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The Benefits of Technology in Health and Fitness

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University of Ottawa Heart Institute
Division of Prevention and Rehabilitation
Exercise Physiology and Cardiovascular Health Lab
November 2, 2017

Technology – Embrace it! (…within reason)

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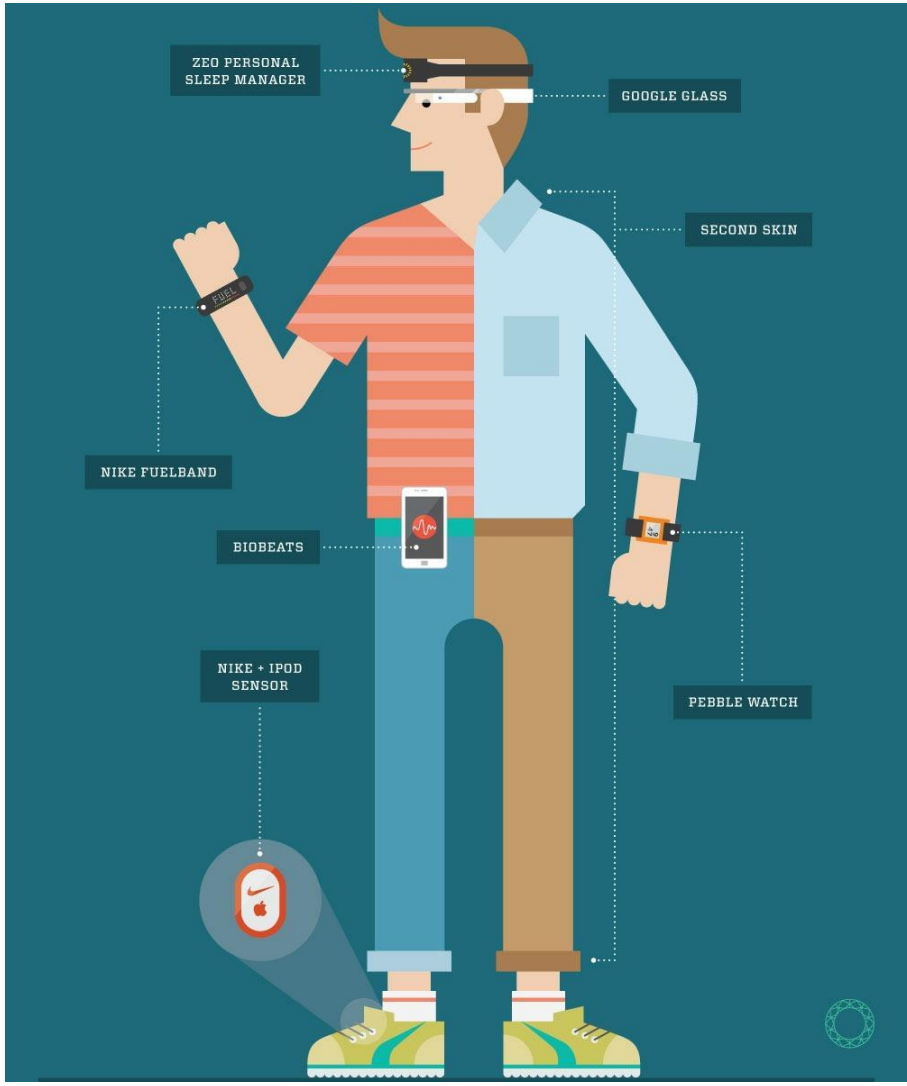
- Wearables
- Phone Apps
- Tele-Rehab
- Virtual Care
- HeartWise Exercise

What is a wearable?

- electronic technologies or computers
  - incorporated into items of clothing and/or accessories
  - can be worn on the body

- communication capabilities
  - allow the wearer to access information in real time



Wearable Technology

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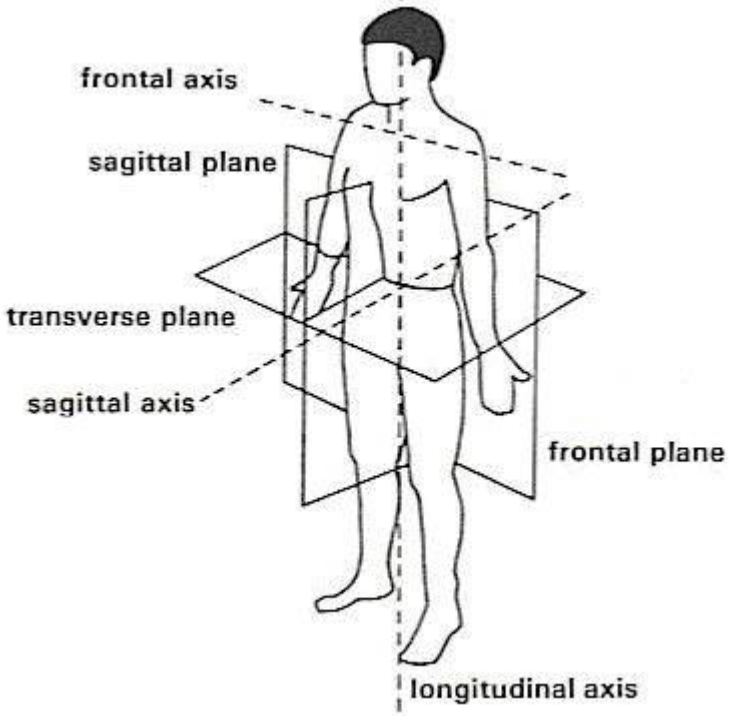
Many options! Many features!

Accelerometers

- measures body movements
  - in terms of acceleration
- piezoelectric sensor
  - detects acceleration



- Uni-axial:
  - measures acceleration about x (longitudinal) axis
- Bi-axial:
  - measures acceleration about x (longitudinal) and y (frontal) axes
- Tri-axial:
  - measures acceleration about x (longitudinal), y (frontal) and Z (sagittal) axes

Heart Rate Monitors

- Chest worn monitors:
  - transmit electrical signals of the heart to a receiver in the watch

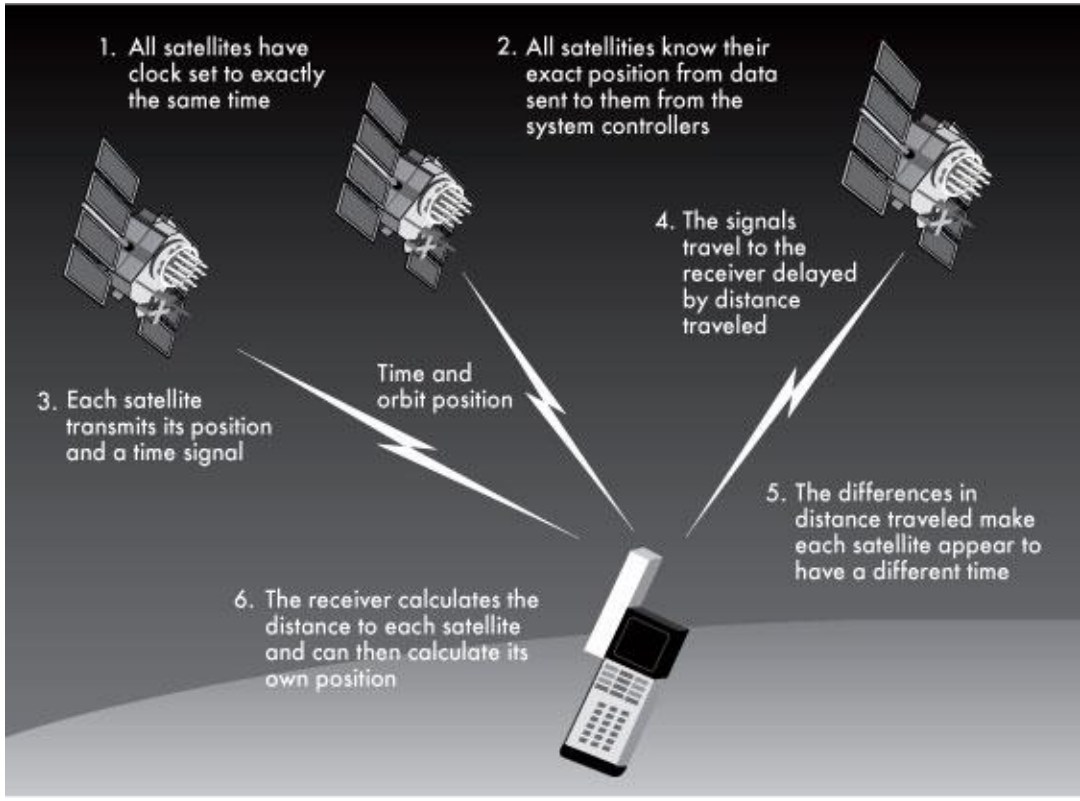
- Wrist worn monitors:
  - use photoplethysmography
  - measures heart rate
  - shine light onto skin
  - measure the amount of light that is scattered by blood flow

