



Omahoito, terveyden mittaus ja analytiikka – mitä tästä tulee?

Ilkka Korhonen

Terveydenhuollon ATK päivät

Tampere

13.05.2015





Terveyseroihin vaikuttavat tekijät

Terveydenhoito

10%

Terveyspalvelujen laatu ja tehokkuus

**Eläminen
(Nurture)**

60%

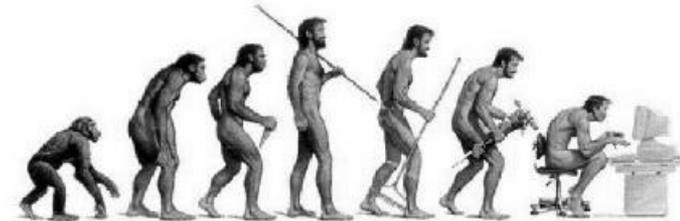
Elintavat, ympäristö, sosioekonomiset tekijät



**Perimä
(Nature)**

30%

Perimä ja sen muutokset eliniän aikana



SA Schroeder: We Can Do Better - Improving the Health of the American People. *N Engl J Med* 2007; 357:1221-8

McGinnis et al., *Health Affairs* 21(2), 2002

TAMPERE UNIVERSITY OF TECHNOLOGY





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. Knuops JAMA 2004;292:1433-
1439



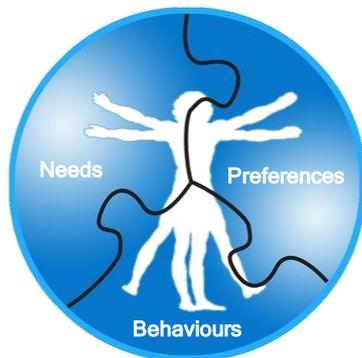
Self-care medicines

Education

**Physical
Activity**

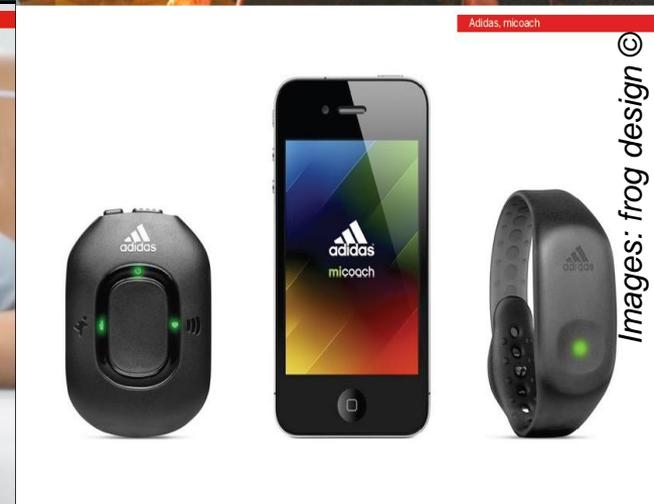
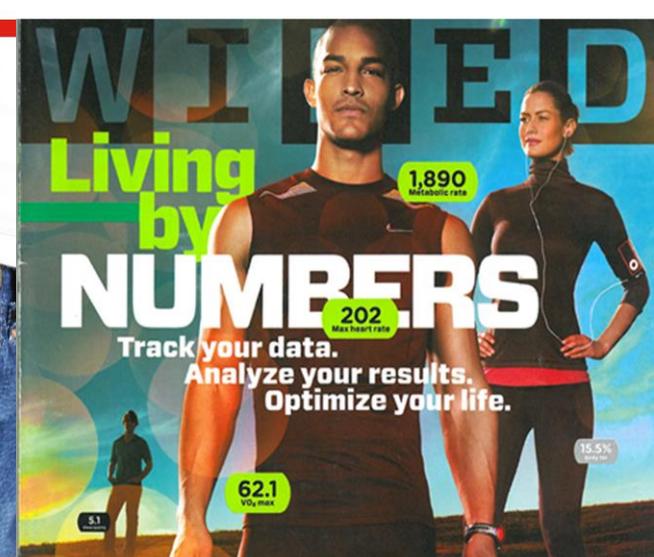
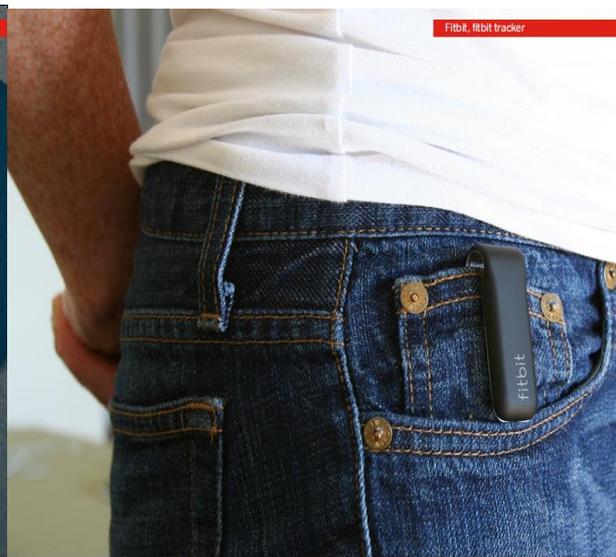
Nutrition

