

# WHAT'S GOING ON IN DIABETES TECH?

## **Shivani Goyal, PhD**

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Strategy Lead, eHealth Innovation, UHN  
Assistant Professor, University of Toronto  
Co-Investigator, Diabetes Action Canada

**@shivani\_go**



Toronto General Hospital Peter Munk Cardiac Centre

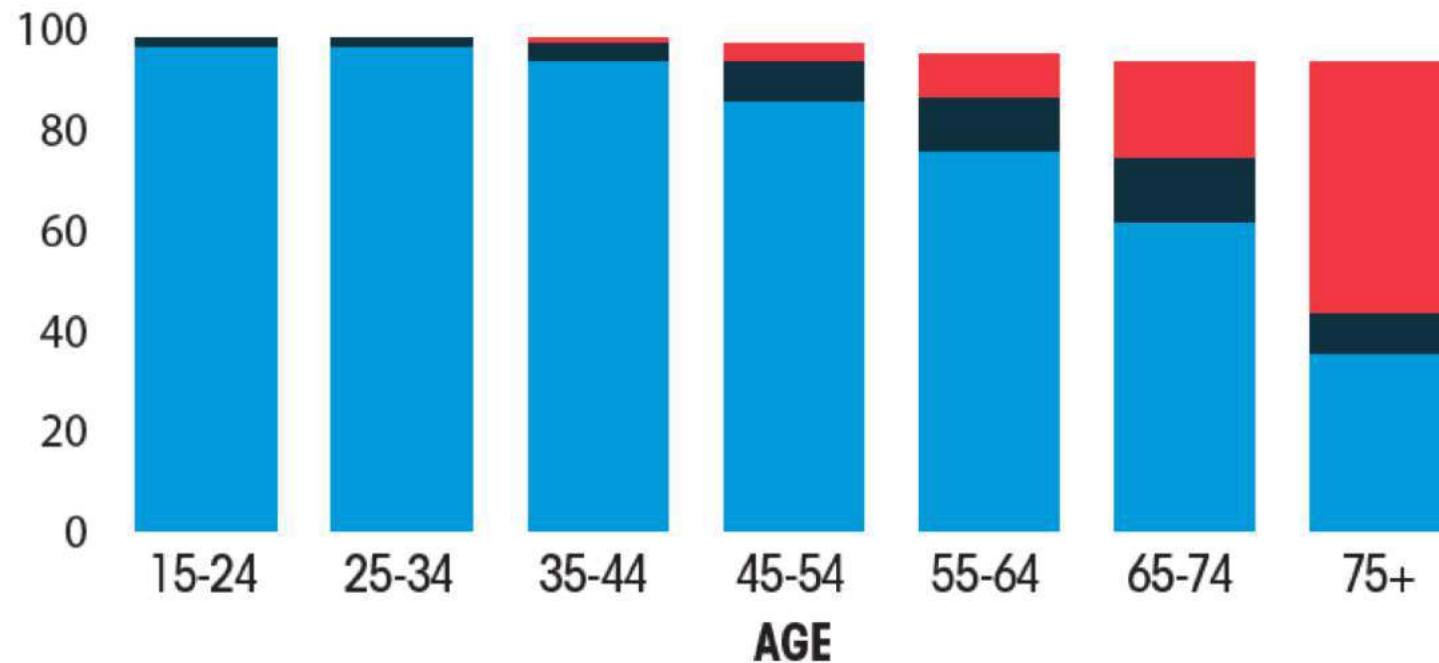
Toronto General Hospital Peter Munk Cardiac Centre

Bondfield

**How can we use digital technologies to improve the lives of people who live with T1D?**

## Nearly all Canadians under the age of 45 use the Internet every day.

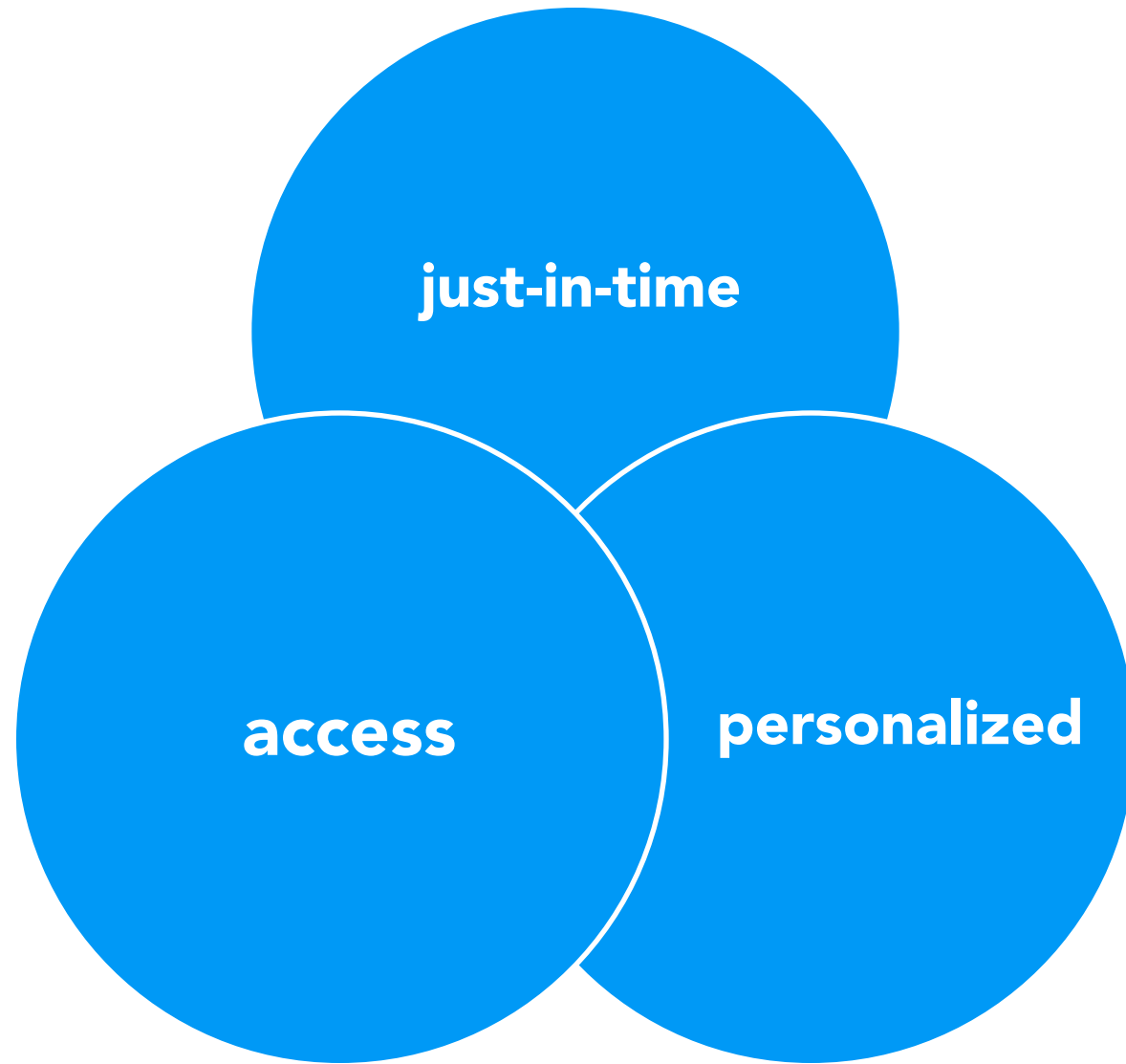
■ Daily ■ A few times a week ■ Did not use Internet in the past month



(statscan, 2017)

