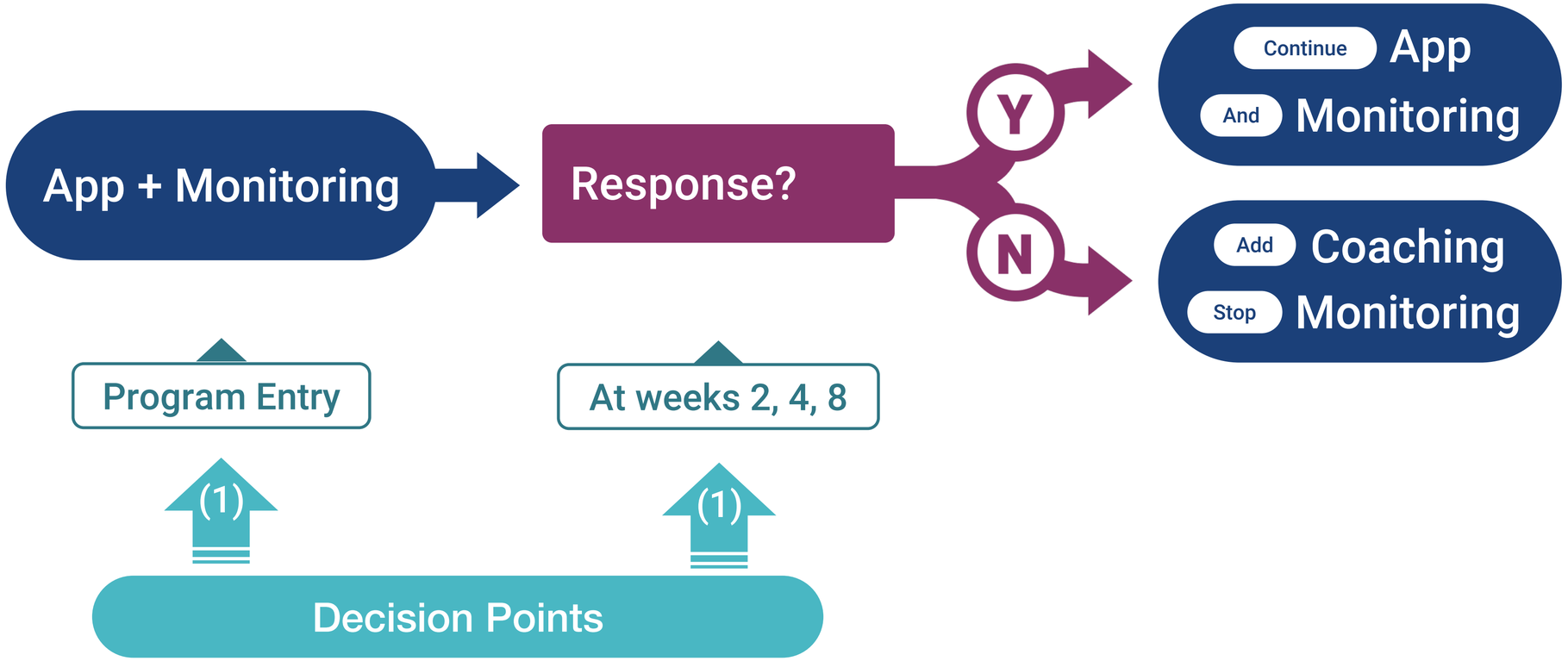

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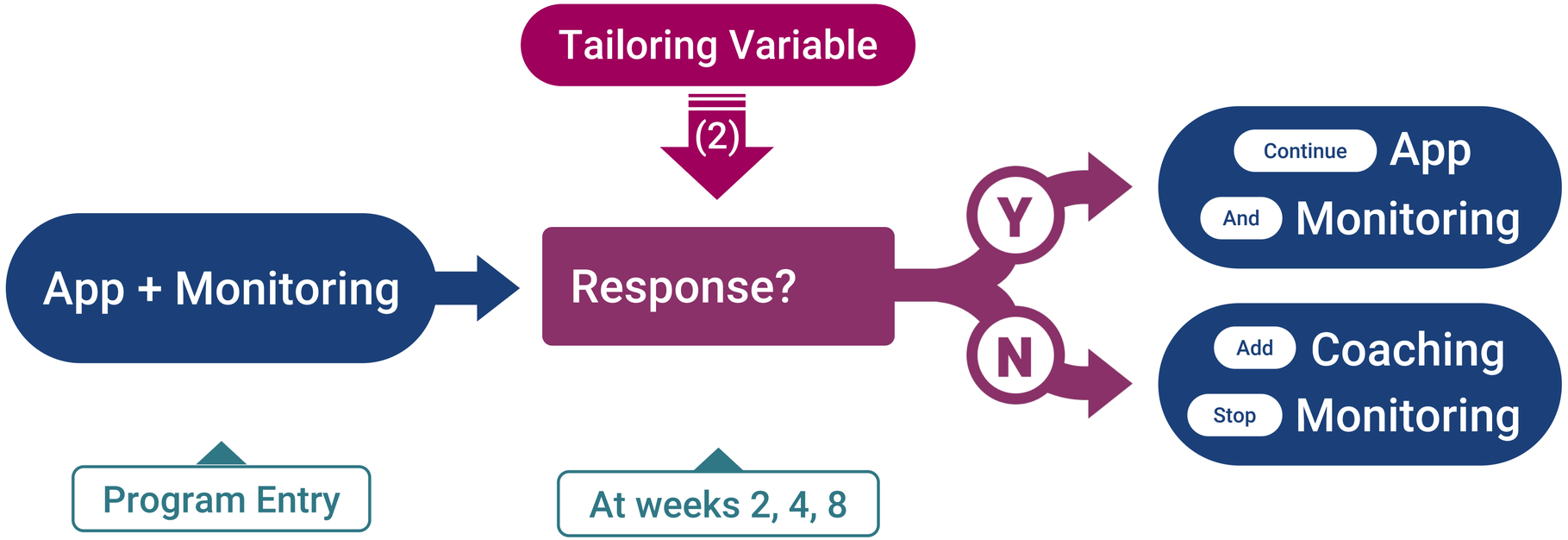
Weight loss in overweight & obese adults



Measured based on:

Average weekly weight loss from program entry to decision point, assessed via Fitbit Aria scale.

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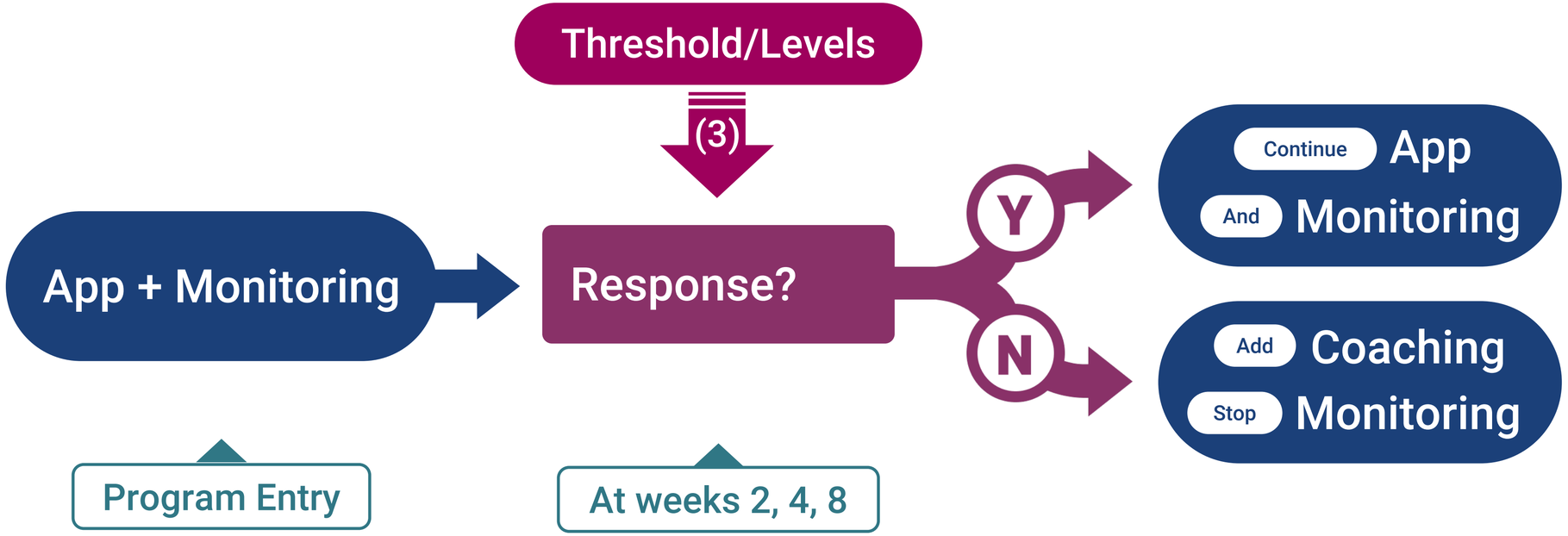
Weight loss in overweight & obese adults



Yes: Average weekly weight loss ≥ 0.5 lb.