IF WE CAN DO



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

Digital 'footprints' of health, behavior and context

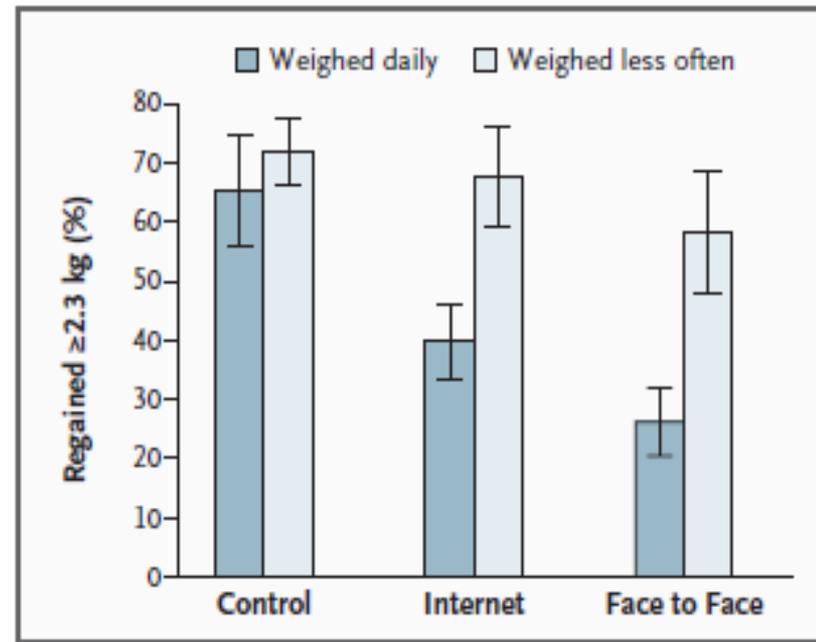


Images: frog design ©

Quantification and modeling of real behaviors in context

Benefits of self-monitoring

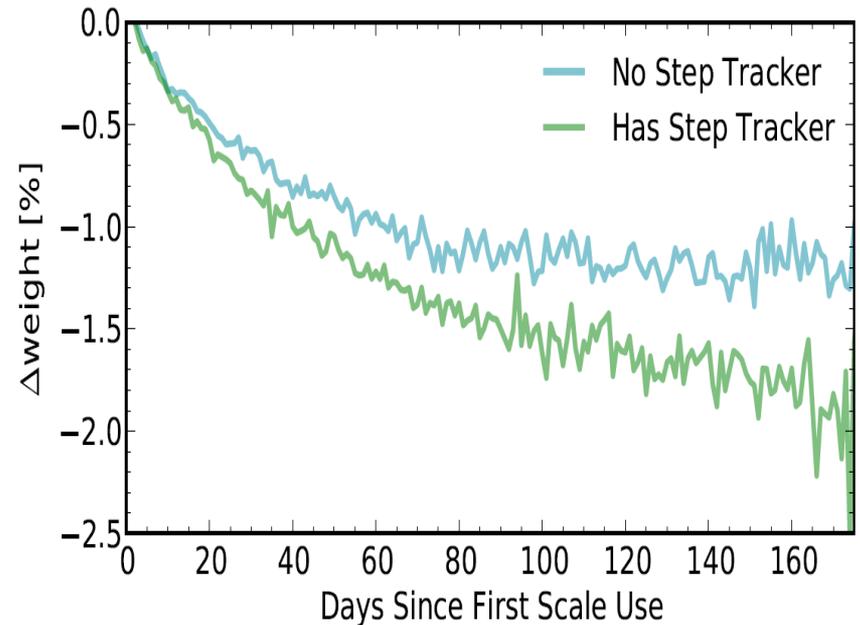
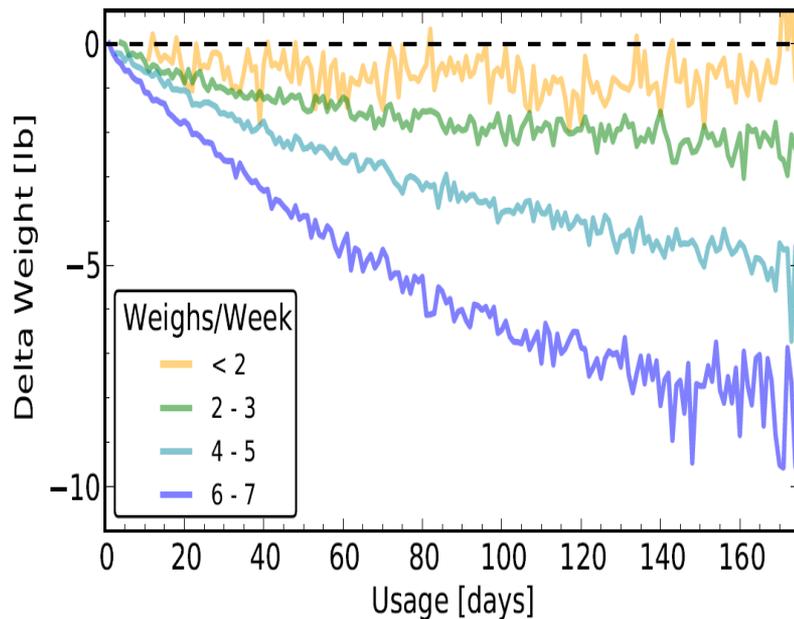
- Daily weight monitoring helps in weight loss and weight maintenance (Kayman et al., 1990; Linde et al., 2004; Wing et al., 2006)
- Regular diet and energy consumption monitoring supports weight loss and may decrease food intake (Baker & Kirschenbaum, 1993; Perri et al., 1989; Foreyt, 2005)
- Step monitoring increases exercising and improved body composition and blood pressure (Bravata et al., 2007; Clemes 2009)
- Self-monitoring is the most efficient method for getting rid of bad habits (Quinn, 2010)



Wing et al., 2006



Self-monitoring is an intervention



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



Withings Health Institute

📈 The progression of physical activity levels among Withings users

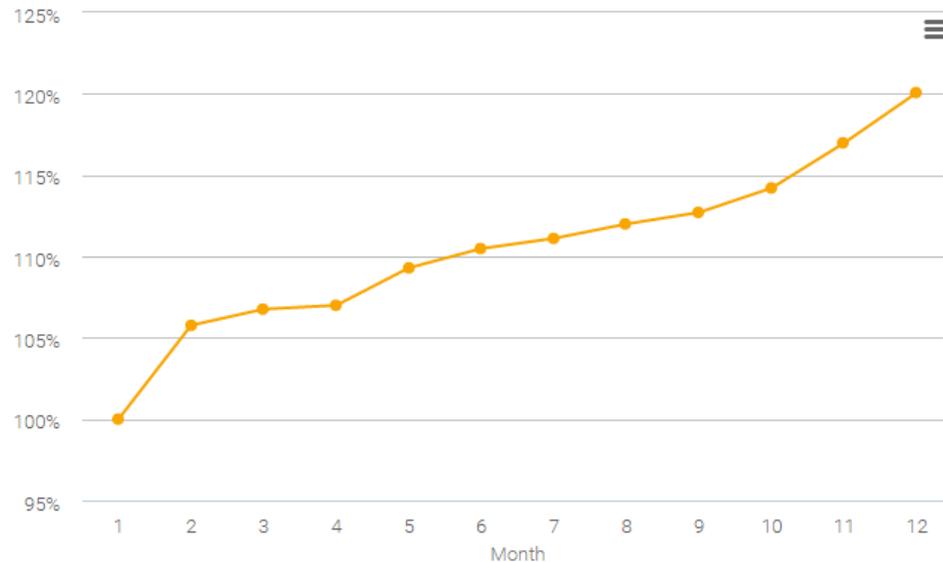
See how the average number of daily steps of the Withings community progresses the first year of activity tracking.

- All
- Men Women
-
- All ages
- 20-29 years
- 30-39 years 40-49 years
- 50-59 years 60 and over

For the selected category, there is a 20.1% variation in the average number of daily steps over the period of one year. Visit us again soon to track the evolution of this trend.



Evolution of the average number of daily steps, measured in percentage relative to the first month of activity tracking



© 2015 Withings

* Anonymized and aggregated data, built on the basis of a random sample of 100000+ Withings users. See below for our **data protection policies and definitions used.**

Global data, updated monthly. Last update: 05/01/2015.



Withings Health Institute

Weight progression among Withings users

See how the BMI of overweight and obese subjects progresses on average during the first two years of weight tracking.

- All
- Men Women

- All ages
- 20-29 years 30-39 years 40-49 years 50-59 years 60 and over

- All categories
- Overweight Moderate obesity
- Severe obesity Morbid obesity



Evolution of the BMI of overweight and obese subjects, in percentage of the BMI registered in the first month of weight tracking



