Are wearable technologies the future of cardiac rehabilitation ?

Assist. Prof. Visal Kantaratanakul, MD,
* Board Certified in Rehabilitation Medicine
* Director, Samitivej Srinakarin Rehabilitation Center
* Member, Exercise Expert Committee,
Ministry of Public Health
* Inviting lecturer, Mahidol University,
Mae Fah Luang University, Kasetsart University

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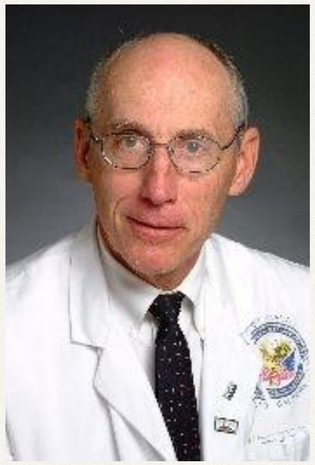
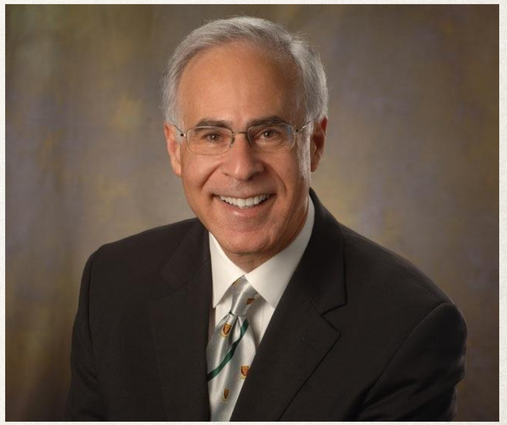
My Mentors in cardiac rehabilitation field





Michael L. Pollock, 61, an Expert on Exercise

By FRANK LITSKY JUNE 12, 1998

Michael L. Pollock, perhaps the nation's most respected expert on how much and how hard adults should exercise, died last Friday at age 61. He suffered a stroke that afternoon at the annual meeting of the American College of Sports Medicine in Orlando, Fla., and died that night, according to the organization.

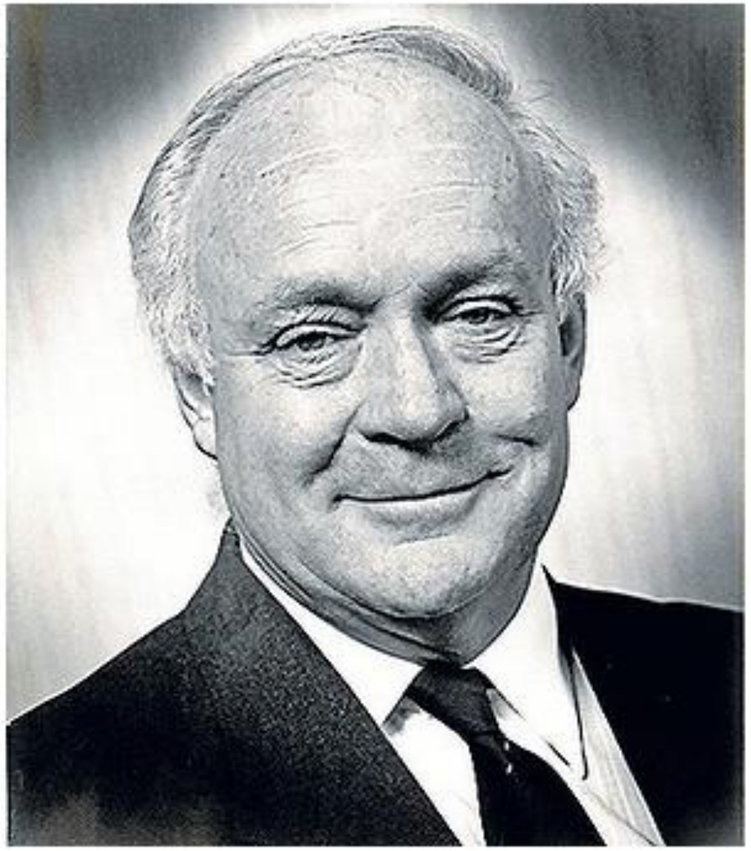
Mr. Pollock, of Gainesville, Fla., published three books and more than 300 articles on exercise. Barry Franklin, the president-elect of the organization, the world's preeminent sports medicine institution, called him "a giant in the field of exercise science, a man largely responsible for the knowledge base we have today in exercise training and cardiac rehabilitation."