Pedometers

- Contain a horizontal, spring suspended lever that moves up and down with each step
- Movement of lever opens and closes an electrical circuit and the accumulated step count is shown on the display
- Distance:
  - steps x stride length (walking speed, height, age, gender)

GPS

- GPS satellites circle the earth in a very precise orbit
  - transmit signal information to earth
- GPS receivers triangulate signals received from satellites
  - calculate position and track movement



Research: Wearables for Prescribing and Monitoring PA

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- Growing area of research
- Validity and reliability studies
- Experimental studies examining effectiveness of wearables in improving physical activity levels
- Observational studies examining effectiveness of wearables in maintaining physical activity

Accuracy of HR monitors

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Letters

RESEARCH LETTER

Accuracy of Wrist-Worn Heart Rate Monitors

Wrist-worn fitness and heart rate (HR) monitors are popular.[1,2] While the accuracy of chest strap, electrode-based HR monitors has been confirmed,[3,4] the accuracy of wrist-worn, optically based HR monitors is uncertain.[5,6] Assessment of the monitors' accuracy is important for individuals who use them to guide their physical activity and for physicians to whom these individuals report HR readings. The objective of this study was to assess the accuracy of 4 popular wrist-worn HR monitors under conditions of varying physical exertion.

JAMA Cardiology Published online October 12, 2016

Table. Concordance Correlation Coefficients for Each Heart Rate Monitor

Device	Agreement With Electrocardiogram: Concordance Correlation Coefficients (95% CI)
Polar H7	.99 (.987-.991)
Apple Watch	.91 (.884-.929)
Mio Fuse	.91 (.882-.929)
Fitbit Charge HR	.84 (.791-.872)
Basis Peak	.83 (.779-.865)

Accuracy of Step Counts

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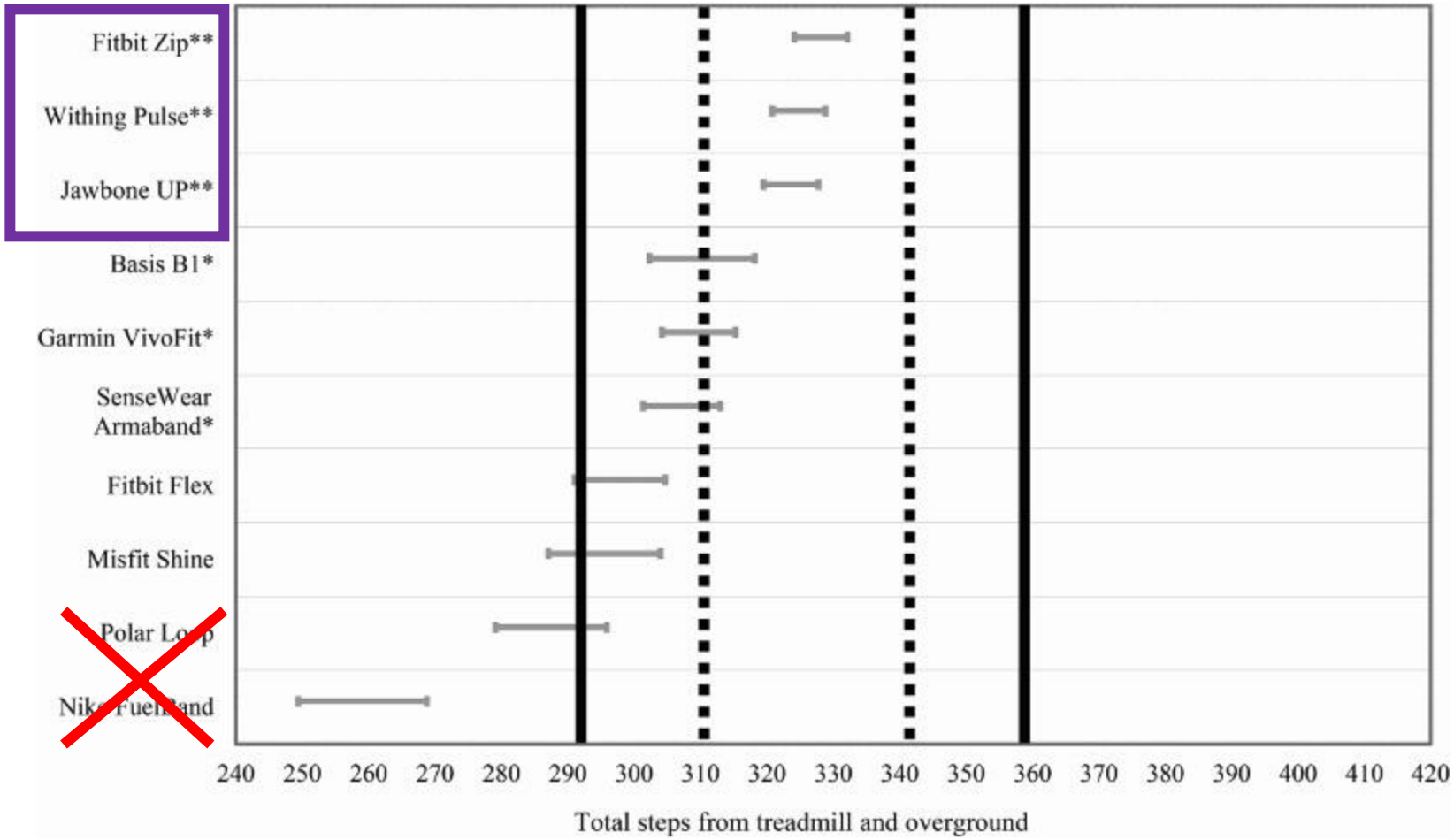


Figure 1. Equivalence testing for all monitors with total steps. *Within the 10% equivalence zone. Dark lines indicate proposed equivalence zone (±10% of the mean). Dashed lines indicated proposed equivalence zone (±5% of the mean). Grey bars indicated the 90% confidence for a mean of the estimated step count.

Published in: Hyun-Sung An; Gregory C. Jones; Seoung-Ki Kang; Gregory J. Welk; Jung-Min Lee; *European Journal of Sport Science* **2017,** 17, 360-368.
DOI: 10.1080/17461391.2016.1255261