No: Average weekly weight loss < 0.5 lb

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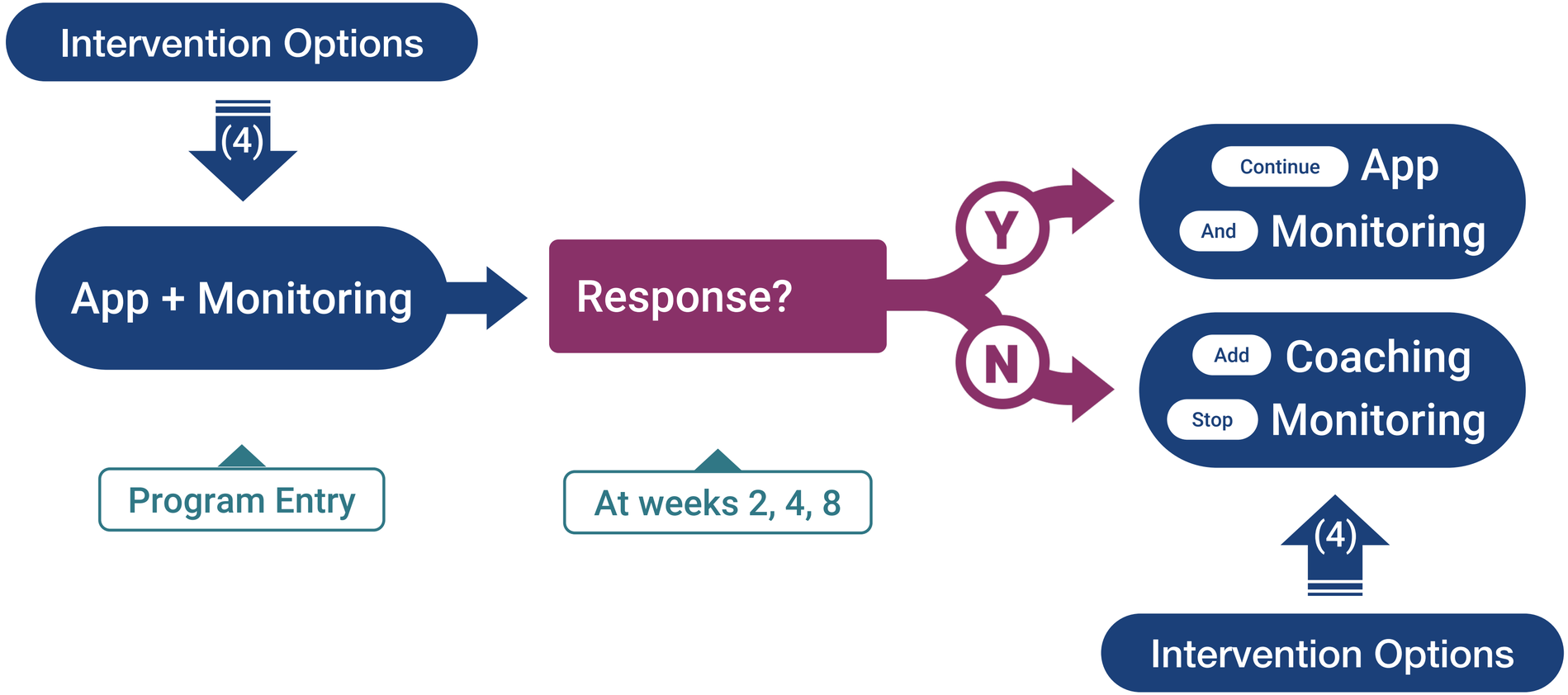
Weight loss in overweight & obese adults



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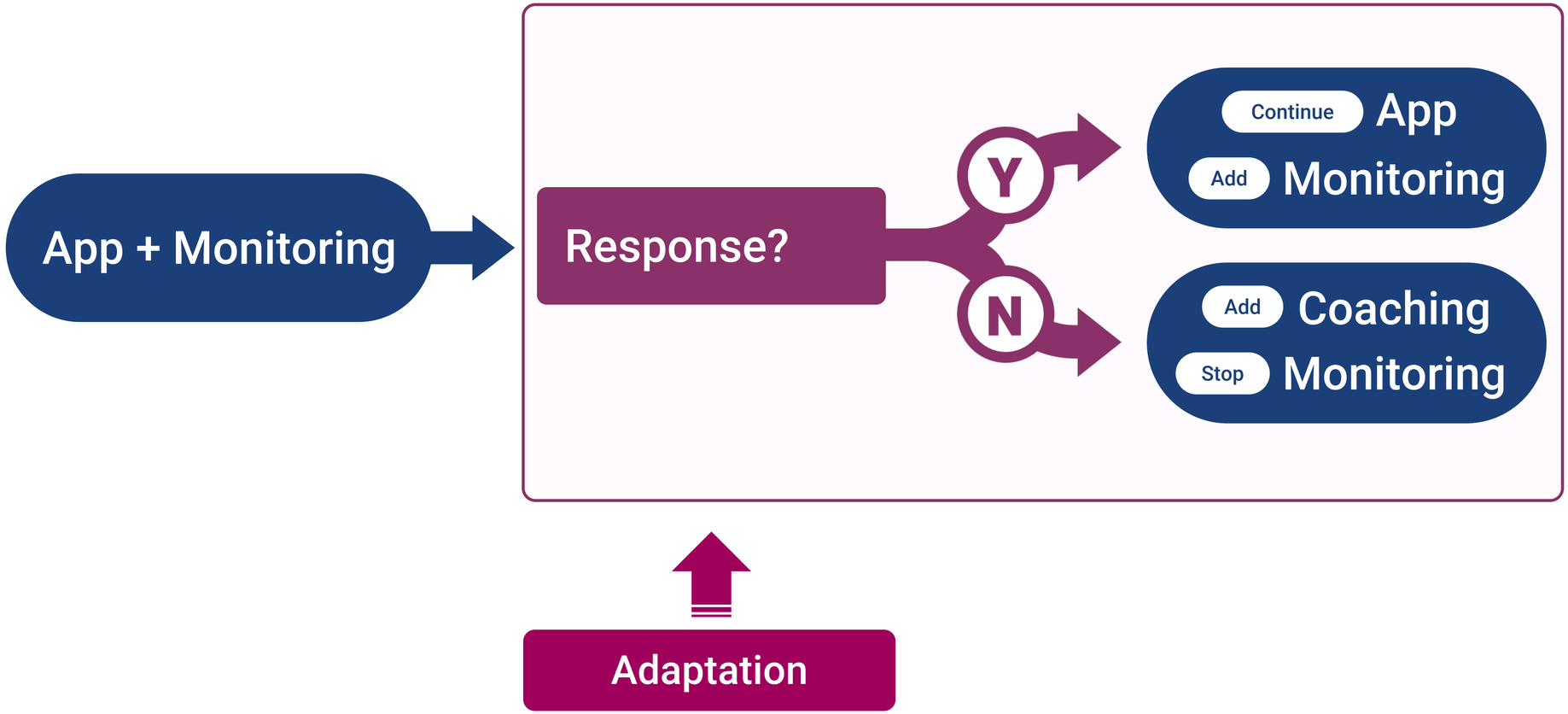

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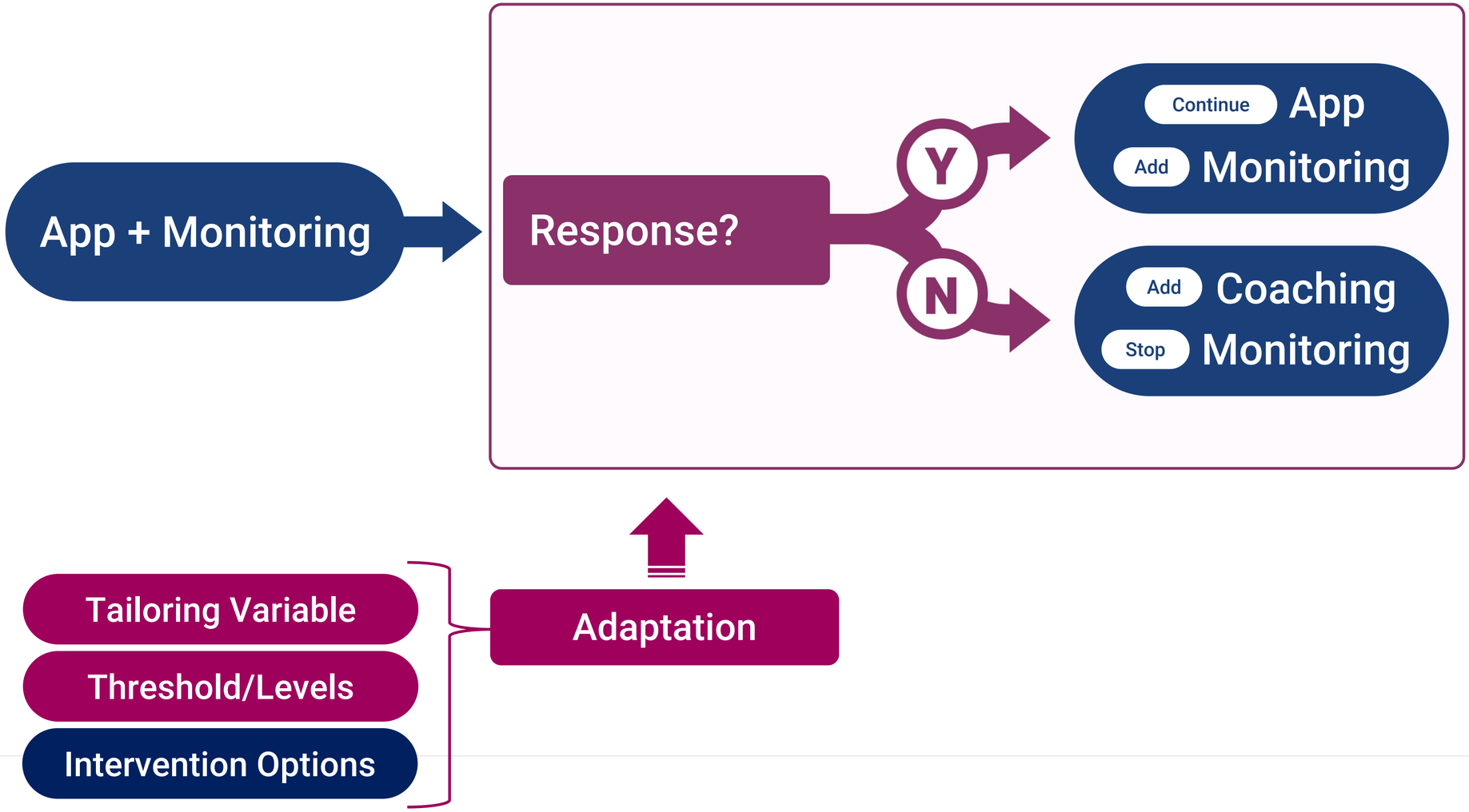

