Using new technologies for understanding and changing behaviors

Ilkka Korhonen

Firstbeat Seminar, Helsinki
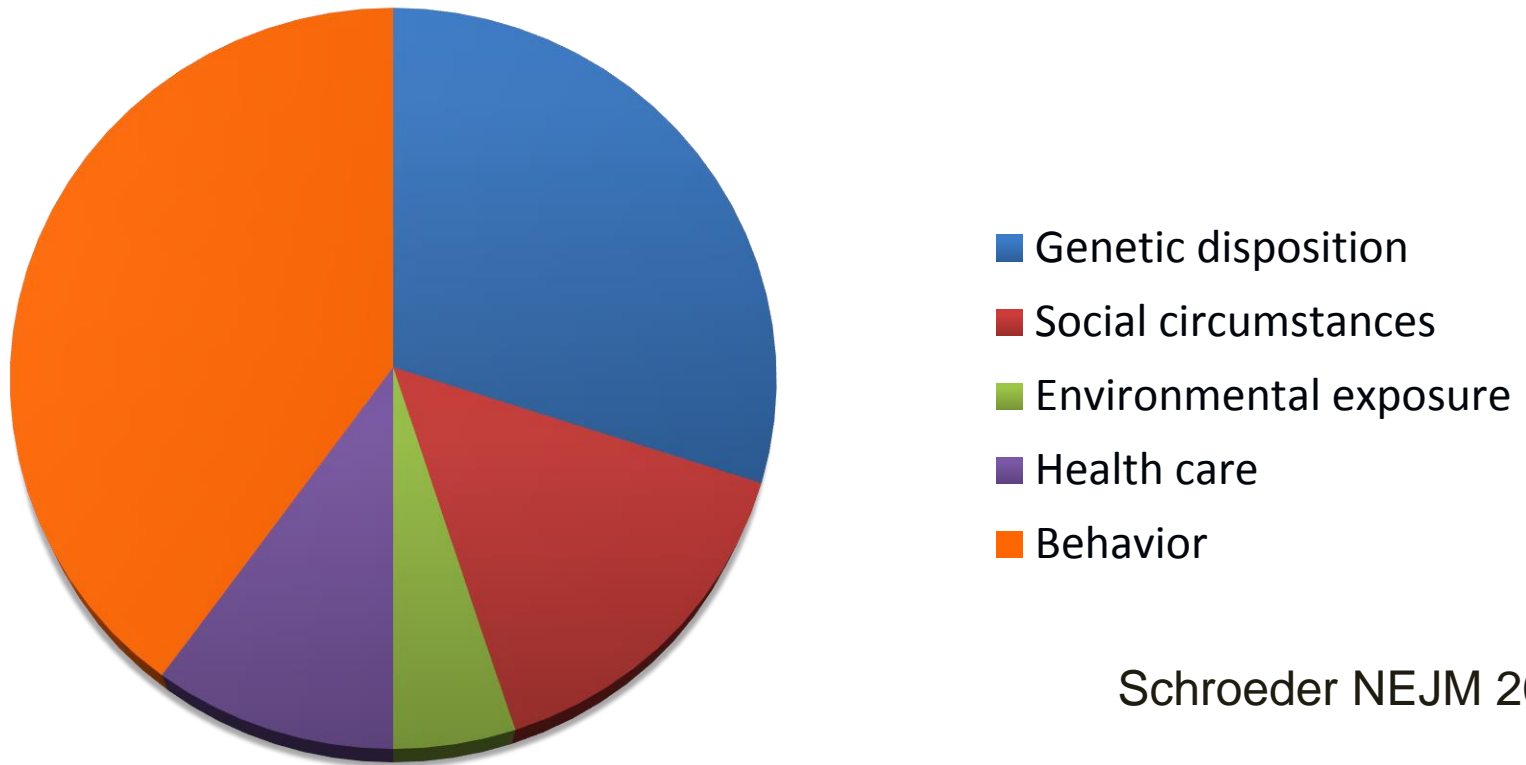**6.3.2014**

Our behavior is killing us...
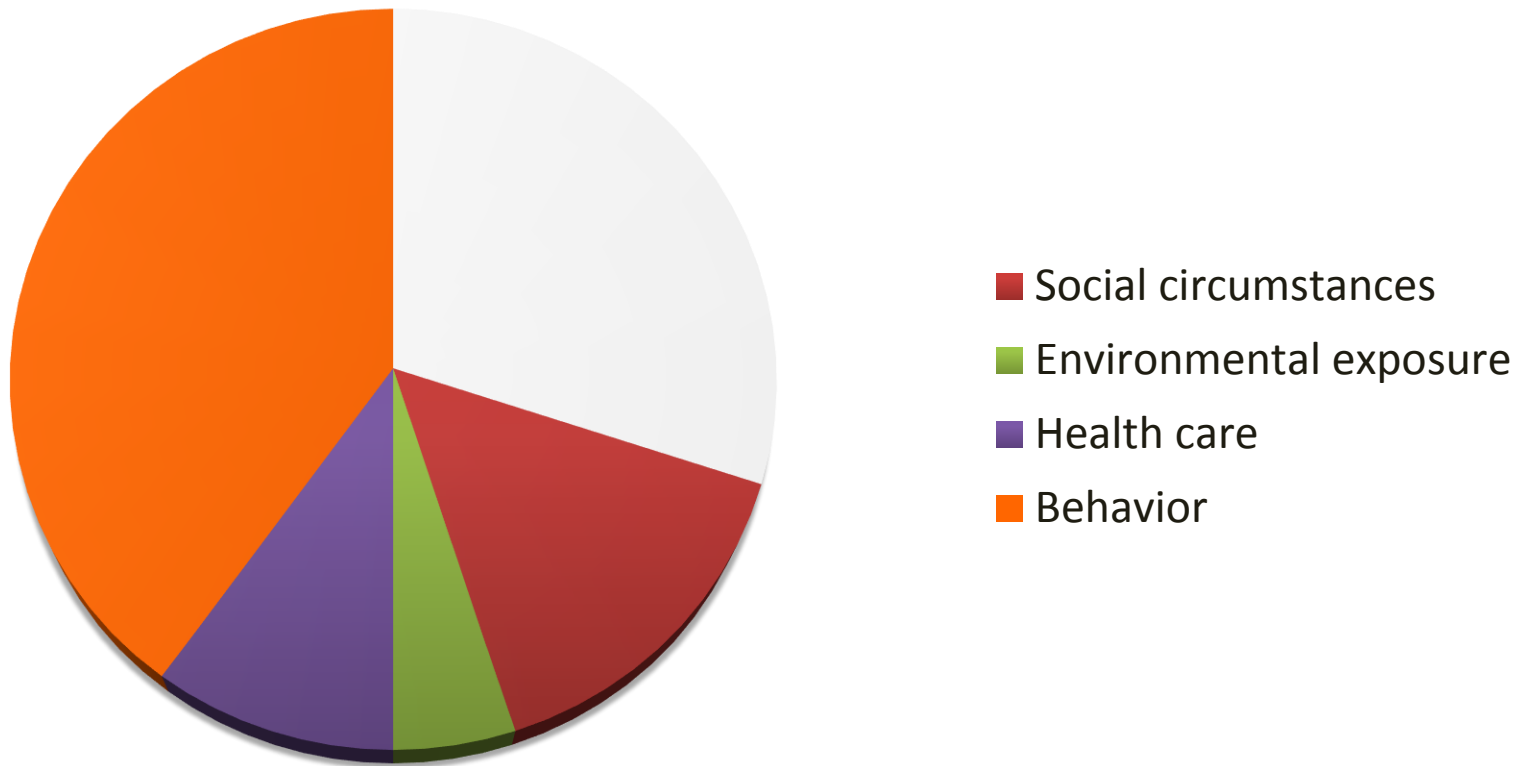
Proportional contribution to premature death

- Genetic disposition
- Social circumstances
- Environmental exposure
- Health care
- Behavior

Schroeder NEJM 2007

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Our behavior is killing us...

Here's the part we can change

Legend:
- Social circumstances
- Environmental exposure
- Health care
- Behavior

Prevention opportunity via behavioral change

- Cardiovascular disease:

73-83%

Nurses Health Study, NEJM 2000;343:16-22, NEJM 2001;345:790-97

- Diabetes type II:

58-91%

Tuomilehto, 2001 NEJM 344(18): 1343-50
Nurses Health Study, NEJM 2000;343:16-22, NEJM 2001;345:790-97

- Cancer:

60-69%

De Lorgeril, Arch Int Med 1998;158:1181-87
HALE Project. Knoops JAMA 2004;292:1433-1439

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These are also medicines

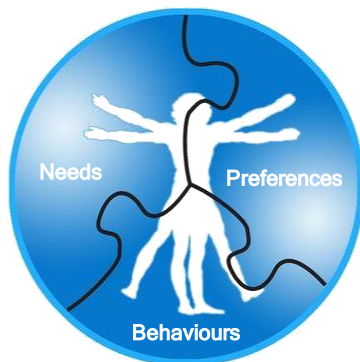**Education**   **Physical Activity**   **Nutrition**

