# A Case Series of End-User Engagement in Rehabilitation Technology Development: A Methodology

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## Background

- Implementation Science (Imp Sci) focuses on promoting the adoption of evidence-based practices.[1]
- User-Centered Design (UCD) focuses on involving end users in the design process for contextual fit.[2]
- Imp Sci and UCD are distinct but overlapping research domains[3] that may shorten the average **17-year gap**[4] between rehabilitation technology development and clinical adoption.

## Purposes

- Present UCD methods that can be easily integrated into the pre-implementation phase of Imp Sci.
- Compare case examples using UCD methodologies to evaluate how each could impact usability, efficiency, and clinical alignment.
- Provide a practical framework for researchers to select UCD methods based on project goals, available resources, and contextual needs.

## Methods

We examined the use of four UCD methodologies[5] in four case studies.

**Case 1**: Gait Measurement Sensors: Advisory Panels

**Case 2**: Consultative Physical Therapy: Advisory Board and Interviews

**Case 3**: Digital Health Portal: Interviews and Think Aloud

**Case 4**: Dashboard for Motion Capture System in Upper Extremity Assessment: Think Aloud

## Merging Implementation Science with User-Centered Design

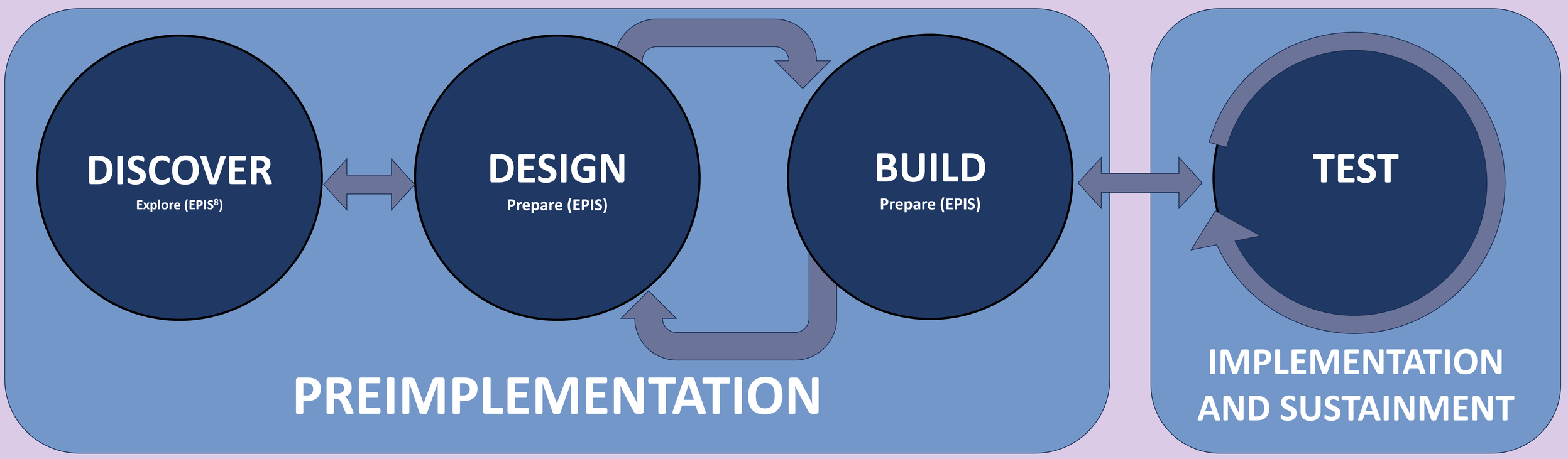



**Figure 1:** Quality Enhancement Research Initiative Framework[6] of Implementation Science integrated with the Discover, Design, Build, Test Model[7] for User-Centered Design

**Table 1:** Summary of results for research method selection

| Method | How to Use | When to Use | Strengths | Limitations |
|---|---|---|---|---|
| **Advisory Panels** | Gather diverse end-users for regular, structured feedback from changing panels of participants. | Early discovery and design iterations. | Fast and efficient saturation of perspectives. | Miss unique experiences. |
| **Advisory Boards** | Establish a formal group of experts/end-users for strategic input from a consistent group. | Early discovery and ongoing development. | Long-term guidance; alignment with community needs. | Perspectives could become stagnant. |
| **Interviews** | Conduct semi-structured, one-on-one discussions with end-users to understand needs and experiences. | Early discovery; Before/after major iterations. | In-depth individual insights. | Time-intensive; small sample sizes limit generalizability. |
| **Think Aloud** | Ask end-users to verbalize thoughts as they interact with prototype to understand practical improvements. | Throughout all pre-implementation; particularly in design. | Reveal usability issues in real-time. | Unfinished design may not reflect natural behavior. |

## Results

- Early use of UCD in pre-implementation improved usability and end-user alignment across all four cases.
- End-user engagement methods could lead to:
  - Fast iteration cycles
  - Elimination of unnecessary features.
  - High clinical relevance
- **Figure 1** displays the integration of UCD into the phases of implementation science.
- **Table 1** provides a summary of four methodologies that can be used to integrate UCD into implementation science.

## Relevance

Using UCD during pre-implementation phase of Imp Sci may improve the efficiency and usability of rehabilitation technologies. Benefits of using Imp Sci and UCD collaboratively include:

- **Fast development**
- **Low development costs**
- **Usable design**
- **High adoption likelihood**

Strategic integration of UCD within Imp Sci supports technology development to improve function and advance patient care throughout the clinical research process.

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