**Smartphones help us talk to our friends,  
find information, buy stuff on Amazon,  
and manage diabetes (?)**





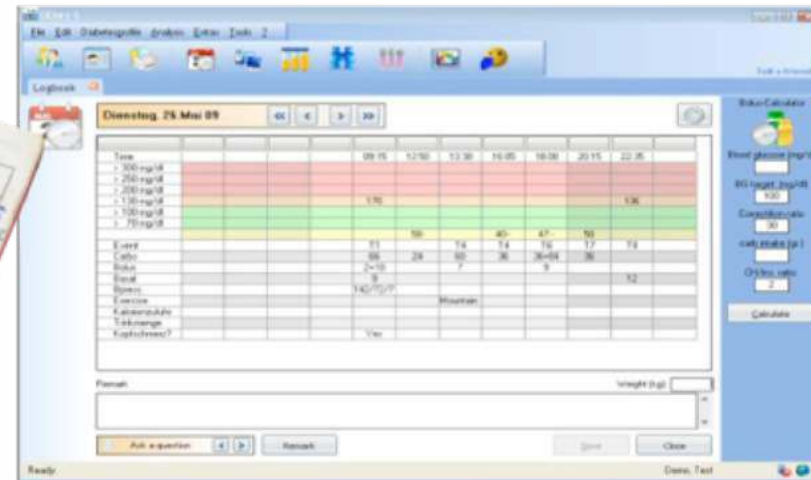
**just-in-time**

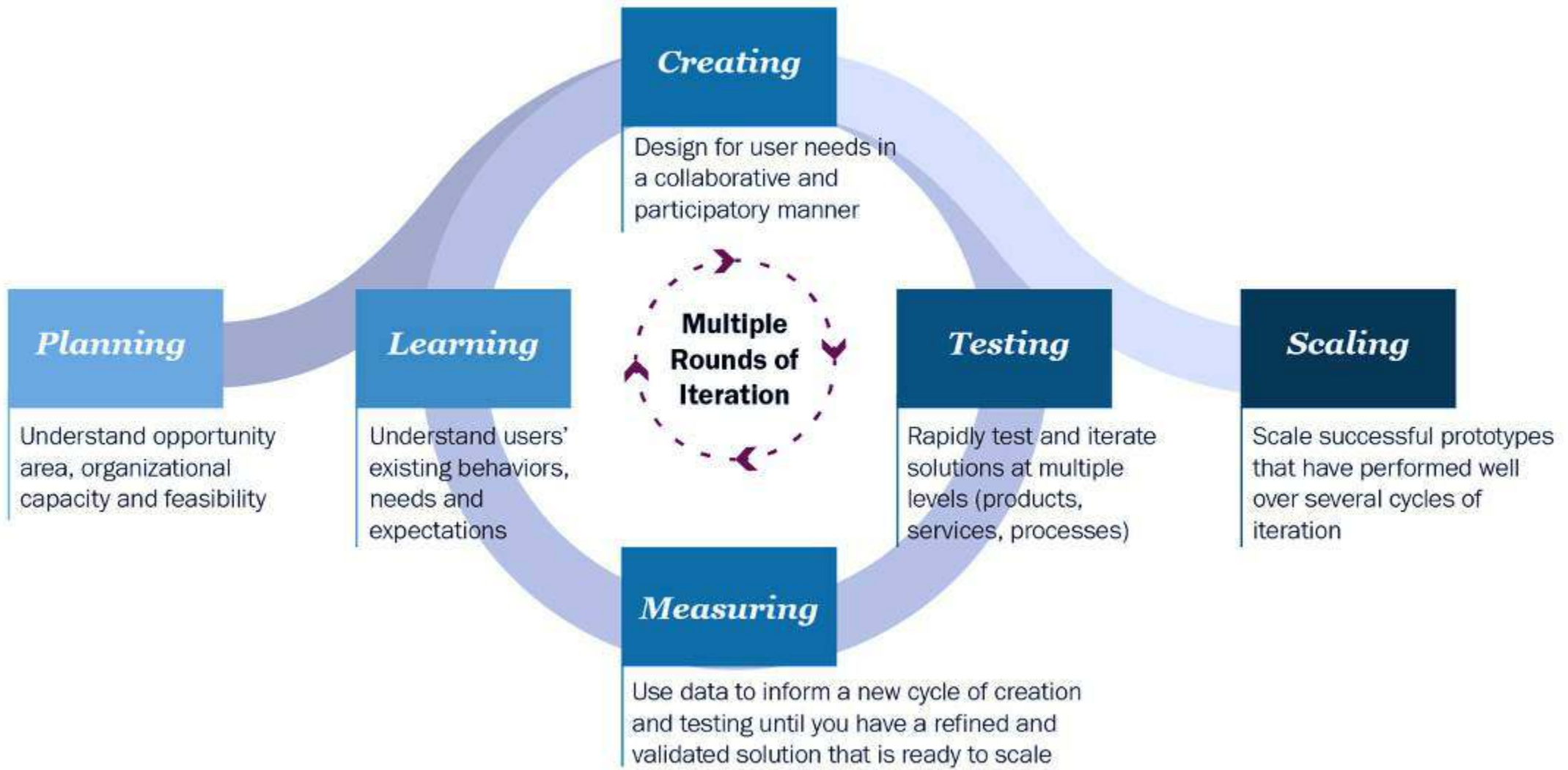
**access**

**personalized**

# SickKids®

THE HOSPITAL FOR  
SICK CHILDREN





<https://www.dalberg.com/what-human-centered-design>



## **data collector vs decision-maker**

Simple data display, decision support prompts and alerts that integrate into the daily workflow.

## **ad hoc information sharing**

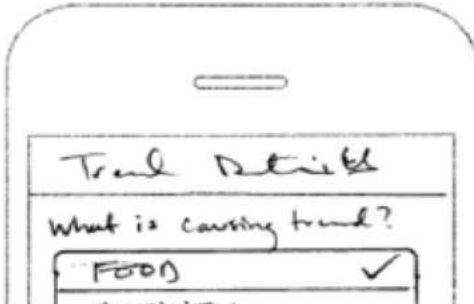
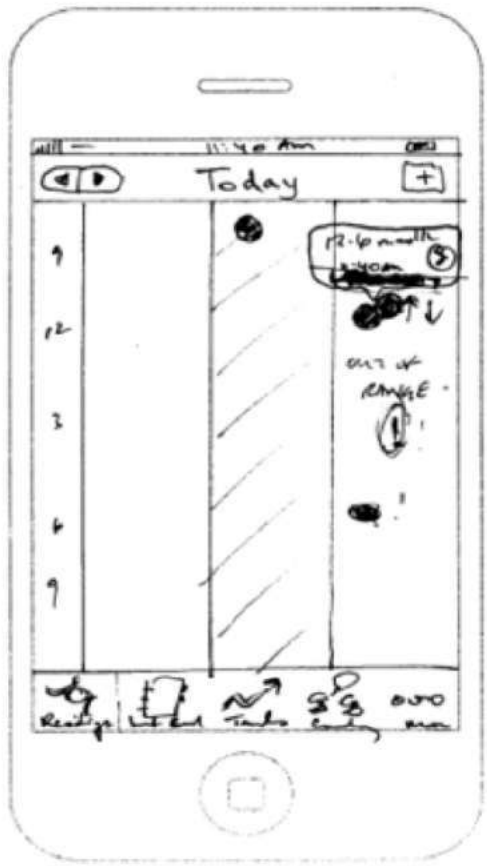
Ability to share data with formal and informal care providers. Need for secure online tools and communities.

## **data trends**

Capture trend-related data and create teachable-moments.

## **fast, discrete transactions**

Interactions should be quick, discrete, and intuitive.



**IMAGERY**







Carrier 3:30 PM

bant Book

Today

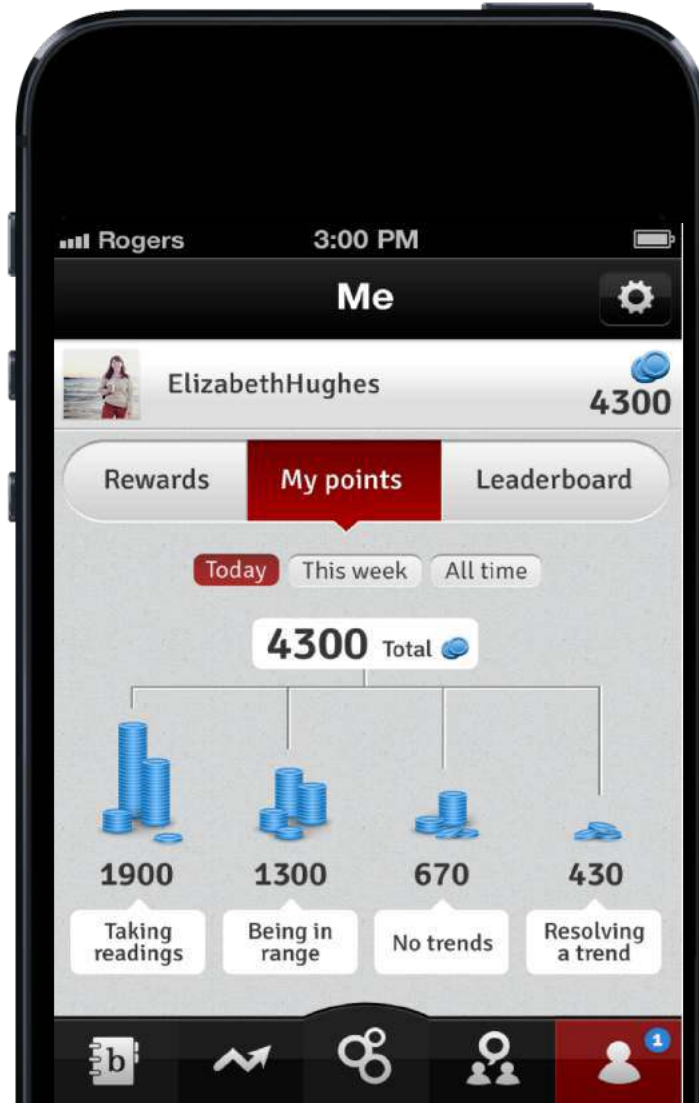
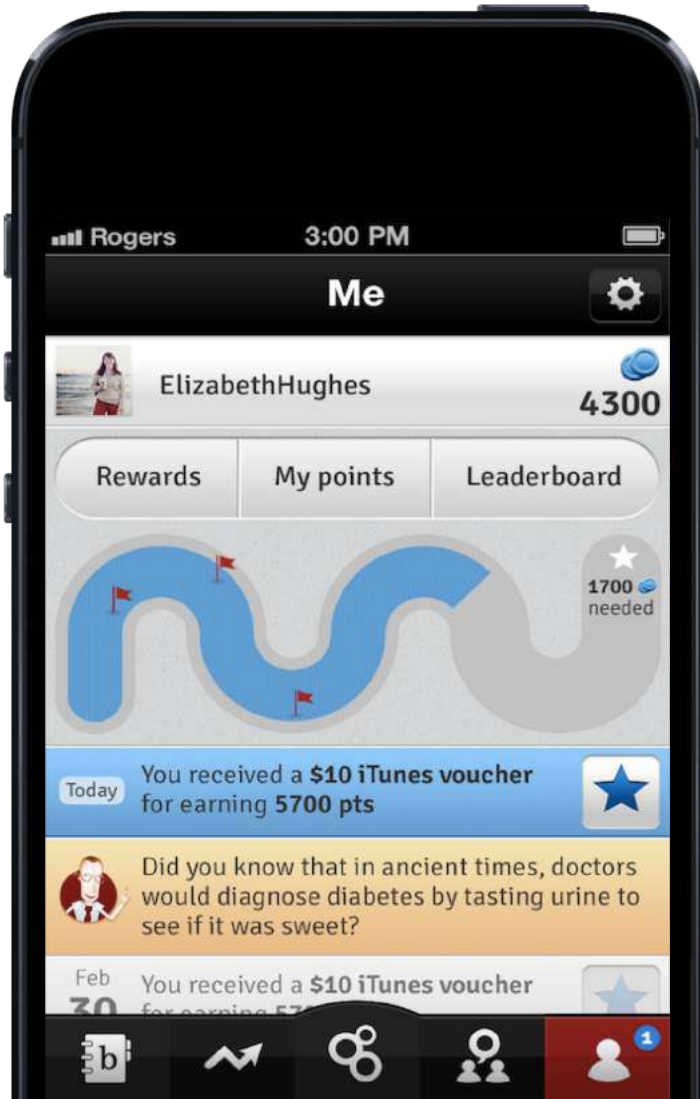
Breakfast	1 reading	11.8 mmol/l
Lunch	1 reading	13.8 mmol/l
Dinner	1 reading	15.3 mmol/l
Bedtime	0 reading	
Snack	3 readings	10.2-15.3 mmol/l

1 day ago

Breakfast	1 reading	11.8 mmol/l
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Rogers 3:00 PM