Education is Medicine
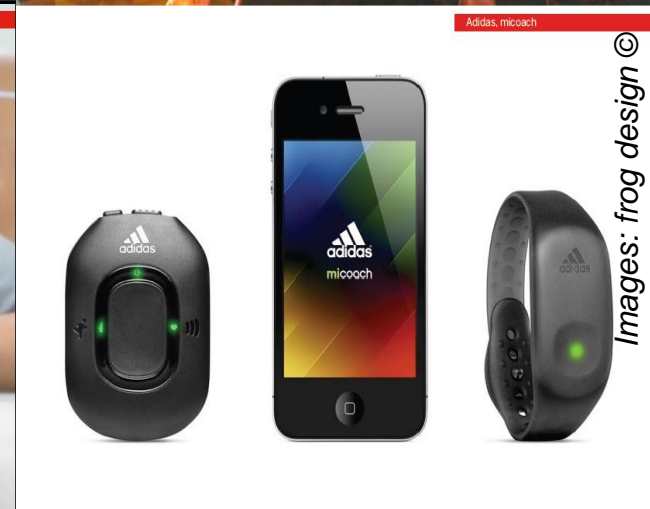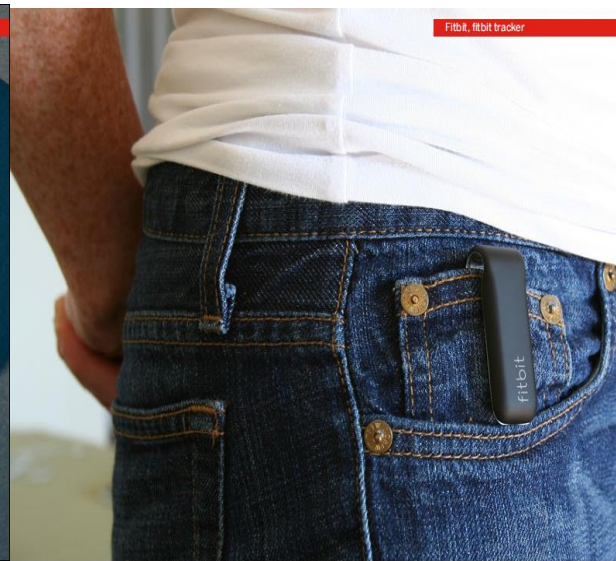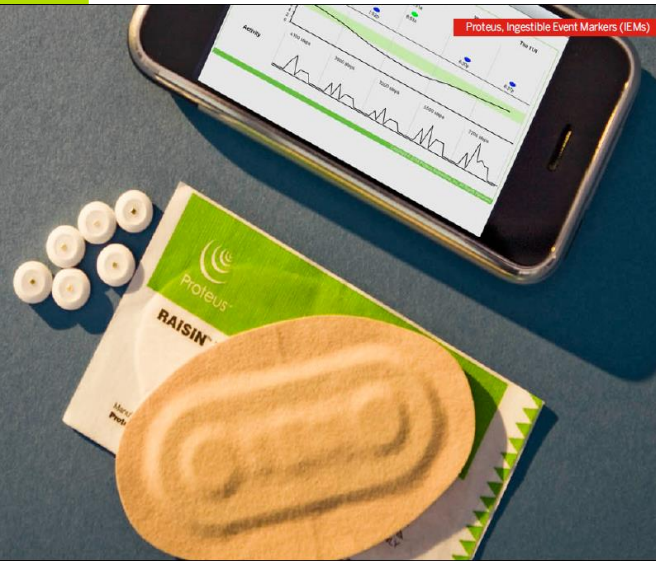**Physical Activity** is Medicine
Nutrition is Medicine

IF WE CAN DO

- Anamnesis
- Prescription
- (Self-) Administration
- Monitoring of Compliance & Outcomes
- Vigilance on Adverse Effects

Digital 'footprints' of health, behavior and context

Images: frog design ©

Quantification and modeling of real behaviors in context

Continuous monitoring and quantification of behaviors is here!

www.firstbeat.fi

HRV analysis based on physiological model and big data based calibration → classification of physiological state and quantification of physical activity
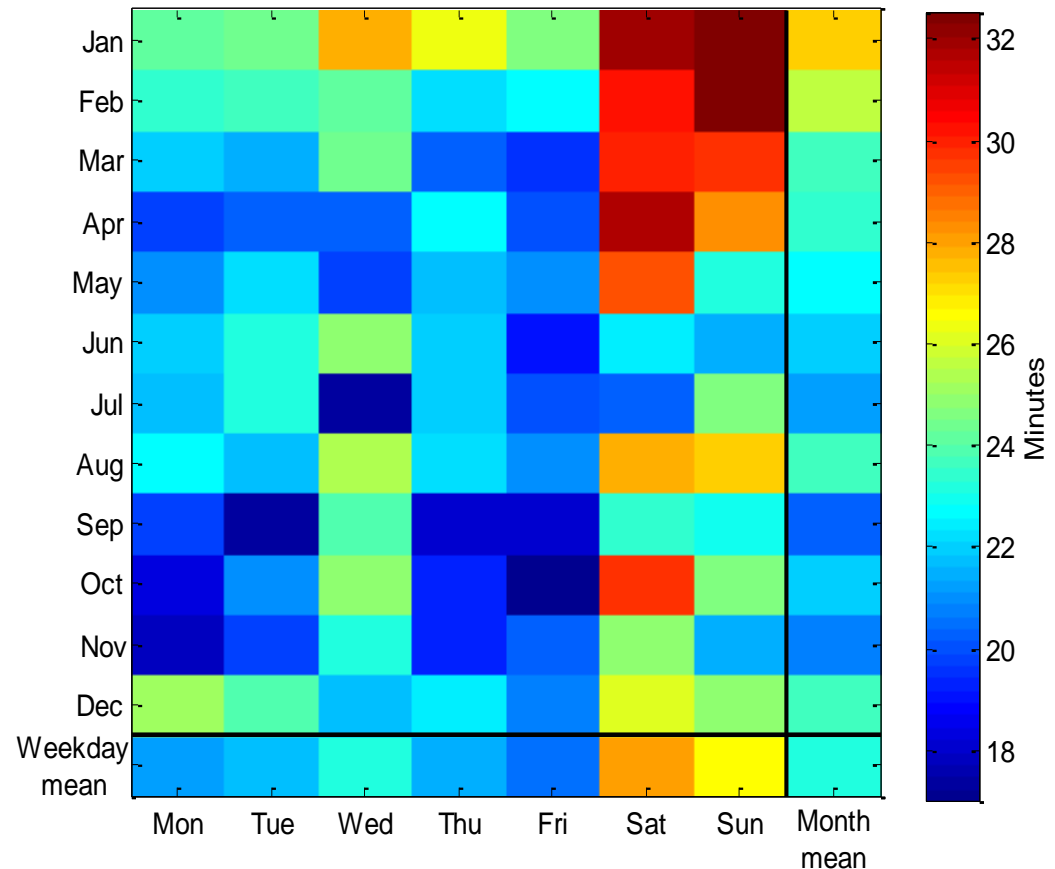
Crowd data → what really happens