Journal of the American College of Cardiology

Volume 67, Issue 21, 31 May 2016, Pages 2453–2463

Original Investigation

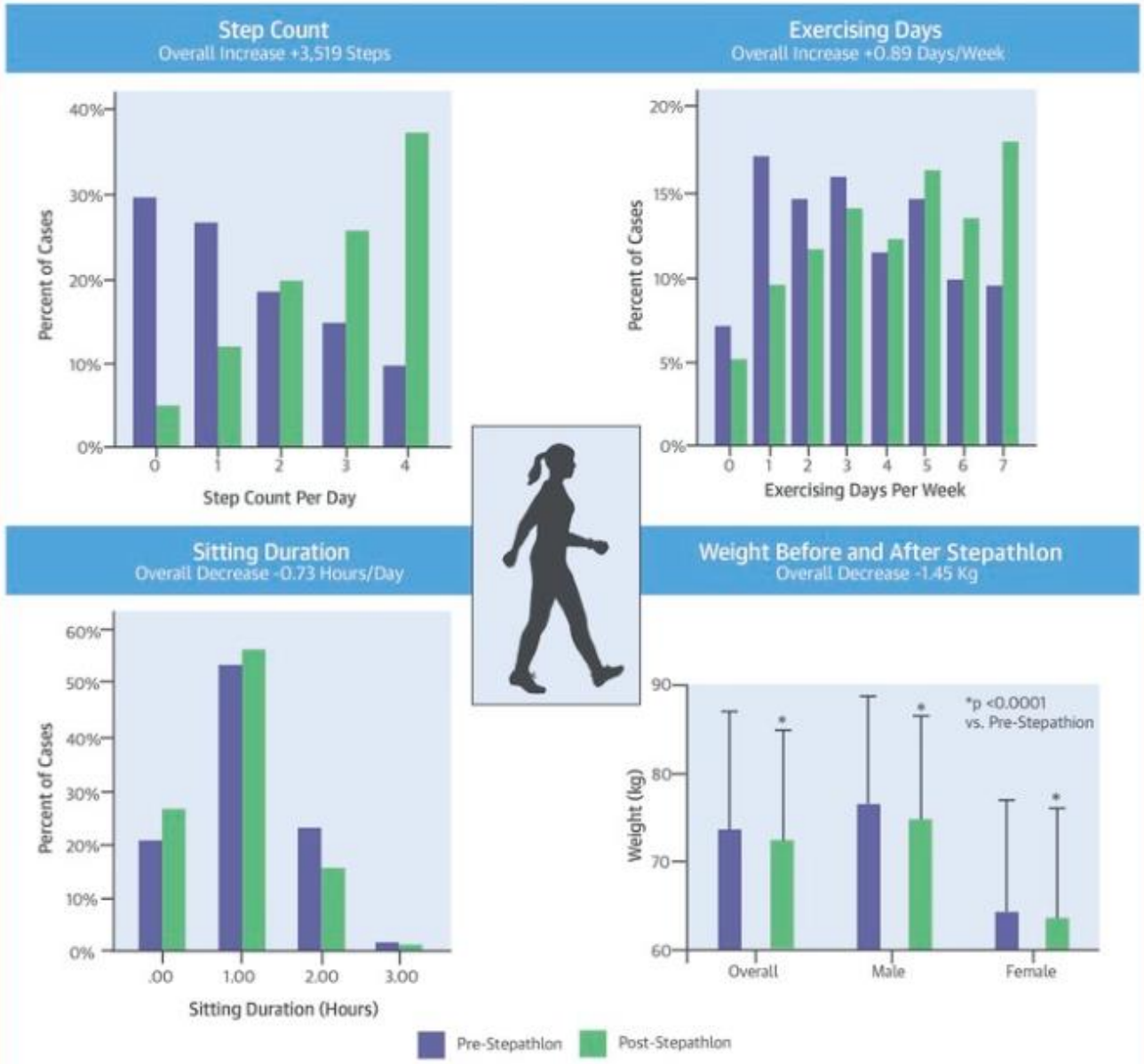
International Mobile-Health Intervention on Physical Activity, Sitting, and Weight : The Stepathlon Cardiovascular Health Study

Anand N. Ganesan, MBBS, PhD[a, b], Jennie Louise, PhD[c], Matthew Horsfall, RN[d], Shane A. Bilsborough, MSc[e], Jeroen Hendriks, RN, PhD[c, d], Andrew D. McGavigan, MD[a, b], Joseph B. Selvanayagam, MBBS, D.Phil[a, b, d], Derek P. Chew, MBBS, MPH[a, b, d]

Purpose: To investigate the feasibility and efficacy of Stepathlon, a low-cost, pedometer-based, workplace physical activity and wellness program.

Intervention/Stepathon: Light-weight, low-cost, non-interactive pedometers were used as a self-monitoring and motivational tool, with the aim of encouraging participants to increase step counts and physical activity.

CENTRAL ILLUSTRATION: Effect of an International Mobile Health Intervention on Physical Activity, Sitting, and Weight: Results of Stepathlon



Ganesan, A.N. et al. J Am Coll Cardiol. 2016;67(21):2453-63.

Research

Telemed J E Health. 2015 Oct 1; 21(10): 782–792.
doi: 10.1089/tmj.2014.0176
PMCID: PMC4842945

Wearable Sensor/Device (Fitbit One) and SMS Text-Messaging Prompts to Increase Physical Activity in Overweight and Obese Adults: A Randomized Controlled Trial

Julie B. Wang, PhD, MPH,[1,2,3] Lisa A. Cadmus-Bertram, PhD,[1] Loki Natarajan, PhD,[1] Martha M. White, MS,[1] Hala Madanat, PhD,[2] Jeanne F. Nichols, PhD, FACSM,[4] Guadalupe X. Ayala, PhD, MPH,[2] and John P. Pierce, PhD[1]

Author information ▶ Article notes ▶ Copyright and License information ▶

	ACTIGRAPH GT3X+			FB		
	TEXTS + FB (INTERVENTION)	FB ONLY (COMPARISON)	*P* VALUE[a]	TEXTS + FB (INTERVENTION)	FB ONLY (COMPARISON)	*P* VALUE[a]
Change from baseline to Week 1						
Steps (*n*/day)	—	—	—	1,266 (491)	−48 (240)	0.01[b]
PA by intensity level (minutes/week)						
MVPA or FA+VA	—	—	—	17.8 (8.5)	2.3 (4.1)	<0.01[b]
All intensity	—	—	—	38.3 (15.9)	−6.7 (11.7)	0.02[b]
Change from baseline to Week 6						
Steps (*n*/day)	24 (276)	−433 (222)	0.20	44 (292)	495 (257)	0.44
PA by intensity level (minutes/week)						
MVPA or FA+VA	−1.1 (2.4)	4.3 (2.0)[c]	0.33	−4.4 (5.0)	4.5 (5.2)	0.72
All intensity	−1.6 (4.5)	7.8 (4.2)	0.13	−16.1 (8.4)	−19.6 (12.1)	0.10

[a]Mixed-model repeated-measures (group by time), alpha level $p<0.05$, adjusted for baseline wear time (in minutes/week).
[b]Between-group significance.
[c]Within-group significance ($p=0.04$).

FA+VA, fairly active+very active; FB, Fitbit One; MVPA, moderate- to vigorous-intensity physical activity; PA, physical activity.

fitbit

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Piezo Rx

STEPS
Your Eventual Goal?
8,000 a day

Check your steps throughout the day... when you can, make choices that will increase your number!

* Averaging 8,000 steps a day? Great! Now it's time to start tracking your MVPA...

MVPA
Moderate/Vigorous Time
Your Eventual Goal?
150 min/wk

Your total minutes of physical activity at a moderate intensity (or higher) for the past 7 days from today.
Minutes of MVPA is strongly associated with your health. Learn more...

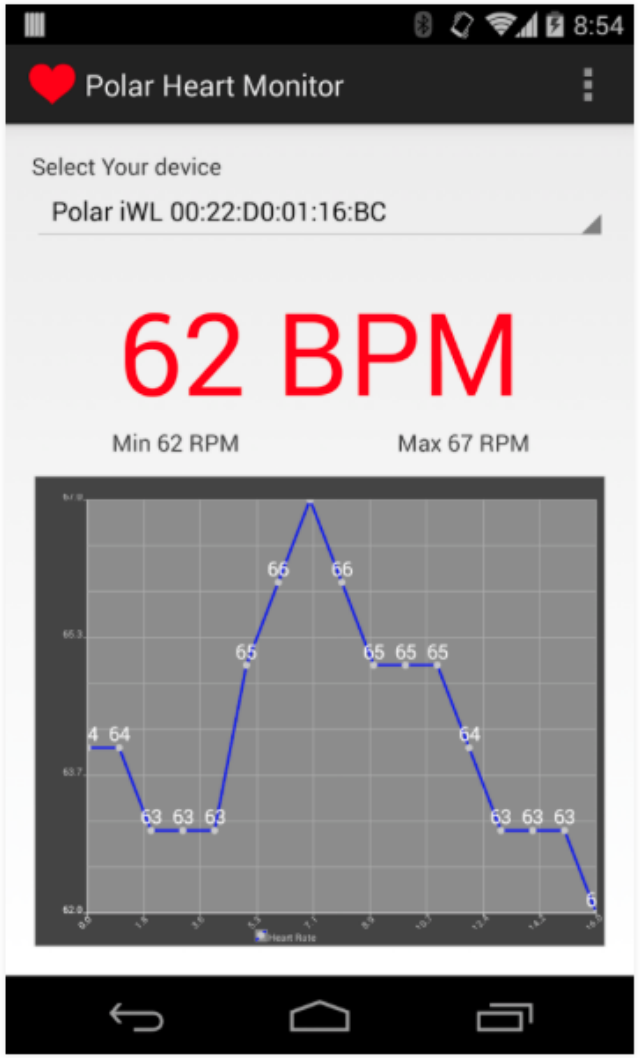
*Averaging 150 minutes a week? Great! Now it's time to start tracking your BOUTS...