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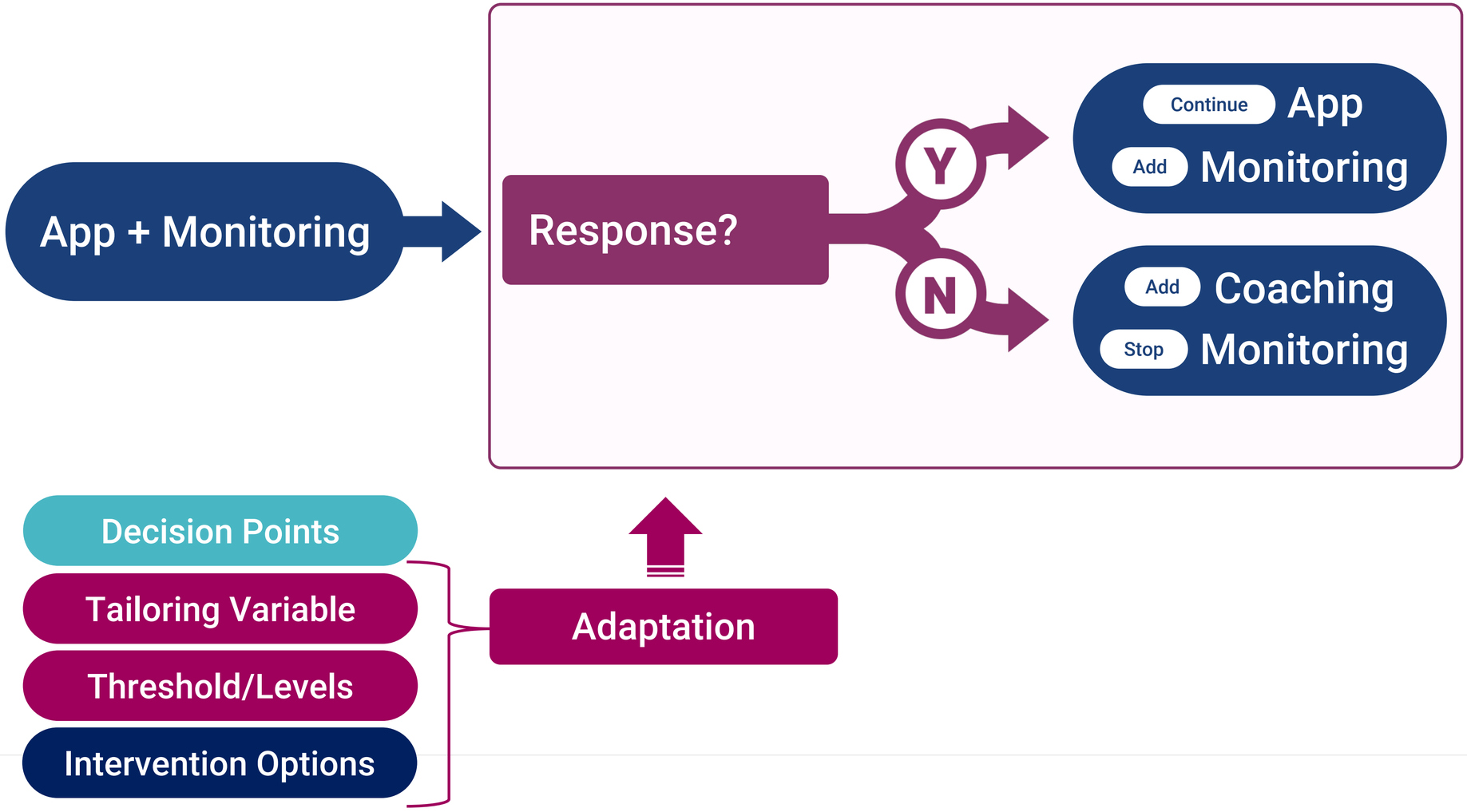

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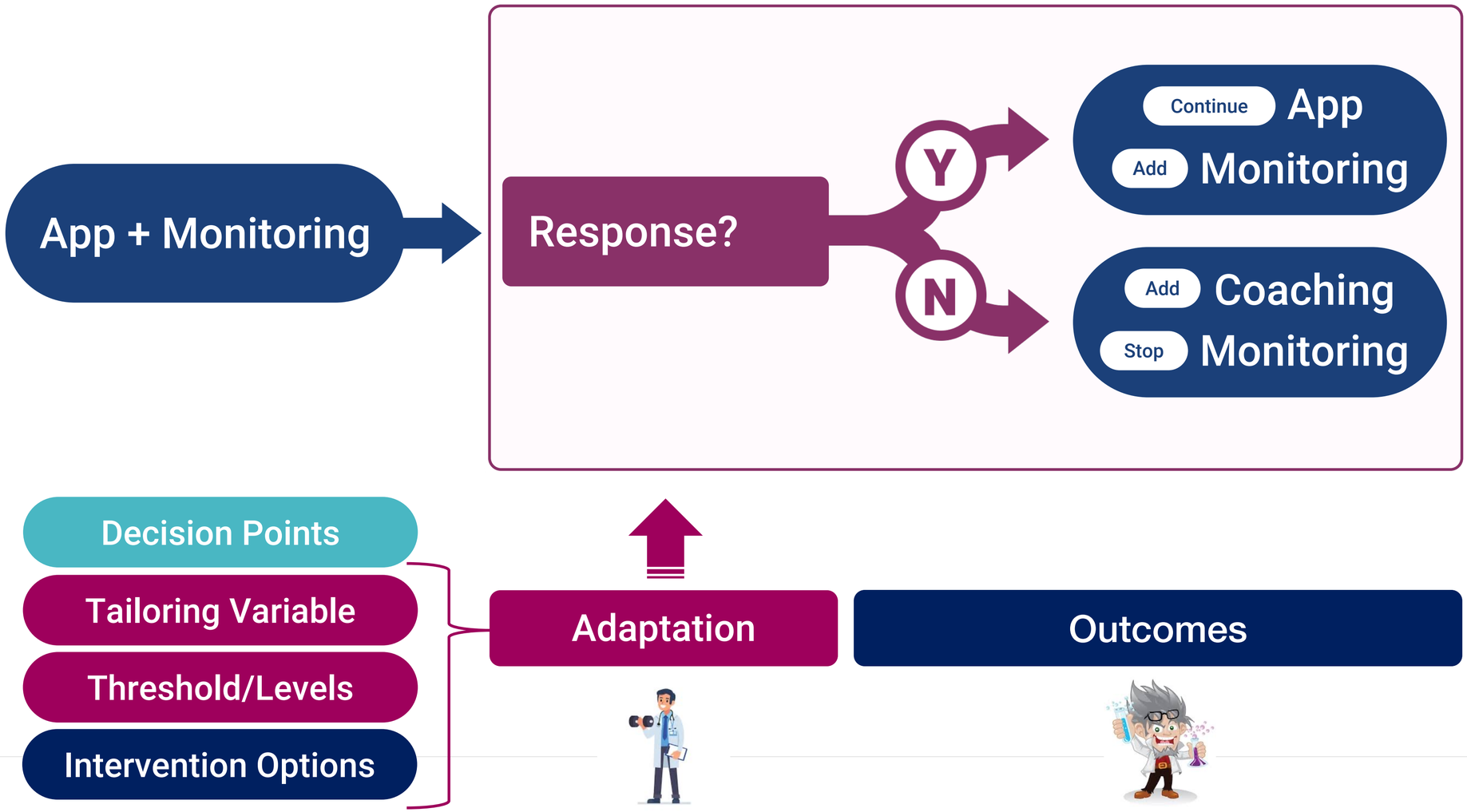

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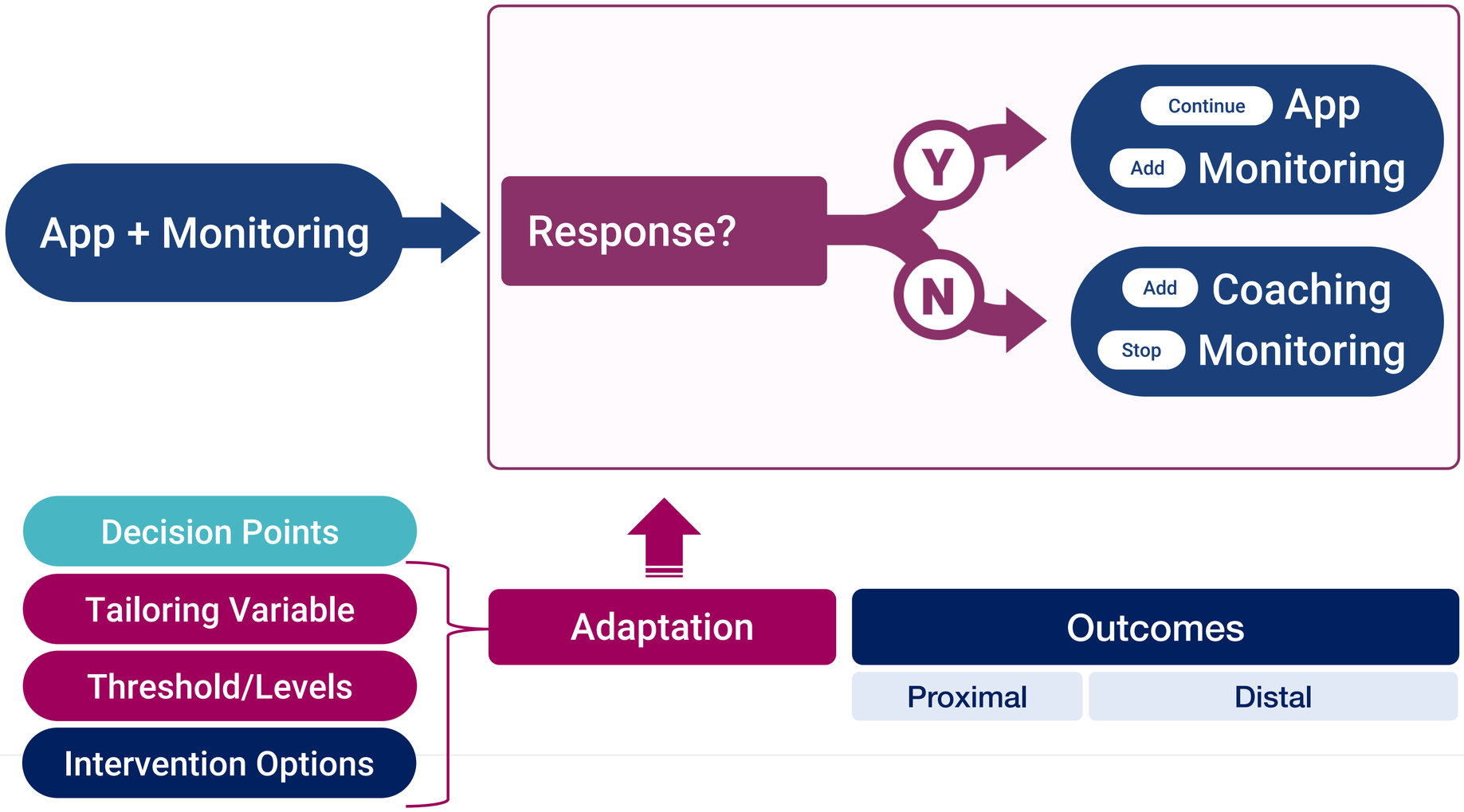