© 2015 Withings

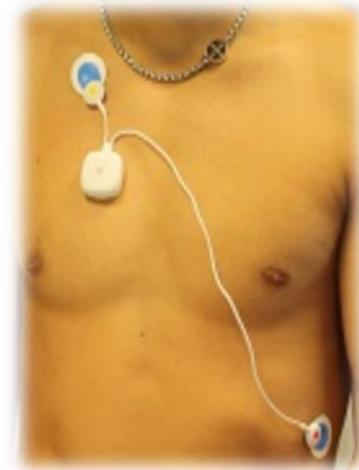
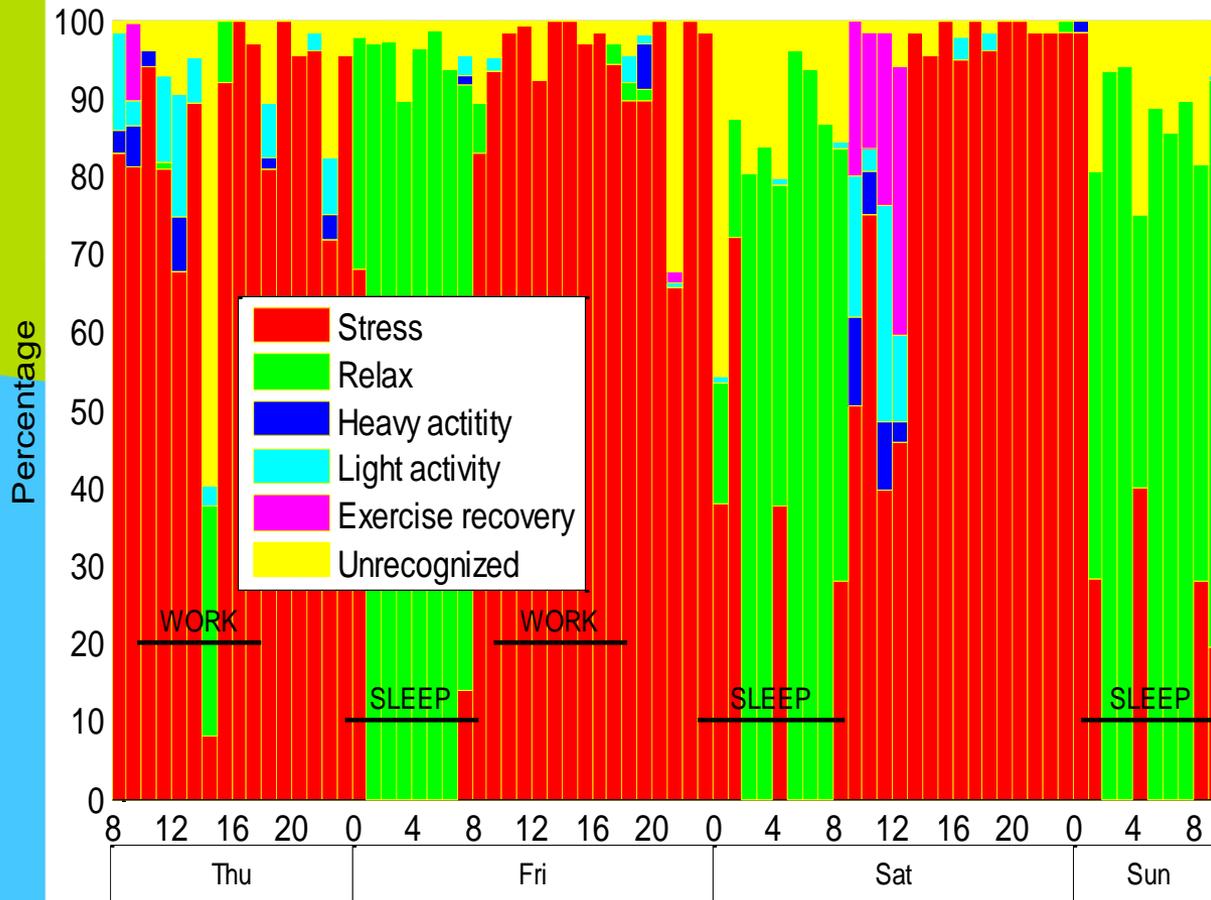
For the selected category, there is a -2% variation in the BMI over the period of two years. Come back regularly to see the evolution of this trend.

* Anonymized and aggregated data, built on the basis of a random sample of 100000+ Withings adult users in overweight or obesity conditions. The BMI (body mass index) class refers to the BMI at the first month of weight tracking. See below for our **data protection policies and definitions used**.

Global data, updated monthly. Last update: 05/01/2015.



Continuous monitoring and quantification of behaviors is here!

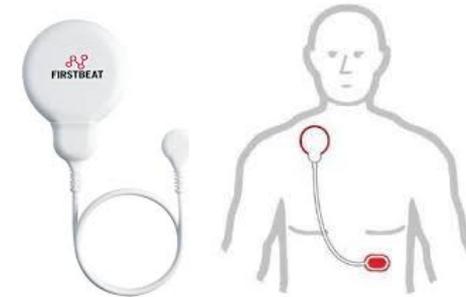
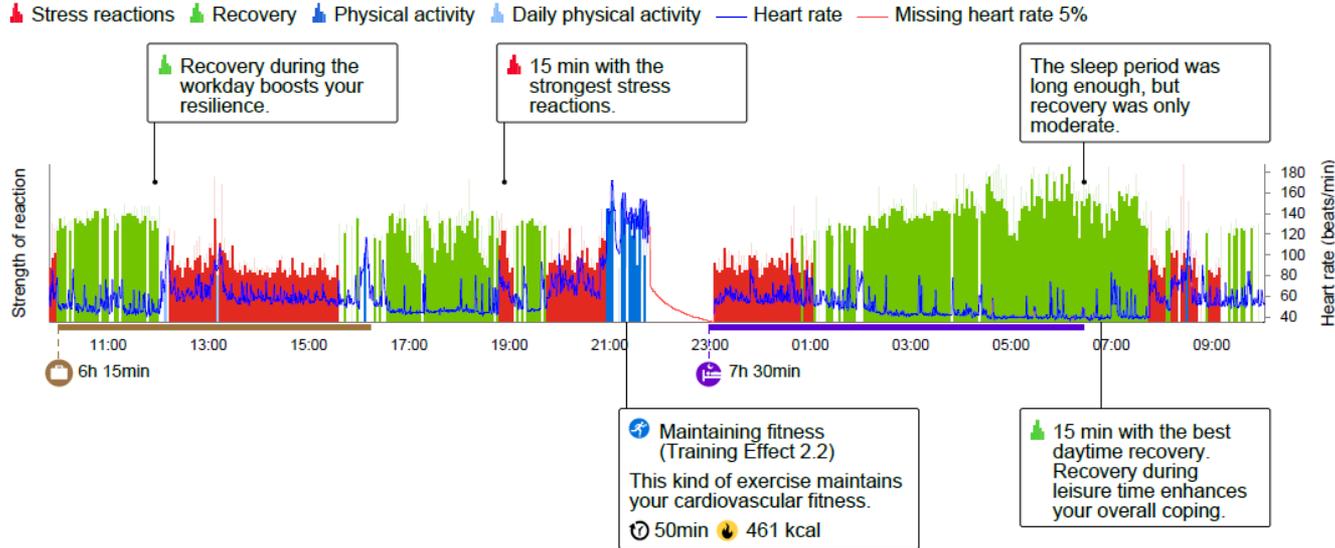


www.firstbeat.fi

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

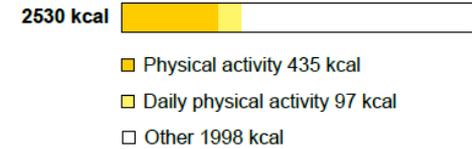


Lifestyle assessment using Bodyguard (ECG based)

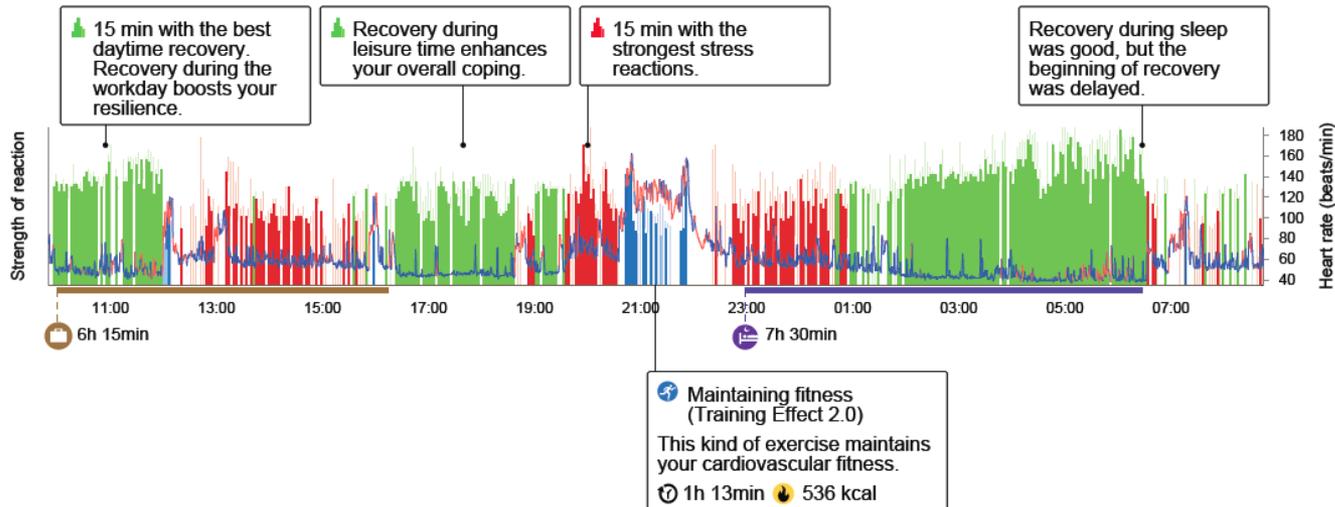


ENERGY EXPENDITURE

Total energy expenditure:

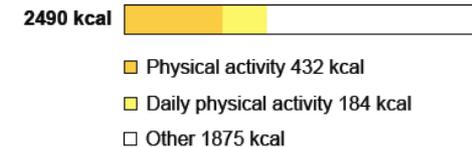


Lifestyle assessment using PPG data (PulseOn)



ENERGY EXPENDITURE

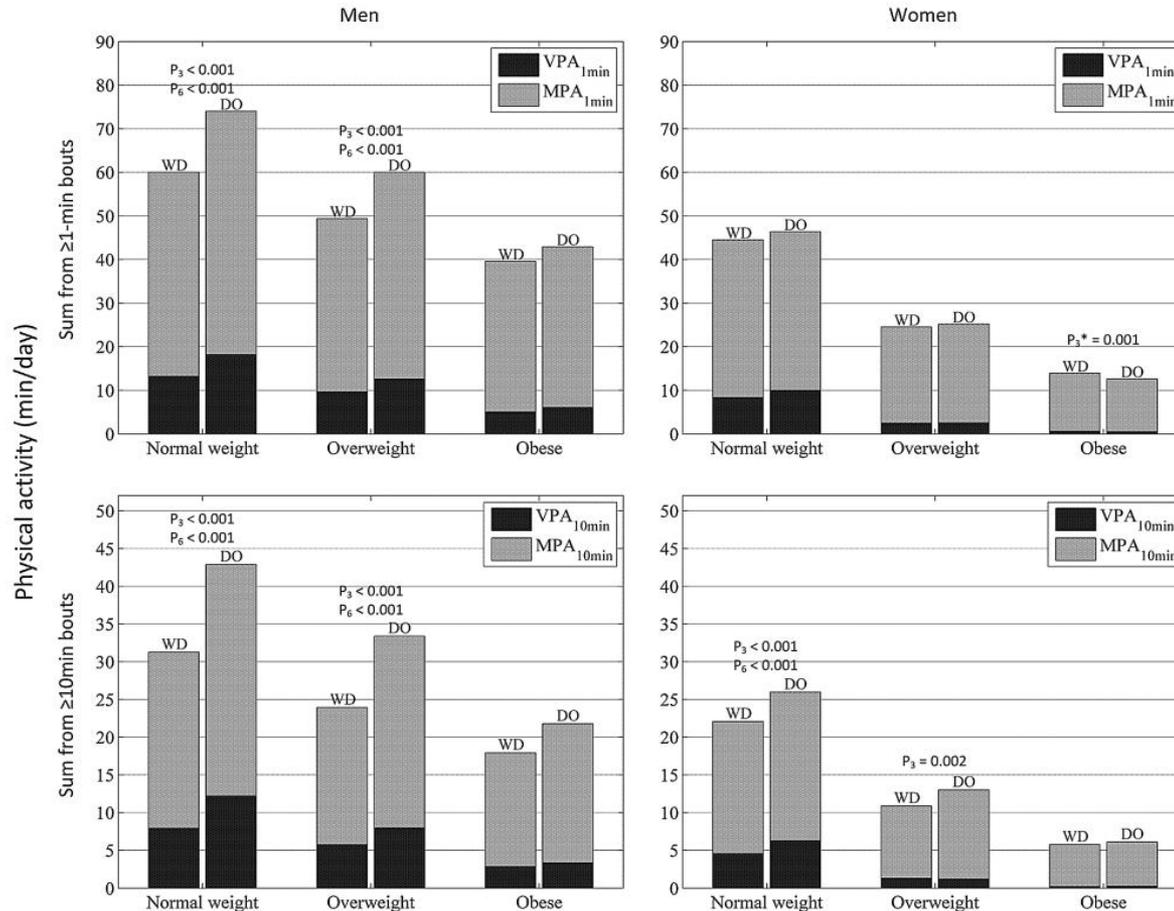
Total energy expenditure:



Objectively measured physical activity in Finnish employees: a cross-sectional study

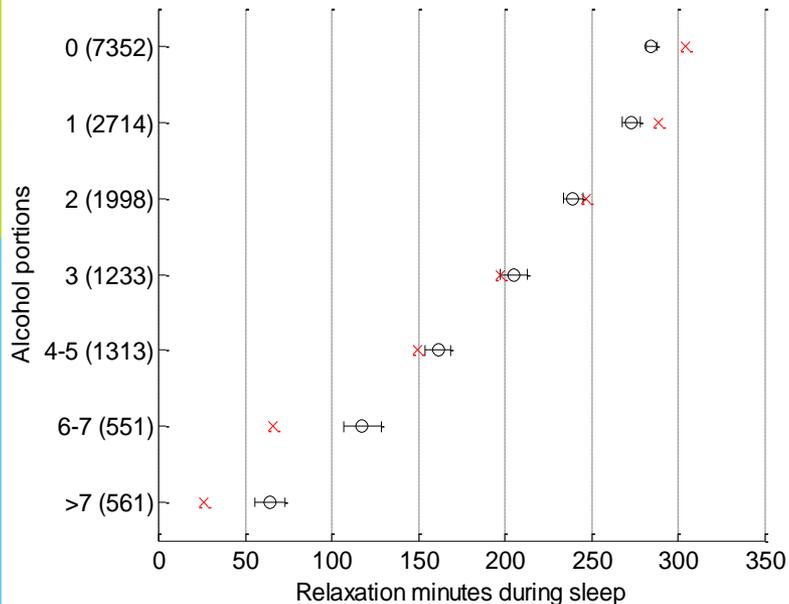
Sara Mutikainen, Elina Helander, Julia Pietilä, Ilkka Korhonen and Urho M Kujala

