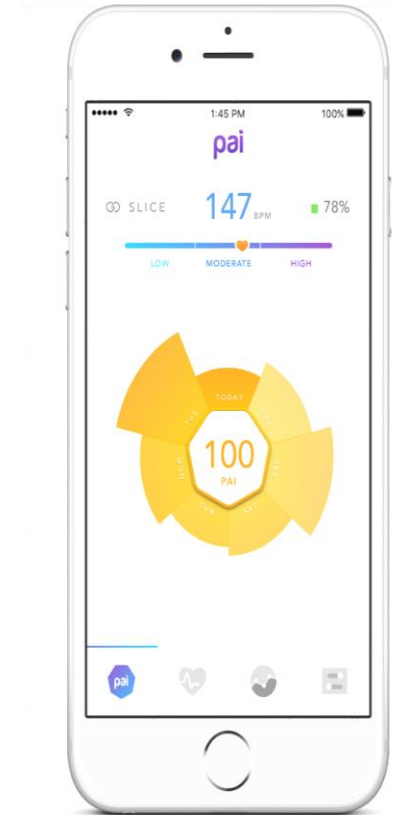


Personal Activity Intelligence

THE LONGER LIFE METRIC



Ulrik Wisløff

K.G. Jebsen – Center for Exercise in
Medicine - NTNU



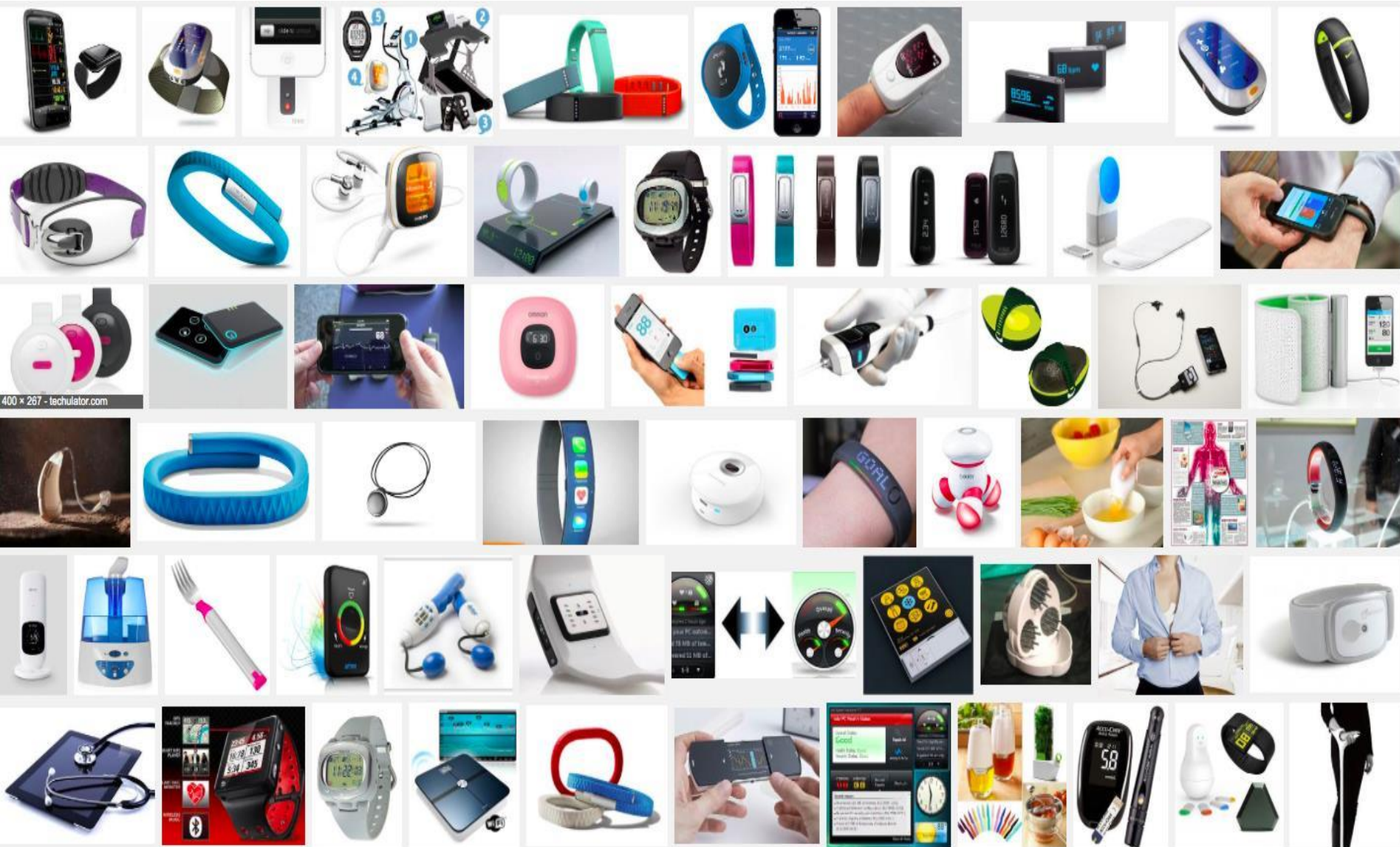
ntnu.edu/cerg



Goals such as '10,000 steps' or '30-minutes of activity per day' tend to be vague, as they do not reflect the body's response is to each activity



Wearable's and Fitness Apps



Even though everybody tries really hard



There is still no simple way to tell you how active you need to be to stay healthy.

There is no standard



Optimize your health with charts & graphs.

Get instant heart rate readings all day, every day.

Analyze your heart rate over time to identify trends and manage stress.

Review resting heart rate trends to see when health and fitness are improving.







The race is about giving you the most advanced information.

To show everything that is possible with today's technology – just because it is possible

Everybody measures heart rate.

Nobody tells you what it means.