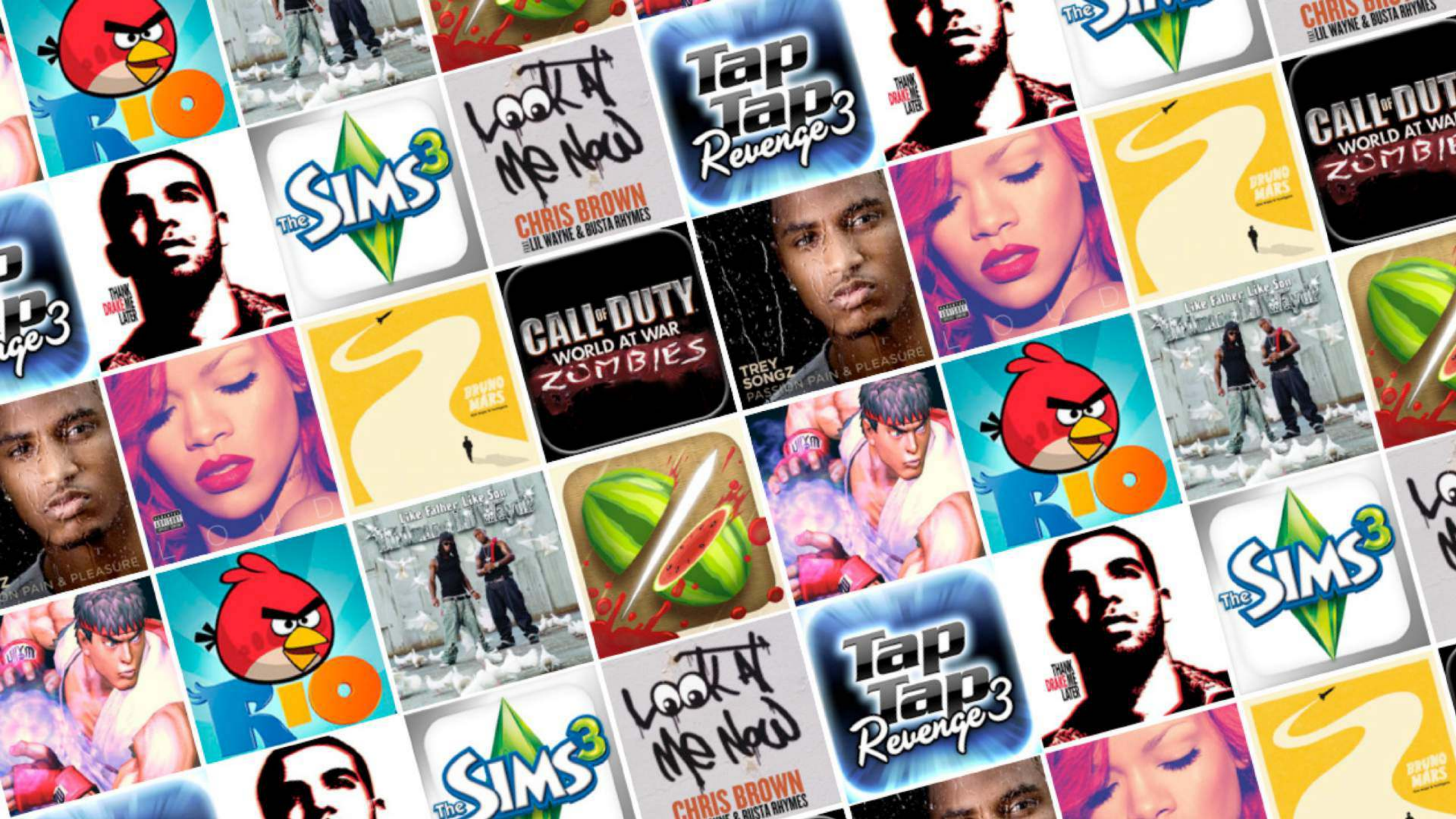
Me

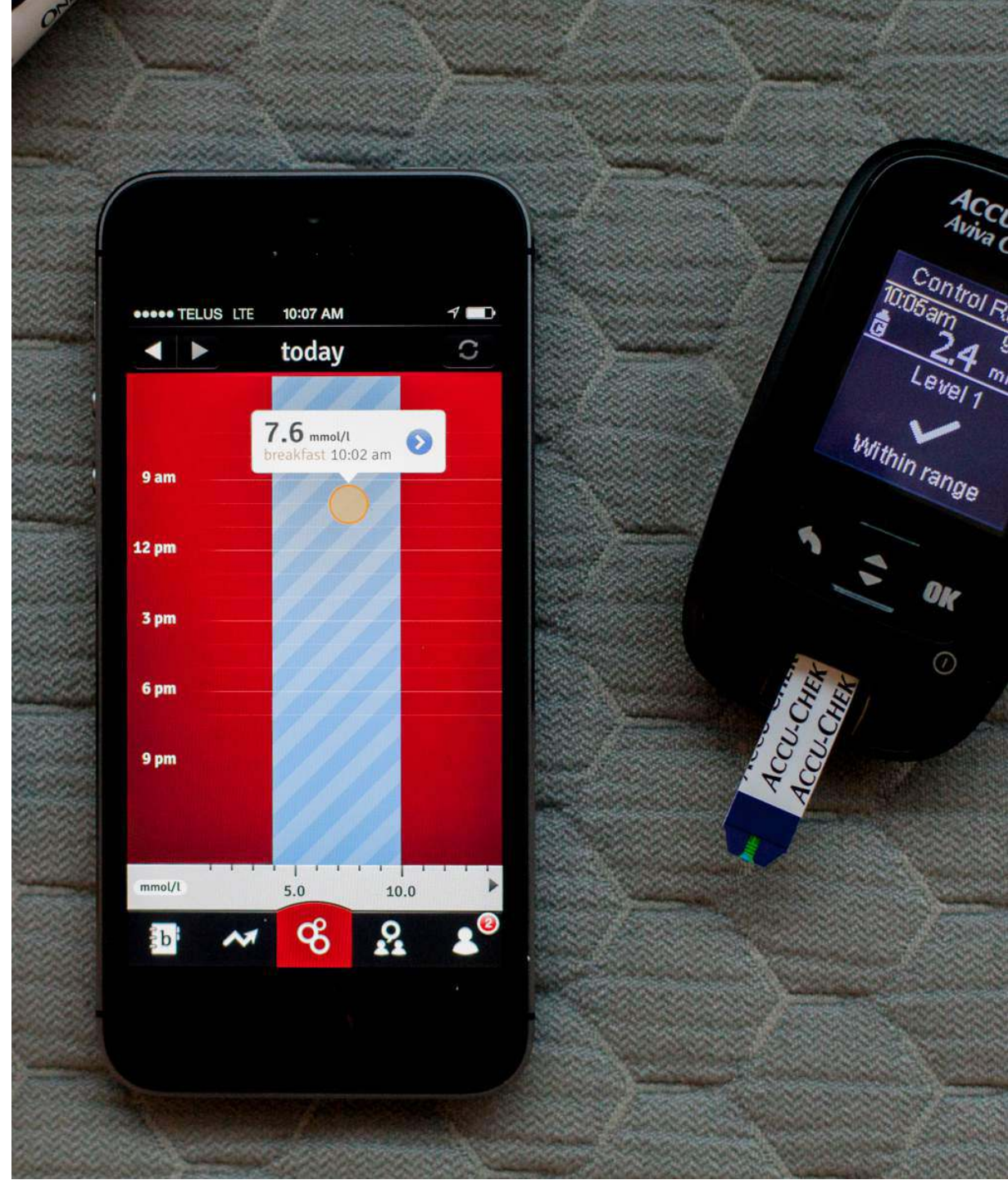
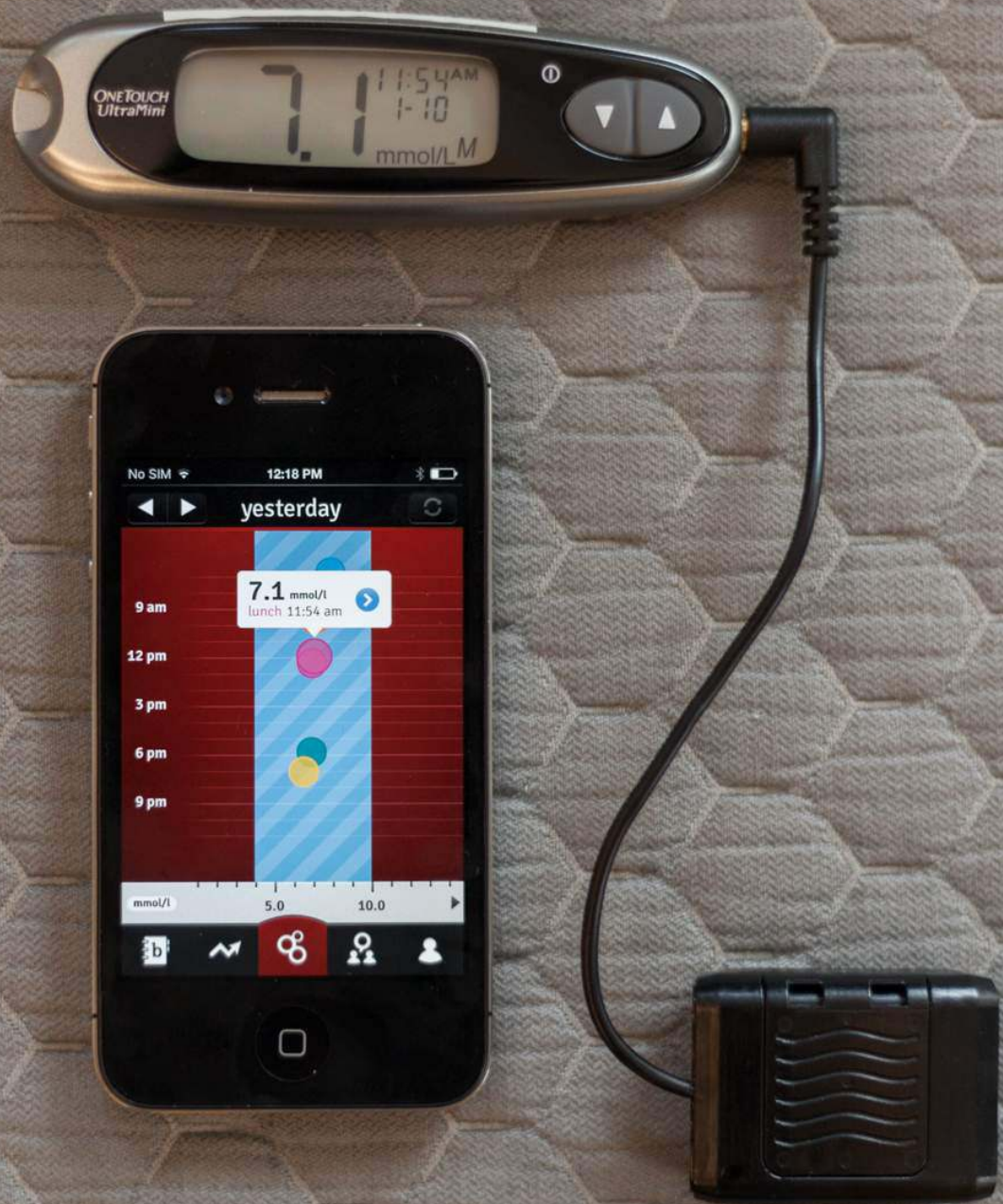
ElizabethHughes 4300

Rewards My points **Leaderboard**

You are 30524 of 30524 Today This week All time

#1	C. Best	4380
#2	ElizabethHughes	4300
#3	McCleod	4190
#4	Dr. Banting	3200







49.6%

increase in average daily SMBG  
from 2.38 to 3.56 ( $p < 0.01$ )

14/16

said they would  
keep using bant

Original Paper

## Design of an mHealth App for the Self-management of Adolescent Type 1 Diabetes: A Pilot Study

Joseph A Cafazzo<sup>1,2,3</sup>, PEng, MHSc, PhD; Mark Casselman<sup>1</sup>, MSc; Nathaniel Hamming<sup>1</sup>, PEng, MHSc; Debra K Katzman<sup>4,5</sup>, MD, FRCPC; Mark R Palmert<sup>5,6</sup>, MD, PhD

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### Abstract

**Background:** The use of mHealth apps has shown improved health outcomes in adult populations with type 2 diabetes mellitus. However, this has not been shown in the adolescent type 1 population, despite their predisposition to the use of technology. We hypothesized that a more tailored approach and a strong adherence mechanism is needed for this group.

**neutral**

no change in A1C for the group that used bant

**-0.58% A1C**

for those performing SMBG > 5 times per day

Original Paper

## A Mobile App for the Self-Management of Type 1 Diabetes Among Adolescents: A Randomized Controlled Trial

Shivani Goyal<sup>1,2\*</sup>, BEng, MSc, PhD; Caitlin A Nunn<sup>3\*</sup>, MSc; Michael Rotondi<sup>4</sup>, PhD; Amy B Couperthwaite<sup>4</sup>, MSc; Sally Reiser<sup>5</sup>, RD; Angelo Simone<sup>5</sup>, MD; Debra K Katzman<sup>6,7</sup>, MD, FRCP(C); Joseph A Cafazzo<sup>1,2,8</sup>, PhD, PEng; Mark R Palmert<sup>3,6,9</sup>, MD, PhD

<sup>1</sup>Centre for Global eHealth Innovation, Techna Institute, University Health Network, Toronto, ON, Canada

<sup>2</sup>Institute of Biomaterials and Biomedical Engineering, University of Toronto, Toronto, ON, Canada

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Canada

## **engagement**

It is difficult to keep people engaged unless you are providing value that evolves with your changing needs.