ALAN JAMES GOBLE, OAM CARDIOLOGIST, REHABILITATION PIONEER

5-7-1925 — 27-7-2012

DR ALAN Goble, the first Australian cardiologist to recognise the importance of cardiac rehabilitation programs and the need for funding to support them, has died at an aged care facility in Balwyn. He was 87.

Goble was the founder and initial chairman of the Heart Research Centre (HRC) after it moved out of the National Heart Foundation in 1993 to be a stand-alone organisation; in



Dr Alan Goble.

Remembering Dr. Terry Kavanagh, a pioneer in cardiac rehabilitation

Dr. Terry Kavanagh

10/09/2018

Jelena Damjanovic

The Faculty of Kinesiology and Physical Education is remembering a leader in cardiac rehabilitation, Professor Emeritus **Terry Kavanagh**, who died on September 10 at the age of 91. Dr. Kavanagh held joint positions at the Faculty of Medicine and the School of Physical and Health Education, later renamed to KPE.

My series of lecture

- Benefits of exercise: 2000
- Setting of cardiac rehabilitation: 2000-Now
- Concept of cardiac rehabilitation: 2000-2010
- Series in APCCRC: CR in Thailand, Return to work, High risk clinic, Metabolic syndrome, Exercise is Medicine
- Cardiac rehabilitation in heart failure, in AICD: 2007-2014
- Model of cardiac rehabilitation: 2012-13
- Cardiac rehabilitation, where program should be promoted: AFCC 2014
- Exercise training: AFCC 2014
- High risk clinic @ World Congress of Cardiology 2014 Melbourne

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1996

Cardiac Rehabilitation Society of Thailand

2018

Cardiac Prevention and Rehabilitation Society of Thailand

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Are wearable technologies the future of cardiac rehabilitation ?

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My covers

- Supporting evidences
- Review of tele-health devices
- Our experiences

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Cardiac telerehabilitation

- without any high technology: telephone call, texting etc.

- With high technology: wearable devices. ECG monitoring etc.

REVIEW Open Access

A review of wearable sensors and systems with application in rehabilitation

Shyamal Patel[1,2], Hyung Park[3], Paolo Bonato[1,4], Leighton Chan[3] and Mary Rodgers[5,6*]

Abstract

The aim of this review paper is to summarize recent developments in the field of wearable sensors and systems that are relevant to the field of rehabilitation. The growing body of work focused on the application of wearable technology to monitor older adults and subjects with chronic conditions in the home and community settings justifies the emphasis of this review paper on summarizing clinical applications of wearable technology currently undergoing assessment rather than describing the development of new wearable sensors and systems. A short description of key enabling technologies (i.e. sensor technology, communication technology, and data analysis techniques) that have allowed researchers to implement wearable systems is followed by a detailed description of major areas of application of wearable technology. Applications described in this review paper include those that focus on health and wellness, safety, home rehabilitation, assessment of treatment efficacy, and early detection of disorders. The integration of wearable and ambient sensors is discussed in the context of achieving home monitoring of older adults and subjects with chronic conditions. Future work required to advance the field toward clinical deployment of wearable sensors and systems is discussed.

Keywords: Wearable sensors and systems, Home monitoring, Telemedicine, Smart home