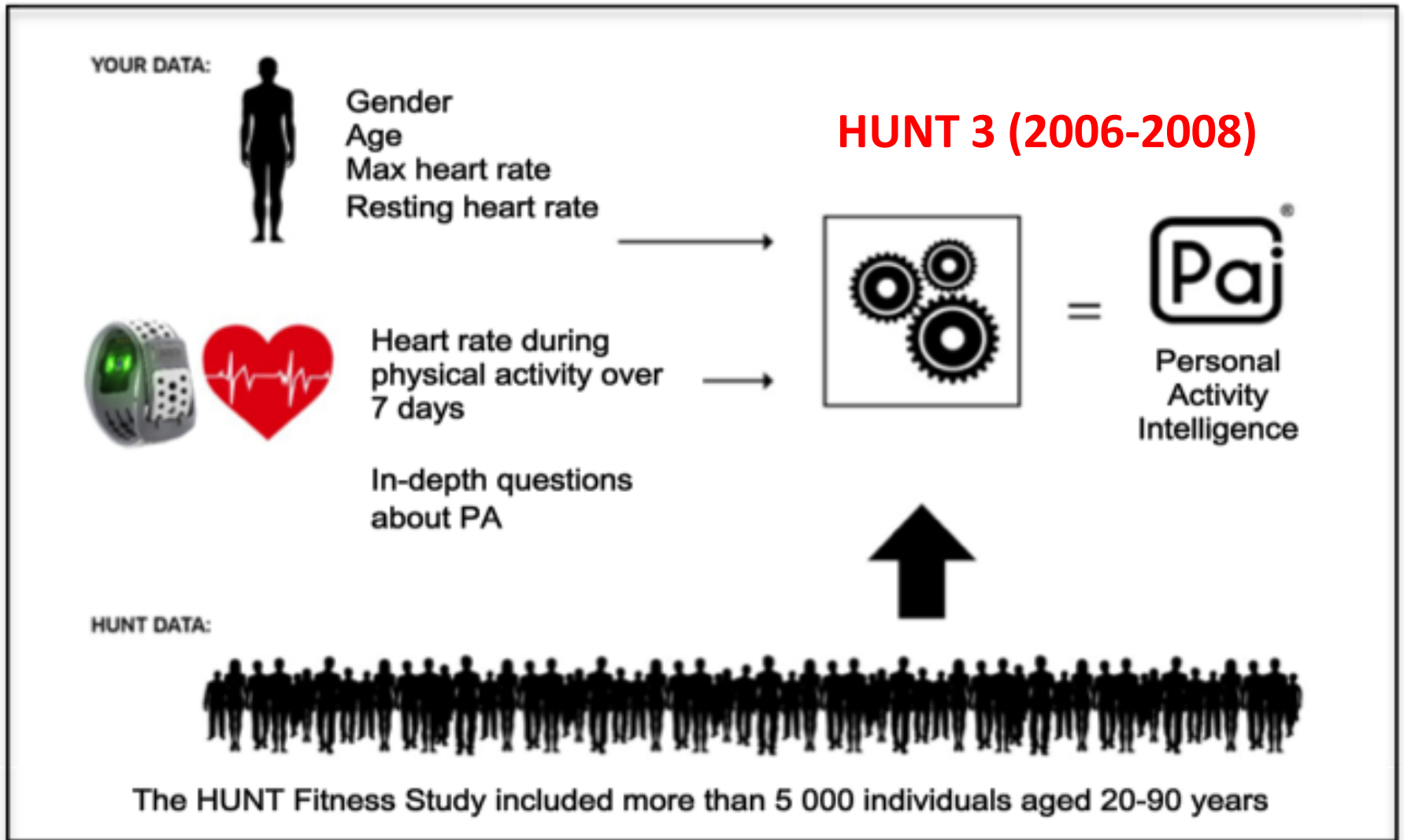


Heart rate reflects the body's response to any type of physical activity!



Scientific question

Can we make a meaningful heart rate metric for PA-tracking that could translate into lower risk of life style diseases?



The PAI level (scale from 0-100) were strongly correlated with health status

Low PAI (<50 weekly) was associated with high levels of cardiovascular risk factors (high blood pressure, high blood glucose, high cholesterol, obesity etc.)

Back to the 80's



HUNT 1 (1984-86)