BMJ Open 2014 4:
doi: 10.1136/bmjopen-2014-005927

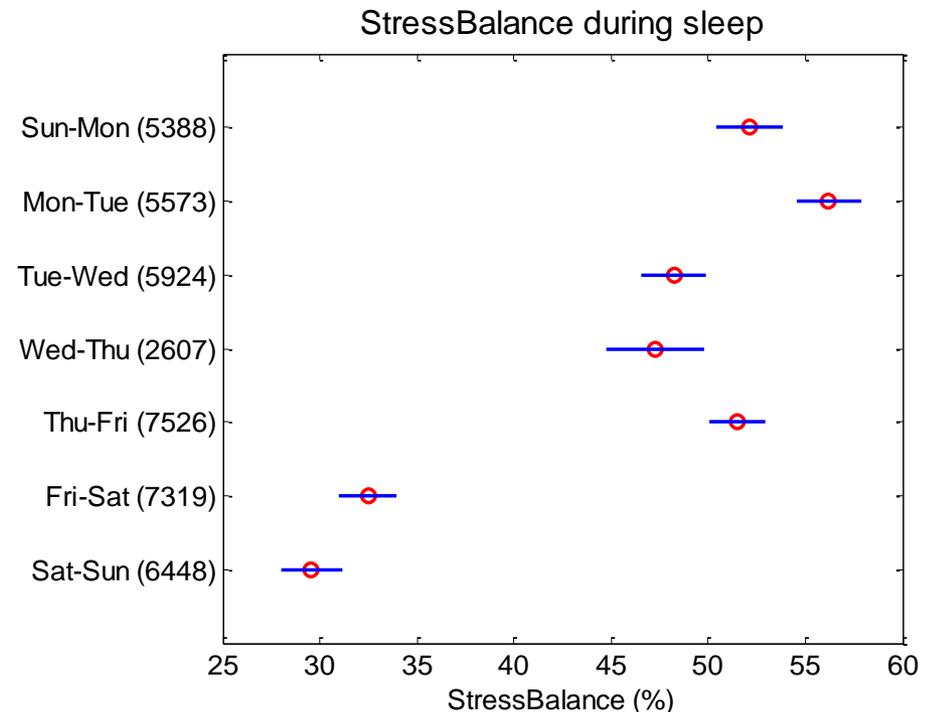


When physiological monitoring meets behavioral measures

Alcohol and physiological recovery during sleep



Physiological recovery during sleep during different weekdays



Based on ~30.000 monitoring days & HRV analysis

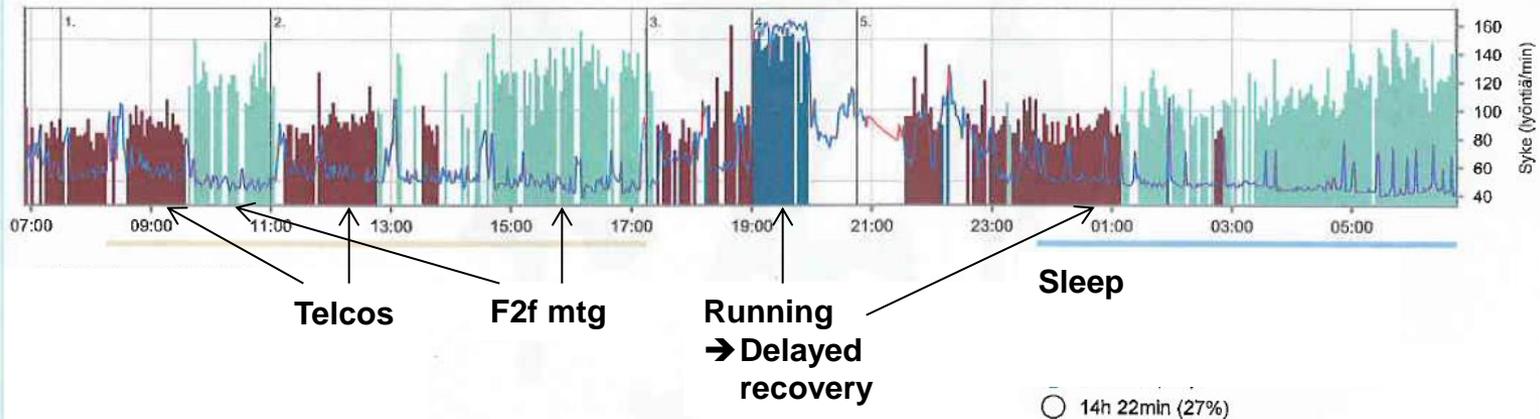


24/7 HRV monitoring combined with diary (=personal context) → personally relevant discoveries!

Physiological Stress (red) and recovery (green)

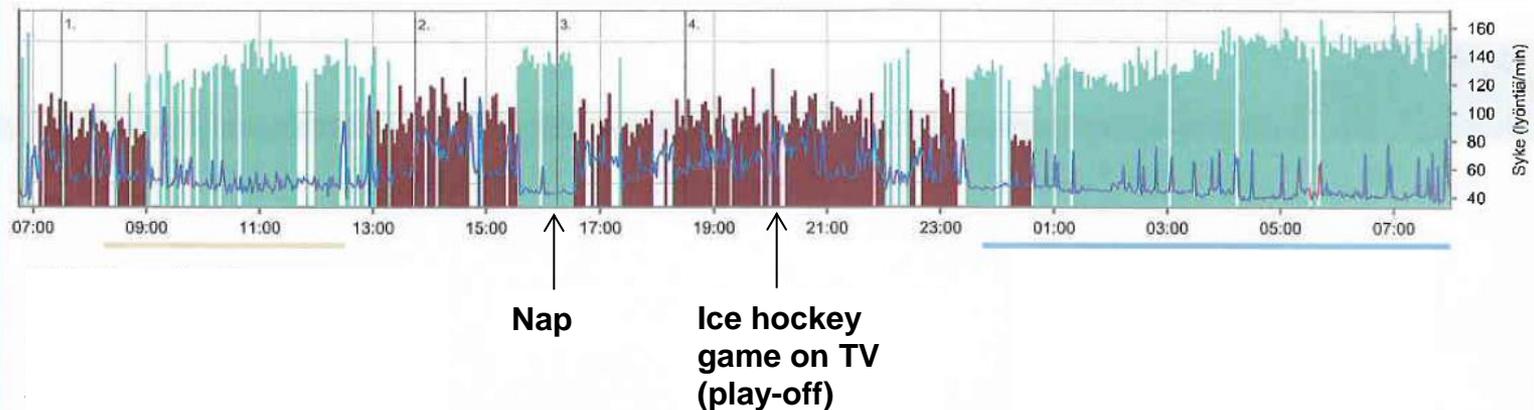
Day 1 – Wed 4th of Apr, 2012

Mittaushäiriöt 7%



Day 2 – Thu 5th of Apr, 2012

Mittaushäiriöt 3%

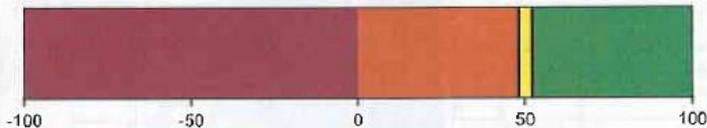


Comparison against norms → "should I do something?"

Physiological recovery during sleep compared to population reference

Day 1 – Wed 4th of Apr, 2012

Palautumisen osuus unen aikana.

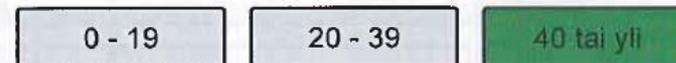


Mittauksen voimavarasapaino on **50**.

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

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

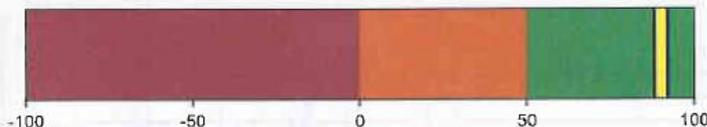
Palautumisen laatu unen aikana.



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

Day 2 – Thu 5th of Apr, 2012

Palautumisen osuus unen aikana.

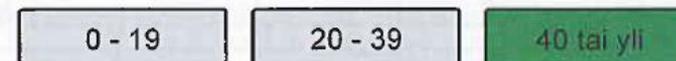


Mittauksen voimavarasapaino on **90**.

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.



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

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

Life style health report based on HRV



Working time

Nä mät reaktiot esiintyivät aikana, joka oli merkitty päiväkirjaan työajaksi.

	Hyvä	Kohtalainen	Heikko	Tuloksesi
Physical activity	> 10 min	6 - 10 min	0 - 5 min	5 min
Physical load	0 - 33 %VO2max	33 - 50 %VO2max	50 - 100 %VO2max	5 %VO2max
Recovery	30 min tai enemmän	15 - 29 min	0 - 14 min	2h 55min

Pisin palauttava jaks o työpäivän aikana oli 22min (04.04.2012 10:40 - 11:02)

Leisure time

Nä mät reaktiot esiintyivät aikana, joka ei ollut merkitty päiväkirjaan työk si ei k uneksi.

	Hyvä	Kohtalainen	Heikko	Tuloksesi		
Exercise	> 20 min	11 - 20 min	0 - 10 min	18min		
Exercise load	Tilapäinen ylikuormitus: 5	Ents ään kehittävä vaikutus: 4	Kehittävä vaikutus: 3	Ylläpitävä vaikutus: 2	Ei merkittävää vaikutusta: 1	Tilapäinen ylikuormitus (5)
Recovery	30 min tai enemmän	15 - 29 min	0 - 14 min	1h 32min		
EE during exercise	378 kcal tai enemmän	189 - 377 kcal	0 - 188 kcal	288 kcal		

Sleep

Nä mät reaktiot esiintyivät aikana, joka on merkitty päiväkirjaan uneksi.