Measurement days #	59724
Individuals, #	17715
Age	44±10 (18-65)
BMI	26±4 (18-40)
Males [%]	47
Activity class	4.9±2.0 (0-10)

Physical activity (>3MET & >10min)
(based on HRV analysis)

>3MET from 10- minute bouts, background (age, gender, BMI, activity class) controlled

Physical activity (cardiorespiratory exercise minutes)

ALL

22 exercise minutes* per day
8 minutes of vigorous exercise**
52% of days without any exercise minutes

FEMALES

17 exercise minutes per day
5 minutes of vigorous exercise

58% of days without any exercise minutes
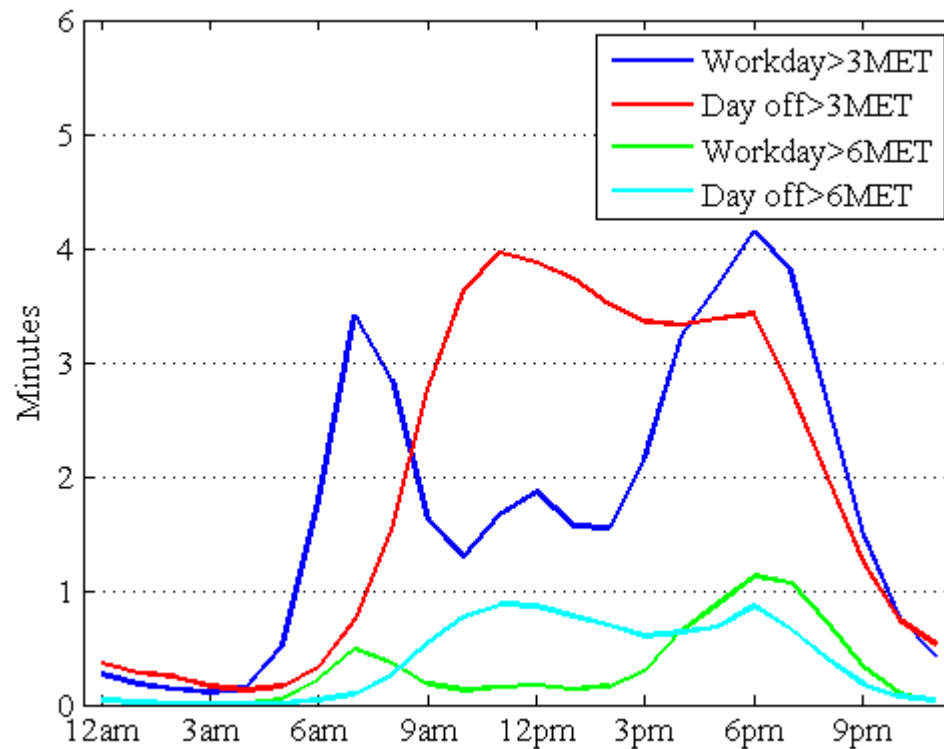
MALES