BOUTS
Your Eventual Goal?
3★ most days, 15★/wk

Each star represents a 10 minute BOUT of continuous activity time, at or above a moderate level (100 Steps/Minute)

Press for Next Display

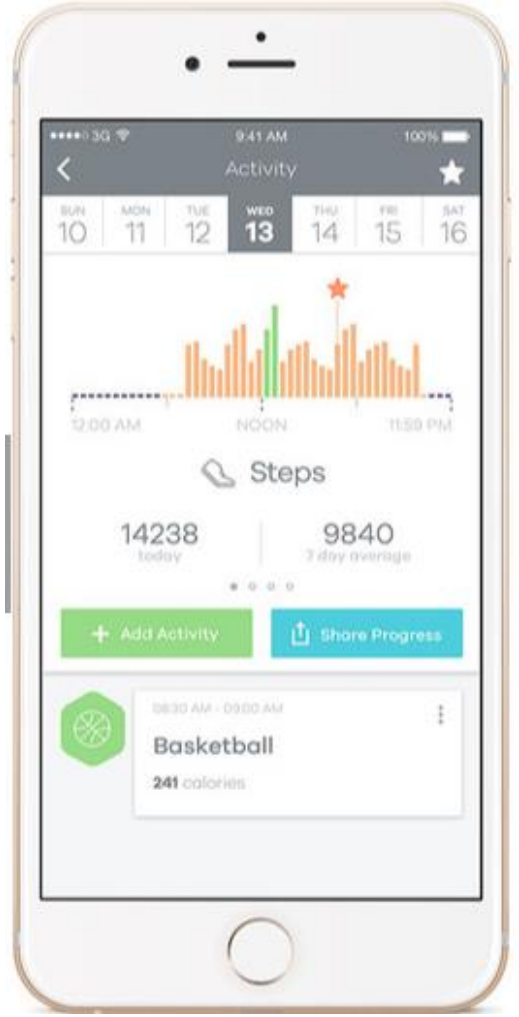

POLAR
127


8:54
Polar Heart Monitor
Select Your device
Polar iWL 00:22:D0:01:16:BC
62 BPM
Min 62 RPM
Max 67 RPM
64
63 63 63
65
66
66
65 65 65
64
63 63 63


iPad
4:20 PM
00:48:15
POLAR
NUMBER
LIST
WHOLE TEAM
COMPARISON
#2 JONES
110
56%
#5 THOMAS
160
82%
#8 BROWN
148
74%
#10 MILLER
140
77%
#13 JOHNSON
169
89%
#16 TAYLOR
115
61%
#21 SMITH
149
75%
#24 ANDERSON
186
98%
#33 WILSON
186
99%
#41 JACKSON
164
84%
#58 DAVIS
145
76%
#77 WILLIAMS
167
85%

bellabeat

- Smart hardware
- 14-day memory
- Motion sensor
- Secure data backup
- Inactivity alert
- High quality wooden composite
- No-charging
- Water resistant
- Smart alarm
- Wireless sync
- Smart vibrations
- Sustainable materials



GARMIN

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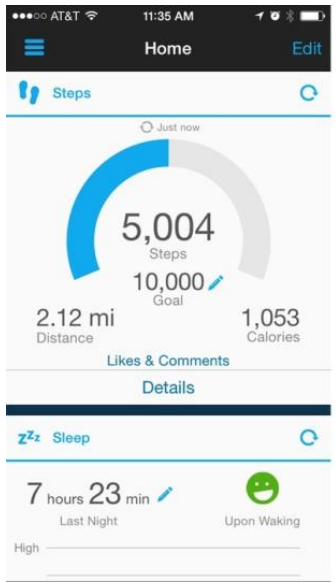

How can we use wearables for exercise prescription?

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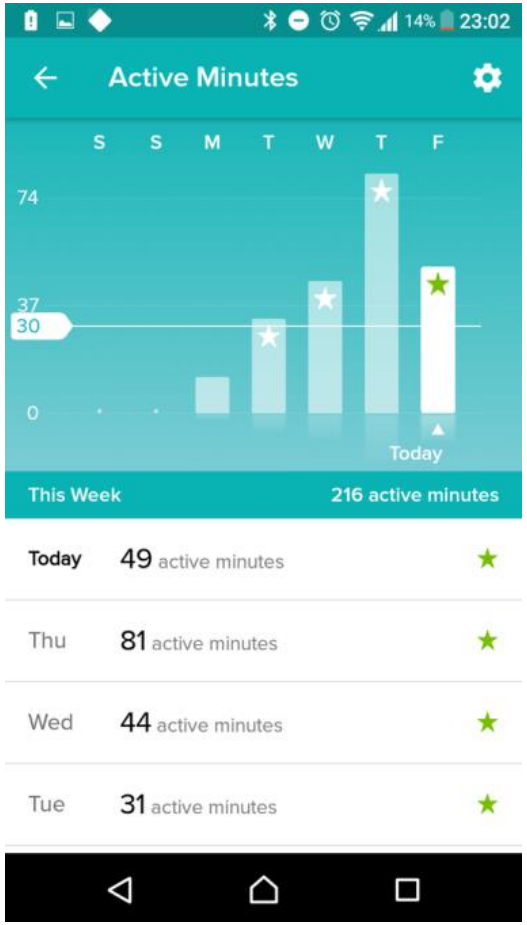
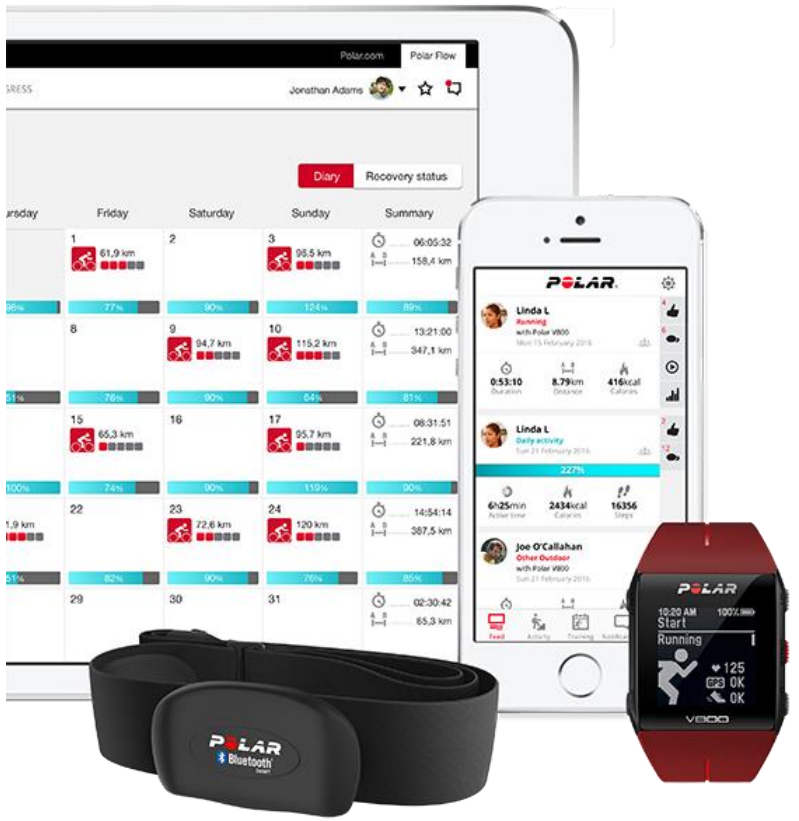
	CACPR Guidelines	Canadian Physical Activity Guidelines
Frequency	Most, preferably all, days of the week	Most, preferably all, days of the week
Intensity	Moderate-to-vigorous intensity aerobic physical activity (40-80% HRR)	Moderate-to-vigorous intensity aerobic physical activity
Time	20 to 40 minutes/bout	150 minutes/week in bouts of ≥ 10 minutes
Type (mode)	Aerobic or resistance training activities or their combination	Aerobic or resistance training activities or their combination