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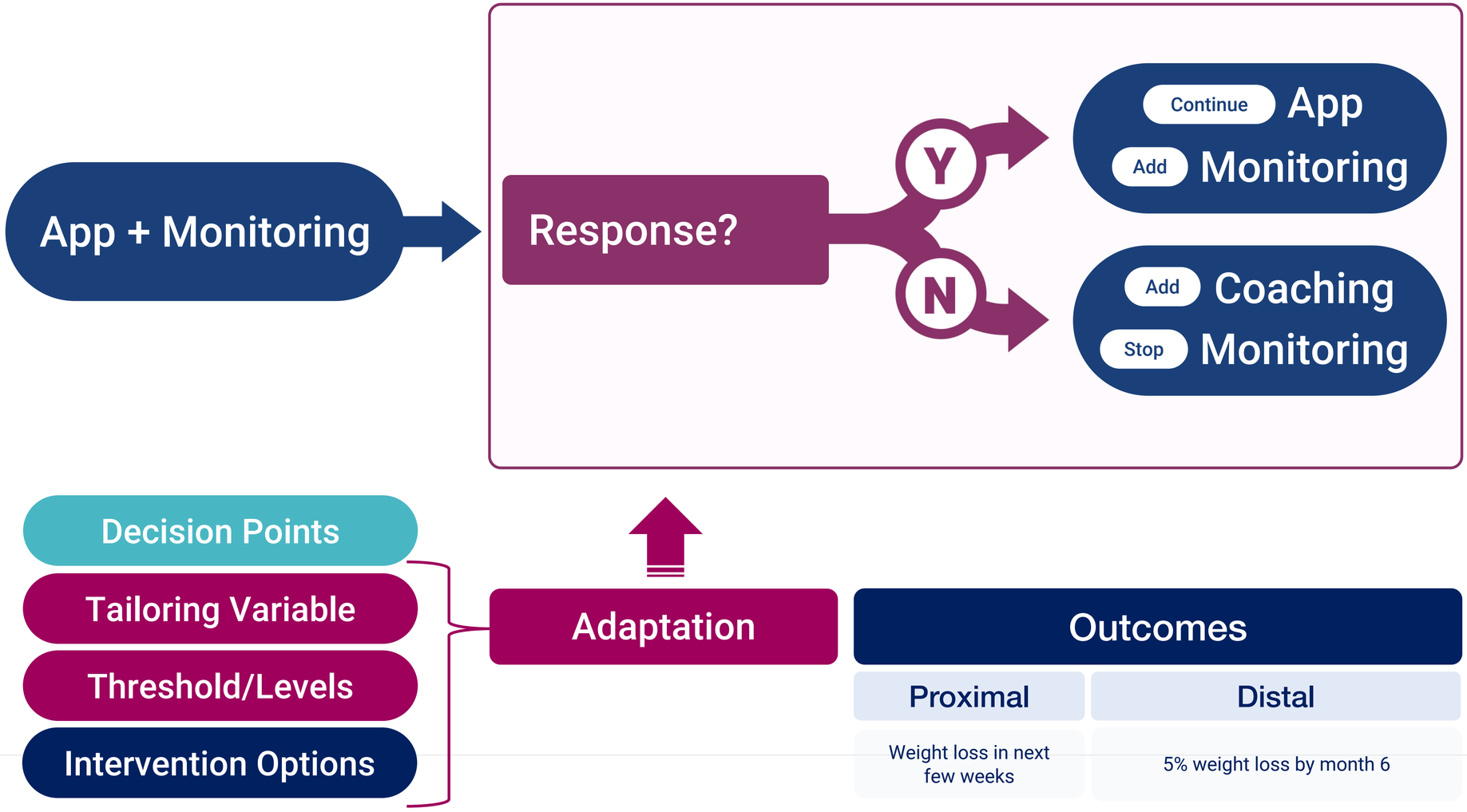
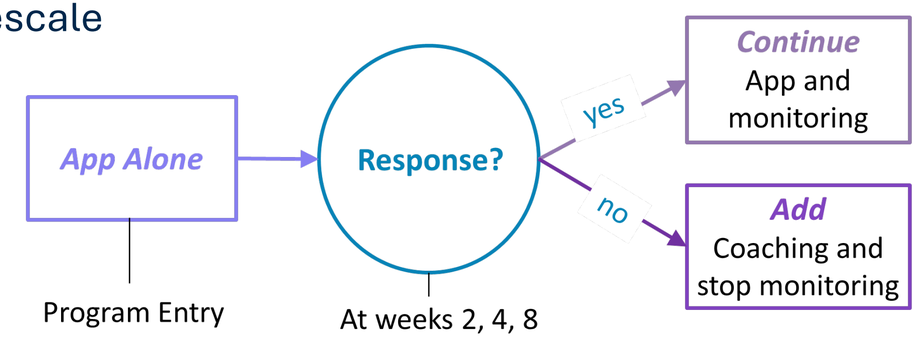


Many Types of Adaptive Interventions

Foundational adaptive intervention: ***Dynamic Treatment Regimes;*** ***Adaptive Treatment Strategies;*** ***Stepped Care Interventions…***	Intervention options adapted on a relatively slow timescale (e.g., every few weeks)
Multi-level adaptive implementation strategy: ***MAISY***	Implementation strategies adapted at multiple levels (e.g., provider and clinic)
Just-in-time adaptive intervention: ***JITAI***	Intervention options adapted on a relatively fast timescale (e.g., every few hours) in daily life. Adaptation is fixed (i.e., same for all individuals) and static (same at all times).
Personalizing JITAI: ***pJITAI***	JITAIs with an RL algorithm that updates the adaptation repeatedly, based on the person's responsivity as they interact with the intervention over time.
Multimodality adaptive intervention: ***MADI***	Human- and digitally-delivered components are blended and adapted on different timescales—slow (for human) and fast (for digital).



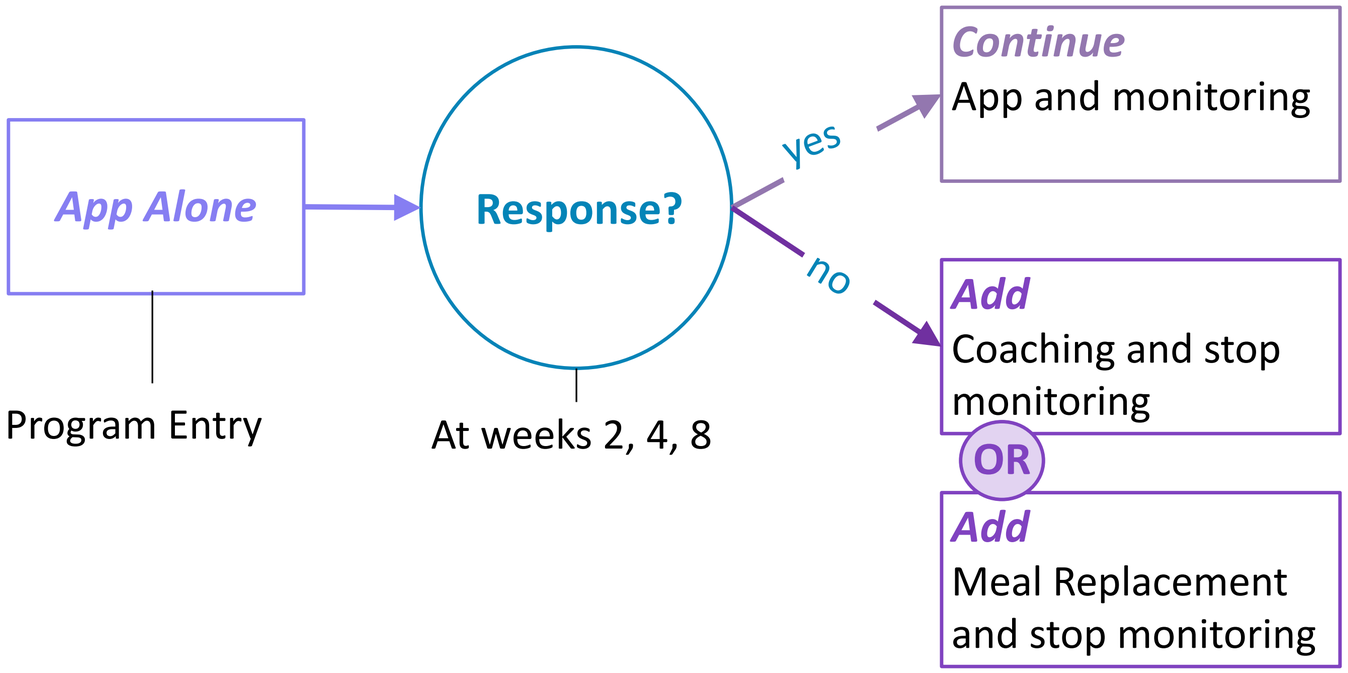
Frequently Asked Questions & Answers

The goal: engage you and help you generate additional questions

1. Go to Kahoot.it (we recommend using your phone)
2. Type the PIN
3. Select a nickname (not your real name)
4. Let’s play