## **data sharing**

The data collected through the platform could not be shared in a seamless way with the clinic.

## **accountability**

Without data transparency it is difficult to create accountability to self-management.

## **integration**

Duplication/redundancies in where data is managed.



Contents lists available at [ScienceDirect](#)

Canadian Journal of Diabetes

journal homepage:  
[www.canadianjournalofdiabetes.com](http://www.canadianjournalofdiabetes.com)

 Canadian  
Diabetes  
Association



ATTD  
2016

## Review

# The Systematic Design of a Behavioural Mobile Health Application for the Self-Management of Type 2 Diabetes

Shivani Goyal MSc <sup>a,b,\*</sup>, Plinio Morita PhD <sup>a</sup>, Gary F. Lewis MD <sup>d</sup>, Catherine Yu MD, MHSc <sup>e,f</sup>, Emily Seto PhD, PEng <sup>a,c</sup>, Joseph A. Cafazzo PhD, PEng <sup>a,b,c</sup>

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bant

Email  
frederick@banting.com

Password  
●●●●●●●●

[Forgot Password?](#)



## Making digital health part of standard of care in Canada is hard.

No reimbursement for allied health professionals.

Delivery of care is complex and often grass roots.

Uncoordinated funding decisions on digital needs.

Slow movement towards interoperable health records.



# Digital health for all Canadians will help transform care

By Michael Green, President and CEO, Canada Health Infoway

...but we want it!



Across the globe, and here at home, innovative patient-centered digital technology is making health care more accessible for patients and more sustainable for funders.

There is no question that information is critical to quality care, whether patients are managing their conditions themselves at home. The gains that have been made in health care are evident and Canadians want secure access to online patient services. Because of the investments Infoway has made with its jurisdictional partners in foundational digital health infrastructure, Canada has never been better positioned to happen.

In fact, patient portals, such as initiatives at Toronto's Holland Bloorview at Sick Children, the Children's Hospital of Eastern Ontario in Ottawa, and the MyHealth portal project, are already providing Canadians with access to their health information.

Working together, we have made great strides and we need to maintain the momentum. Harris/Decima reports that 80 to 90 per cent of Canadians want access to other consumer health services, but only between six and 10 per cent actually use them.

Leveraging these untapped opportunities to support patient-centered care through digital health tools and capabilities is the emerging focus in Canada's digital health strategy. Canada, in particular, is a country where the expansion of consumer-oriented digital health makes a

## Majority of Canadians eager to use virtual visits

December 19, 2018



TORONTO – A new study commissioned by Medisys Health Group, in collaboration with Edelman and LegerWeb, reveals that Canadian employees are demanding healthcare at their fingertips – apps that let individuals connect directly and instantly with nurse practitioners, physicians and other health professionals through secure text and video chat, anytime and anywhere.

“Average smart phone usage has increased by 60% over the past three years – this coupled with ongoing access barriers and supply and demand challenges within our healthcare system makes it clear why Canadians are looking to supplement traditional doctor’s office visits with virtual consults,” said Dr. Vivien Brown, vice president, medical affairs, Medisys Corporate Health.

The Medisys virtual health study, which surveyed more than 1,500 Canadian employees, revealed the following:

- 2 in 3 Canadians would use virtual care if it was provided in their employee benefit plan
- 71% of Canadians are willing to trade off current benefits for improved access to healthcare professionals and technology-supported services like virtual care
- Virtual care is most appealing to parents and caregivers (69%), those dealing with chronic health conditions (70%) and millennials (67%)
- Only 9% of employee benefit plans currently include virtual care coverage

# Walmart Brings One Drop's Diabetes Management Platform to Hundreds of Retail Stores Nationwide



Retail expansion increases accessibility of healthcare technology and support for people with hypertension

[Payer](#) [Provider](#) [Consumer](#) [North America](#)

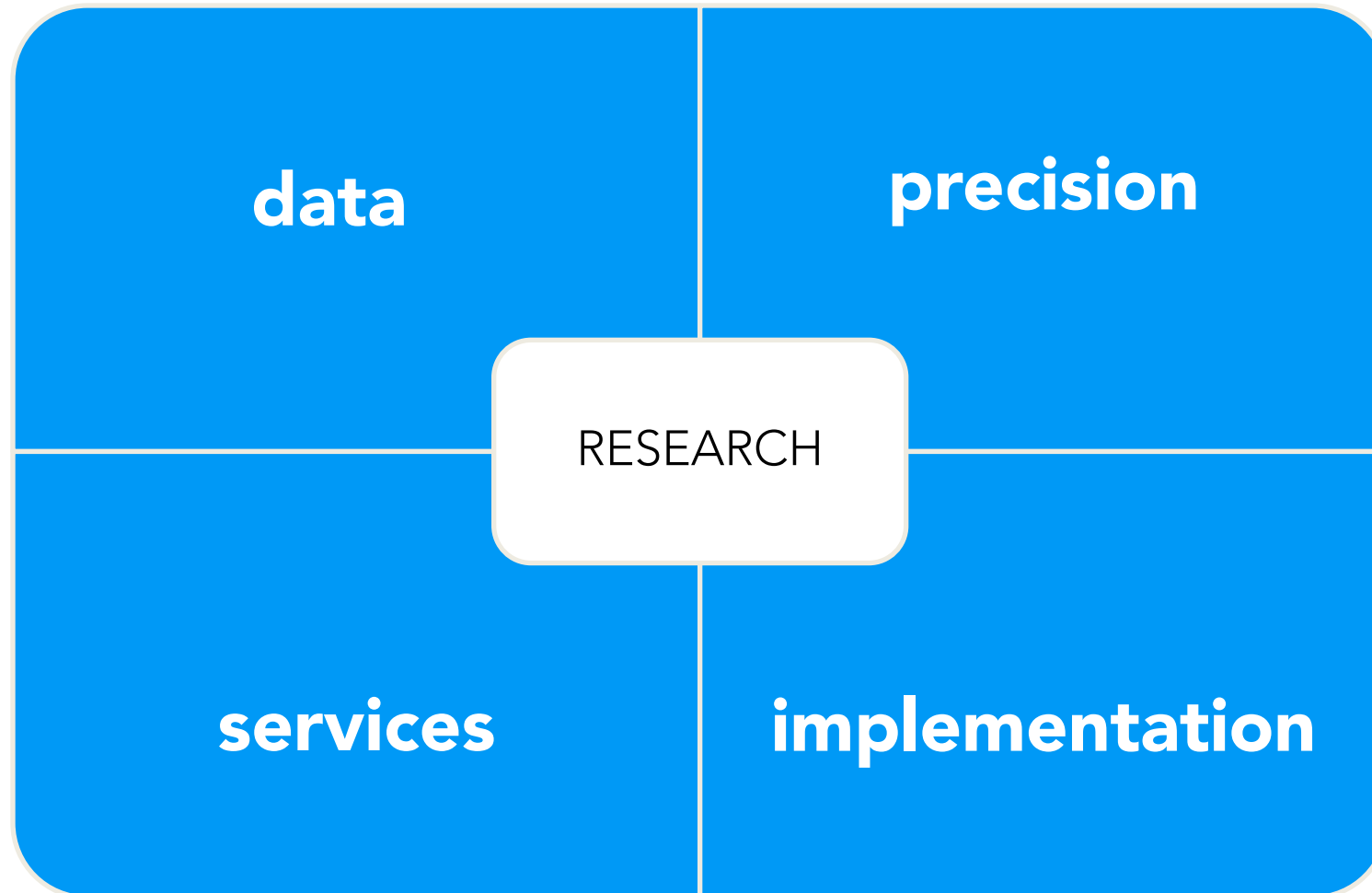
## WellDoc's BlueStar cleared for Type 1 diabetes management, CGM integrations

This is the seventh FDA clearance for the longstanding mobile diabetes management platform.





designed for our needs in our system



**How might we better support emerging youth as they transition through to adult care?**



## People living with T1D

- Competing priorities
- Independent trouble-shooting
- Difficulty making a connection with the adult team
- Rebuilding support networks
- Navigating a new world of coverage

## Providers

- Unclear transfer process and accountability
- Incomplete transfer of patient information
- Poor uptake of available structured tools into practice

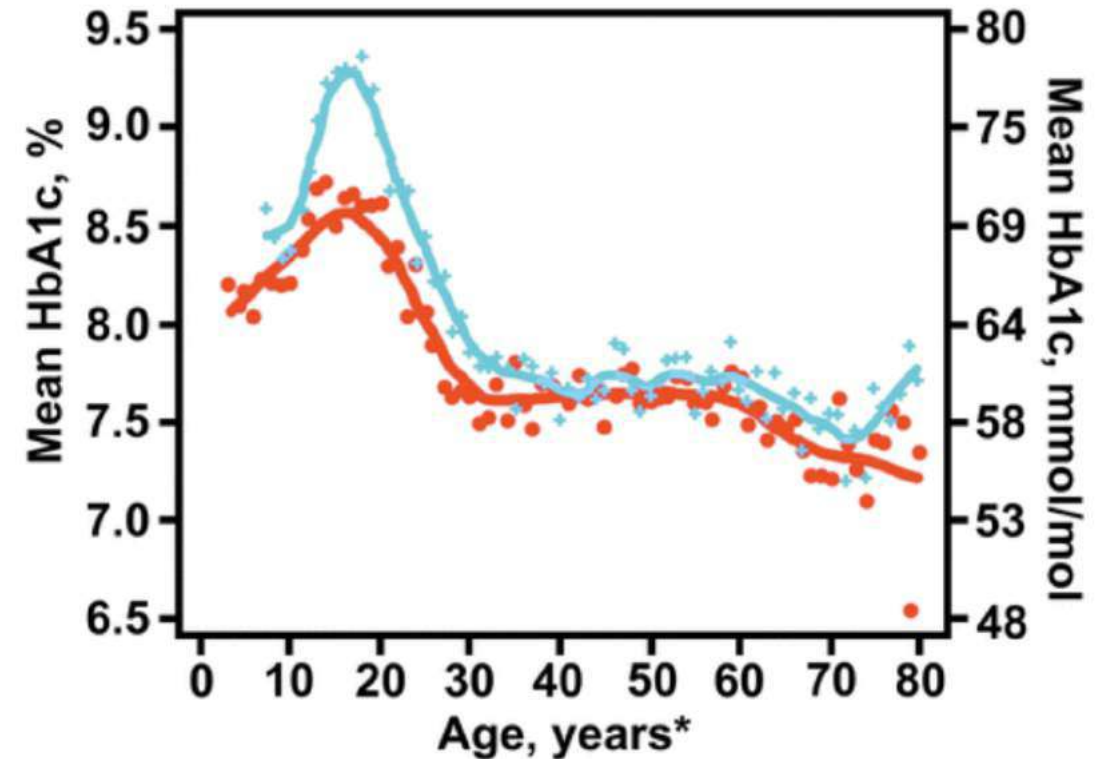
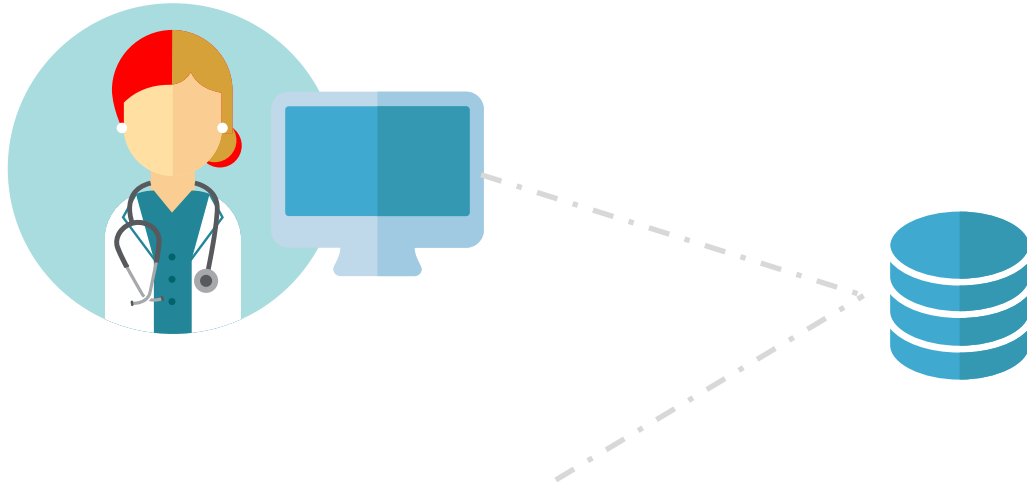