30 exercise minutes per day
10 minutes of vigorous exercise*

45% of days without any exercise minutes

*Exercise in at least 10 min bouts above 3 METs (metabolic equivalent)
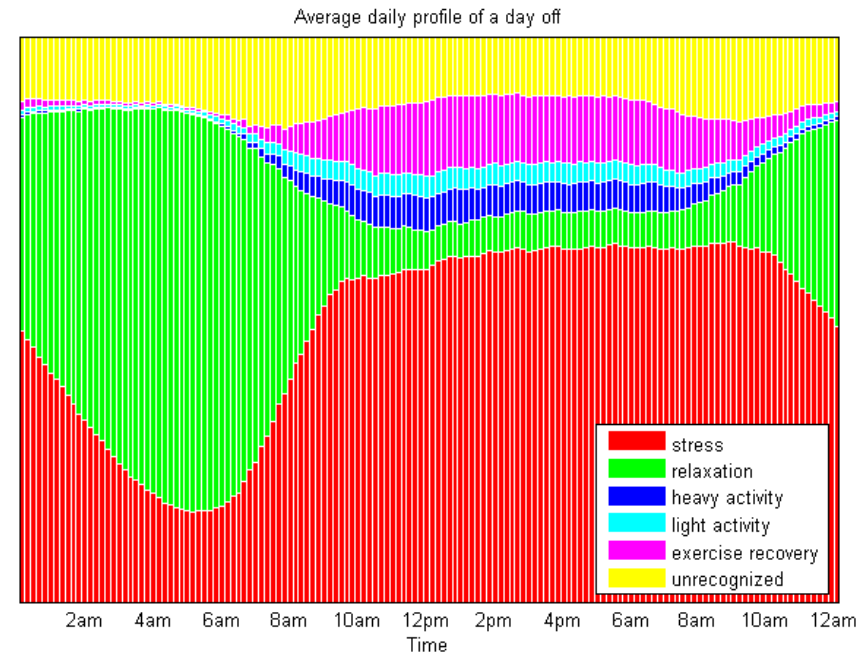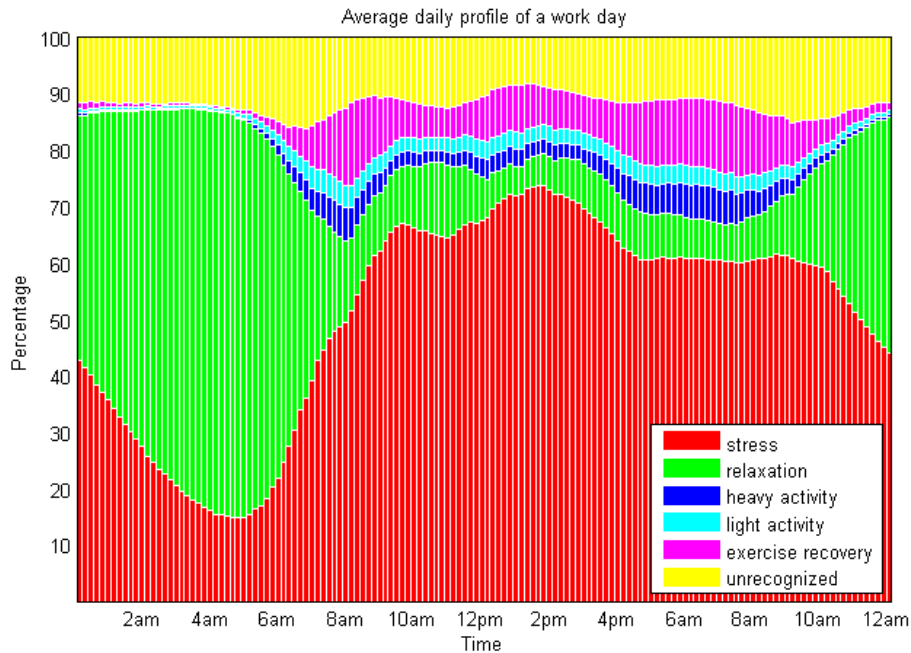**Exercise at level >6MET from the exercise minutes

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Daily profile of physical activity

Daily profile of stress and recovery
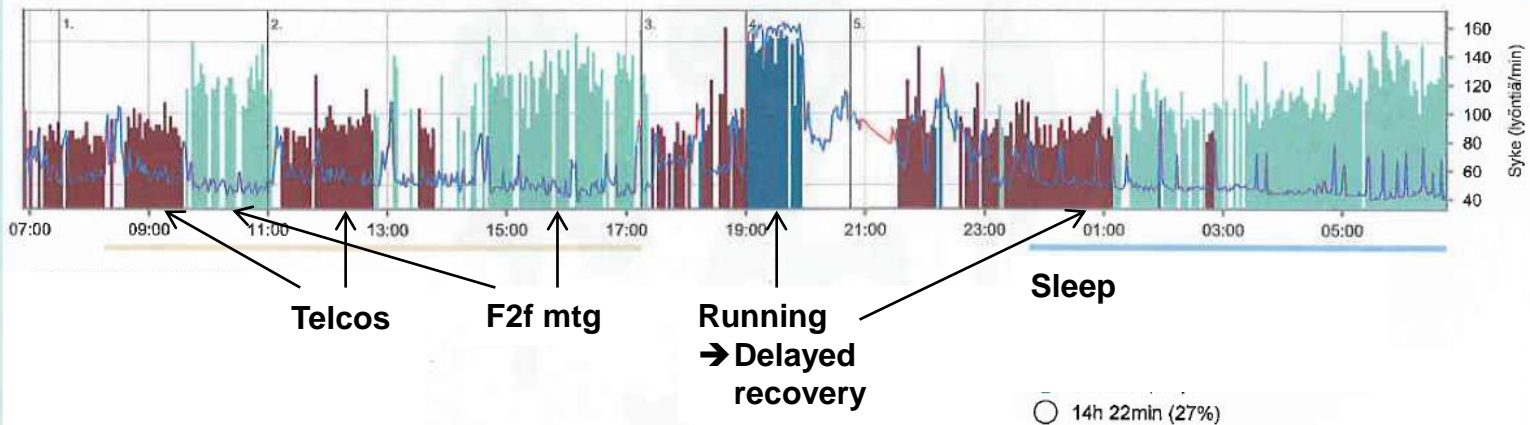
Working day (N=22 270)   **Free day (N=15 015)**

