Using behavior design to optimize the patient experience in smart devices and digital health applications

Lara Zaki
FEI Strategy and Innovation Consultant
As a consultant in the front end Innovation team, Lara focuses on the strategic directions of early-stage medical device design and development.
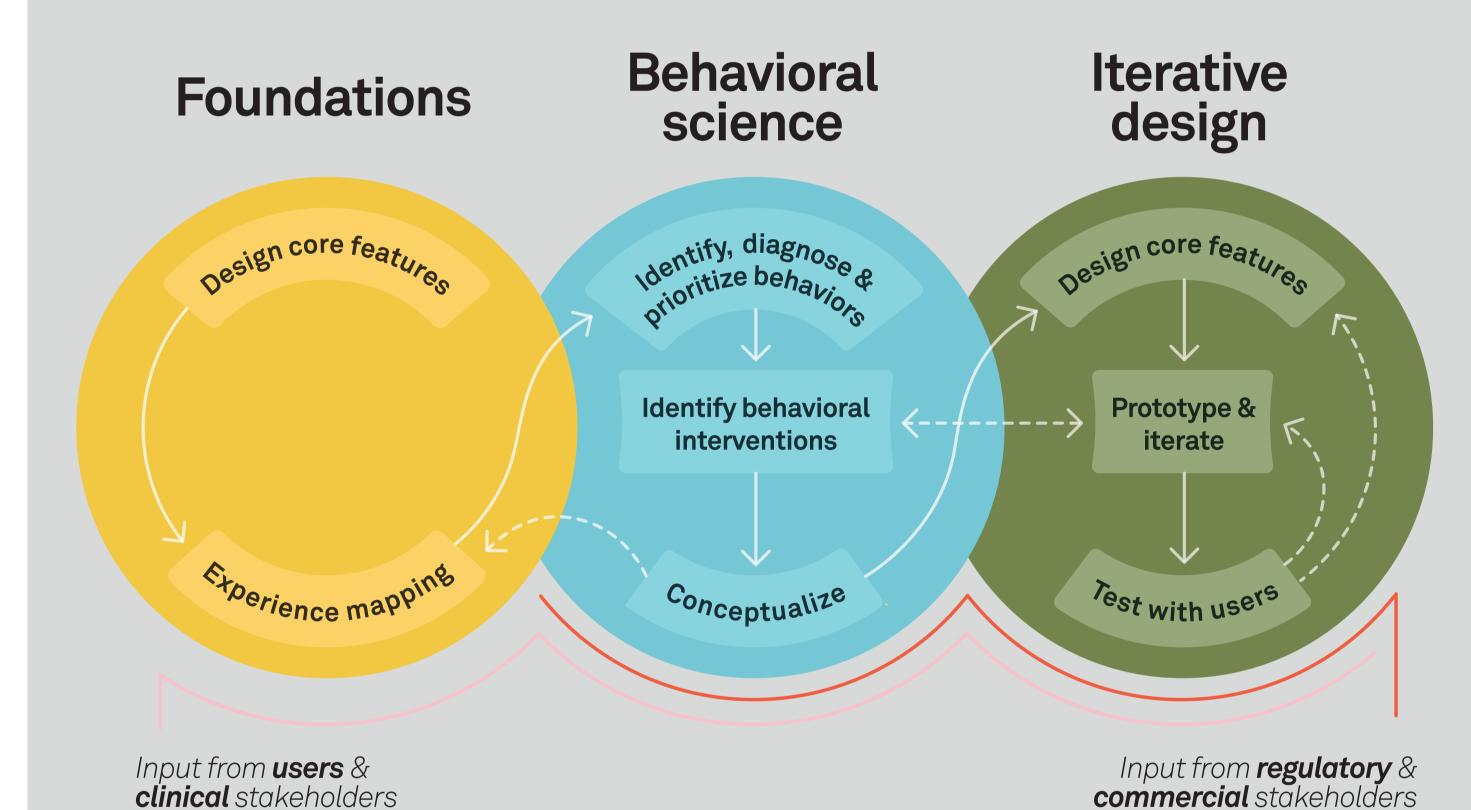
Introduction

Smart injectable devices and their surrounding digital health applications can be effective tools to enhance patient engagement and adherence to treatment regimens, ultimately ensuring the best health outcomes. However, without careful consideration of the patient group and the unique circumstances and psychologies that influence their device interactions, digital products can be built on false assumptions.