FIG. 2. Average HbA1c by year of age: 2010–2012 versus 2016–2018. Orange line represents 2010–2012 cohort, and blue line represents 2016–2018 cohort.

# ONBOARDING

PEDS



ADULT



# 1 ONBOARDING

# 2 SUPPORT

PEDS



ADULT



Looks like your first adult endo visit is coming up. Here is what you can expect:

# 1 ONBOARDING

# 2 SUPPORT

# 3 REPORT

PEDS



ADULT



Just checking in, how has your last month been?  
1- Everything is great ...

# phase 1 co-design

## patient journey mapping

Received feedback from patients (n=13) on their transition experience.

## current state service mapping

Map the existing transition process at each site (4+8), to better understand the variability between sites and provinces..

## semi-structured interviews

One round of semi-structured interviews among the stakeholders (5-8 per group) for both ON and QC.

## co-design sessions

Two rounds of co-design workshops among the stakeholders (5-8 per group) for both ON and QC.

# TRANSITIONING FROM PAEDIATRIC TO ADULT CARE

EMPATHY

**IMPORTANT!**  
DIABETES EDUCATORS  
**MUST MAKE TIME**  
TO ANSWER  
**QUESTIONS!**

**MY STORY**  
IT CAN BE  
**EMOTIONAL**  
FATIGUING

CONNECTION

I'M AFRAID  
OF TALKING TO  
DOCTORS  
BECAUSE I DON'T WANT  
THEM TO THINK I'M  
NOT TRYING HARD ENOUGH

**DEALING WITH STIGMA**  
I WAS AN  
ATHLETE

TRANSITION TO  
UNIVERSITY IS  
CHALLENGING

GROWING WITH IT  
**SOCIAL MEDIA**

USE  
GADGET  
TECHNOLOGY

**PHONES**

**TEXT**

**MENTORSHIP**

AM I  
READY TO  
TRANSITION?

**SAY IS**  
WE NEED  
BETTER  
COMMUNICATION

**BOTH WAYS**

LET'S  
TALK  
ABOUT  
THE  
TRANSITION

**FEELING GRATEFUL**  
FOR THE  
GROUP

TAKE CARE OF MY  
DIABETES  
SO I CAN  
FOCUS ON MY GRADES

**TYPE 1 & 2 DIABETES ARE DIFFERENT!**

TRAC PROGRAM  
IS GREAT!  
I'VE  
IMPROVED MY GRADES  
AND I CAN  
FOCUS ON MY GRADES

DO I  
NEED  
TO  
USE  
THE  
APP?

SO I  
DON'T  
HAVE  
TO  
DO  
THE  
APP  
MYSELF

AM I  
AT THE  
RIGHT  
AGE  
TO  
TRANSITION?

WHAT  
ARE  
THE  
BEST  
WAYS  
TO  
TRANSITION?

I  
MISSED  
MY  
FIRST  
DAY  
OF  
HIGH SCHOOL

**THE FEELING OF DISCONNECTING**  
FROM THE  
TEAM  
AT THE  
TRANSITION  
IS HARD!

IT'S  
IMPORTANT  
TO  
HAVE  
A  
STRONG  
ADVOCATE  
FOR ME

IT CAN BE  
HARD  
TO  
ADVOCATE  
FOR  
YOURSELF  
UNTIL  
YOU'RE  
18

WE'RE  
MORE  
INDEPENDENT  
AT  
UNIVERSITY

WE  
NEED  
A  
STRONG  
ADVOCATE  
FOR ME

HI

**TRANSITION CLINIC**  
**MEET THE ADULT TEAM**

**TRAC PROGRAM**

Type 1 Diabetes  
Think Tank Network

ERICA BOTE  
Think  
Link  
Project



**Your Experience Transitioning From Pediatric To Adult Clinical Care**

**Transitioning From Pediatric To Adult Clinical Care**

**Your Experience Transitioning From Pediatric To Adult Clinical Care**

**Your Experience Transitioning From Pediatric To Adult Clinical Care**

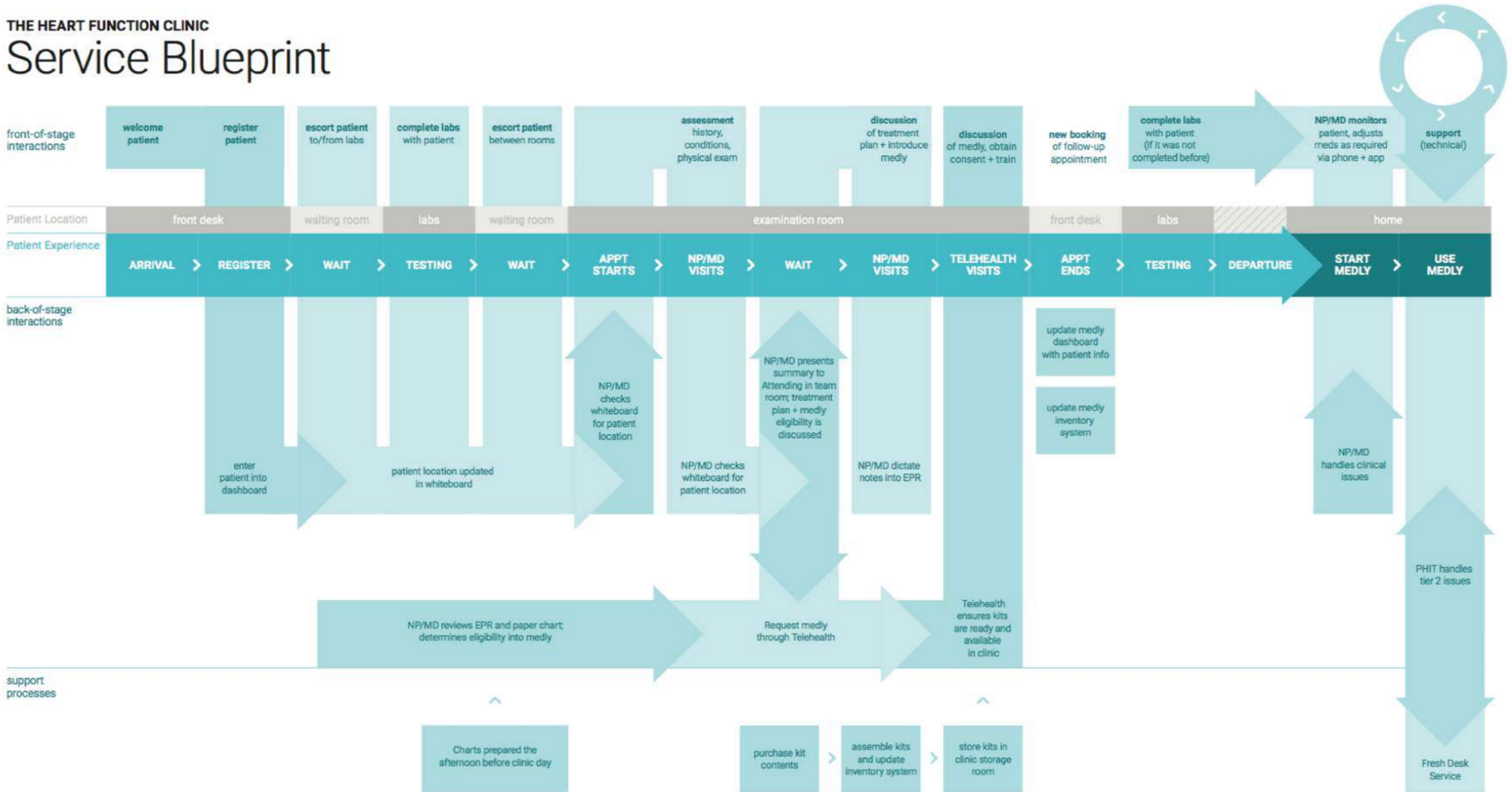
**Transitioning From Pediatric To Adult Clinical Care**

We Transition		Thinking About Transition		Transition		Post Transition	
moving pediatric care full time		Thinking about the possibility of moving pediatric care full time		moving pediatric care full time		moving pediatric care full time	
Age: 17		Age: 17		Age: 17		Age: 17	
<p>Age: 17 Gender: female From Living with T1D</p> <p>Post Transition moving pediatric care full time</p>	<p>Age: 17</p> <p>Age 17, I was in the 4th grade and I was kind of shy.</p>	<p>Age: 17</p> <p>Early on, I was kind of shy and I was kind of nervous.</p>	<p>Age: 17</p> <p>During the transition, I was kind of nervous and I was kind of shy.</p>	<p>Age: 17</p> <p>During the transition, I was kind of nervous and I was kind of shy.</p>	<p>Age: 17</p> <p>During the transition, I was kind of nervous and I was kind of shy.</p>	<p>Age: 17</p> <p>During the transition, I was kind of nervous and I was kind of shy.</p>	<p>Age: 17</p> <p>During the transition, I was kind of nervous and I was kind of shy.</p>
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**Feelings and Thoughts**  
How do you feel about the transition?

THE HEART FUNCTION CLINIC

# Service Blueprint



How might we accelerate research in T1D?



