# Leveraging Smart Home Technology for Personalized Health Promotion

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# ROAD MAP

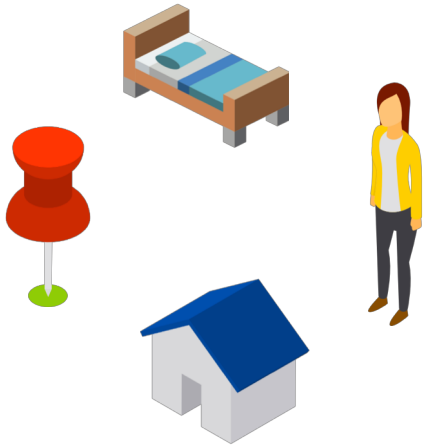
- The UbiLab
- Smart Home Technologies
- Current Work
- Discussion
- Recommendations
- The Future

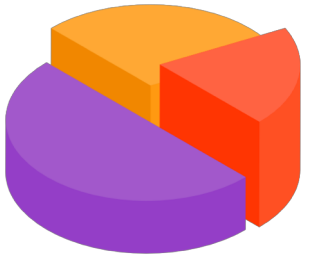
# WHAT IS SMART HOME TECHNOLOGY?

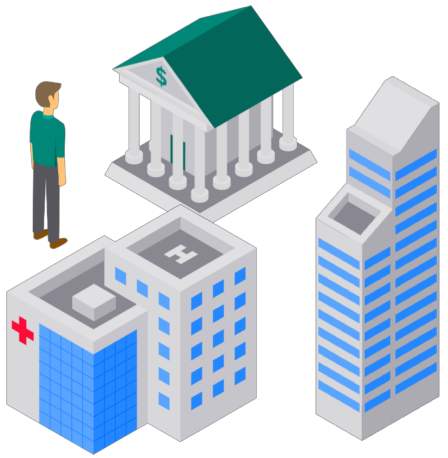
- “a home outfitted with technology that can communicate and be controlled from another location”
- **ecobee** smart wi-fi thermostat

# RECOGNIZE THESE BRANDS?

# CONCEPTUAL FRAMEWORK







**Collect**

- Sensors collect data (presence, step, heart rate, sleep, etc.)

**Monitor & assemble**

- Compile data in real-time and upload to the cloud

**Analyze**

- Analyze data generate holistic view of health

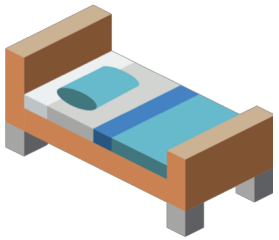
**Promote**

- Data visualized in dashboards, providing actionable feedback

# HEALTH PROMOTION MODEL

Diana, age 35, has an ecobee 4 and an wearable device

She checks her health behaviours via the app or web platform



How does her sleep compare to other Canadians?

How much physical activity has she done this past week?

Modify, adjust and maintain health behaviour

# PUBLIC HEALTH SURVEILLANCE

*"The **continuous**, **systematic collection**, **analysis** and **interpretation** of health-related data needed for the planning, implementation, and evaluation of public health practice."*

- "Triple aim" of health care
  - Improve patient outcomes
  - Improve access to care
  - Make health care systems cost effective

# REMOTE PATIENT MONITORING (RPM)

**Objective:** *To improve patient's health through the use of enabling and self-monitoring technologies, reducing the need for assisted or environmental supports as status deteriorates*