	Hyvä	Kohtalainen	Heikko	Tuloksesi
Total recovery	50 - 100	0 - 49	-100 - -1	51
Recovery quality	50 tai enemmän	20 - 39	0 - 19	62
Sleep time	> 7 h	5,5 - 7 h	0 - 5,5 h	7h 5min

Keskimääräinen palautumisen määrä unijakson aikana oli 4h 58min.



Mutta: käyttääkö kukaan?

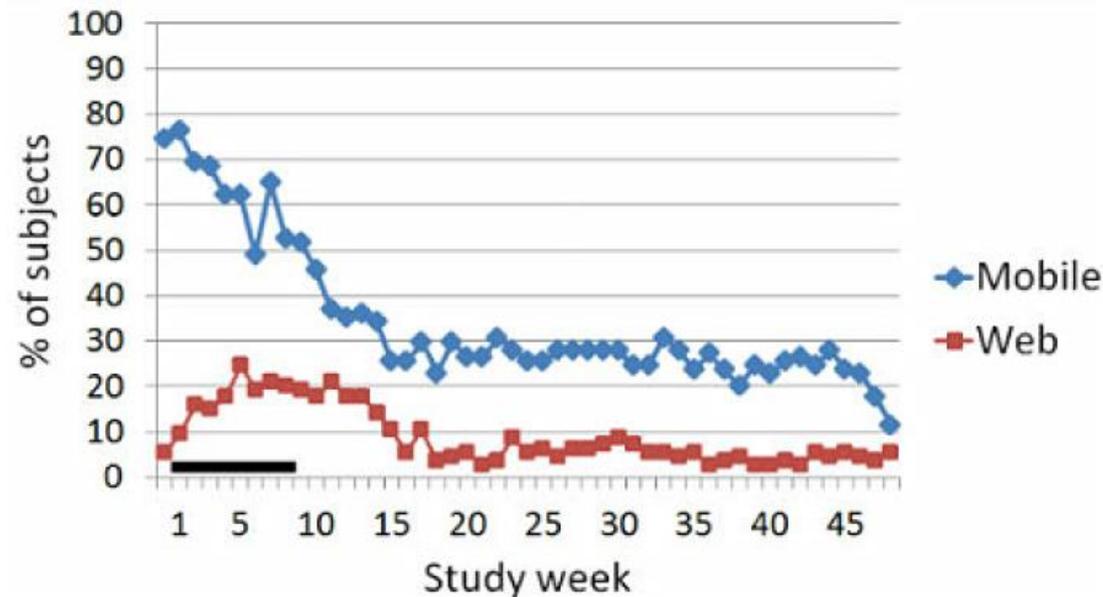
JMIR MHEALTH AND UHEALTH

Mattila et al

[Original Paper](#)

Personal Health Technologies in Employee Health Promotion: Usage Activity, Usefulness, and Health-Related Outcomes in a 1-Year Randomized Controlled Trial

Elina Mattila^{1,2}, PhD; Anna-Leena Orsama¹, MSc; Aino Ahtinen¹, MSc; Leila Hopsu³, MSc; Timo Leino³, DMSc; Ilkka Korhonen^{1,2}, PhD



Mutta: käyttö kukaan?

JOURNAL OF MEDICAL INTERNET RESEARCH

Helander et al

Original Paper

Factors Related to Sustained Use of a Free Mobile App for Dietary Self-Monitoring With Photography and Peer Feedback: Retrospective Cohort Study

Elina Helander¹, PhD; Kirsikka Kaipainen², MSc; Ilkka Korhonen^{1,2}, PhD; Brian Wansink³, PhD

Table 3. Adherence data for users who downloaded the free dietary self-monitoring app between October 15, 2011 and April 3, 2012 (n=189,770).

User group	Activity level	Description	Count, n (%)	Pictures per user, mean (SD)	Usage period in days, mean (SD)
Dropouts	Non-users	No pictures or no valid pictures	131,001 (69.03%)	-	-
Dropouts	Non-actives	Only 1 valid picture	32,948 (17.36%)	-	-
Users	Semi-actives	At least two valid pictures and less than 10 pictures or usage period shorter than 7 days	20,926 (11.03%)	4.1 (3.7)	9.3 (19.2)
Users	Actives	At least 10 pictures and usage period longer than 7 days	4895 (2.58%)	58.9 (99.5)	46.6 (37.7)





Taltioni 2015

Katsaus nykyhetkeen ja menneeseen

- ▶ Tuotannossa **pian 2,5 vuotta.**
 - > v2.0, Taltioni mobiili apps
 - > Teknologiapohja teknisesti toimiva ja vakaa
 - > Seuraavaksi valmistelussa Apple Healthkit yms. integraatiot
- ▶ Käyttäjämäärä **25K käyttäjää ja kasvu 3-500 käyttäjää viikossa.**
- ▶ Jäsenistö: 66 jäsenorganisaatiota
 - > Yhteensopivia palveluita 13
 - > 2 kuntaräätälöityä Taltioni-mobiilia
 - > Tulossa 2015: Hämeenlinnan minunterveyteni.fi ja Auria Biopankin Biopankkitili