# There is a need to accelerate research in T1D

So maybe patients could register through a digital medium (apps/website) and consent to three levels of participation:

1. Consent to be part of a T1D Registry
2. Consent to be contacted for clinical research opportunities
3. Consent to share patient-reported information



Diabetes Action Canada  
Type 1 Diabetes Registry

Get Started

Sign In



## **T1D Think Tank and Diabetes Action Canada Workshop**

November 2018 in Toronto, Ontario

# We need ...

advocacy power

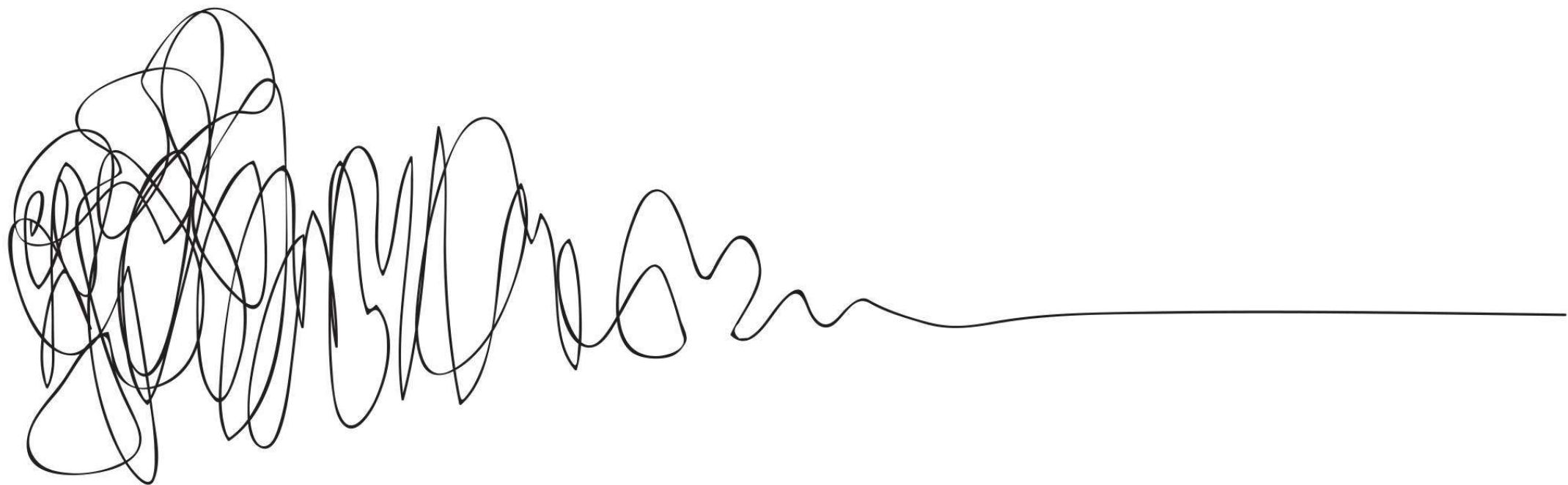
local communities

data liberated

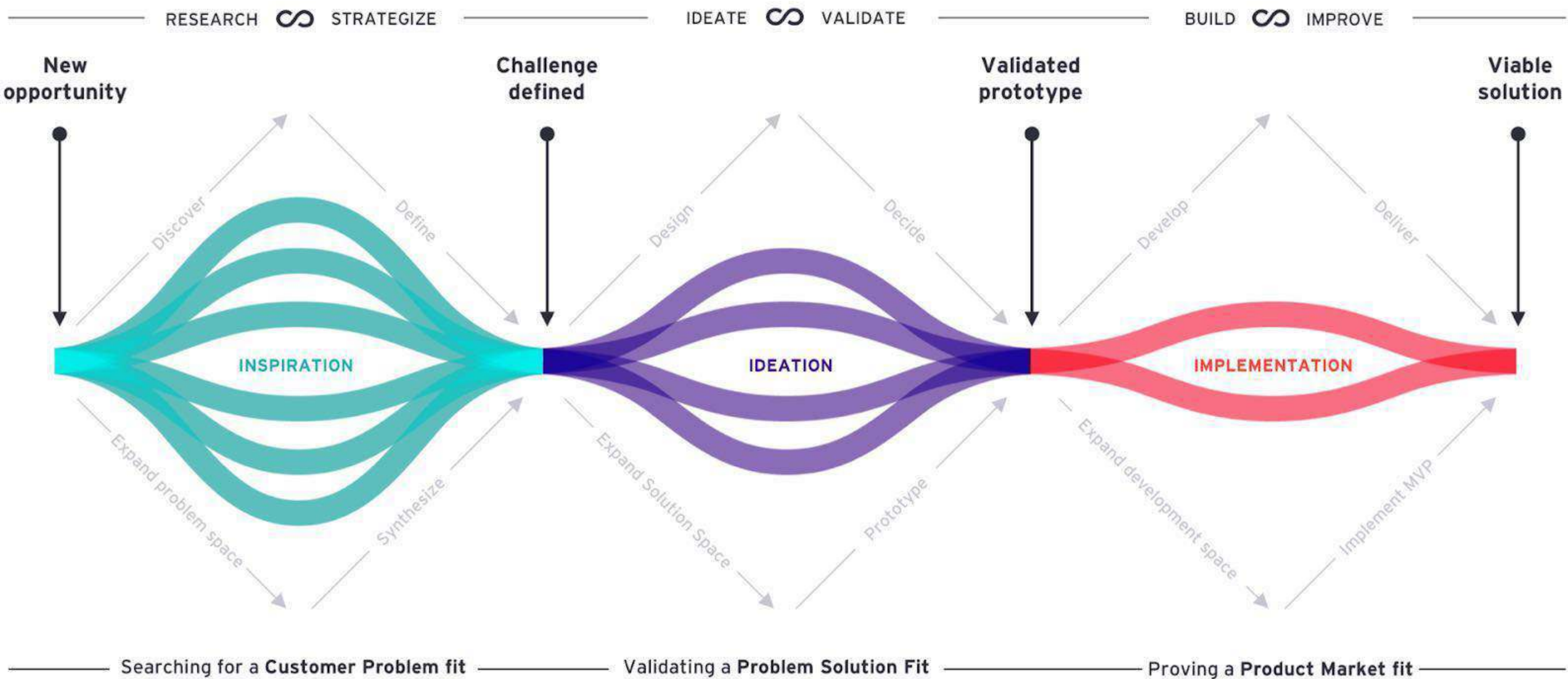
resources

digitally enabled  
services

mental health  
services







# diabetes journey map

Reverse Kirk

1 choose your team journey

A camping trip in Joshua Tree National Park

2 identify the big stages

What are the chapters in the story of your journey?

Education & Skills Development

Pre Planning

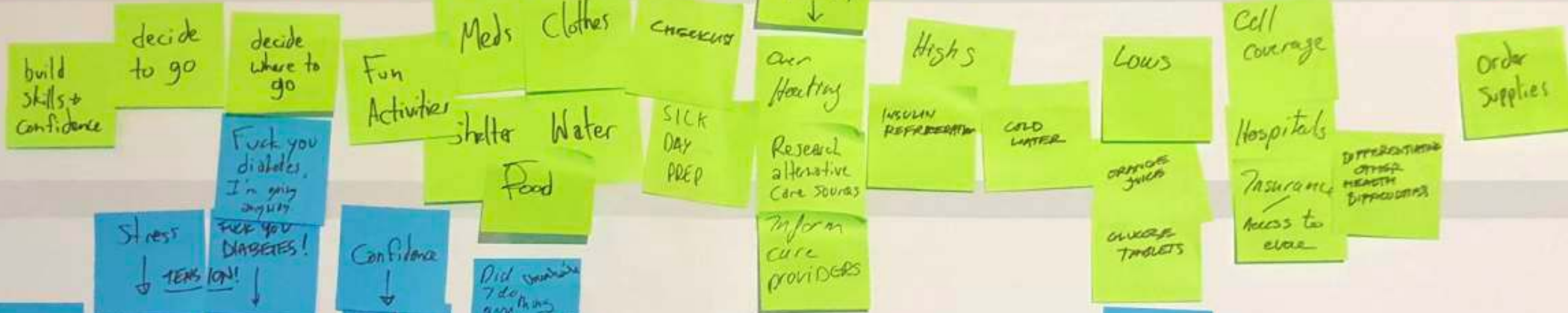
Plan

Prep

Execute

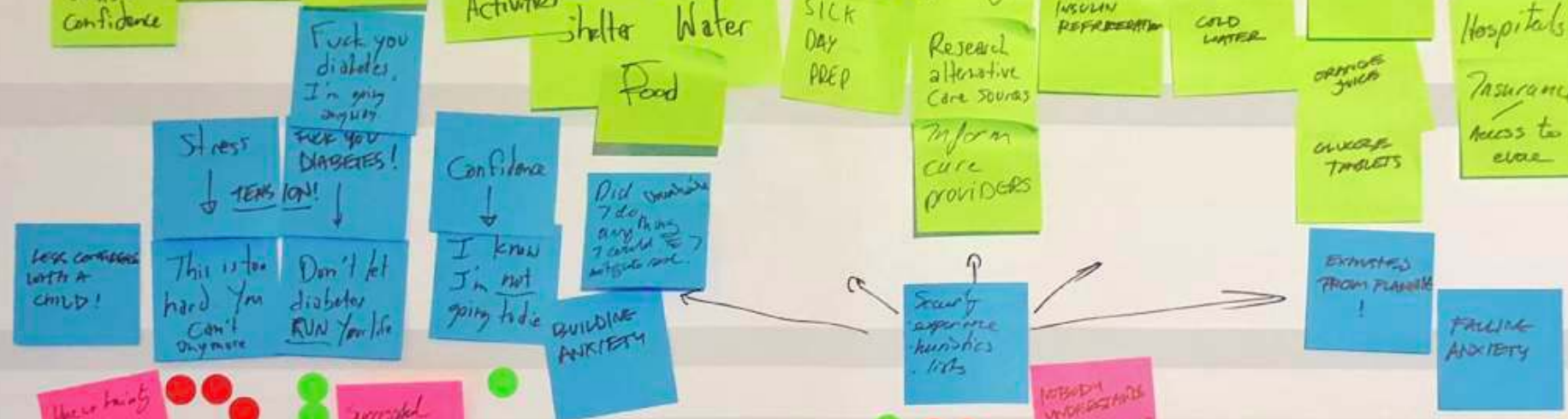
3 fill in the detailed steps

Contexts—Where are you?  
People—Who are you with?  
Actions—What do you do?



4 capture your feelings

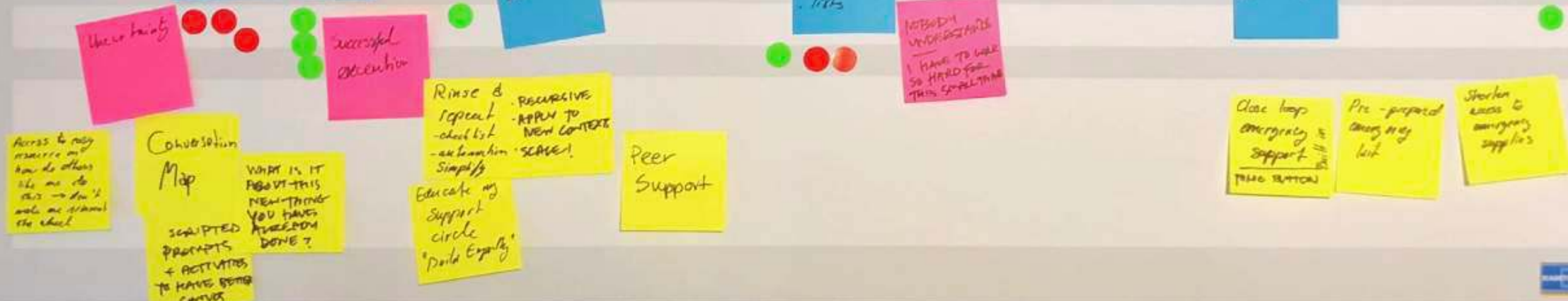
What are you thinking?  
What are your emotions?  
Why do you feel this way?