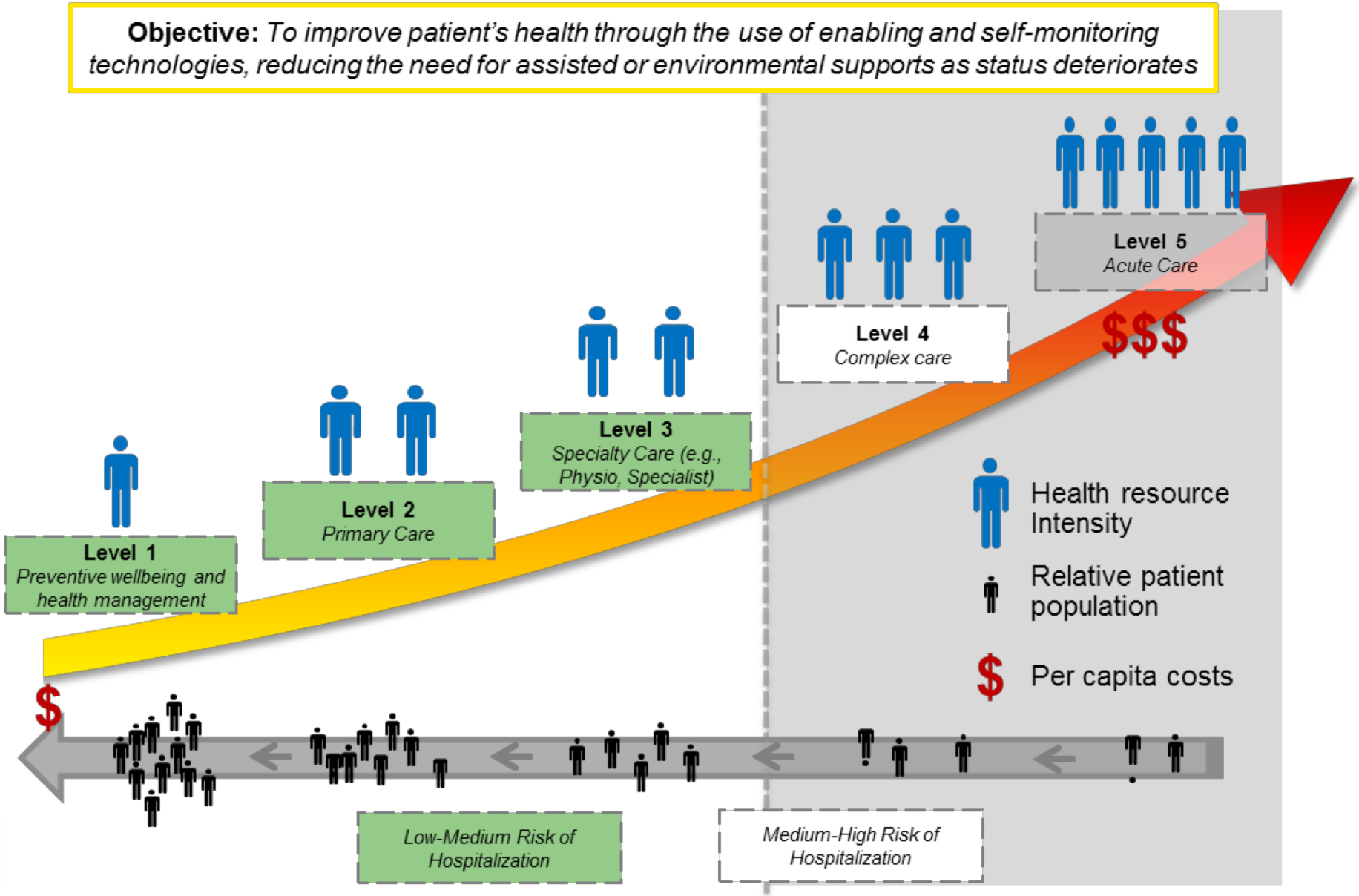
## RPM Streams

***Environmental Monitoring*** *(cameras, motion sensors etc.)*

***Assisted Monitoring*** *(third-party monitoring and HHR intervention)*

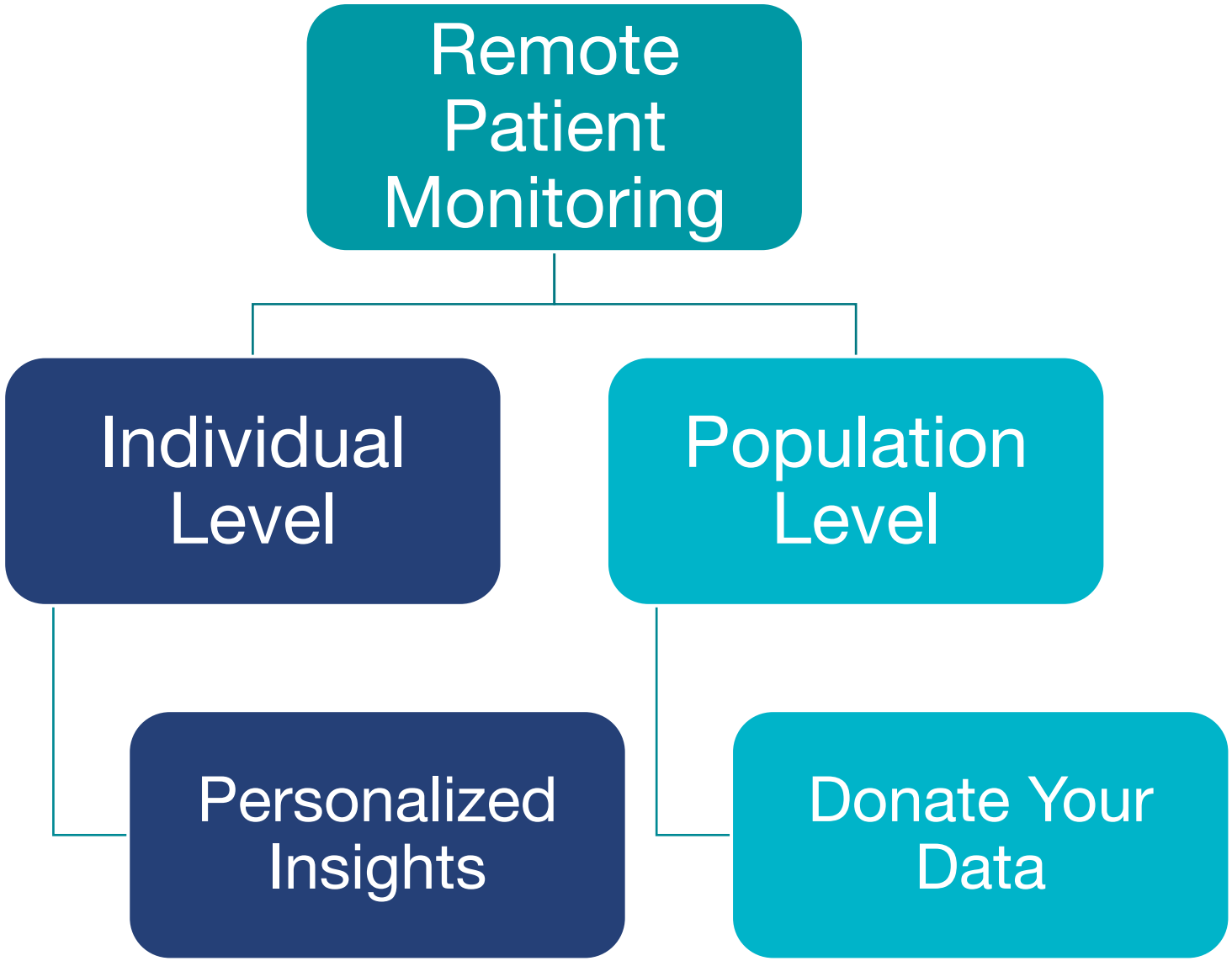
***Self-Monitoring*** *(Interactive education sessions, health vital monitoring etc.)*

**Enabling Information systems** (websites, patient portals etc.)




Source: Canada Health Infoway

# INDIVIDUAL & POPULATION LEVEL



# ZERO-EFFORT DATA COLLECTION

CIHR IRSC