Patel et al. Journal of NeuroEngineering and Rehabilitation 2012, 9:21

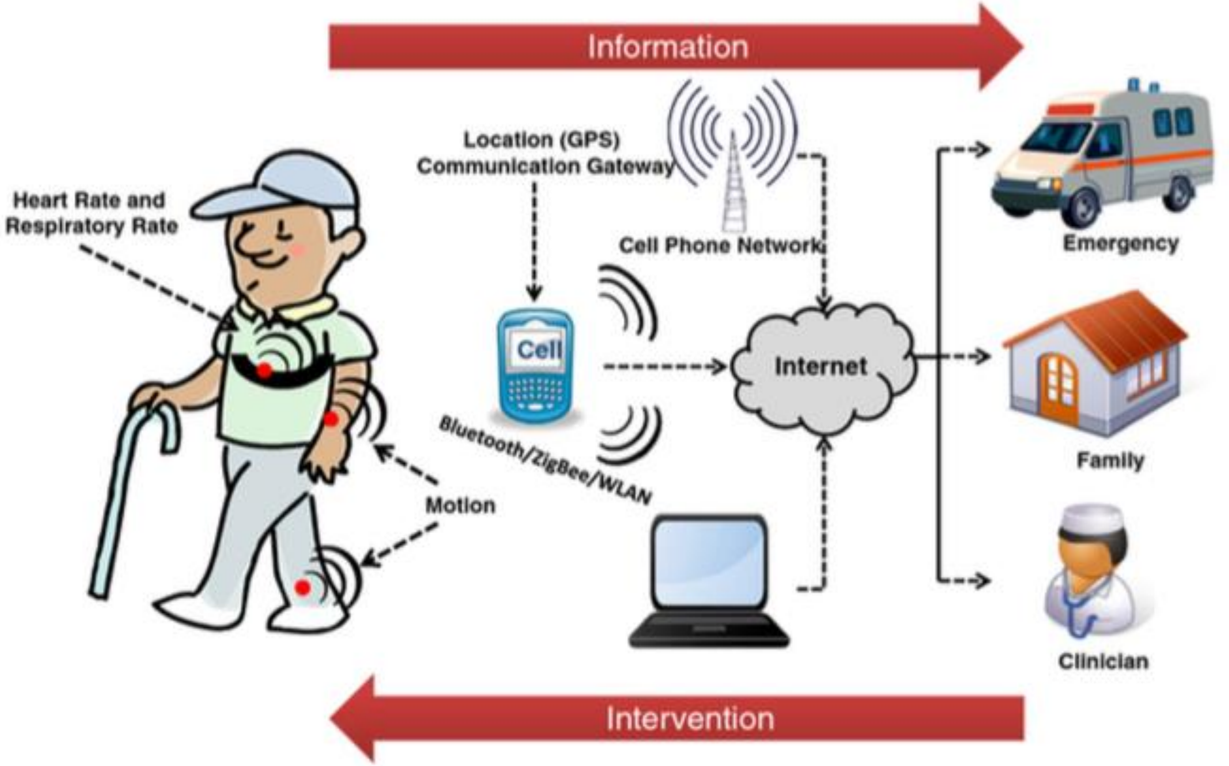
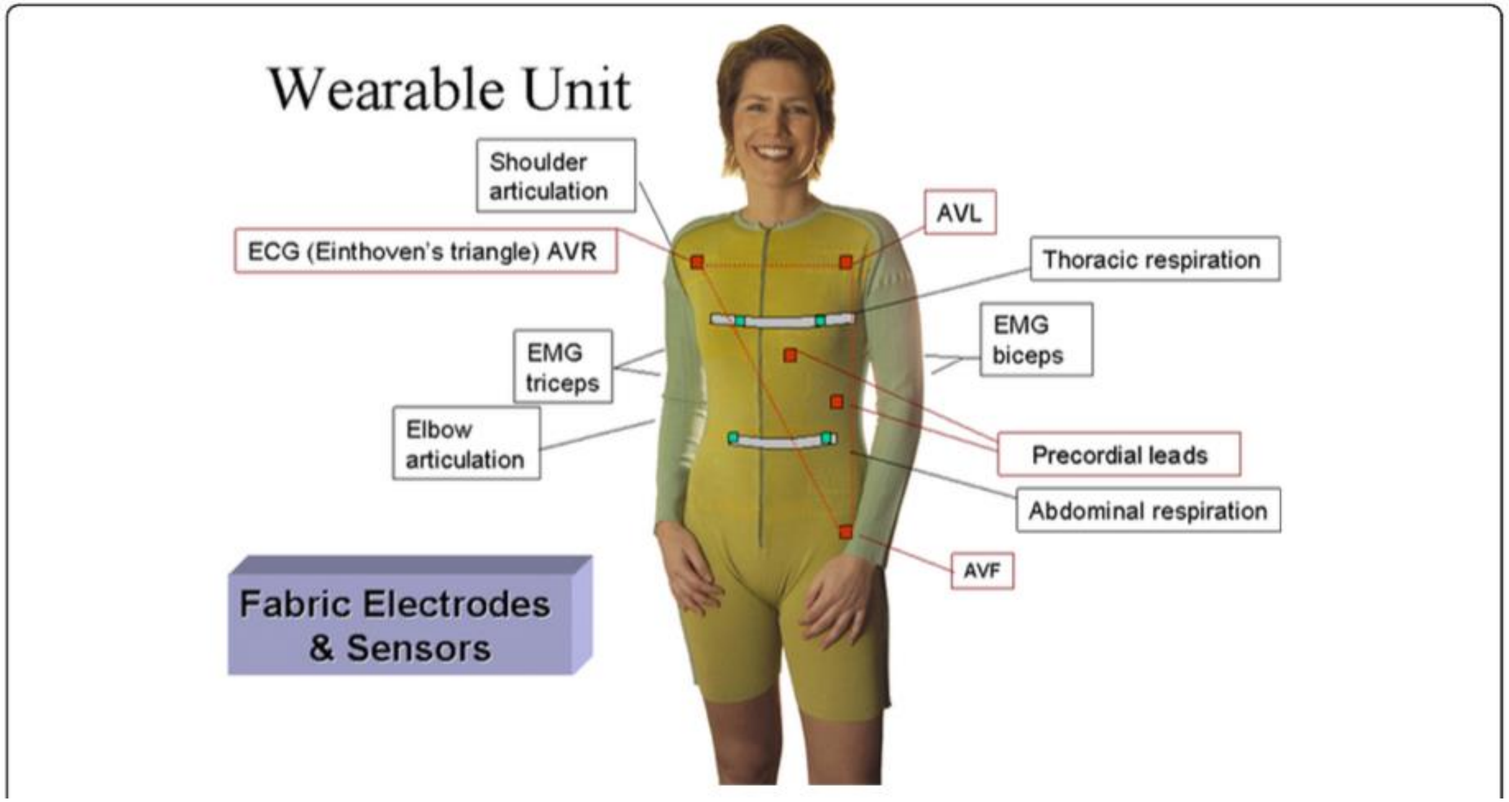