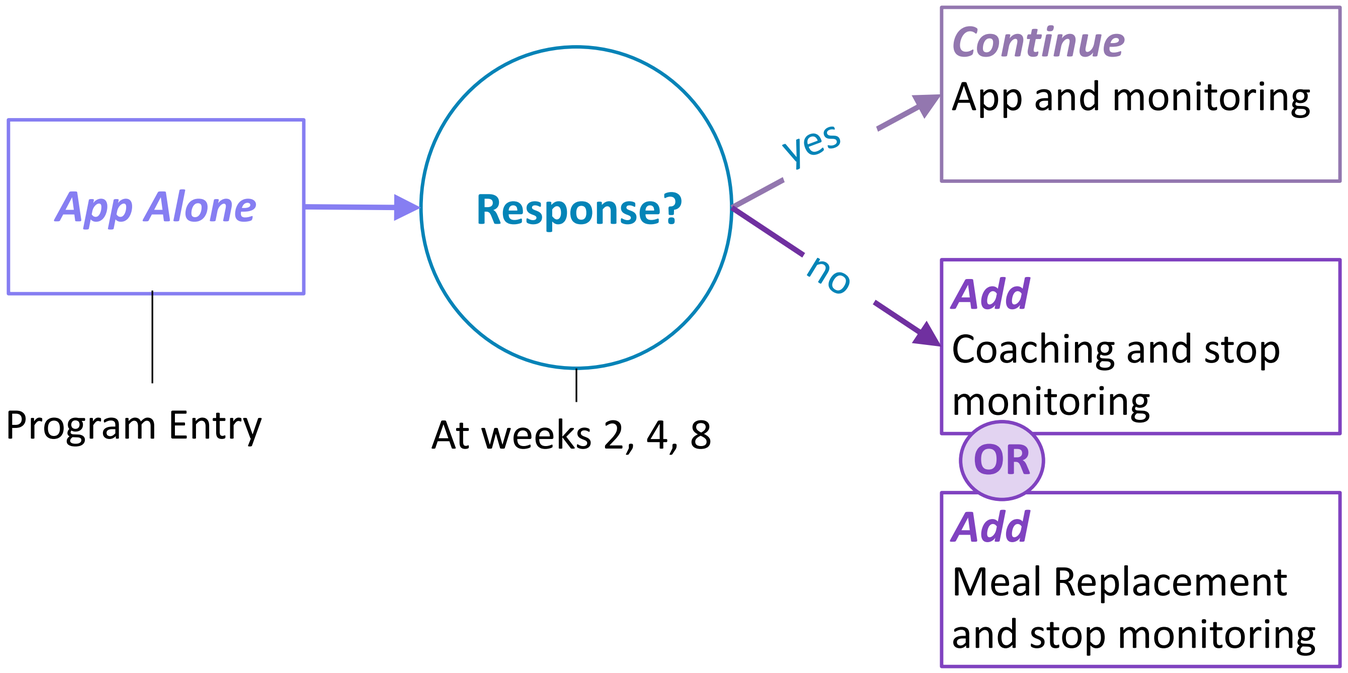
Q1: Must an adaptive intervention recommend a single intervention component at each decision point?

A1: No. An adaptive intervention can recommend a set of treatments.



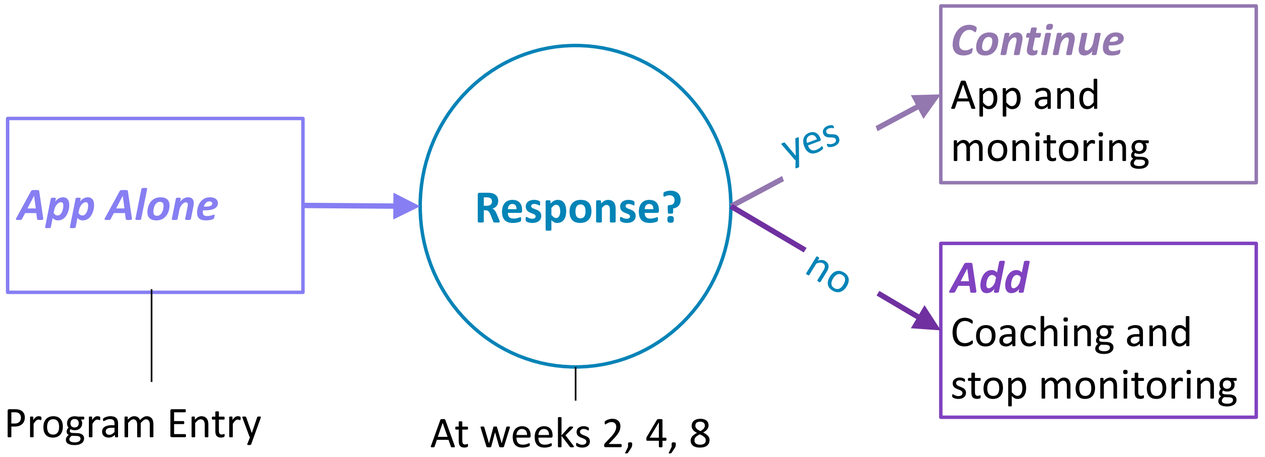
Q2: Is it the case that adaptive interventions seek to replace clinical judgement?

A2: No. The goal is to provide guidance on when and how to make critical decisions about treatment.



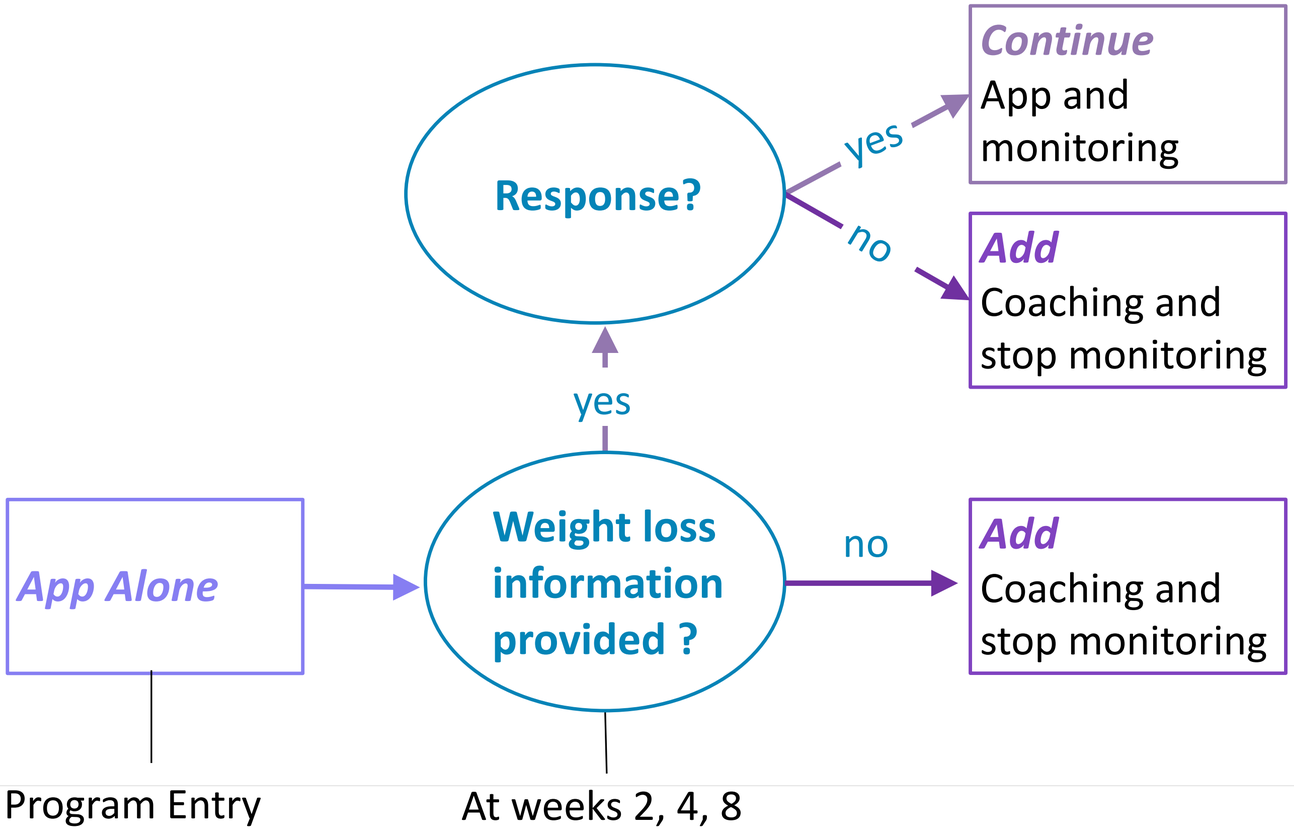
Q3: Is it the case that adaptive interventions are non-standard because they involve randomization?

A3: Not quite. In most clinical settings, we would not randomize as part of intervention.



Q4: How do I address missing data in an adaptive intervention?

A4: This question really means “How should the provider deliver treatment in the absence of a tailoring variable?” You (the researcher) must plan for this in the intervention design.