5 identify high & low points

6 generate ideas

Learn from the high points.  
Improve the low points.  
Create a better future.



Matt Lumpkin

## Your Diabetes Neighbourhood

### WHAT IT IS

A digital tool that connects people living with Type 1 Diabetes with others in their community.

### HOW IT HELPS

Connecting with peers in your own neighbourhood both reduces feelings of isolation and creates a meaningful sense of community for people living with T1D.

## Well-being

### WHAT IT IS

A digital tool that gathers data about your emotional well being and helps you to connect with mental health professionals or trained peers.

### HOW IT HELPS

This tool will expand the nature of care for people with T1D by bringing mental health care providers and peers into the circle of care.

It will then ask you if you want to be connected virtually to a mental health professional or a trained peer

### HOW IT WORKS

You create "Your Diabetes Neighbourhood" profile, entering your interests, hobbies, and preferences

The app prompts you "How are you feeling?"

# Diabetes Moments

### WHAT IT IS

A digital tool that connects people living with T1D around shared experiences.

### HOW IT HELPS

Diabetes Moments creates meaningful connections between individuals that have shared experiences and that want to learn from one another.

### HOW IT WORKS



A teenager turns 19 years old



They begin to worry about how their transition to the adult healthcare system will impact their care and ability to manage their diabetes



They log on to Diabetes Moments and explain, in their own words, what they are experiencing and what questions they have



The application reviews their response, and suggests a community thread titled "Transitioning to the Adult System"



They will also be given the option to be matched with a 23 year-old living with T1D who has recently been through a similar experience



**Ongoing co-design sessions with people living with T1D  
n= 20+, total respondents= 76**

I want to know about studies.

I need to be able to easily determine if this study is important to me

I deserve to know the status and results of studies I participate in.

My study experience matters.

How do you engage the people who struggle the most?

“I want to be part of studies, but they need to match with my life and values, and be a positive experience.”`

## cathy



"I want to feel like I'm part of a community of people who are going through the same struggles as I am."

age 21 yrs

sex female

location Toronto

age of diagnosis 10 yrs

## eddy



"I want to help support others living with T1D and teach about new findings that can help improve their management."

age 45 yrs

sex male

location Moncton, NB

age of diagnosis 10 yrs

## erin



"I want to be sure that my T1D doesn't negatively affect the lives of my children."

age 34 yrs

sex female

location Vancouver, BC

age of diagnosis 6 yrs

## background

As a new mother, Erin just started going back to work part-time. She is busy trying to balance all of the needs of her baby, work and her diabetes. Over the years, Erin has built a strong virtual community of others living with T1D through Facebook groups, forums and Instagram. She knows that she can leverage these groups to help support her when she is in need.

In addition to living with diabetes, Erin is also a T1D researcher. She has conducted multiple studies around exercise and diet, and has also been a participant in many studies. Participating in studies helps her to feel up-to-date on what is happening in T1D research and further contribute to its advancement. Erin wants to participate more, but even as a researcher, finds it hard to know what other studies are happening. She is also worried that many study designs would not fit into her lifestyle.

## characteristics



## values & aspirations

- find better ways to manage her stress
- spend more time with her children
- learn about other research that is happening
- participate more in research

## design implications

- ability to have both a patient & researcher profile, possibility to toggle between the two
- ability to quickly identify one's study eligibility
- easily navigate the platform
- stagger questionnaires as much as possible
- ability to share study posts on social media

## needs & frustrations

- doesn't want her T1D to affect children
- worried that children might inherit T1D
- better ways to manage her time
- needs better ways to find out about research

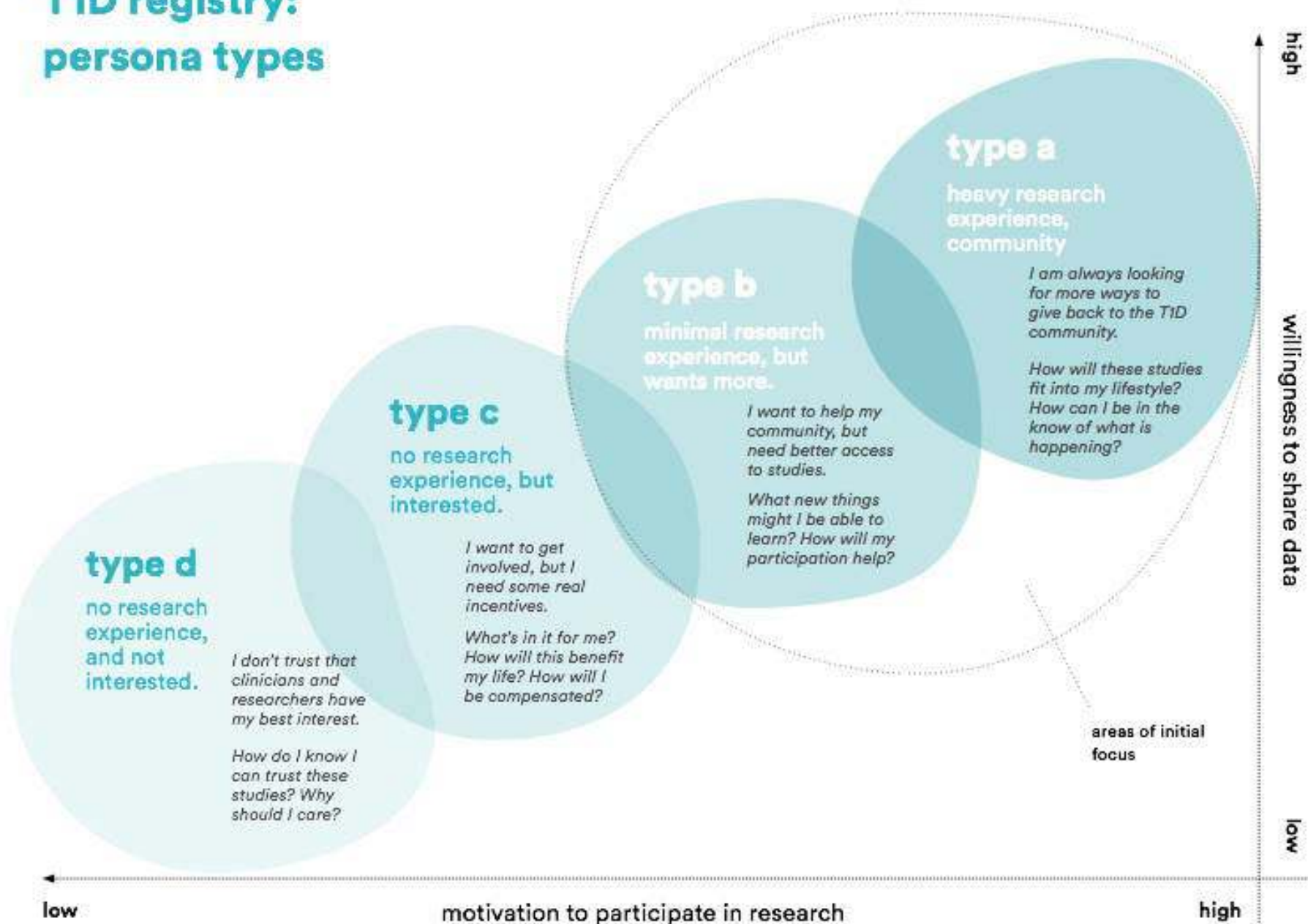
## technology

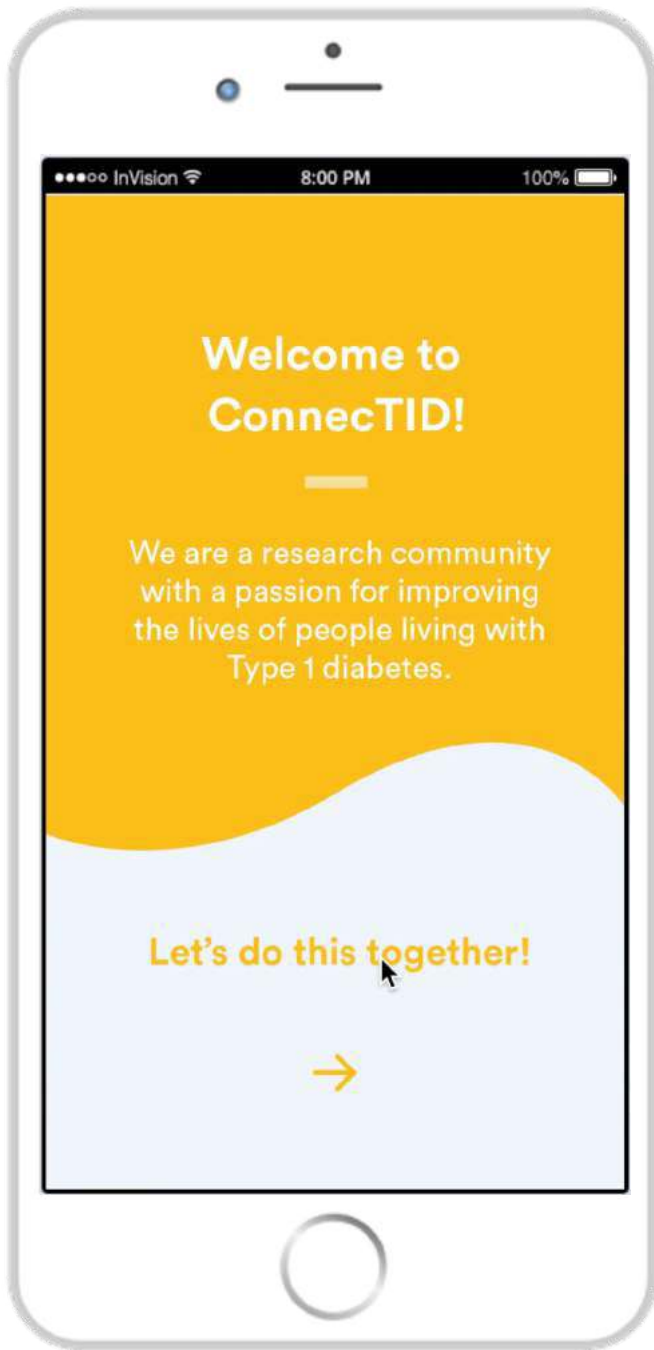


## type a

heavy research experience, community leader.

## T1D registry: persona types





# Welcome to ConnectTID!

We are a research community  
with a passion for improving  
the lives of people living with  
Type 1 diabetes.



Let's do this together!





# privacy by design

Principles of Privacy by Design may be applied to all types of personal information, but should be applied with special vigour to sensitive data such as medical information and financial data. The strength of the privacy measures implemented tends to be commensurate with the sensitivity of the data.

The objectives of Privacy by Design — ensuring strong privacy and gaining personal control over one's information, and, for organizations, gaining a sustainable competitive advantage — may be accomplished by practicing the [7 Foundational Principles](#)  , which are intended to serve as the foundation of one's privacy practices.