Frequency

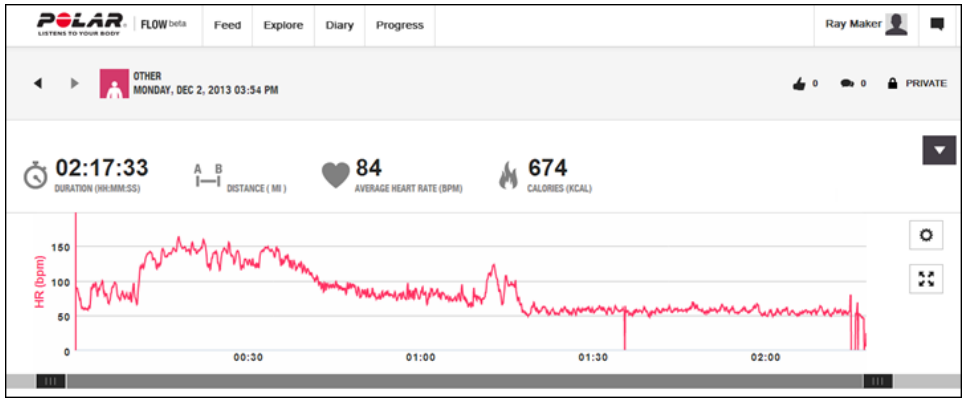

Active Minutes
S S M T W T F
74
37
30
0
Today
This Week
216 active minutes
Today 49 active minutes
Thu 81 active minutes
Wed 44 active minutes
Tue 31 active minutes

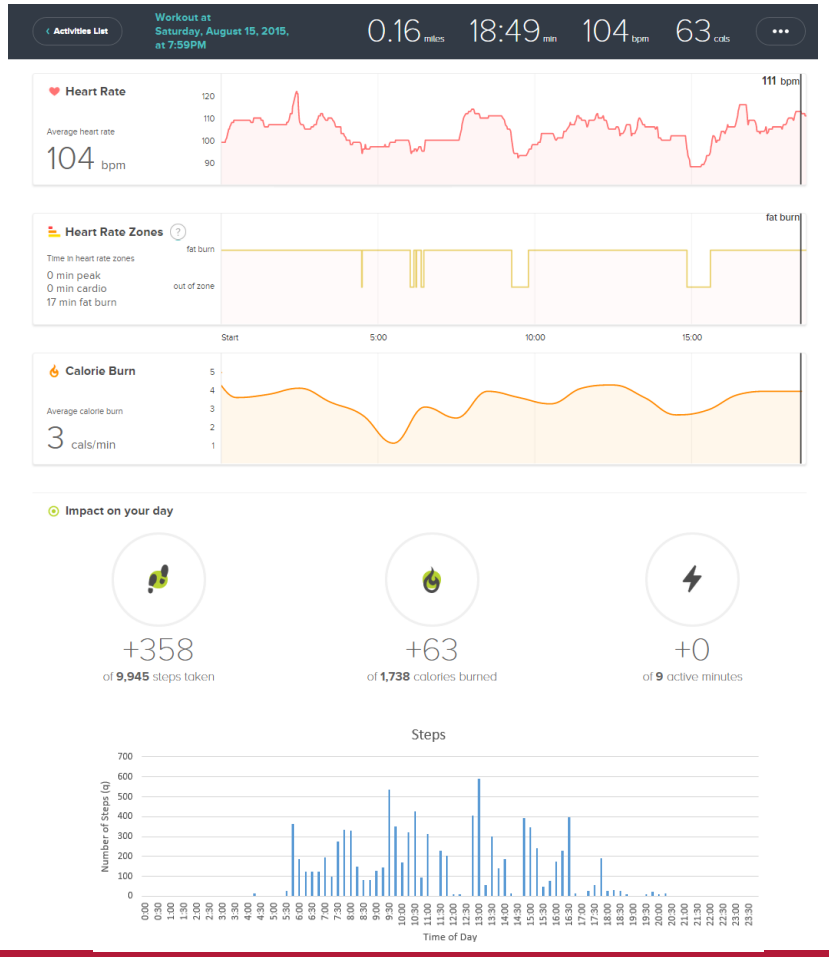

Omron Health Management Software
File Display Options Help
BI-LINK
Download Data
Print
Options
Create CSV File
Create PDF File
User Name Matt Cutts
Memo 1
Memo 2
Change Screens
OMRON
Pedometer
Monthly Steps Record
Record for 9/2007
Viewing Options Daily Weekly Monthly Yearly Total
Previous Next Most Recent
Changing Graph
Steps Graph
Aerobic Walking Time Graph
Calories Graph
Distance Graph
Fat Burned Graph
Walking Report
Monthly Total Daily Average Daily Goal Achievement Level
Steps 108,324 7,737 ---
Aerobic Steps 11,140 796 ---
Aerobic Walking Time (min.) 118 8 ---
Calories (kcal) 4,710 336 ---
Distance (mile) 40.96 2.93 ---
Fat Burned (g) 262.7 18.8 ---
Steps
How to read graph
Total Steps including Aerobic Steps
Aerobic Steps
15,000
12,000
9,000
6,000
3,000
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Date