♂ 19,269

♀ 20,029



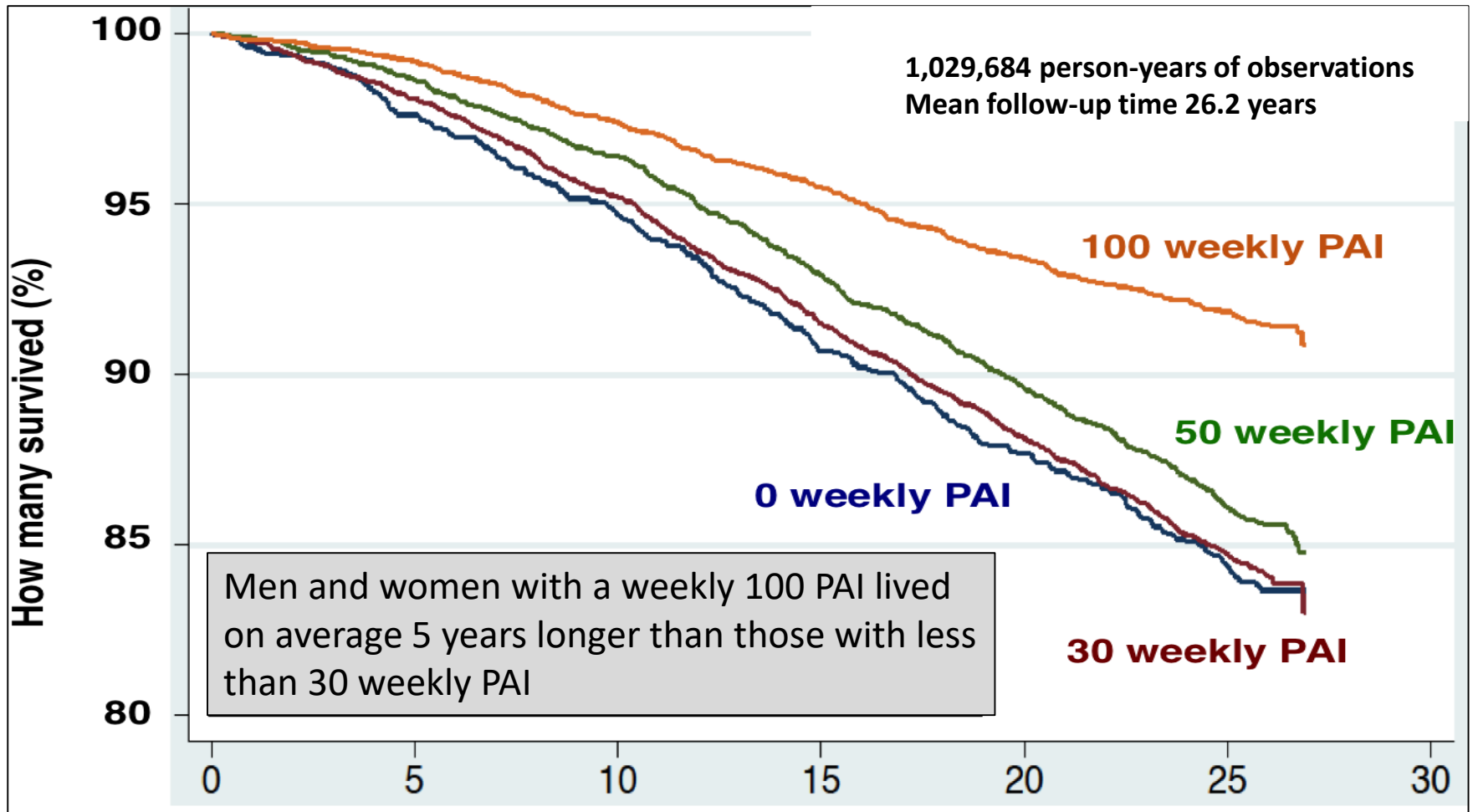
~26 years

1,029,684 person-years of observations

2012

10,062 deaths

3,857 CVD deaths



Most effect of 100 weekly PAI in those starting at “young age”. For instance individuals aged **55-60 years old and 100 weekly PAI lived on average 7 years longer** than those with less than 100 weekly PAI, whereas the corresponding number for **those above 70 years old were about 2 years increased lifespan.**



Smokers

Men and women smokers with ≥ 100 PAI had CVD risk reductions of 30%



Hypertension

Hypertensive men and women with ≥ 100 PAI had CVD risk reductions of 30%



Overweight

Overweight men and women with ≥ 100 PAI had CVD risk reductions of 30%



Type 2 Diabetes

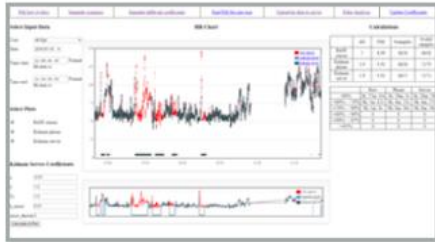
Type 2 Diabetic men and women with ≥ 100 PAI had CVD risk reductions of 54%

“To get such a product to the market you need at least 200 million USD”

So we either needed investors that would, in practical terms, own 99% of our idea/product or we needed to collaborate with someone state-of-the-art hardware



We built a strategically strong team to make our innovation fly



The engineer

$$\bar{y}(t) = \frac{y(t) - y_{rest}}{y_{max} - y_{rest}} ; \bar{y}_k = \frac{y_k - y_{rest}}{y_{max} - y_{rest}}$$

$$z(t) = c_1(e^{c_2 \bar{y}(t)} - 1) ; z_k = c_1(e^{c_2 \bar{y}_k} - 1)$$

$$P = \int_{-T}^0 z(t) dt ; P = \sum_{i=-N}^k \Delta T_i z_i$$

$$V = c_3 + c_4(1 - e^{-P})$$

$$PAI = 100 \frac{(V - c_3)}{V_{threshold} - c_3}$$

The biomedical modelling doctor



The marketing guy

The scientist



The door opener





Destination California



The scientist and the marketing guy on their way from Los Angeles to Silicon Valley

In a Porsche Boxster – hired by the marketing guy!