Canadian Institutes of Health Research
Instituts de recherche en santé du Canada

Public Health Agency of Canada
Agence de la santé publique du Canada

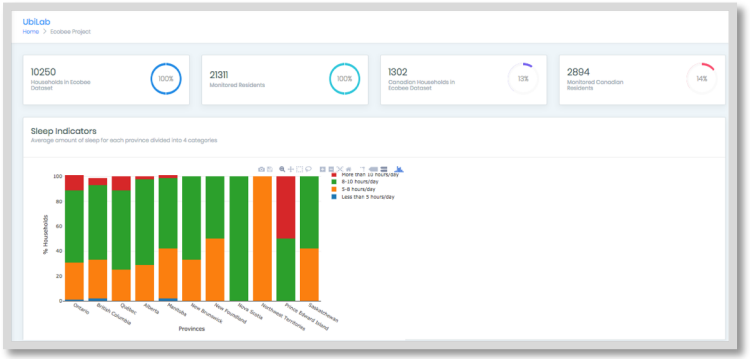
MaRS

# HEALTHY BEHAVIOUR DATA CHALLENGE

Public Health Agency of Canada

Agence de la santé publique du Canada

## DASHBOARD




## SENSORS

Sensors in the home and wearables will collect health data

## PUBLIC HEALTH OFFICIALS

Public Health officials will have access to database of compiled data (include PASS Indicators)