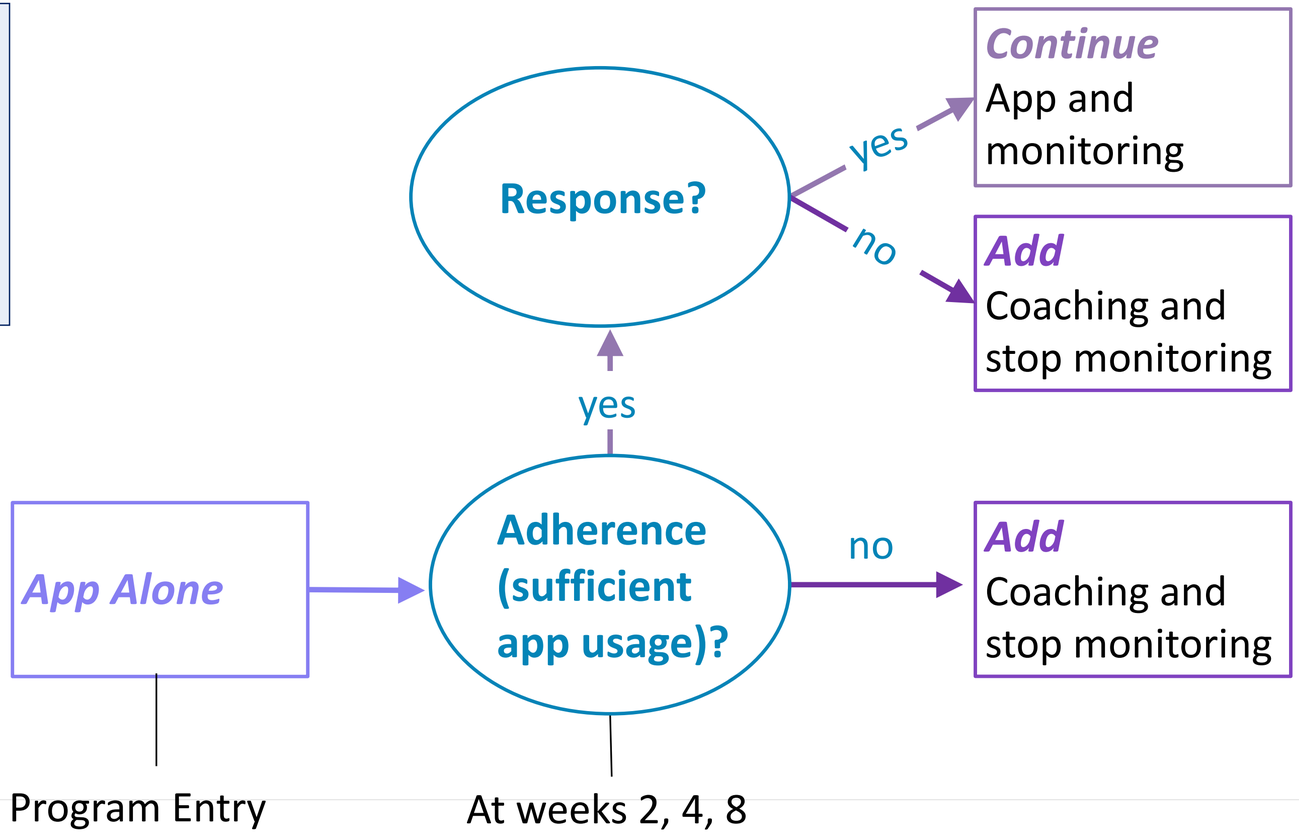


Q5: How do I address non-adherence in an adaptive intervention?

A5: As with missing data, this is not something we fix statistically; rather, we address via intervention design. There is no study data here!

Adherence

The extent to which an individual follows the intended suggestions to complete a focal task.



Q6: In an adaptive intervention the tailoring variable must be assessed repeatedly.

A6: No. The tailoring variable can be assessed just once.

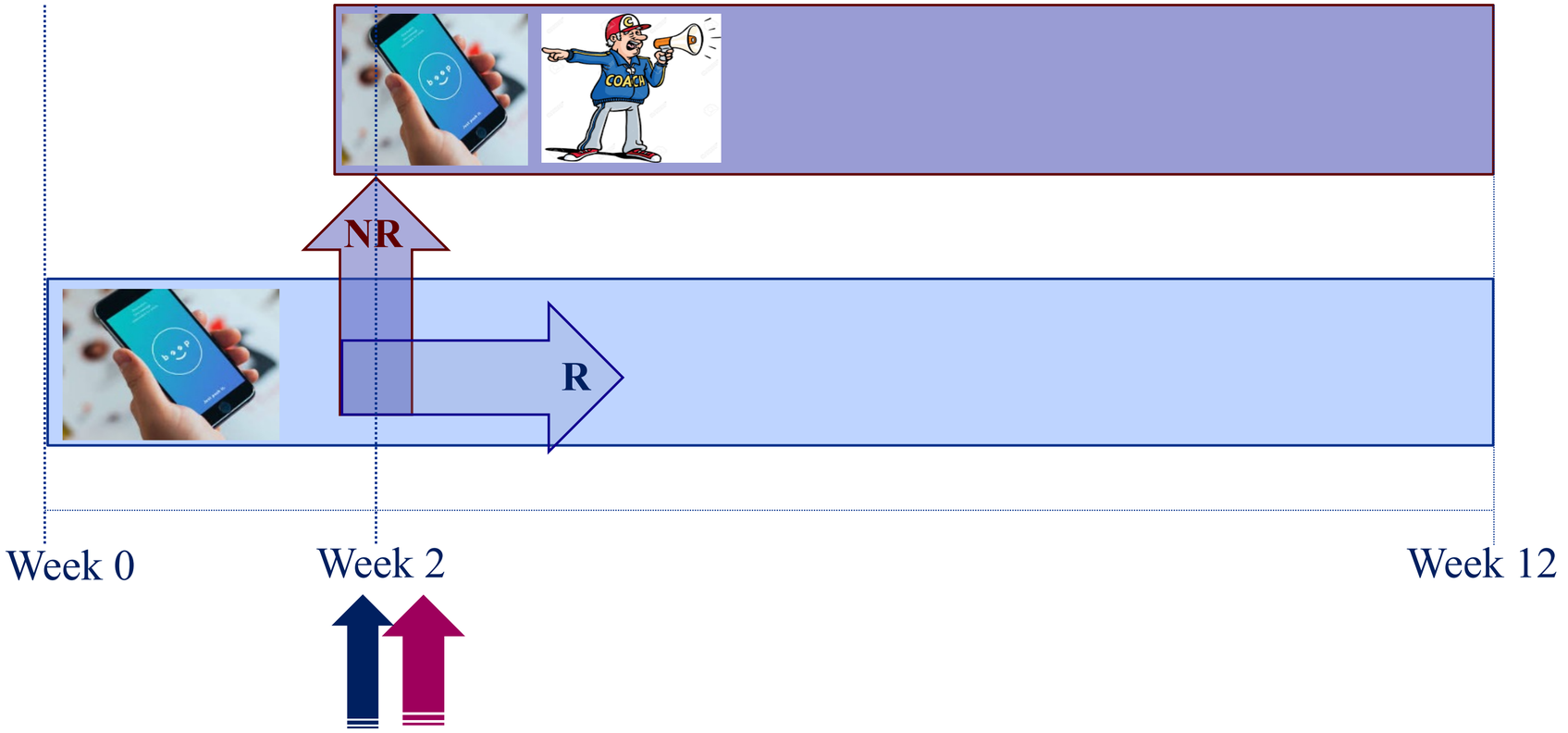
There are two issues here:

Decision Point Frequency: Whether the intervention decision is triggered once (e.g., week) or repeatedly (e.g., week 2, 4, and 8).

Assessment Frequency: Whether the tailoring variable (like response status) is measured once or requires repeated assessments prior to each decision point.

Q6: In an adaptive intervention the tailoring variable must be assessed repeatedly.

A6: No. The tailoring variable can be assessed just once.

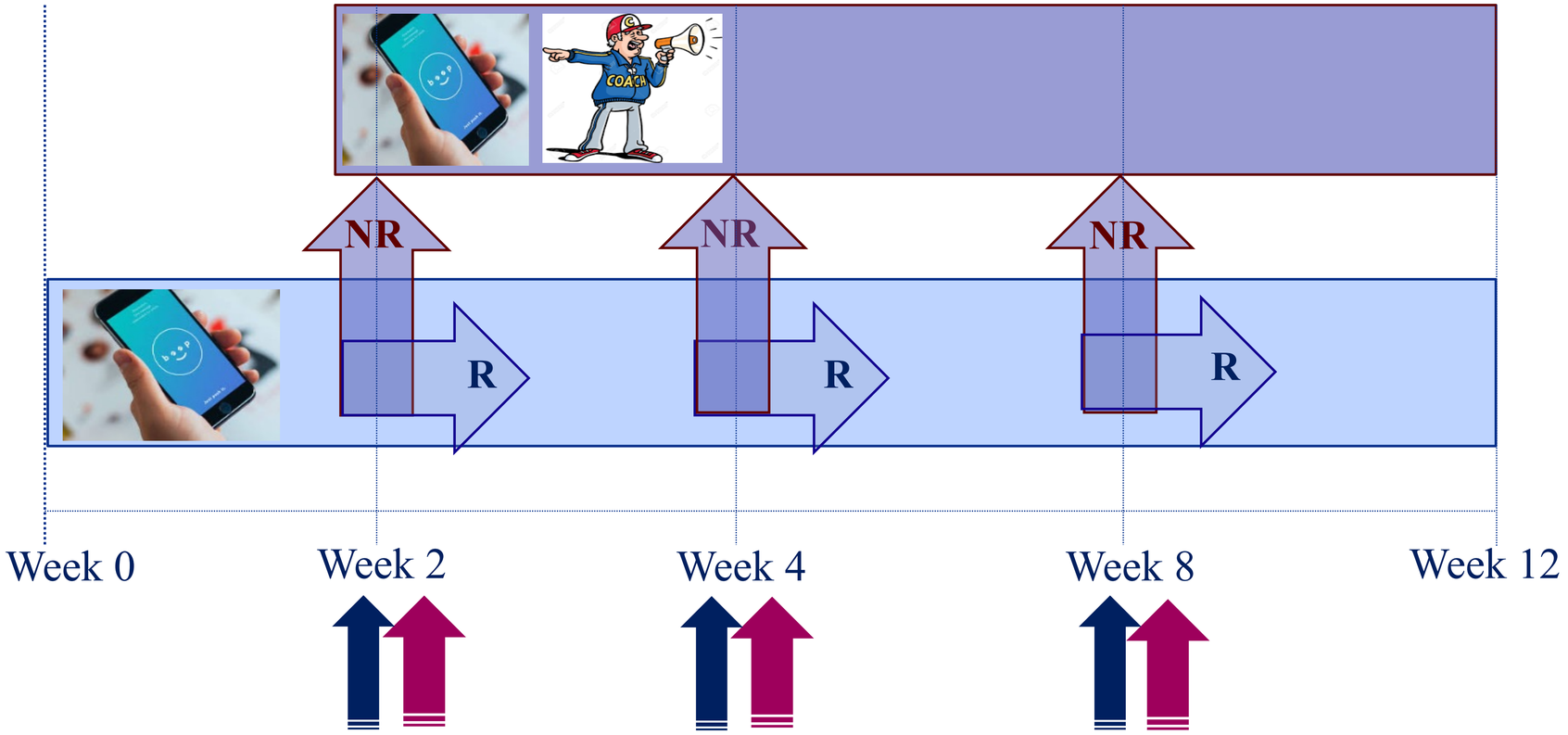


Decide once

Assess once prior to decision point

Q6: In an adaptive intervention the tailoring variable must be assessed repeatedly.

A6: No. The tailoring variable can be assessed just once.