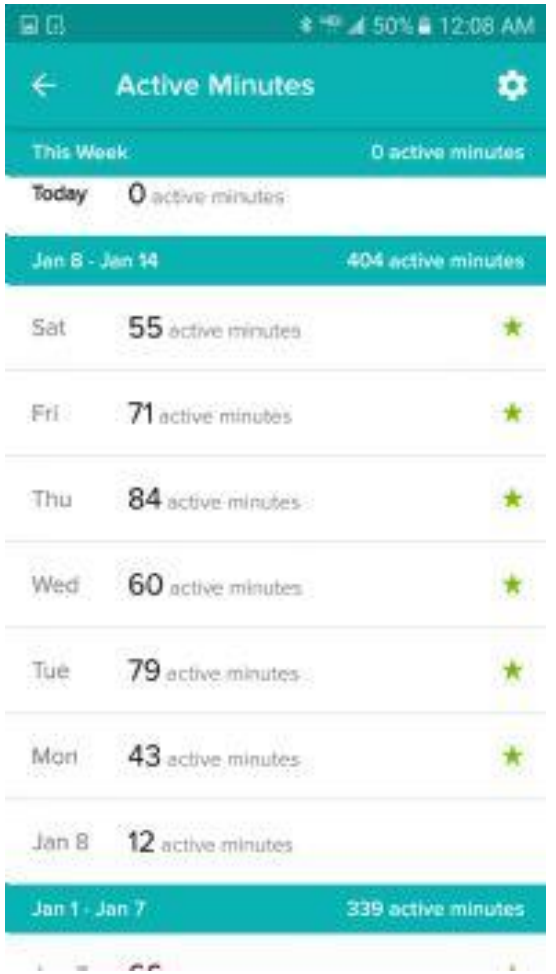

POLAR
Bluetooth

Intensity

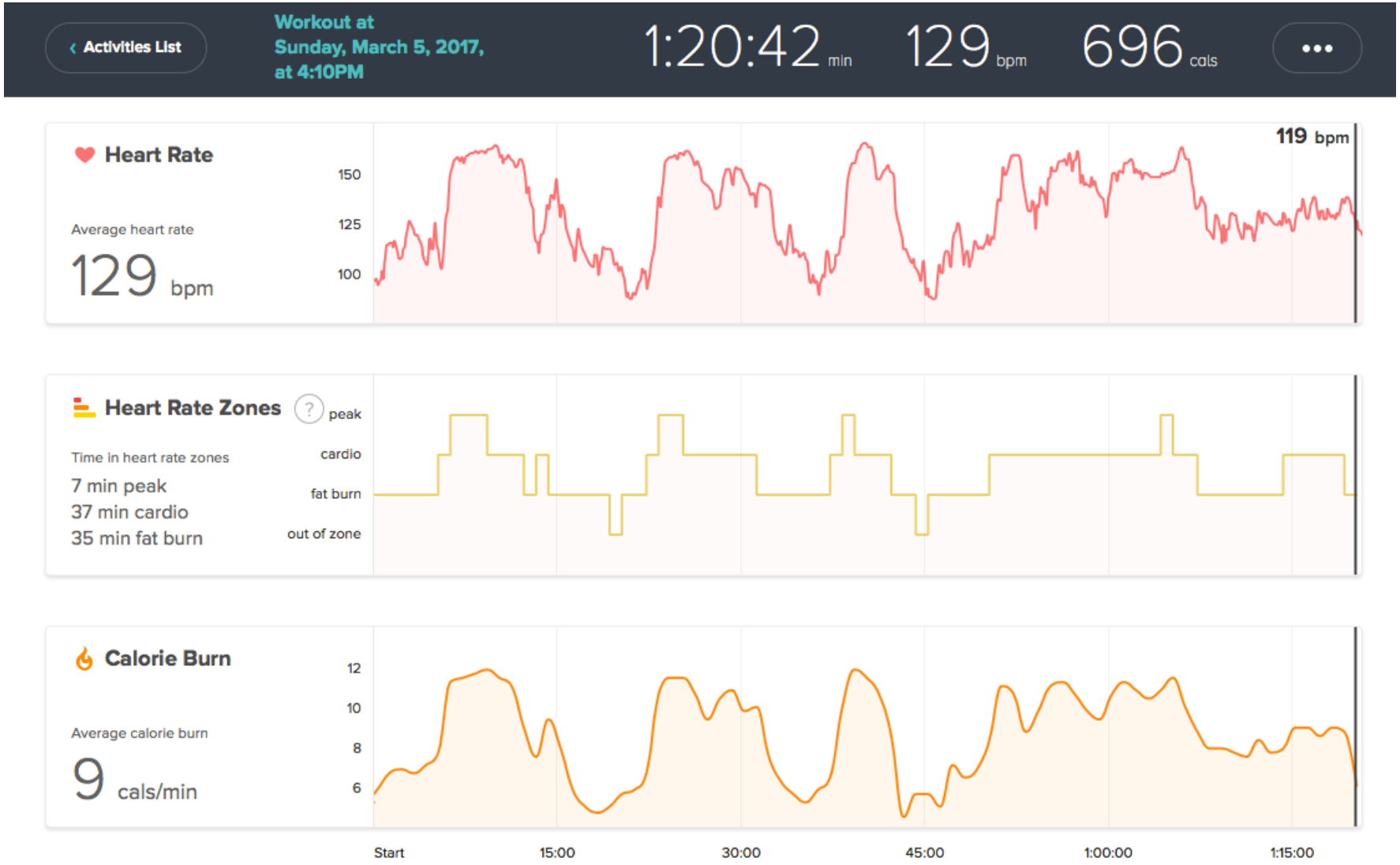
- ≥3 METs
- > 100 steps/minute
- ≥ 40% VO_2 reserve
- ≥ 64% peak HR
- ≥ 12 RPE



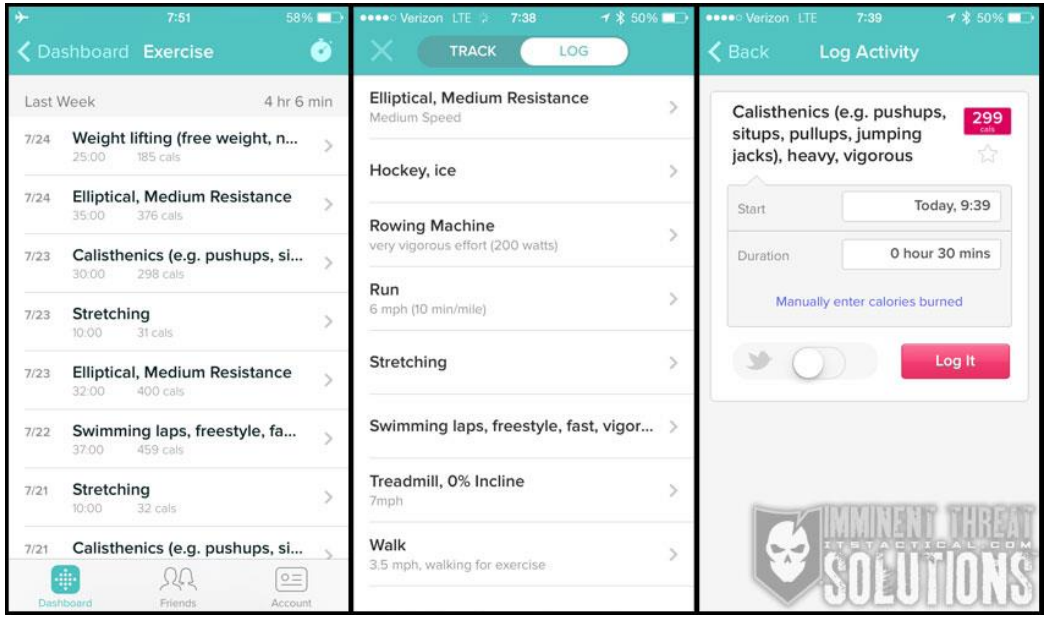




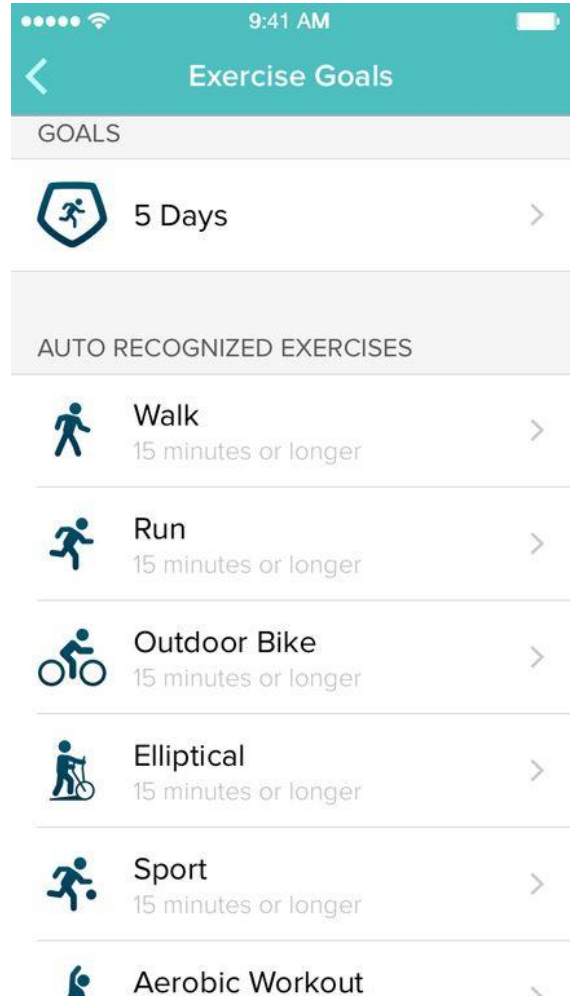
Time


‹ Activities List
Workout at
Sunday, March 5, 2017,
at 4:10PM
1:20:42 min
129 bpm
696 cals
Heart Rate
Average heart rate
129 bpm
150
125
100
119 bpm
Heart Rate Zones
peak
cardio
fat burn
out of zone
Time in heart rate zones
7 min peak
37 min cardio
35 min fat burn
Calorie Burn
Average calorie burn
9 cals/min
12
10
8
6
Start
15:00
30:00
45:00
1:00:00
1:15:00

Type (Mode)


7:51
58%
Dashboard
Exercise
Last Week
4 hr 6 min
7/24 Weight lifting (free weight, n... 25:00 185 cals
7/24 Elliptical, Medium Resistance 35:00 376 cals
7/23 Calisthenics (e.g. pushups, si... 30:00 298 cals
7/23 Stretching 10:00 31 cals
7/23 Elliptical, Medium Resistance 32:00 400 cals
7/22 Swimming laps, freestyle, fa... 37:00 459 cals
7/21 Stretching 10:00 32 cals
7/21 Calisthenics (e.g. pushups, si...
Dashboard
Friends
Account
Verizon LTE 7:38 50%
TRACK
LOG
Elliptical, Medium Resistance
Medium Speed
Hockey, ice
Rowing Machine
very vigorous effort (200 watts)
Run
6 mph (10 min/mile)
Stretching
Swimming laps, freestyle, fast, vigor...
Treadmill, 0% Incline
7mph
Walk
3.5 mph, walking for exercise
Verizon LTE 7:39 50%
Back
Log Activity
Calisthenics (e.g. pushups, situps, pullups, jumping jacks), heavy, vigorous
299
Start
Today, 9:39
Duration
0 hour 30 mins
Manually enter calories burned
Log It
IMMINENT THREAT
SOLUTIONS


POLAR
75
Running


9:41 AM
Exercise Goals
GOALS
5 Days
AUTO RECOGNIZED EXERCISES
Walk
15 minutes or longer
Run
15 minutes or longer
Outdoor Bike
15 minutes or longer
Elliptical
15 minutes or longer
Sport
15 minutes or longer
Aerobic Workout