## REAL-TIME

Population level health data will be monitored in near real-time

# MOVING FORWARD

- Building a platform for data visualization
- Bringing insights and evidence based health information to users and public health officials
  - Mobile app
  - Dashboards

# METHODOLOGY

**Pilot study**
- Fitbit data
- ecobee data

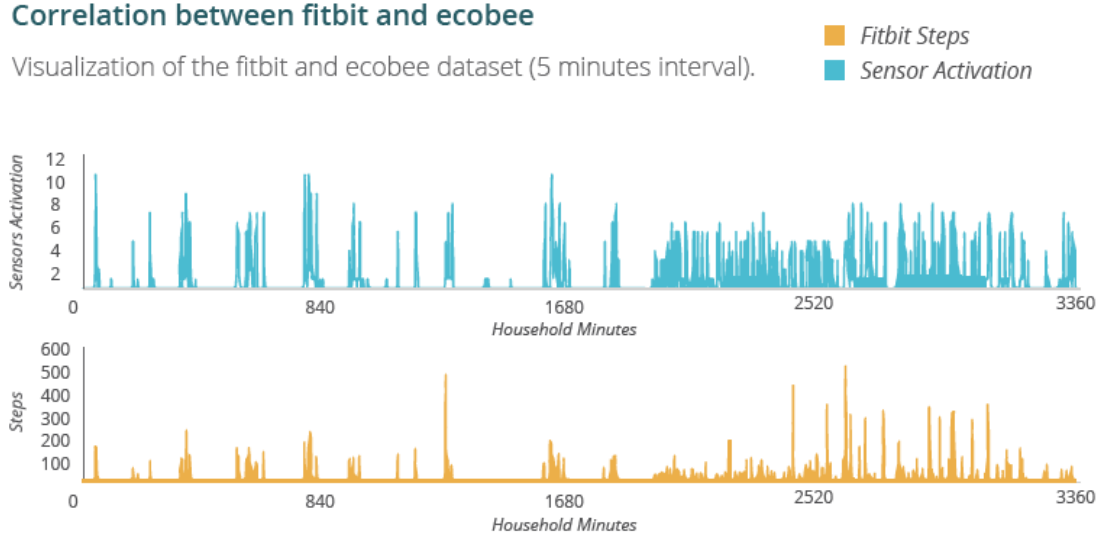
→ 8 participants, 386 person hours

**DYD dataset**
- Metadata
- Thermostat data

→ 21,311 participants, 10,250 households

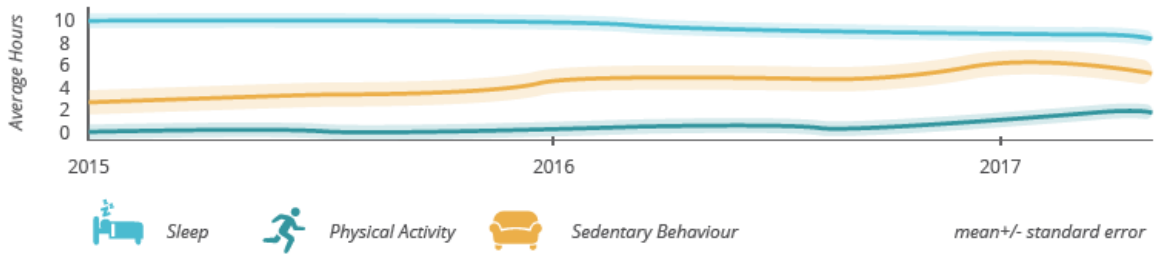
### Correlation between fitbit and ecobee

Visualization of the fitbit and ecobee dataset (5 minutes interval).