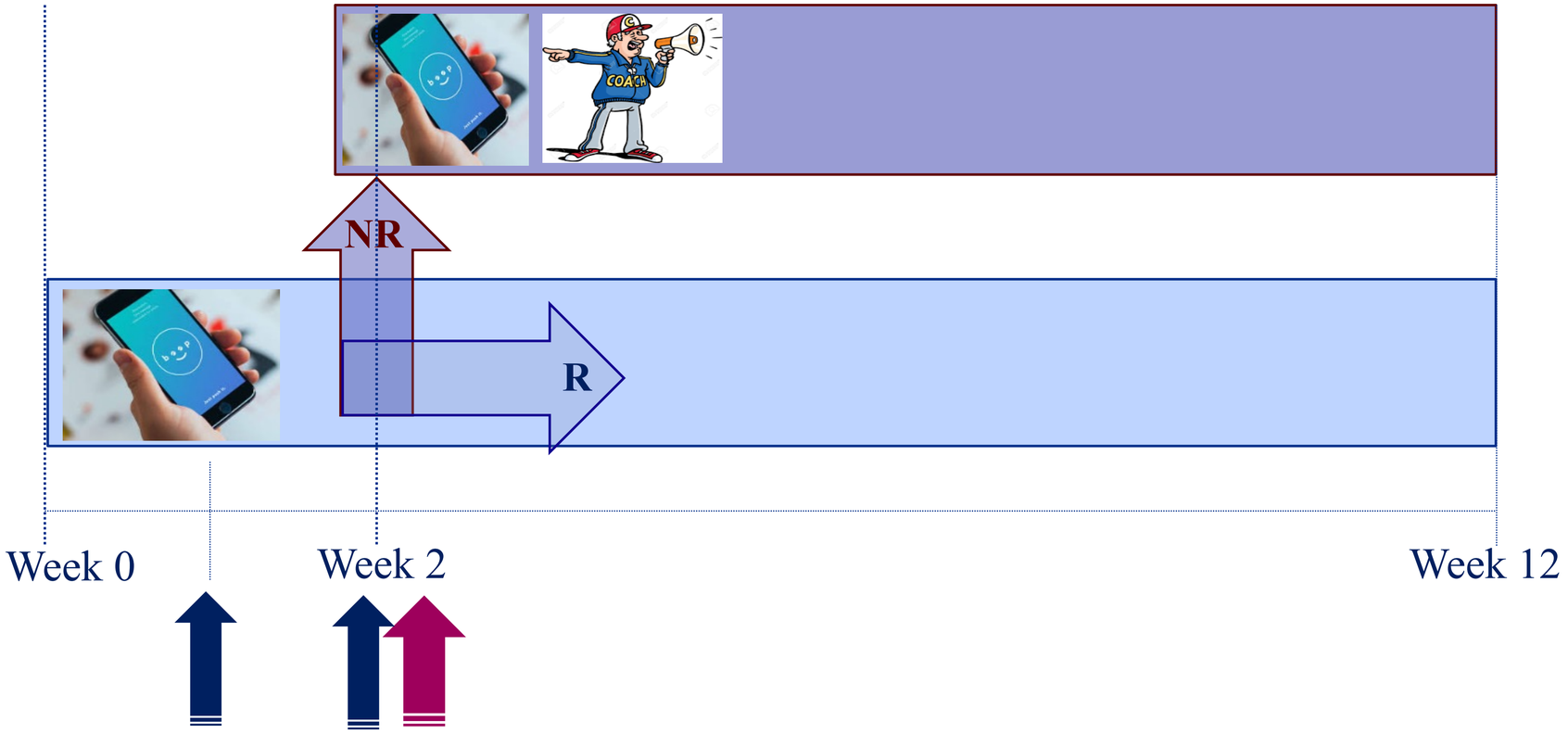


Decide multiple times

Assess once prior to decision point

Q6: In an adaptive intervention the tailoring variable must be assessed repeatedly.

A6: No. The tailoring variable can be assessed just once.



Decide once

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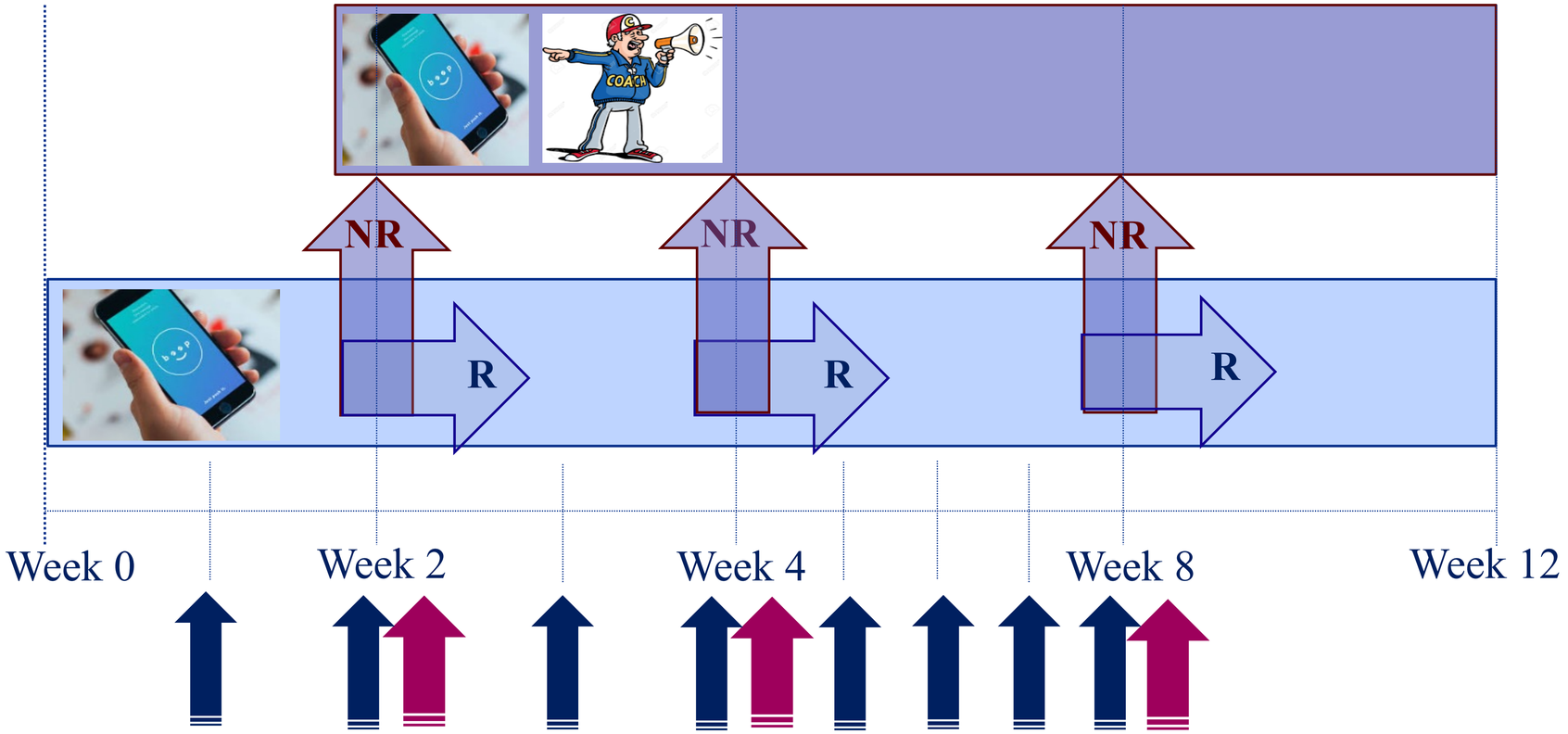


Decide multiple times

Assess multiple times prior to decision point

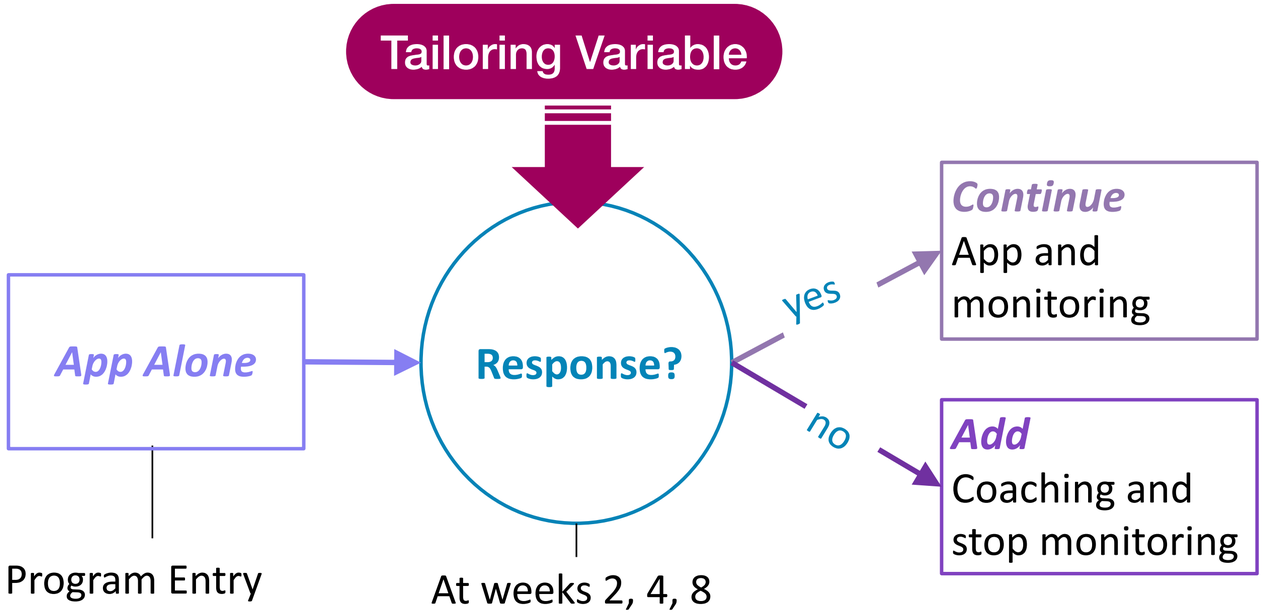
Q6: In an adaptive intervention the tailoring variable must be assessed repeatedly.

A6: No. The tailoring variable can be assessed just once.