TeleRehab: Program Description

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- Each site connects to the UOHI through the Ontario Telemedicine Network technology during regular sessions.
- Session is lead by physiotherapists at the UOHI and supervised by local healthcare professionals.
- Each session includes a warm-up activity, aerobic exercise, low-intensity resistance training and an educational component

- *Session duration:* 1 hour, 2x per week
- *Program duration:* 8-12 weeks

Ottawa Valley Family Health Team

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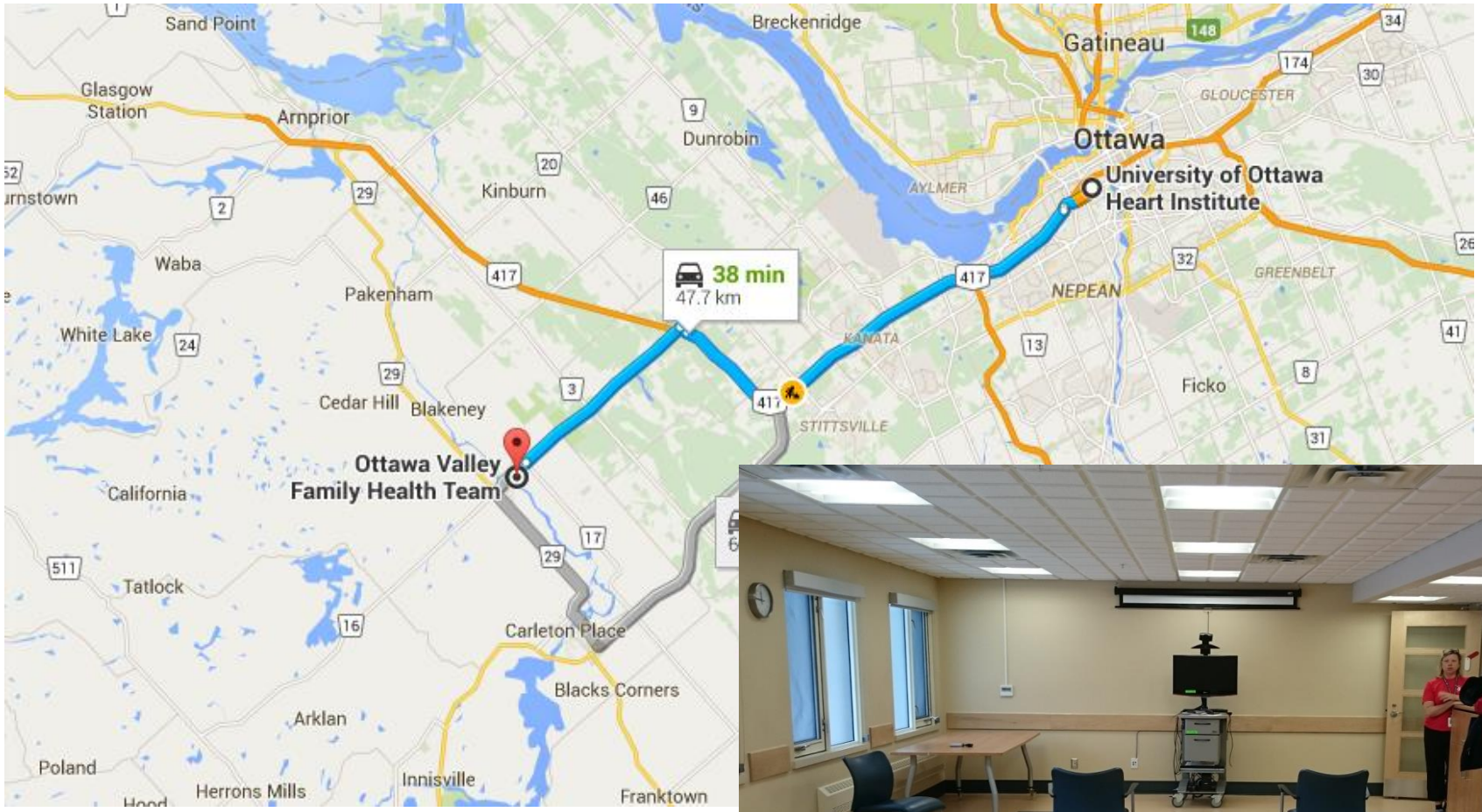

St. Francis Memorial Hospital

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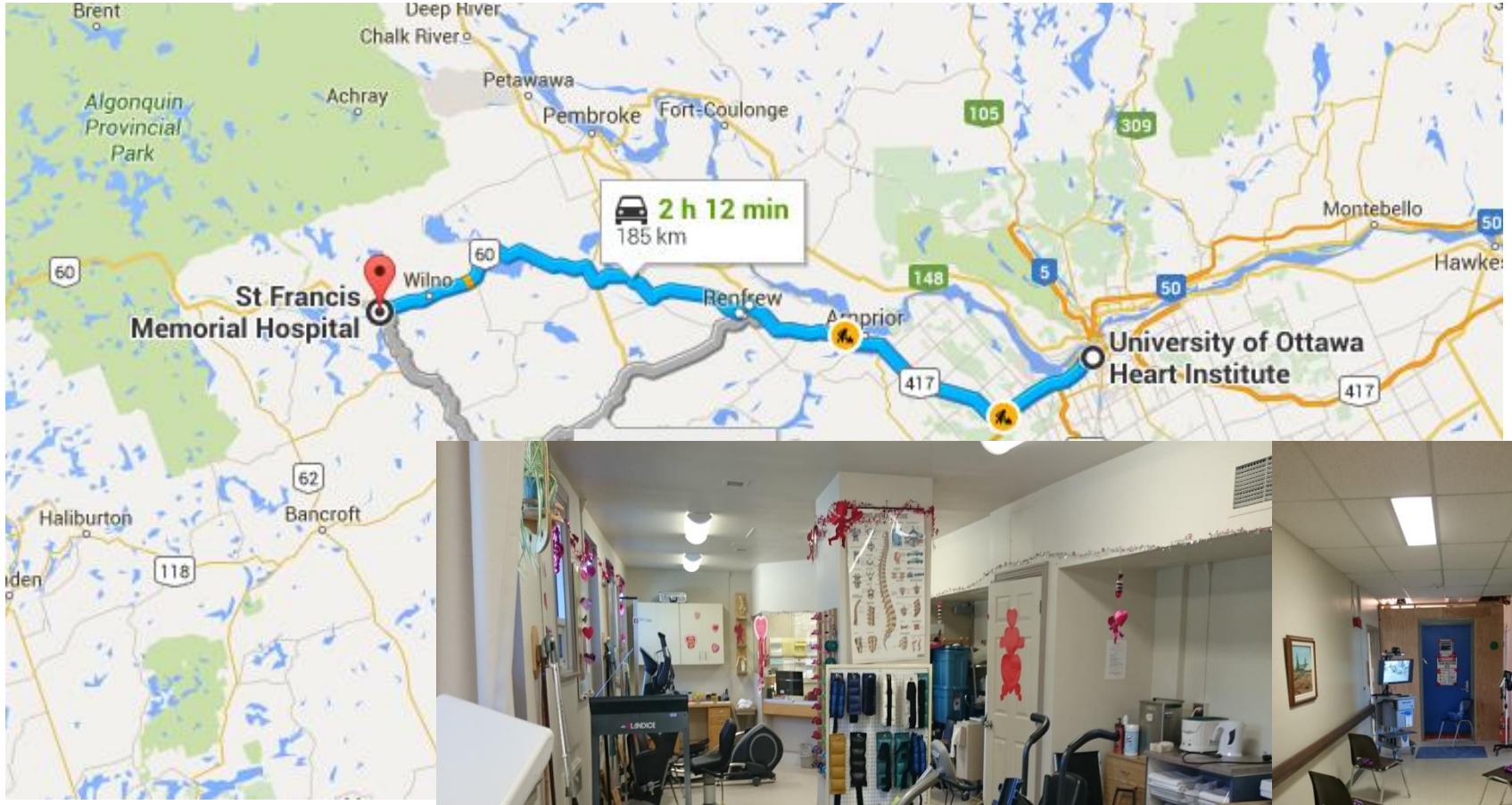