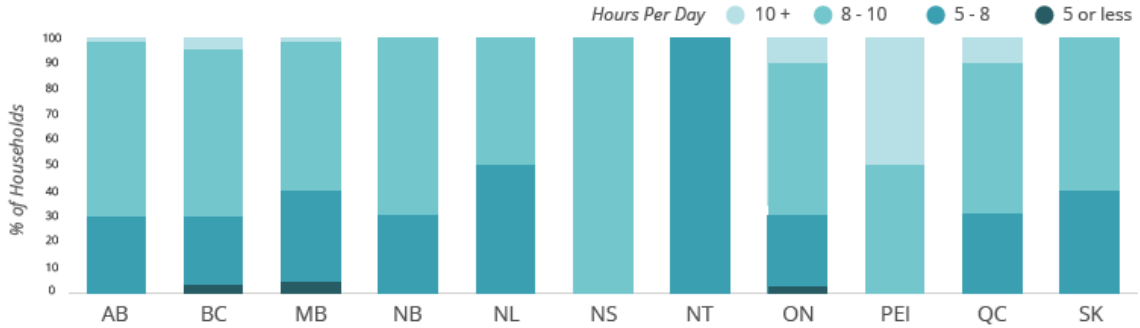

### Health Indicators

Canadian household trends for sleep, physical activity and sedentary behaviour from January 2015 to March 2017 from ecobee data.