Figure 1 Illustration of a remote health monitoring system based on wearable sensors. Health related information is gathered via body-worn wireless sensors and transmitted to the caregiver via an information gateway such as a mobile phone. Caregivers can use this information to implement interventions as needed.



Application of system

- health and wellness monitoring
- safety monitoring
- home rehabilitation
- assessment of treatment efficacy
- early detection of disorders.

Are wearable tech the future of CR ?

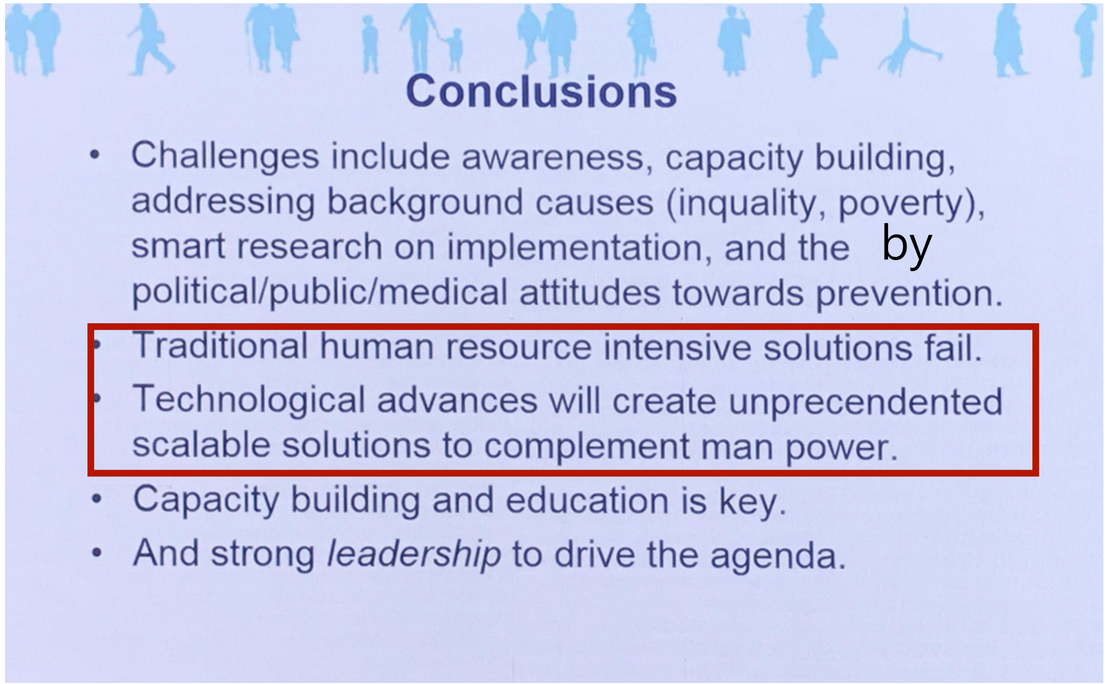
The answer is YES

There are 3 topics in this conference on wearable

- The Role of Technology in Exercise Promotion
Dr. Tee Joo Yeo

- this lecture

-Cardiac Rehabilitation using Wearable Sensor for Monitoring Physical Activity by Dr. Yutaka Kimura



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Telehealth exercise-based cardiac rehabilitation: a systematic review and meta-analysis

Jonathan C Rawstorn,[1,2] Nicholas Gant,[2] Artur Direito,[1] Christina Beckmann,[3] Ralph Maddison[1]

Objectives

This meta-analysis aimed to determine the benefits of telehealth exCR on exercise capacity and other modifiable cardiovascular risk factors compared with traditional exCR and usual care, among patients with coronary heart disease (CHD).

Results

- 11 trials (n=1189) met eligibility criteria
- Physical activity level was higher following telehealth exCR than after usual care.
- Compared with centre-based exCR, telehealth exCR was more effective for enhancing physical activity level, exercise adherence, diastolic blood pressure and low- density lipoprotein cholesterol.
- Telehealth and centre- based exCR were comparably effective for improving maximal aerobic exercise capacity and other modifiable cardiovascular risk factors.

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Rawstorn JC, et al. Heart 2016;102:1183–1192.

Telehealth defining

Telehealth exCR interventions used ICT (eg, telephone, mobile/smartphone, mobile application [app], portable computer, Internet, biosensors) to deliver or monitor structured exercise training that included prescriptive components such as frequency, level of intensity and duration. Telehealth and centre-based exercise could be deliv- ered alone or as part of comprehensive CR.

Rawstorn JC, et al. Heart 2016;102:1183–1192.

Telehealth exercise-based cardiac rehabilitation: a systematic review and meta-analysis

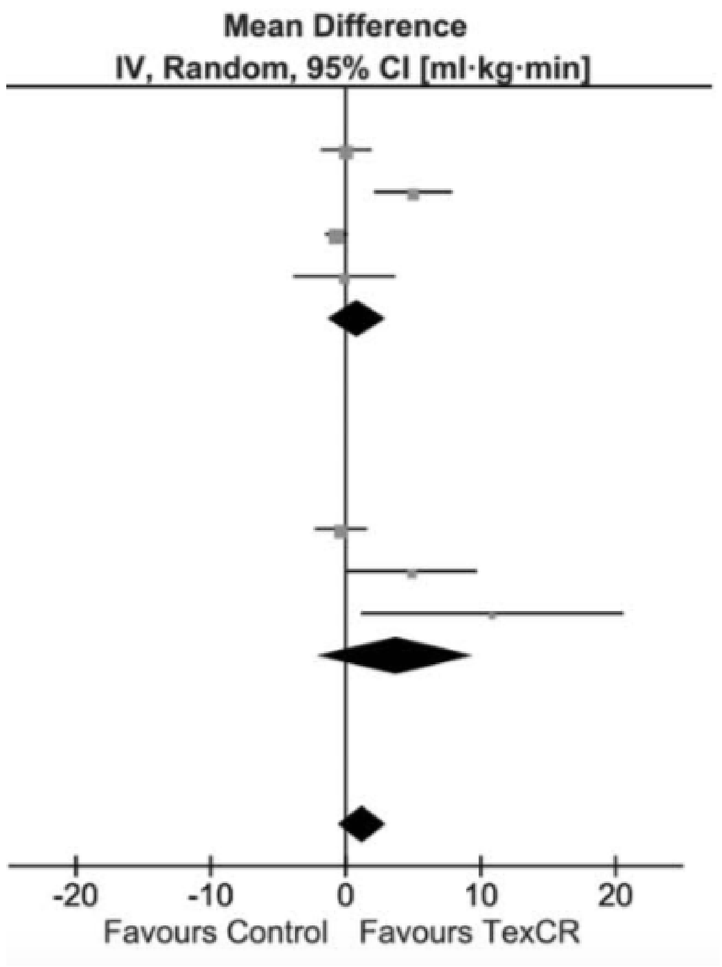
Jonathan C Rawstorn,[1,2] Nicholas Gant,[2] Artur Direito,[1] Christina Beckmann,[3] Ralph Maddison[1]