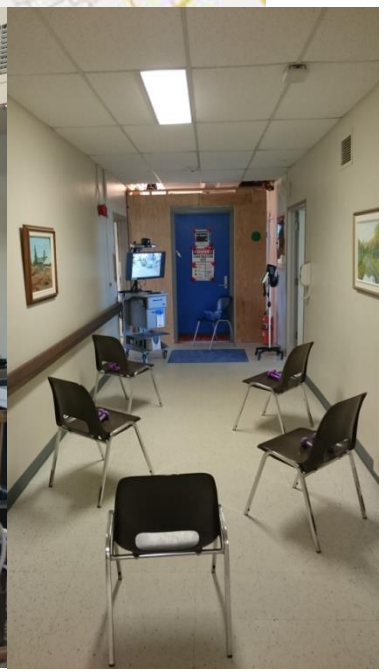

Winchester District Memorial Hospital

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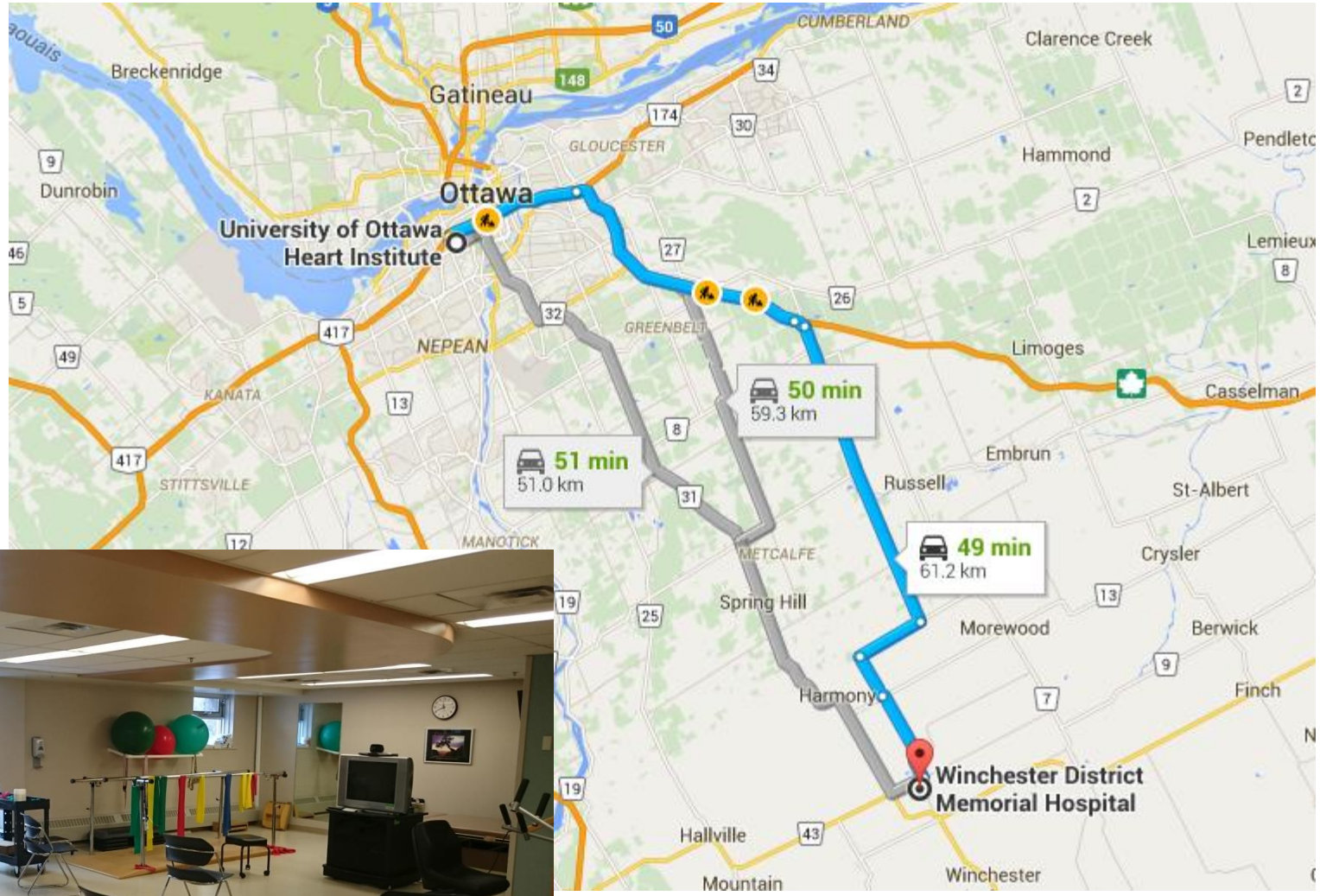

Additional Locations

3 Additional Sites Pending:

Arnprior

Bourget

Kemptville

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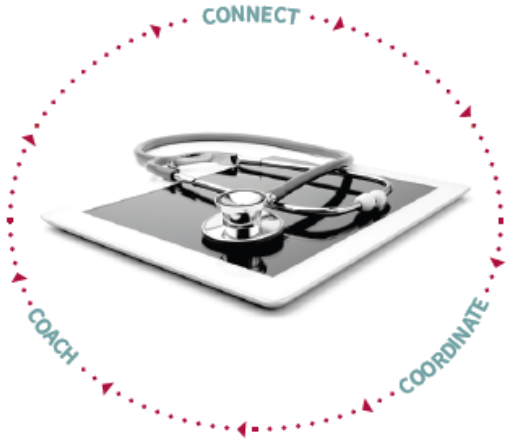
THE VIRTUAL CARE PROGRAM

ACTIVATING PATIENTS TO PROACTIVELY MANAGE THEIR HEART HEALTH



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CANADIAN WOMEN'S HEART HEALTH CENTRE

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VIRTUAL CARE PROGRAM

The Reality

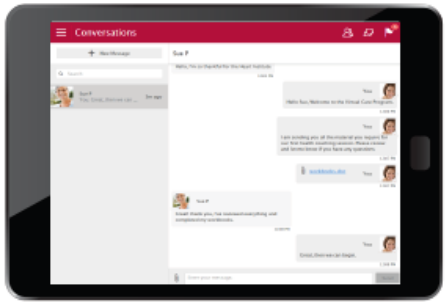
With your hectic schedules and constant demands, who has time to keep on top of the latest health news?

Nowadays, people need fast and convenient services for health information and support to prevent and treat health problems.

What is the Virtual Care Program?

The "Virtual Care Program", (**a free program**) uses an online cardiovascular health management platform to help you control and manage your risk factors for heart disease.

The platform allows you to track and monitor risk factors such as high blood pressure, diabetes, nutrition, weight and more.



What can I expect?

Once you are registered in the program, you will be asked to answer a series of questions on your health. Once these are complete, you will receive a notification on whether or not you qualify for our health coaching service.

Should you qualify, your assigned coach will contact you within 1-2 business days to introduce themselves and greet you. Your health coach and you will decide on appointment dates for your coaching sessions. You will continue to have ongoing communication with your coach for six months.

The health coach will help you set up trackers, reminders and goals and will provide specific risk factor education along with encouragement.

What are some of the features?

There are a series of great features in the platform that can assist you in managing your heart health, these include:

Communication with physical activity devices: The platform will have the ability to communicate with electronic devices and activity monitors such as the "Fitbit" and many more.

Wellness Trackers: You will automatically be assigned trackers for the risk factors that may not meet target values. The trackers help you monitor progress and can even send you reminders to log your steps or take your blood pressure. Trackers are particularly helpful when you are working toward a health goal such as weight loss or quitting smoking.

Progress Reports: By tracking your risk factors (such as daily steps, calories, blood pressure etc), the platform will provide progress reports that can assist you in the teaching, instructing, and advisement on health-related issues by a certified "Health Coach".

One on one health coaching: You can interact with a health coach if you qualify for this service (see the FAQ's section for details on how to qualify). The health coach's role is to relay specific health information in real time and to help empower you to become an active self-manager of your own heart health.

Online support groups: You will be able to access an online support community where you can post questions and seek encouragement and tips from other people with similar health goals.

Health library: For all your heart health education needs, you will have access to a trusted and reliable database of information where you can learn important strategies to help you achieve your health priorities.

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DE L'UNIVERSITÉ D'OTTAWA

HWE REACH

Number of HWE Sites	>200
Number of Regional Coordinating Centres	6
Number of persons trained in HWE Training Program	>1500
Number of free HWE programs	>50

Thank you! Questions?

UNIVERSITY OF OTTAWA HEART INSTITUTE
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  - Dr. Jennifer Reed, Associate Scientist, Director of the Exercise Physiology and Cardiovascular Health Lab