Decisions made	Example	Assessment of tailoring variable prior to decision point	Example
Once	Decision about next steps are made at week 2, based on response status	Once	At week 2, response status is determined based on weight loss measured once, at week 2
Once	Decision about next steps are made at week 2, based on response status	Repeatedly	At week 2, response status is determined by summarizing weight loss measured weekly in the previous 2 weeks
Repeatedly	Decision about next steps are made at week 2, 4 and 8, based on response status	Once	At week 2, 4, and 8, response status is determined based on weight loss measured once at that decision time
Repeatedly	Decision about next steps are made monthly, based on response status	Repeatedly	At week 2, 4, and 8, response status is determined based by summarizing weight loss measured weekly prior to that decision point

Q7: The proximal outcome must be measured in an adaptive intervention.

A7: No. But the proximal outcome at an earlier time point can be a tailoring variable



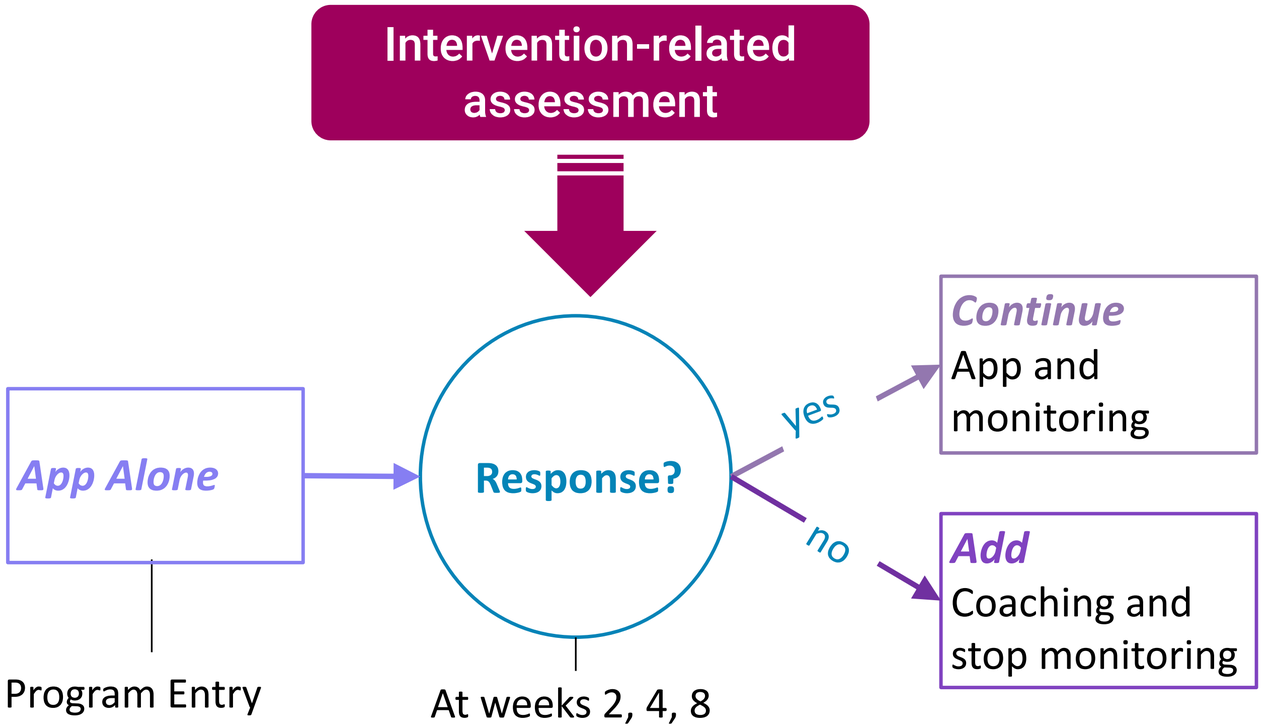
Outcomes	
Proximal	Distal
Weight loss in next few weeks	5% weight loss by month 6

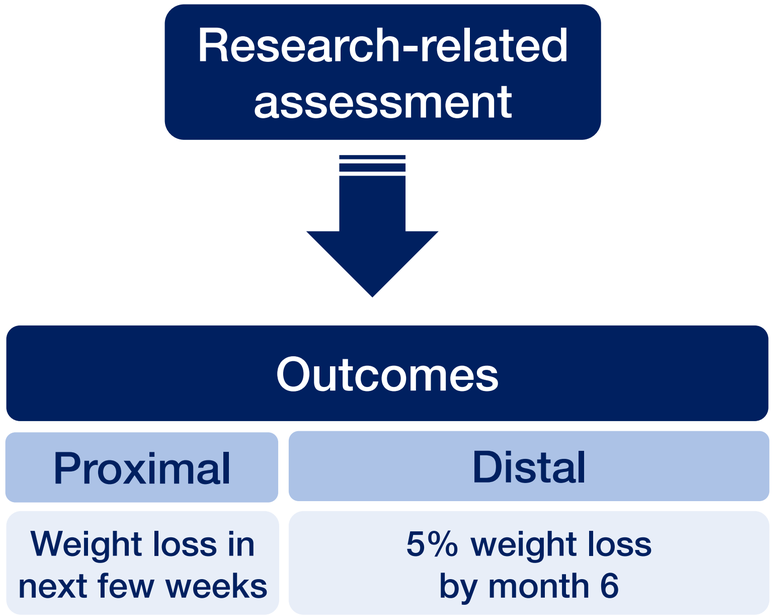
Measured based on:

Average weekly weight loss from program entry to decision point, assessed via Fitbit Aria scale.

Q8: Must the distal outcome in an adaptive intervention be measured?

A8: No. Like the proximal outcome, the distal outcome is a research assessment, not an intervention-related assessment





Q9: We don’t have to worry about intervention engagement when planning an adaptive intervention. The adaptation will ensure intervention engagement.

A9: No. Intervention engagement should be considered and addressed in adaptive interventions.

Adherence

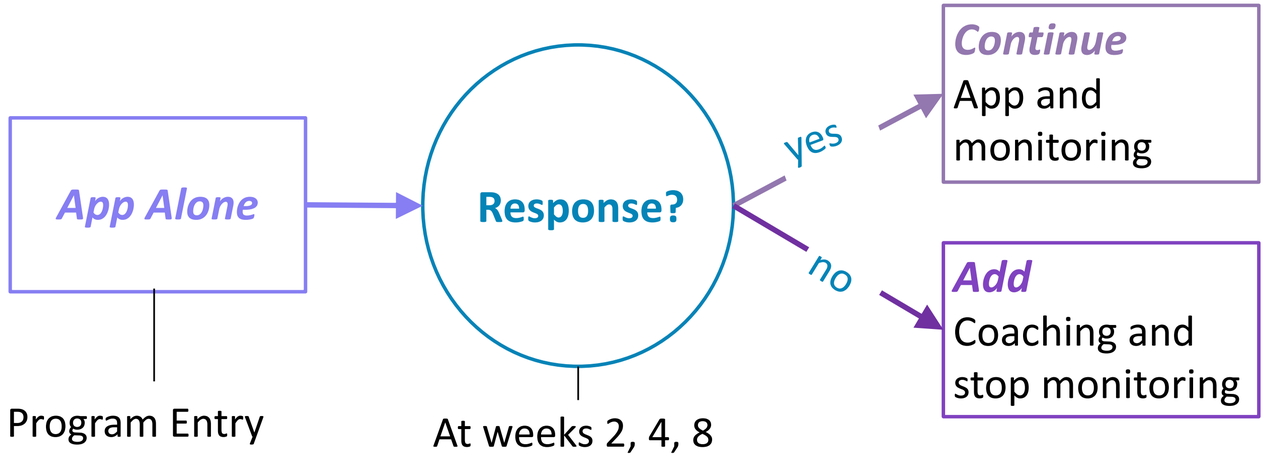
The extent to which an individual follows the intended suggestions to complete a focal task.

A person may follow instructions, but not engage

Engagement

The investment of physical, affective, and cognitive energies in a focal stimulus or task.

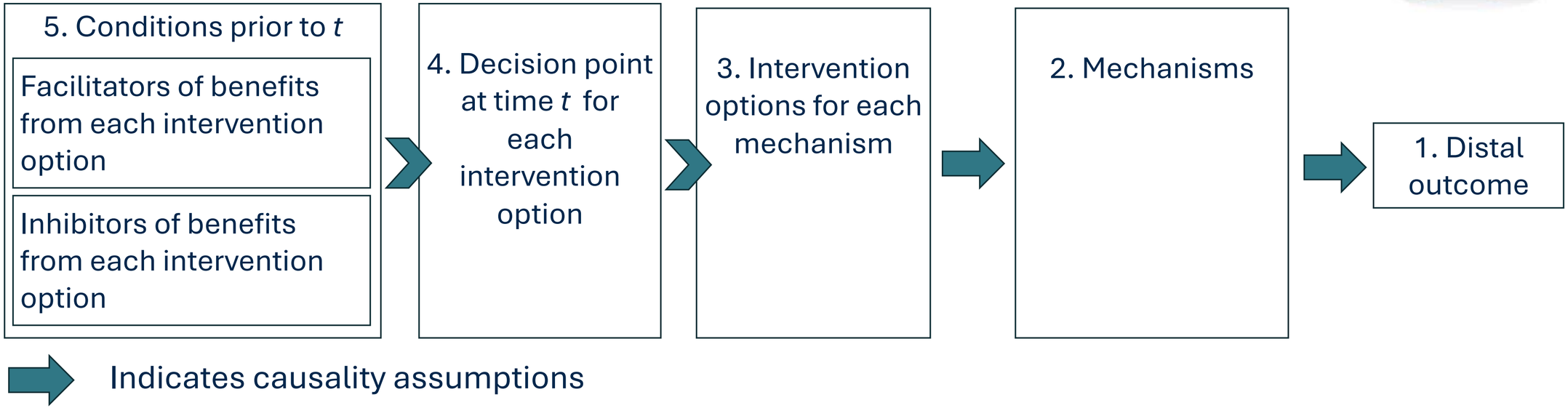
A person may engage with a task without following instructions



Nahum-Shani, I., Shaw, S. D., Carpenter, S. M., Murphy, S. A., & Yoon, C. (2022). Engagement in Digital Interventions. American Psychologist.

Q10: How should I start developing an adaptive intervention

A10: Sketch out a conceptual model based on existing evidence



* The numerical ordering indicates suggested steps to guide the process, although the process is likely iterative

Nahum-Shani, I., & Murphy, S. A. (2025). Just-in-Time Adaptive Interventions: Where Are We Now and What Is Next?. Annual Review of Psychology, 77.

Q&A

🕐 10 min