24/7 HRV monitoring combined with diary (=personal context) → personally relevant discoveries!
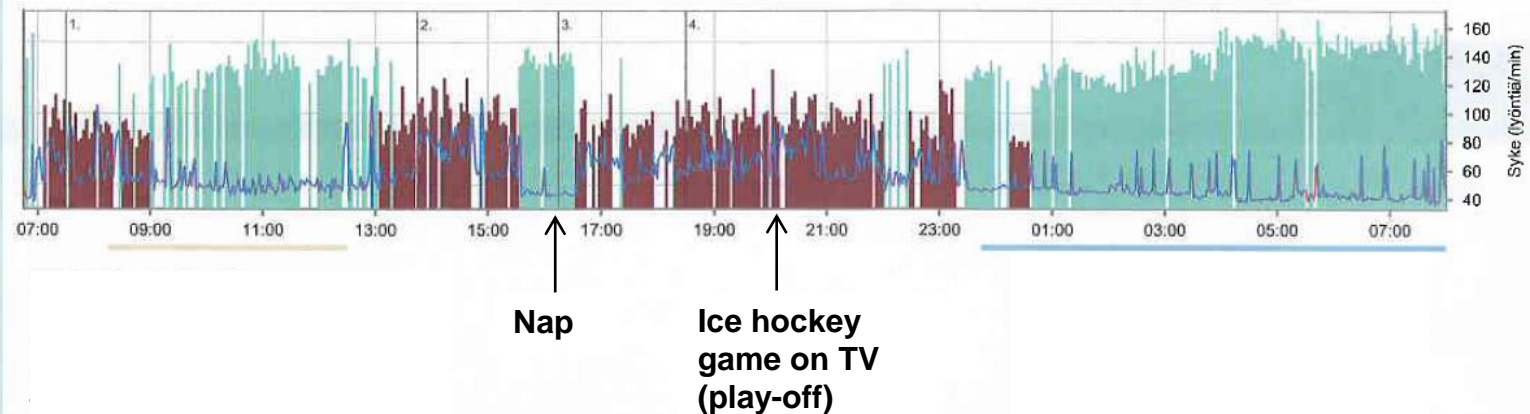
Physiological Stress (red) and recovery (green)

Day 1 – Wed 4th of Apr, 2012

Mittaushäiriöt **7%**

Telcos   F2f mtg   Running → Delayed recovery   Sleep

○ 14h 22min (27%)

Day 2 – Thu 5th of Apr, 2012

Mittaushäiriöt **3%**

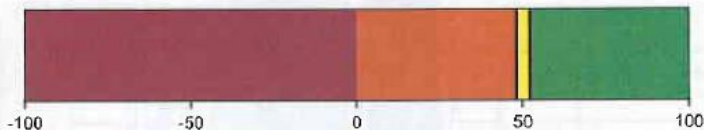Nap   Ice hockey game on TV (play-off)

Comparison against norms
➔ "should I do something?"

Physiological recovery during sleep compared to population reference

Day 1 – Wed 4th of Apr, 2012

Palautumisen osuus unen aikana.

Mittauksen voimavaratasapaino on **50**.

Tulos perustuu stressin ja palautumisen suhteellisiin
osuuksiin (%) unijakson aikana.

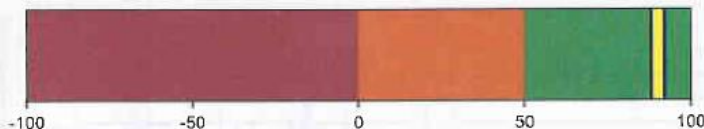Your sleep time was 7h 0min. Recommended sleep duration is min 7h

Palautumisen laatu unen aikana.

| 0 - 19 | 20 - 39 | 40 tai yli |

HRV based recovery measured by RMSSD is **52**ms.
Population age-adjusted average is **34**ms.

Day 2 – Thu 5th of Apr, 2012
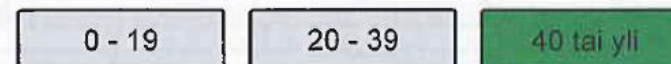
Palautumisen osuus unen aikana.

Mittauksen voimavaratasapaino on **90**.

Tulos perustuu stressin ja palautumisen suhteellisiin
osuuksiin (%) unijakson aikana.

