INTELLIGENT FUTURES RESEARCH LAB

The goal of the Intelligent Futures Research Lab (IFRL) at Nationwide Children's Hospital (NCH) is to build a healthier future for all children and families using intelligent methods and approaches to scientific research and development.

"I see the profound impact of our work in using wearables for pediatric cancer survivors. It underscores the need for robust guidelines and frameworks in human-centered design, ensuring that technology not only advances scientific research but also genuinely serves the needs and improves the lives of children and families."

**— Emre Sezgin, PhD**

*Principal Investigator, Intelligent Futures Research Lab at NCH*

## The situation

The optimal approach to human-centered design involves collaboration across multiple stakeholder groups, including representative patients, rather than developing technologies in a silo. Considering the global relevance of pediatric cancer survivorship, the IFRL team investigated the use of commercial wearables to engage children and their parents in monitoring physical activity.

## The resource

The wearable selection process aimed to ensure that the entire user experience was considered, leading to implementation of a product that's well suited to the needs and preferences of its intended users. The usability validation component of DiMe's V3+ Framework places human-centered design at its center, along with a stand-alone summary describing the principles of human-centered design.

## The impact

In addition to design experts and healthcare professionals, IFRL team worked alongside children who were patients visiting the NCH oncology clinic as well as their parents. Participants were identified based on their recent completion of cancer therapy and willingness to engage in the project, ensuring a diverse representation of experiences and needs when selecting commercial wearable technologies to monitor and promote physical activity.

The IFRL team thought about the potential discomfort attributed to body strap and wrist worn wearables to address behavioral health concerns for the children, and co-designed the audio and haptic feedback with their parents. As a result, the research team ensured that the sensor-based digital health technology selected meets the needs of all users, to be captured by adherence metrics and changes in physical activity levels over time. Ongoing in-person interviews conducted as part of formative usability testing, as well as surveys such as the System Usability Scale, initially demonstrate promising qualitative feedback regarding user satisfaction.

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"I have seen firsthand how an iterative approach to formative usability testing can make a world of difference. It is like sculpting, where each session chips away redundant details, leaving us with a product with core components that are co-created with its intended users."

**— Emre Sezgin, PhD**

*Principal Investigator, Intelligent Futures Research Lab at NCH*

## The situation

Children who have completed cancer treatment have unique needs for monitoring and promoting their physical activity. An iterative approach to formative evaluation is employed to achieve the goal of designing a wearable that is effective and easily used by pediatric cancer survivors.

## The resource

Initial usability testing involves a small group of pediatric cancer survivors to gather feedback on the wearable's comfort, usability, and engagement. The usability validation component of DiMe's V3+ Framework emphasizes the interplay between product design and formative evaluation activities in an iterative manner.

## The impact

The researchers from the IFRL at NCH initially deployed the wearable for a period of 6 weeks, allowing for comprehensive evaluation of the device's impact. Children aged 13-18 years and their caregivers were engaged through e-surveys, focus groups, and/or 1-1 interviews.

Continuous feedback from users informed iterative improvements, ensuring the wearable remains aligned with user needs and preferences. These considerations included comfort, lightweight design, water resistance, long battery life, practical functionalities such as displaying time and date, and easy-to-navigate interfaces suitable for children. As a result of this process, the IFRL team plans to demonstrate how the sensor-based digital health technology's (sDHT) design meets the needs of their users by capturing overall satisfaction in post-use questionnaires and evaluating specific device features in focus group discussions conducted as part of a summative usability study. After data collection, usage statistics before and after the iterative design improvements will be compared.

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"It's not just about the child who wears it. It is equally about the caregivers who interact with it. This dual-user perspective guides our design process, ensuring we address the unique needs and concerns of the parents, toward creating minimal-risk and usable sensor-based digital health technologies."

**— Emre Sezgin, PhD**

*Principal Investigator, Intelligent Futures Research Lab at NCH*

## The situation

For the pediatric cancer survivor population, children's age aligns with various developmental stages resulting in physical and behavioral differences. Combined with data access restrictions, regulation, and legislation considerations, parental involvement is an influencing design factor and family-focused vs child-focused utility may differ.

## The resource

The design of a wearable for children who have completed cancer treatment should consider care partners as technology users. The usability validation component of DiMe's V3+ Framework includes use specification and use-related risk analysis activities to address the needs of all intended users.

## The impact

The IFRL team at NCH evaluated the measures required to deploy an app aiming to collect information from children of different age groups. This was particularly challenging because for data privacy and exchange protocols and legislations for patients and minorities (such as hospital policy for consent/assent, HIPAA, COPPA, CURES Act, commercial product EULAs), there is no well-defined guideline for apps to manage children's data. These mechanisms ensure that parents are informed and have control over the data shared, which is also a common practice with patient portals, to enhance data security and provide a gateway for data exchange.

Therefore, early on in the testing process during a use-related risk analysis, the research team ensured that the sensor-based digital health technology's (sDHT) design safely met the needs of their users, including the enablement of sharing personal health information (PHI) with 3rd-party apps per the aforementioned policies and legislations.