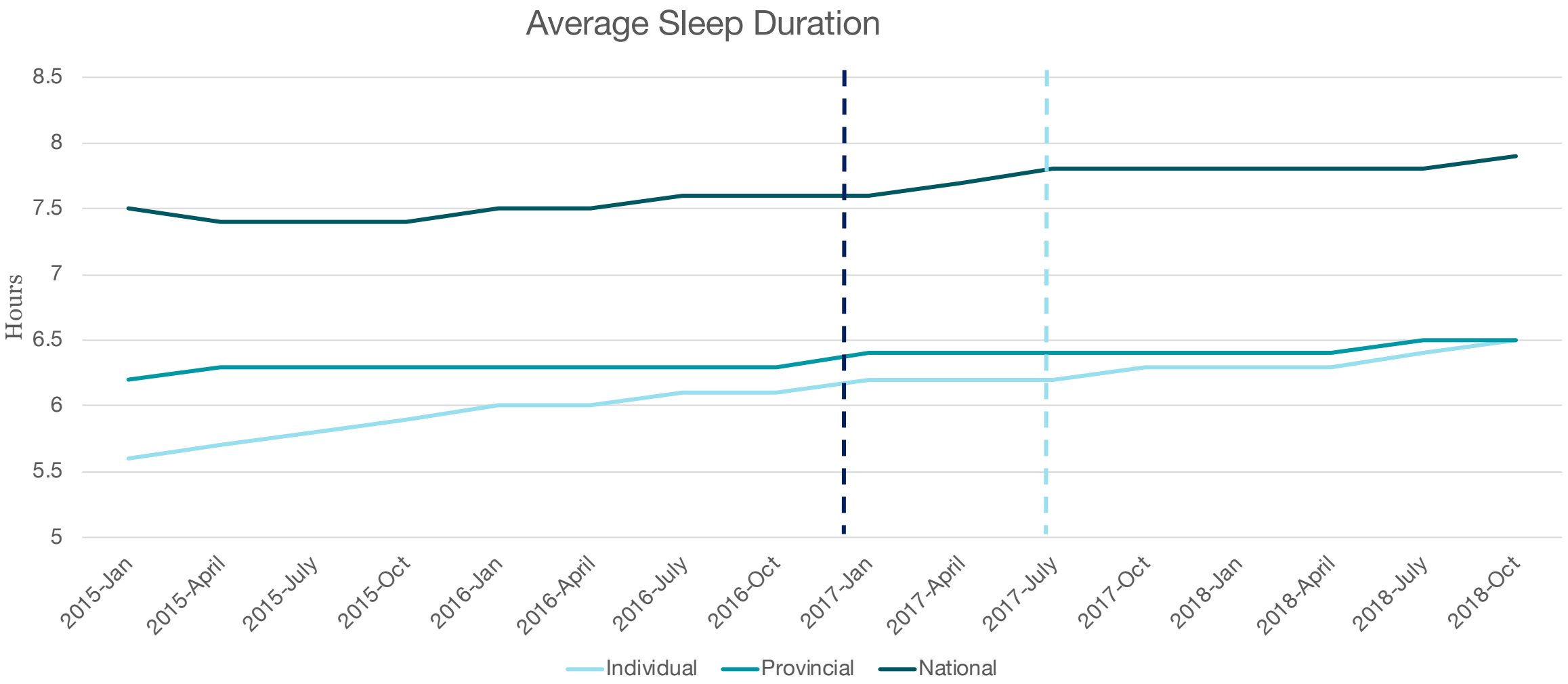



### Sleep Indicator

Provincial breakdown of average sleep duration



# POTENTIAL ANALYSIS FOR REAL TIME MONITORING

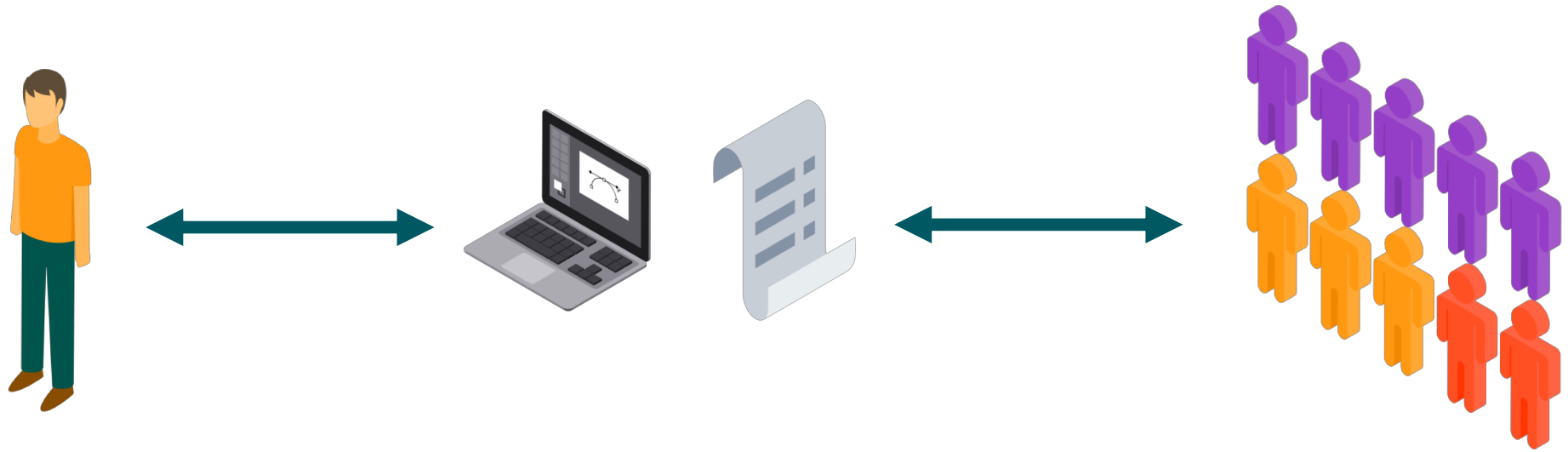


# ADVANTAGES

- Zero-effort/ unobtrusive for participants and users
- Real time data collection and analysis
- Individual level personalized feedback

# HEALTH PROMOTION STRATEGIES

- Compare healthy behaviours and incentivize individuals with personalized goals
- Create peer-to-peer groups and build motivation to achieve healthy behaviours
  - Example carrot app to improve physical activity
- Monitor the effectiveness of health promotion interventions



# CURRENT CHALLENGES

- Interoperability
- Data governance and access to data
- Public health governance/organization

ecobee

# ACKNOWLEDGEMENTS


- UbiLab Team
- ecobee

# MOVING FORWARD

How is **UbiLab** using **ecobee** to understand population health

## Public Health Surveillance

Decision makers are able to access statistics in order to plan better interventions.

## Smart Living

Technologies like ecobee can be used to enable our healthcare system to be more proactive and family members to remotely care for their loved ones.

**Emergency alert!**
Help people with limited mobility

## Ubilab

The Ubiquitous Health Technology Lab is developing algorithms to translate ecobee data into healthcare data-driven insights.

**Sleeping pattern**
Help users understand their sleeping habits.
Evaluate the impact of technology on sleep patterns.

**Sedentary Behaviour**
Help users quantify their sedentary behaviour.
Understand the amount of sedentary time of the Canadian population.

**Physical Activity**
Help users monitor their in-home physical activity.
Assess the effectiveness of physical activity programming.

1 Anonymous sensor data is collected by the ecobee thermostat.

2 The UbiLab processes the data using machine learning and statistical models to convert data into healthcare insights.

3 Anonymized data is provided to decision makers in the form of a cloud-based dashboard.

- Emergency Services
- Health care providers
- Public Health Officials
- Policy Makers

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# MOVING FORWARD


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# THANK YOU!

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