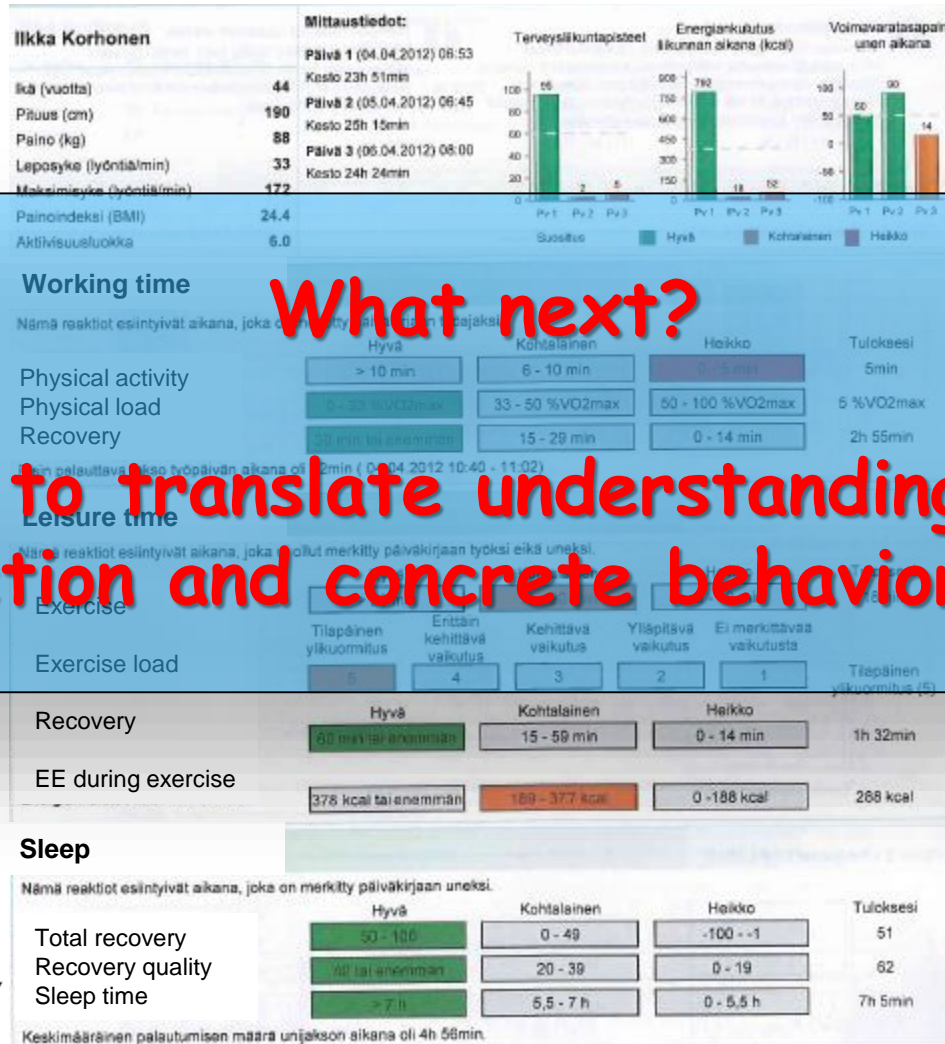Your sleep time was 8h 15min. Recommended sleep duration is min 7h
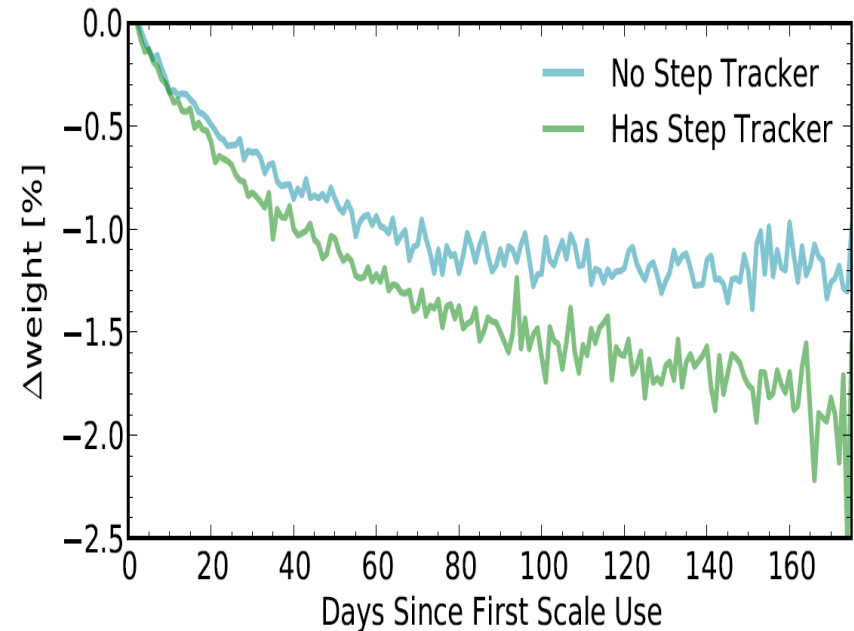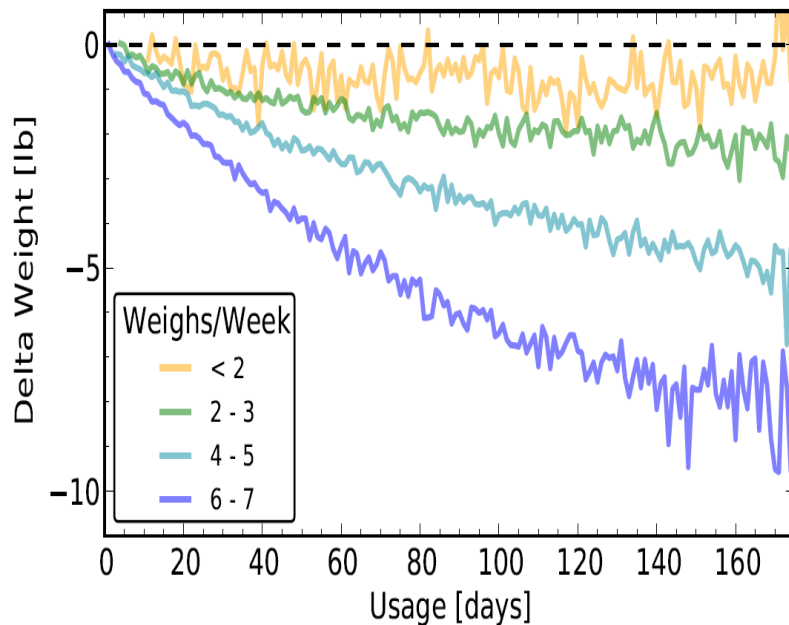
Palautumisen laatu unen aikana.