To leverage the power of digitisation, efforts should be focused on the specific decision-points in a user journey that have demonstrable impact on long-term engagement. The overarching user experience (UX) strategy as well as the individual features of the product must prioritize a set of target user behaviors that make a difference, while respecting and complementing the existing user journey.

By following this 3-phase behavior design framework, solution providers can de-risk the development of digital products and optimize their impact on the patient experience.

Foundations — Design core features, Experience mapping
Behavioral science — Identify, diagnose & prioritize behaviors, Identify behavioral interventions, Conceptualize
Iterative design — Design core features, Prototype & iterate, Test with users

Input from *users & clinical stakeholders*
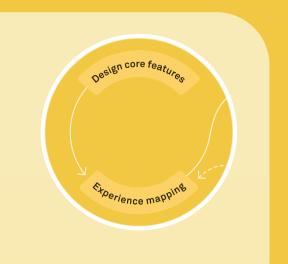Input from *regulatory & commercial stakeholders*

What is behavior design?

Behavior design facilitates the development of products and interventions that are informed by behavioral and cognitive science principles. When applying behavior design methods, the aim is to design products based on an understanding of how people make decisions, behave, and interact with the environment. This ensures that the products encourage engagement in healthy behaviors as easily as possible.

Applying a behavior design framework

To create products that are informed by applied behavioral science, Team implements a behavior design framework to ensure a systematic and balanced approach. The following framework integrates behavioral science principles with UX design, research and iterative testing methods. It is made up of three core phases: foundations, behavioral science, and iterative design. Together, these represent a series of iterative and inter-connected activities that streamline the design of smart devices and digital health applications.

Phase 1: Foundations

The first phase of the framework focuses on developing a robust understanding of the patient experience in the context of the care ecosystem, to build a foundation upon which behavior science methods can be built. Exploratory research and experience mapping are combined to achieve this and build a comprehensive view of the patient experience that is informed by evidence. In the development of smart devices and digital health applications, this phase needs to contextualize device use within broader care pathways, from diagnosis to treatment.
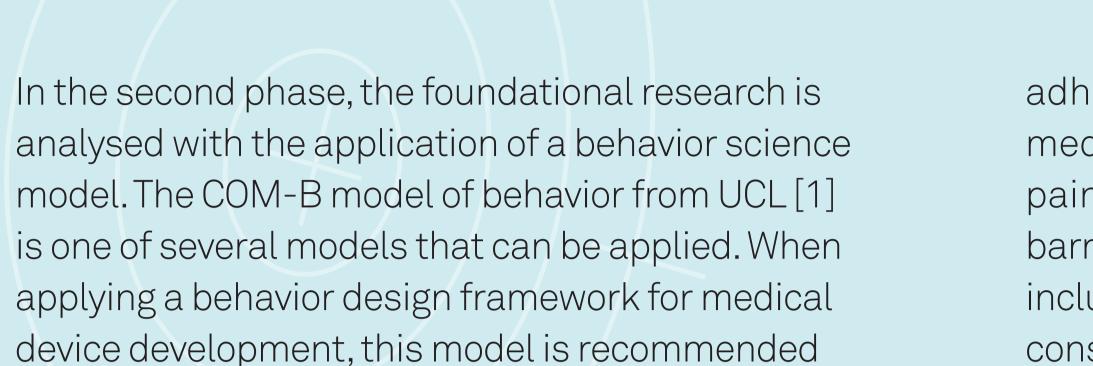
Several key insights can be investigated in this process, including:

1. Standards of care
2. Touch-points with healthcare professionals
3. Tools and techniques currently implemented
4. Pain-points surrounding initial training and onboarding
5. Pain-points surrounding adherence
6. Errors observed with existing devices
7. Internal factors related to device use (e.g. motivations, knowledge, emotions, cognitive ability)
8. External factors related to device use (e.g. resources, time, stigmas, physical abilities, accessibility, device design)

Methods and approaches

Depending on the information available, these insights are revealed through a combination of semi-structured interviews, observational studies, analysis of previous validation studies, and literature reviews. The research should be designed to systematically build an understanding of the circumstances that influence behaviors related to device interactions.

Learnings can then be translated into a comprehensive experience map, highlighting clinical touchpoints, tools, pain-points, emotions and decision points.

Phase 2: Behavioral science

In the second phase, the foundational research is analysed with the application of a behavior science model. The COM-B model of behavior from UCL [1] is one of several models that can be applied. When applying a behavior design framework for medical device development, this model is recommended as it facilitates a systematic approach to not only the understanding of target behaviors, but also the identification of relevant evidence-based interventions.
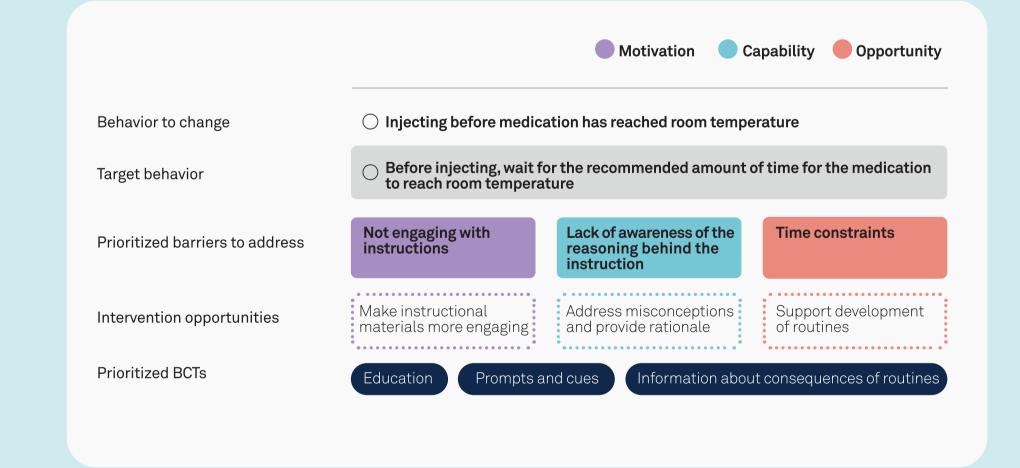
The key activities in this phase include identifying, diagnosing and prioritizing behaviors, as well as identifying and conceptualizing behavior change techniques.

COM-B
Capability +**O**pportunity +**M**otivation =**B**ehavior

Identify, diagnose and prioritize behaviors:

The first step is to translate the research insights into prioritized target behaviors that have the greatest potential impact on clinical outcomes, and are therefore the most relevant to address with the digital solution. These should be specific, measurable behaviors that contribute to patient engagement and adherence.

These behaviors are then "diagnosed" based on data in the experience map. Each behavior can be understood in terms of the different barriers to achieving that desired behavior. In the COM-B model, a behavior is defined as a culmination of factors relating to capability, opportunity, and motivation[1]. By identifying barriers related to these three factors, development teams can better understand where to focus digital interventions. For example, the foundational research on user adherence may reveal that not waiting for the medication to reach room temperature increases pain perceptions and affects drop-off rates. The barriers preventing users from waiting sufficiently may include both opportunity-related barriers, such as time constraints, and capability-related barriers, such as lack of knowledge of the consequences.