**Principle 1: Proactive not reactive: preventative not remedial**

**+**

**Principle 2: Privacy as the default setting**

**+**

**Principle 3: Privacy embedded into design**

**+**

**Principle 4: Full functionality: positive-sum, not zero-sum**

**+**

**Principle 5: End-to-end security: full lifecycle protection**

**+**

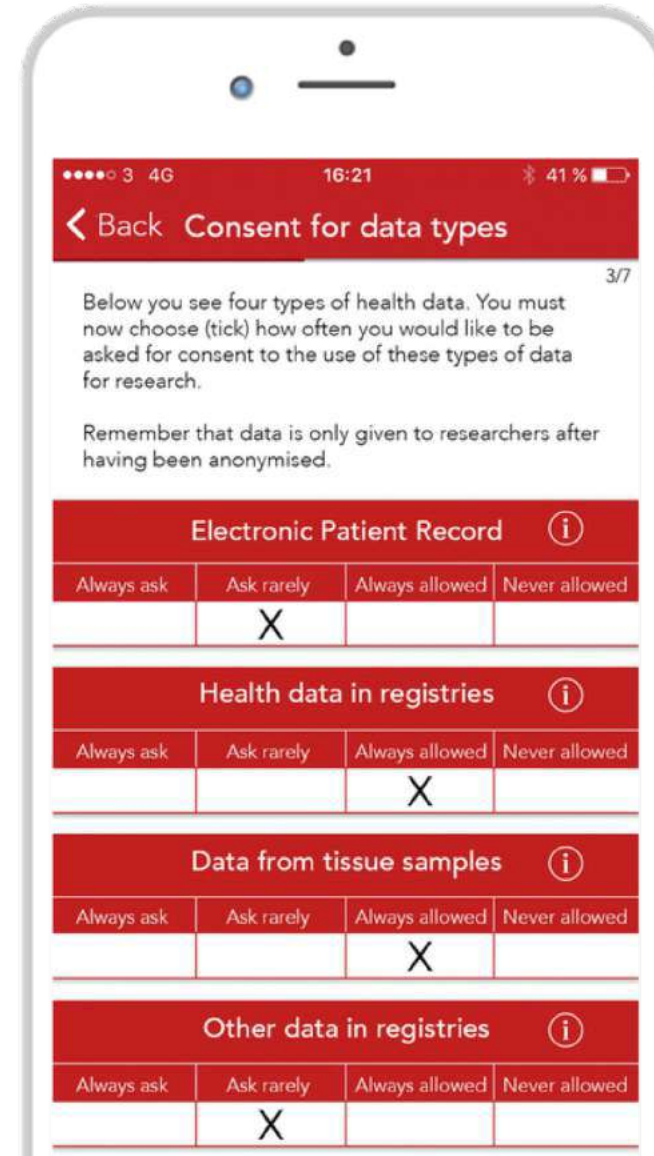
**Principle 6: Visibility and transparency: keep it open**

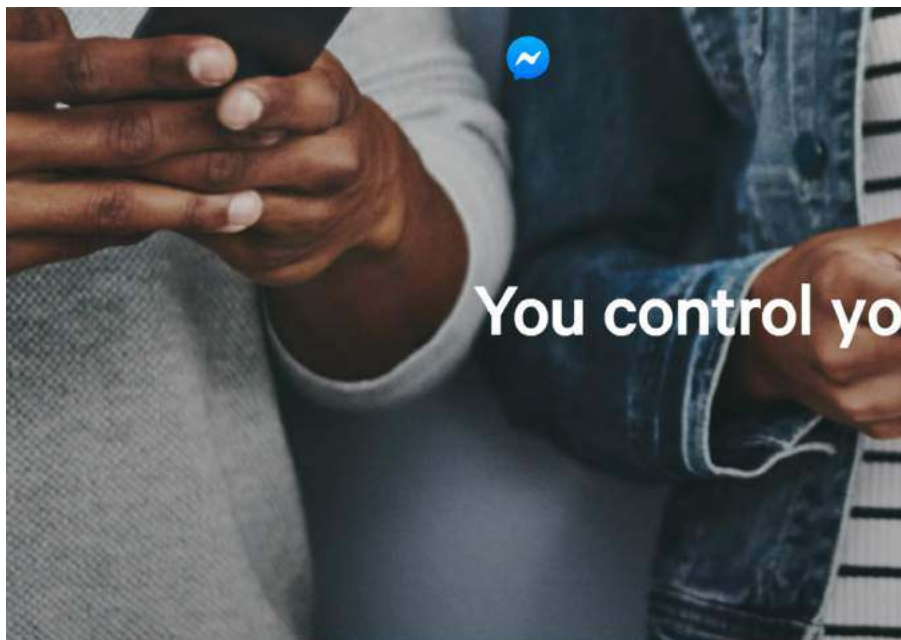
**+**

**Principle 7: Respect for user privacy: keep it user-centric**

**+**

# Denmark





You control yo

# Apple is now presenting its privacy policy as if it were another product

The privacy policies themselves have not changed.



Christine Fisher, @cfisherwrites  
11.06.19 in Security

Comments

161  
Shares



Engadget

It's not uncommon for users to skip reading an app's privacy policy because it's too long and jumbled. Apparently, Apple wants to change that. Today, it released a new privacy page that makes its privacy policy easier to read and understand. The new privacy page looks more like a product page than your standard screen of black on white text.

Pr

Who you talk to and what you share should be a secure place for you to connect with the world. Security

2:45

## for people living with T1D

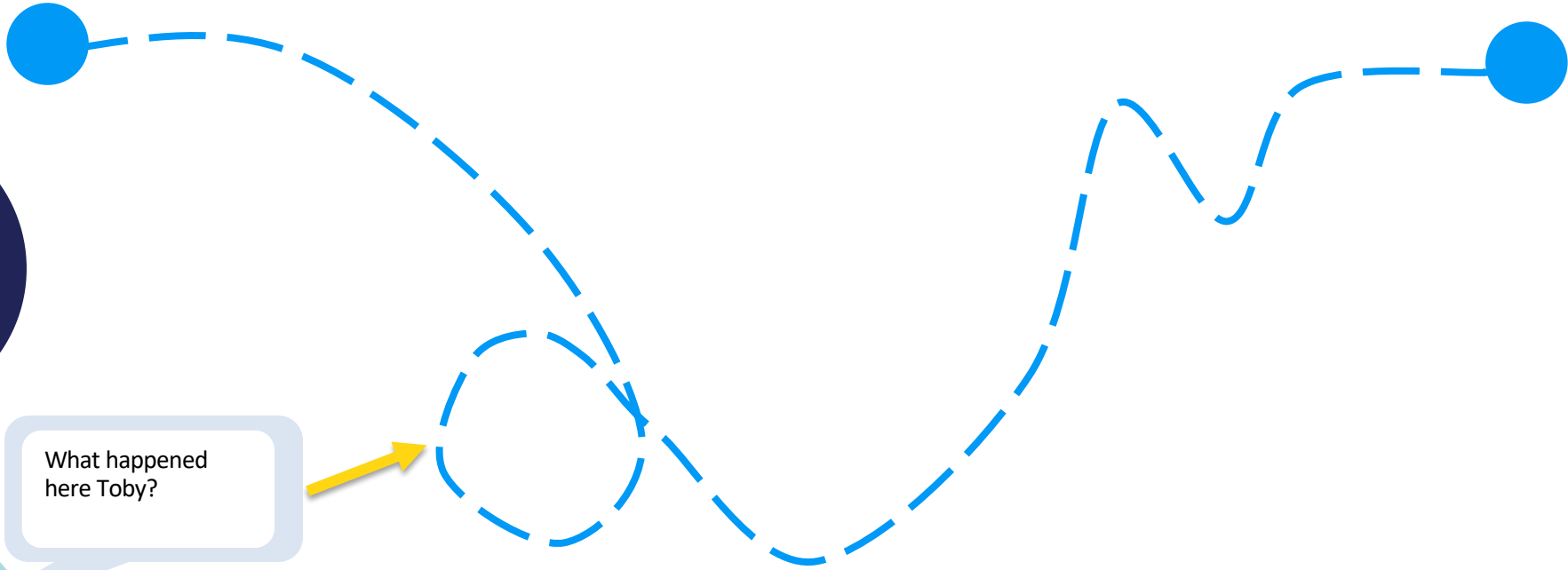
- ✓ Connect them with *all* types of studies from across Canada
- ✓ Present studies in a simple and patient-friendly way
- ✓ Easily determine eligibility through matching algorithm
- ✓ Gain visibility into study progress
- ✓ Granular control on data sharing, privacy by design

## for researchers

- ✓ Accelerate recruitment with access to a diversity of patients
- ✓ Develop a research community
- ✓ Receive feedback from patients on current and future research
- ✓ Competitive advantage when applying to grants
- ✓ Knowledge translation channel

**How might we provide better support in between visits?**





What happened here Toby?





**X 160,000**







**AI**



**X 160,000**

**Digital technologies have the potential to reshape the way we experience health.**

## Wisdom



CHOOSING YOUR DEVICES IS AN INCREDIBLY PERSONAL DECISION. HERE ARE THE STORIES OF OTHER PEOPLES' PRIORITIES AND CHOICES.

Different people choose different devices to fit their lifestyle, budget, and health needs. All of these stories are from real people. Learn from others and find out what's right for you.

### FILTER WISDOM BY PRIORITIES & CONCERNS

- All
- Avoiding Lows
- Cost
- Ease of Use
- Comfort
- Advanced Tech
- Unwanted Attention
- Trusting Tech
- Data Overload



"HUSTING, A PUMP GIVES YOU



"KEEP IT AS SIMPLE AS YOU



"YOUR HEALTH AND WELL BEING



BETTER  
SAILING  
INGS THAT  
OP DOING  
OOD

"I KNOW THAT DEVICES ARE GETTING BETTER AND I WANT TO GIVE MYSELF EVERY OPPORTUNITY TO LIVE AS LONG AND HEALTHY AS POSSIBLE."

**Rosemary**  
Budget Analyst

Sensor & Injections

"THESE DEVICES SAVE LIVES AND AS HORRIBLE AS I FIND IT BEING CONSTANTLY TETHERED, IT HAS SAVED ME FROM OVERNIGHT LOWS, PROLONGED HIGHS AND HAS HELPED ME STAY ACTIVE WITH VERY LITTLE RISK AND FEWER FINGER STICKS."

**Lolly**  
Engineer, Dancer,  
Instructor, Mom

Sensor & Injections



ES ARE  
I WANT TO  
AS LONG  
SIBLE."

"I LIKE THE FREEDOM THE PUMP GAVE ME FOR FOOD."

**Joyce**  
Designer, Artist

Sensor & Pump

"I ALWAYS KEEP MY SUPPLIES IN A CHEERFUL CONTAINER - NOTHING SERIOUS OR TECHY LOOKING - SO THAT EACH SELF-CARE BEHAVIOR I DO SOMEHOW FEELS LESS MEDICALIZED."

**Julie**  
Yogini, Meditator,  
Traveler, Tree Hugger,  
Researcher, Birder

Sensor & Injections

ther,

# THANK YOU

All of the co-design partners

Our funders

Team at University Health Network

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Contact me at [shivani.goyal@uhn.ca](mailto:shivani.goyal@uhn.ca)