| 0 - 19 | 20 - 39 | 40 tai yli |

HRV based recovery measured by RMSSD is **79**ms.
Population age-adjusted average is **34**ms.

Identification of areas with most improvement potential – seeing the big picture

Life style health report based on HRV

What next?

How to translate understanding into action and concrete behaviors?

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Self-monitoring is an intervention

© Jacob Arnold, Jung Hong, and Shelten Yuen, R&D Fitbit Inc

Real-Time Intervention to decrease Sedentary Time

© *Donna Spuijt-Metz*

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Differences in Accelerometry Counts in 10 minute periods after being prompted
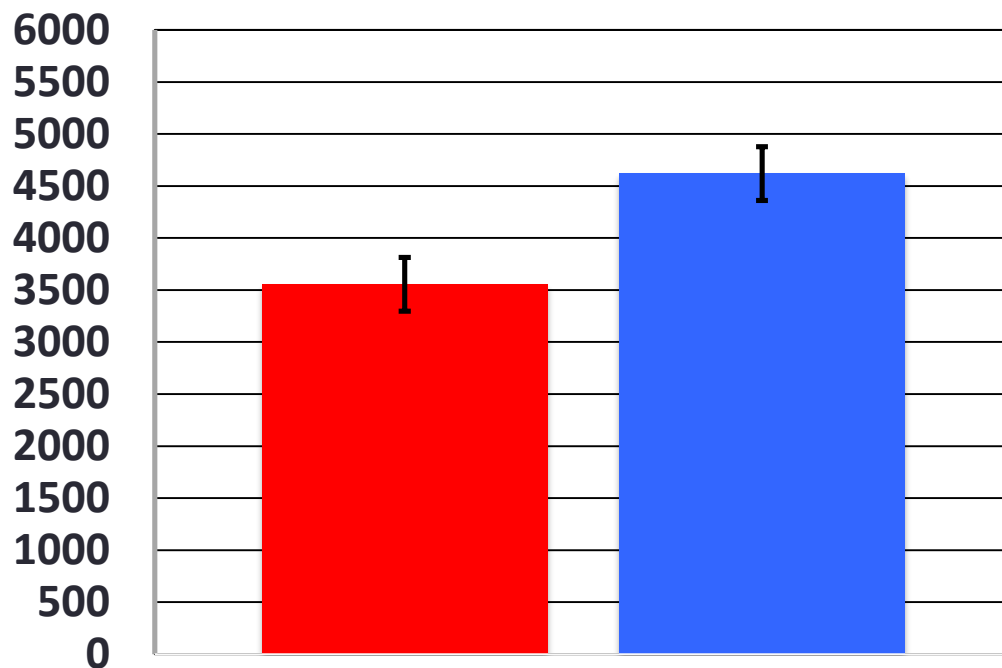
Counts

No prompt vs. Prompt

- Accelerometer counts were 1,066 counts higher
- in the following 10 minute period
- compared to when SMS prompts were not sent ($p < 0.0001$)

© Donna Spuijt-Metz

■ **No Prompt**　■ **Prompt**

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Conclusions

- New technologies move health monitoring from era of photographing to Hollywood
- Challenges become
  - Making sense of the data
  - Acting on data
  - Scaling of services – consumerizing
  - ➔ Focus of progress today!

Competitive landscape

Thank you!

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