The behaviors to target in product design can be prioritized based on readiness for change, impact on patient outcomes, and spillover effect – meaning the extent to which the behavior also influences other important behaviors in the patient journey.
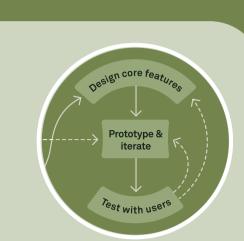
Identify behavioral interventions:

The COM-B model is part of a broader approach to behavior change intervention design developed at UCL that includes a taxonomy of behavior change techniques (BCTs) and a guide on where they have shown success. Self-monitoring of behavior, prompts / cues, behavioral rehearsal, and information about consequences are examples of BCTs that are linked to certain behavioral barriers.

By applying this approach and conducting a literature review, development teams can select BCTs relevant to target behaviors, based on literature citations, implementation feasibility, and applicability to the specific demographic. These BCTs are not prescriptive – instead they provide a starting point that helps de-risk the innovation process and enable concept development that is informed by evidence.

Conceptualize interventions:

Once a set of BCTs has been selected, these techniques can be translated into tailored concepts. For example, concepts could be related to specific mediums of educational material, informative packaging, connectivity features, or companion apps. In an innovation process, it's important to provide structured prompts, or 'design challenges' that guide ideation without constraining creativity. BCTs and other insights can be embedded into these prompts to ensure the team does not lose sight of the user, and the opportunities for intervention.

	Motivation	Capability	Opportunity
Behavior to change	Injecting before medication has reached room temperature		
Target behavior	Before injecting, wait for the recommended amount of time for the medication to reach room temperature		
Prioritized barriers to address	Not engaging with instructions	Lack of awareness of the reasoning behind the instruction	Time constraints
Intervention opportunities	Make instructional materials more engaging	Address misconceptions and provide rationale	Support development of routines
Prioritized BCTs	Education	Prompts and cues	Information about consequences of routine

Phase 3: Iterative design

Once concepts have been generated, these are iteratively designed, prototyped and tested in the third and final phase.

Design core features

It is important to design specific features that bring the concepts to life, to test whether they have the intended impact with the specific patient demographic. For example, if a concept in development is a smart device with a connected app, the features should reflect specifically what kind of data will be useful for patients to monitor, what language should be used to present the data in the app, and what kind of feedback patients need from the device. This is informed by the BCTs and the behavioral barriers previously established, as well as the foundational research. A blueprint of what the digital product should look like can then be outlined, answering the question: How can the behavioral techniques be embedded into the user experience?

Prototype, iterate, and test with users

Continuing the example of a smart device with a connected app, rapid prototyping techniques can then be used to iterate app features with feedback from clinical and regulatory experts, along with representative samples of users using functional and interactive, code-free mock-ups of the digital interface. This allows developers to validate proposed presentations of data to users, and ensure it is being interpreted as intended. These can be tested alongside existing devices, or 3D-printed prototypes before progressing to more complex demonstrators. To collect actionable feedback to base iterations on, testing can incorporate qualitative feedback as well as task performance data that identifies potential usability challenges. This collection of evidence is combined with insights from the behavioral science application to build confidence in the solution.

Incorporating stakeholder input

Throughout the application of this framework, the design needs to be evaluated against clinical, regulatory and commercial requirements.

Continuously consulting with experts and conducting risk assessments early on in the process will help de-risk the development and produce a digital product that is effective, but also compliant and marketable.

Conclusion

The behavior design framework provides a structured approach to developing smart devices and digital health applications that optimize patient experience and outcomes, making the most of what digital tools have to offer. This framework de-risks digital device development by rooting it in insights from literature and the user journey, while operating within the constraints of a highly regulated space. Its application helps streamline innovation efforts and optimize the success of digital solutions designed for patients.

References:
• [1] Michie, S., van Stralen, M.M., & West, R. (2011). The behavior change wheel: A new method for characterising and designing behavior change interventions. Implementation Science.