Predicting Depression via Social Media

Munmun De Choudhury

Michael Gamon

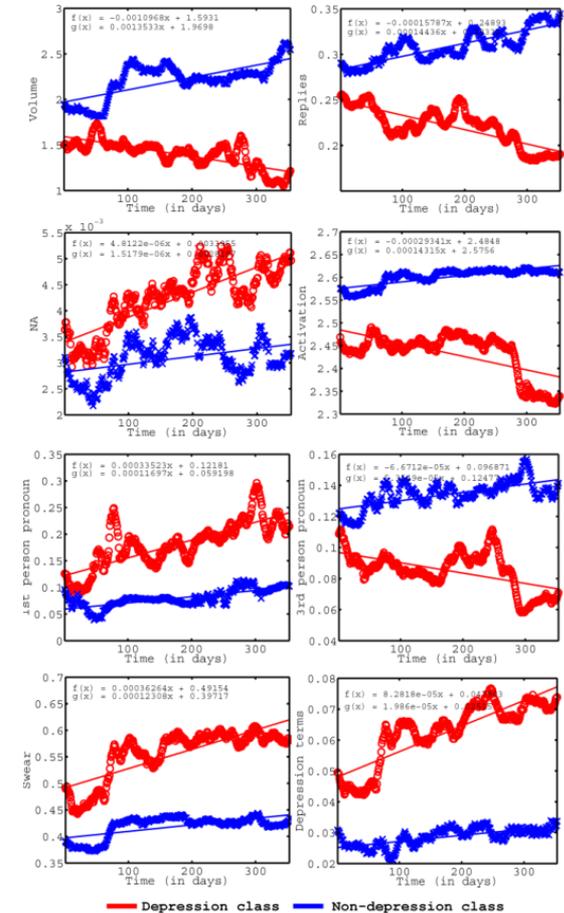
Scott Counts

Eric Horvitz

Microsoft Research, Redmond WA 98052

{munmund, mgamon, counts, horvitz}@microsoft.com

All data is health data –
not only traditional health data



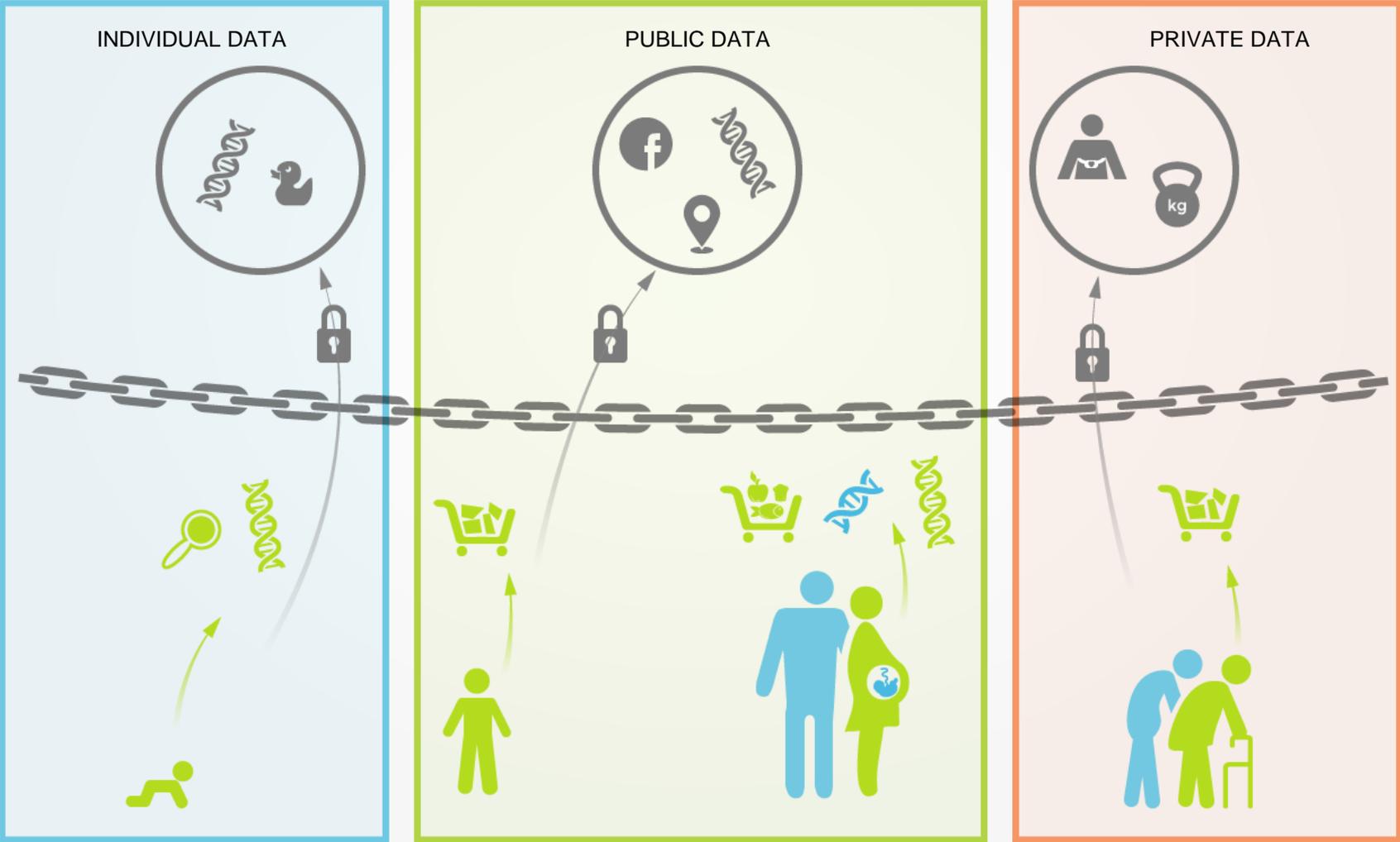


DIGITAL HEALTH REVOLUTION

Digital Traces in Connective Preventive Health

CHALLENGE TODAY

Digital data is easily captured but has limited benefits because of silos



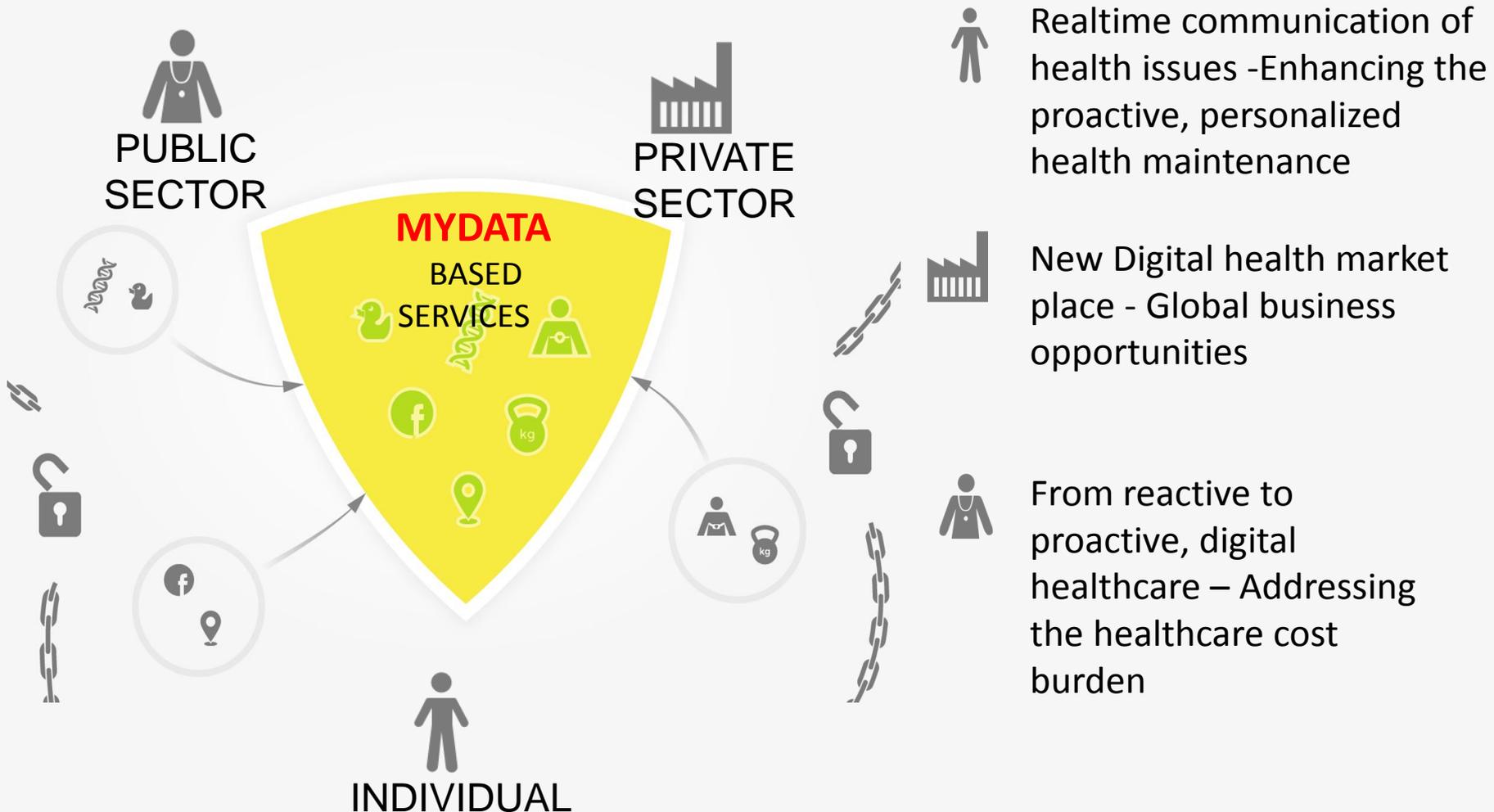
OUR VISION

“Your digital traces are health related – we’ll give them value”