Apple Campus
One Infinite Loop



Destination Norway

The door opener



MIO FUSE
Heart Rate + Activity Tracker



MIO LINK
Heart Rate Wristband



MIO ALPHA 2
Heart Rate Sport Watch

Destination Vancouver





The whole team went to Vancouver

No Porsche Boxster!





Destination Las Vegas

2016 International



THE GLOBAL STAGE FOR INNOVATION

www.cesweb.org





Mio Slice
Powered by NTNU - Norway

THE WALL STREET JOURNAL.

New Ways to
Track Fitness

PERSONAL JOURNAL | D1



James Freeman
The Tax Reform
Party of 2016

OPINION | A13

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42 million unique monthly visitors

With Mio, Track Your Activity Intelligence, Not Steps

BY GEOFFREY A. FOWLER

We've all heard the advice: Take 10,000 steps daily. That seemingly simple goal sold millions of fitness trackers, most of which put your step count front and center.

It's also one reason many of these gadgets end up gathering dust. I have a hard time squeezing in thousands of steps between meetings and lunch over my keyboard. And for those who can't board, a 10,000 hardly guarantees a Kar-10,000 dasher physique.

Now fitness gadgets are ditching step counting for heart-rate tracking—and much more personalized measures. Mio Global, familiar to serious athletes for its wrist pulse trackers, developed a



PERSONAL TECHNOLOGY

fitness metric that interprets your specific heart patterns, based on a large health study. To maintain optimal health, Mio claims, just do enough strenuous activities to keep your Personal Activity Intelligence score at 100. Easy as PAI.

Actually, it's a commitment—tough but attainable for someone like me who's climbing back onto the fitness wagon. But using Mio's new PAI app to monitor my activity has changed the way I think about getting in shape. While Mio's hardware isn't (yet) as elegant as others on the market, PAI is the best example yet of how wearables can turn data about our bodies into tailored, actionable advice—and hopefully longer lives.

Step counters ignore the imperative to raise your heart rate, which the American Heart Association and others say is key to stemming our No. 1 killer, heart disease. (Walking isn't necessarily strenuous, unless you only go uphill.) Ba-



Fitness trackers collect a lot of data. A new app from Mio tries to turn that data into an overall cardiac health score called Personal Activity Intelligence, PAI. A screen shot of the PAI score app Mio, right.

heart rate as an additional index of overall fitness and stress. Jawbone offers a "smart coach" that looks for patterns in your habits. The Apple Watch records heart rate during workouts, and replaces step-counting with three rings that make a game out of increasing calorie burn, moderate exercise and standing.

Mio's PAI goes further, turning all that heart-rate data into one easy-to-understand number. Connect the PAI smartphone app to a Mio band such as the \$150 Fuse, and every time you raise your heart rate, you contribute to your PAI score. The more you exert yourself, the more points you earn. Research shows keeping your PAI consistently at 100 or higher could increase your life span by at least two years, and up to 10 years if you are under 50, Mio says.

Everyone's PAI is a little different, by design. The formula takes into account age, gender, resting heart rate, max heart rate and other signals unique to your body. It's Big Data for your body—finally,

on a Tuesday after getting stuck at your desk on a Monday.

I took an hour-long three-mile walk that tallied nearly 6,000 steps, yet earned me just 7 PAI. But 30 intense minutes on a bike was worth 56 PAI. The app includes a slider tool to help you estimate what kind of activity you need to do, and for how long, to earn any amount of PAI. You don't



an understanding about what lifestyle factors contribute to disease and death, including a prevalence of obesity.

Two years ago, a team led by Norwegian University of Science and Technology Prof. Ulrik Wisloff used HUNT data to create a mathematical model of the optimal amount of cardio activity to lengthen lifespan, giving birth to the PAI score.