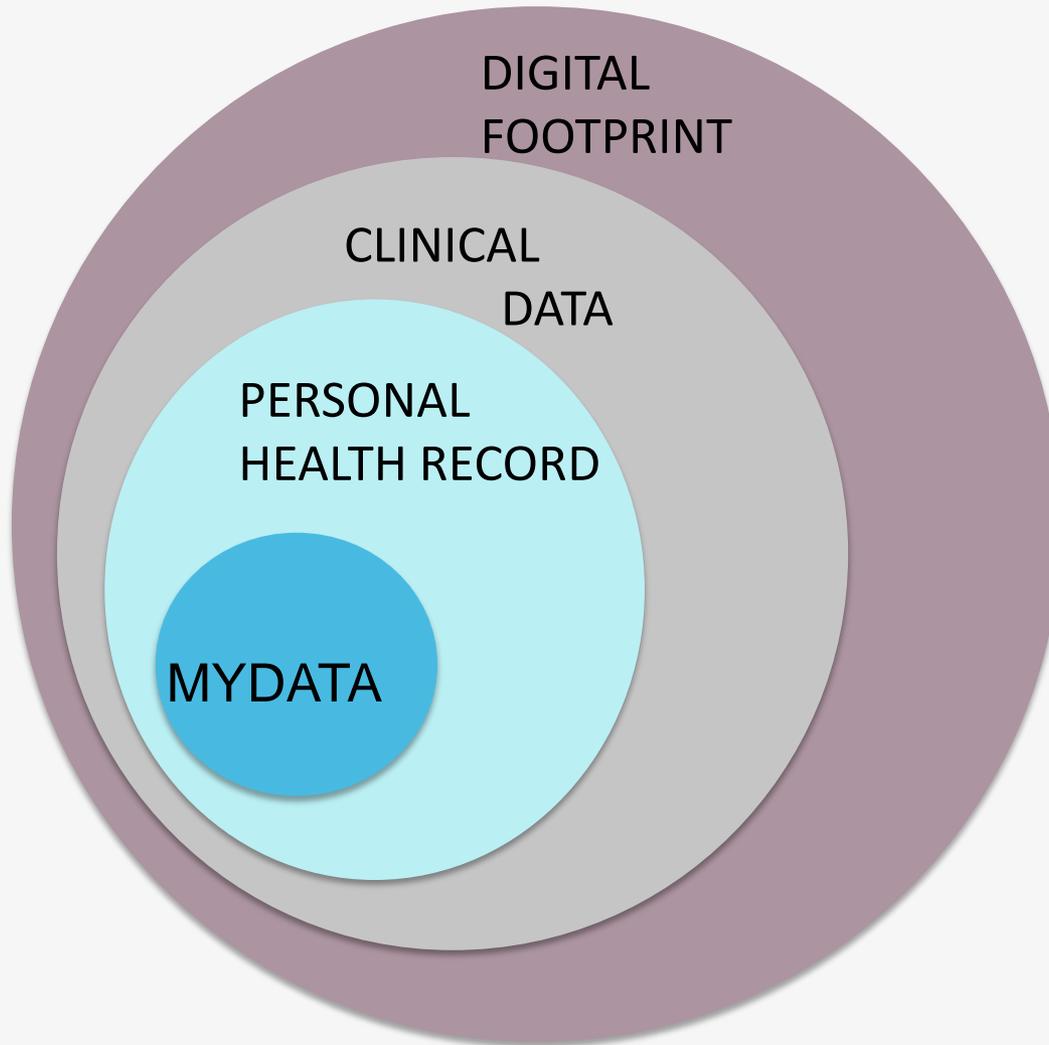


OUR SOLUTION

Personalized, predictive, preventive, participatory service ecosystem



REVOLUTION NEEDS DATA LIBERATION

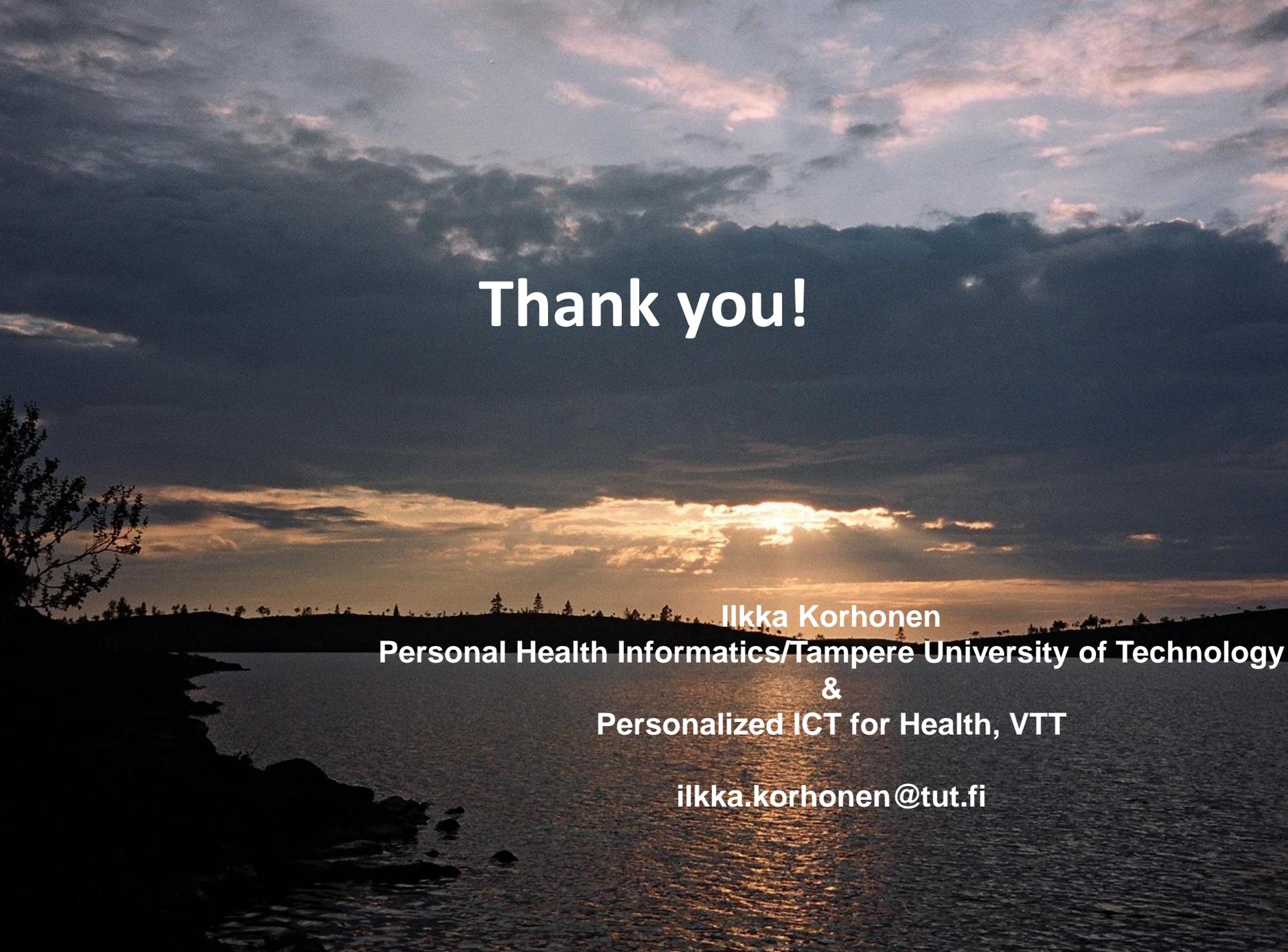


DHR project explores how more of health-related data could be transformed into Mydata, which can be utilized, combined and shared by individuals for their own benefit.

Yhteenveto

- Terveydenhuollon haasteet 2000-luvulla krooniset sairaudet ja niiden ehkäisy vähenevillä resursseilla
- Vastauksena painopisteen siirtäminen kansalaisten omatoimisuuden suuntaan ja ennaltaehkäisyyn
 - Käyttäytymis- ja elintapamuutokset
 - Omahoito, omaseuranta - mahdollisuudet
- 2000-luvun uudet terveysteknologiat on suunniteltava kansalaisille ”kuluttajina”
 - Teknologia, design ja palvelut erottamattomia
 - Korkea käytettävyys, kookuttavuus ja miellyttävyys välttämättömiä myös sairaudenhoidossa - omahoidossa
- Haasteena omaseurannan huono saavuttavuus
 - Tietosiilot
 - Kaikki data on terveysdataa



A sunset over a lake with a dark sky and a bright sun low on the horizon. The sun is partially obscured by clouds, creating a golden glow. The water reflects the light, and the sky is filled with dark, dramatic clouds. The foreground shows the dark silhouette of a rocky shore and some trees on the left.

Thank you!

Ilkka Korhonen
Personal Health Informatics/Tampere University of Technology
&
Personalized ICT for Health, VTT

ilkka.korhonen@tut.fi