"It's not as simple as counting minutes of exercise per week," said Mr. Wisloff in an interview, but from cross-country skiing. He maintains a PAI of 130 to 150, though says there's little statistical advantage in longevity to overshooting 100.)

Mio won't describe everything that goes into PAI, and Mr. Wisloff's research has yet to be published in a peer-reviewed journal.

Dr. Richard Stein, a cardiology professor at NYU and spokesman for the American Heart Association, said he wasn't familiar with the specifics of PAI, but agrees it's useful to consider both the quantity and intensity of physical activity.

Many wrist-based trackers have a reputation for poor accuracy in heart-rate data. Mio, which has been making heart trackers for 15 years, pointed to a San Francisco State University study that found Mio's tech had a high correlation to readings from an electrocardiograph machine during cycling and running.

PAI still has a few other problems. The bulky Mio Fuse band was originally designed to measure workouts, but leaving it on all day to measure PAI means you have to charge it nightly. The PAI app also sometimes struggled to connect with the Fuse over Bluetooth. Anyone looking for a simple PAI experience will probably want to wait until this summer, when Mio plans to ship a sleeker new made-for-PAI wearable called the Six.

Mio says they're also open to making PAI available for other fitness devices in the future. (I'd love it as an app on the much more handsome Apple Watch.) The fitness software race is still wide

have to tell it you're exercising; as long as the waterproof armband is reading your pulse, it knows on its own.

The fitness industry is filled with mumbo-jumbo and pseudoscience, but PAI has roots in one of the largest longitudinal health research projects. The HUNT Study tracked 20 years of activity from 60,000 Norwegian people to gain

What's Your Personal Activity Intelligence?

Mio gives more credit for strenuous activity

Activity:

Sarah walks to and from work 20 minutes + 45 minute walk with dog after work = 10,500 Steps, 10 PAI score

DAY 1

Sarah walks to and from work 20 minutes + Goes to the gym for 1 hour spin class and weights = 5,500 Steps

Analysis:

Even though Sarah's step count is over 20,000, the leisurely pace means heart rate stays low and overall health benefits are limited.

Sarah didn't reach her 20,000 daily step goal but earned more PAI.

Even though Sarah's step count is over 20,000, the leisurely pace means heart rate stays low and overall health benefits are limited.

Sarah didn't reach her 20,000 daily step goal but earned more PAI.

FAST COMPANY

999 reasons
BUZZFEED is No. 1

OMG?! **NETFLIX**
beats **AMAZON!**

Can you guess where
APPLE ranks?

Crazy numbers at **UBER**,
SNAPCHAT, **SOULCYCLE**

Yes, **TACO BELL!**
(Sorry, Chipotle)

Why **FACEBOOK**
scares everyone

Goodbye **GOOGLE**,
Hello **ALPHABET**

What the heck is
RIOT GAMES?

Badass obsessions:
AIRBNB, **FARFETCH**, **HUDL**

Can **SLACK** make you
love work?

THE WORLD'S 50 MOST INNOVATIVE COMPANIES

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THE WORLD'S 50 MOST
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TOP COMPANIES WITHIN FITNESS

Mio

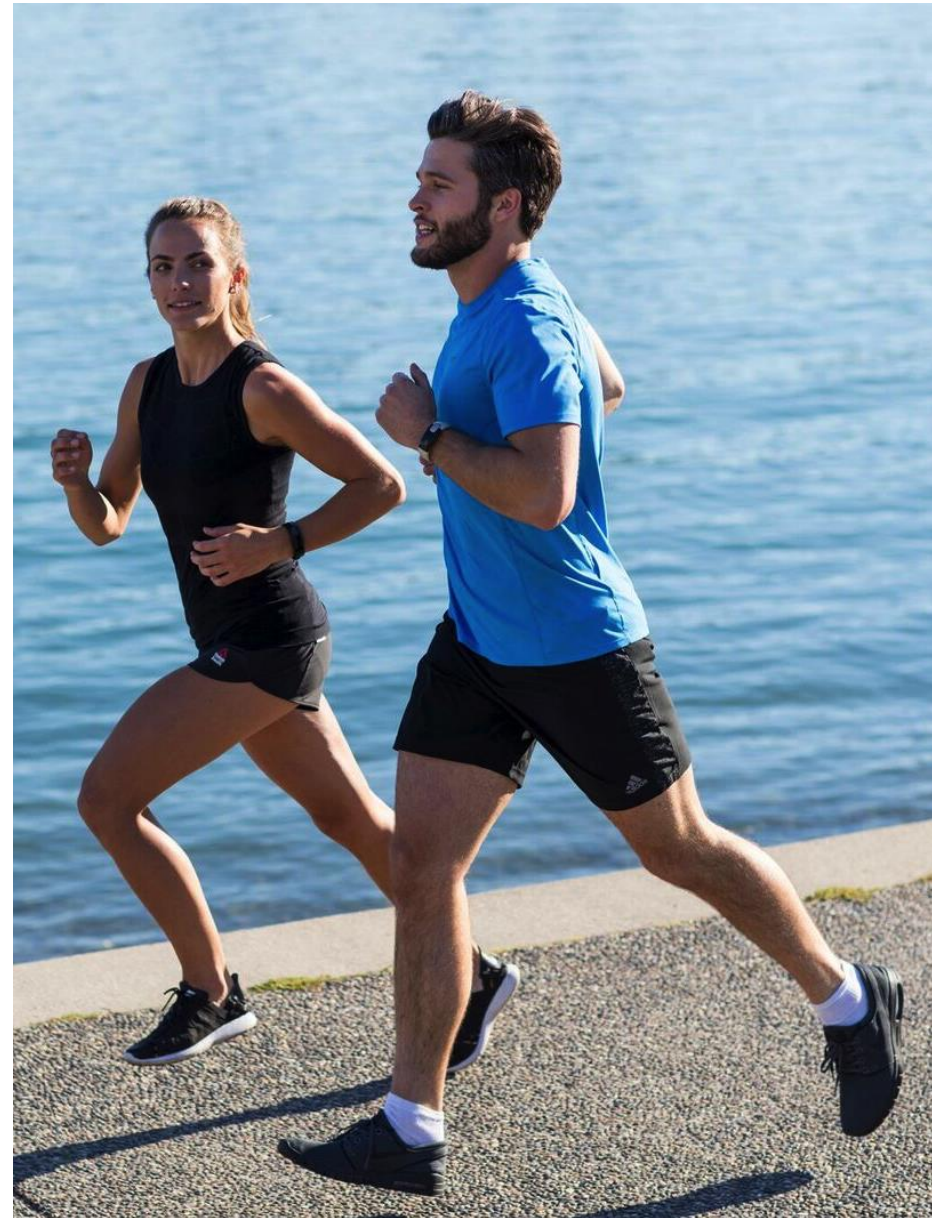
«For calculating a better metric for wearables»



- ✓ Meaningful and big data for your body
- ✓ Not “only another new metric”



- ✓ Associated with longevity regardless of following today's advice for PA or not
- ✓ Potential to become a motivational game changer for PA – meaningful data to the user



How to reach a 100 PAI?

100 PAI can be achieved at different intensities, frequencies and duration in various preferred activities over the course of 7 days, the higher the intensity, the shorter the time needed.



How hard is it to obtain 100 PAI?

The algorithm incorporates the fact that the major reduction in mortality occurred between the least active (<50 PAI) and the next-least active people (51-99 PAI), and it is easier to earn the first 50 vs. the next 50 PAIs.

More beneficial to obtain more than 100 PAI?

In terms of risk, no further reductions in CVD or all-cause mortality were observed for scores progressively higher than 100 PAI.

Different from today's advice for PA?

Participants who did not obtain ≥ 100 PAI had increased risk of dying regardless of meeting the physical activity recommendations from leading health authorities.



MIO SLICE

ALL-DAY HEART RATE + ACTIVITY TRACKER



THE FIRST WEARABLE TO FEATURE PAI



PAI – A New World Standard for Activity Tracking?

Powered by NTNU - Norway

Knowledge for a better world

Worldwide PAI





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