Conclusions

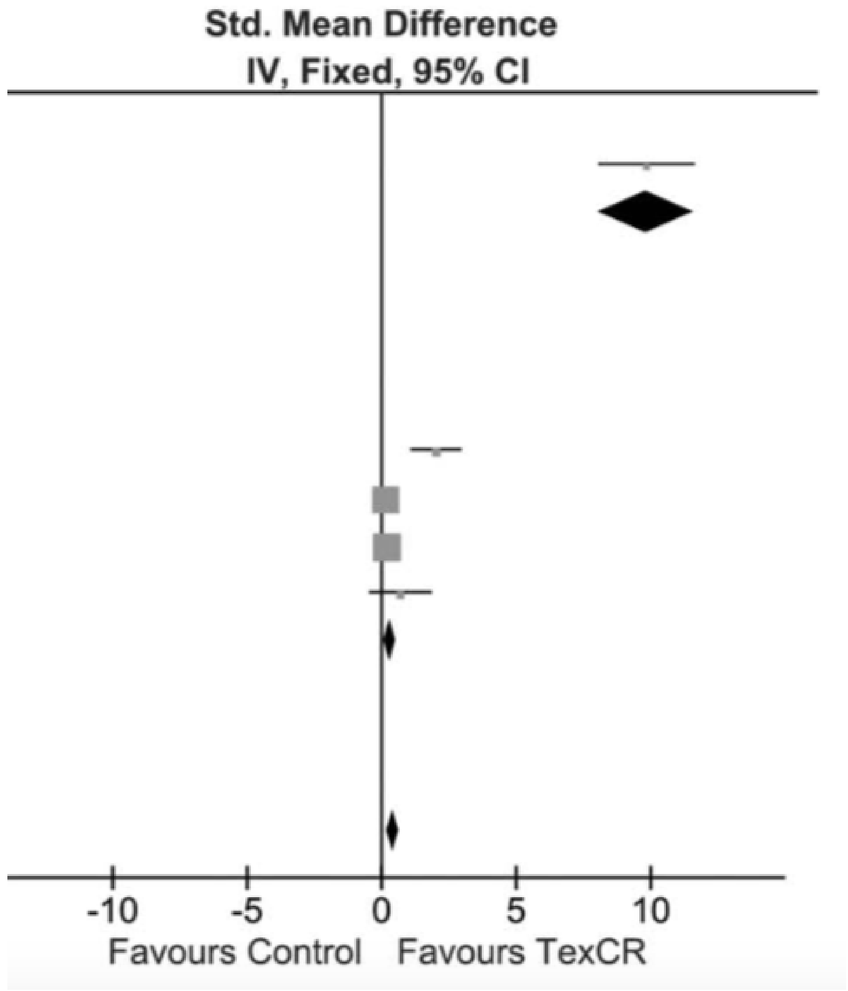
- Telehealth exCR appears to be at least as effective as centre-based exCR for improving modifiable cardiovascular risk factors and functional capacity, and could enhance exCR utilisation by providing additional options for patients who cannot attend centre-based exCR. Telehealth exCR must now capitalise on technological advances to provide more comprehensive, responsive and interactive interventions.

Rawstorn JC, et al. Heart 2016;102:1183–1192.

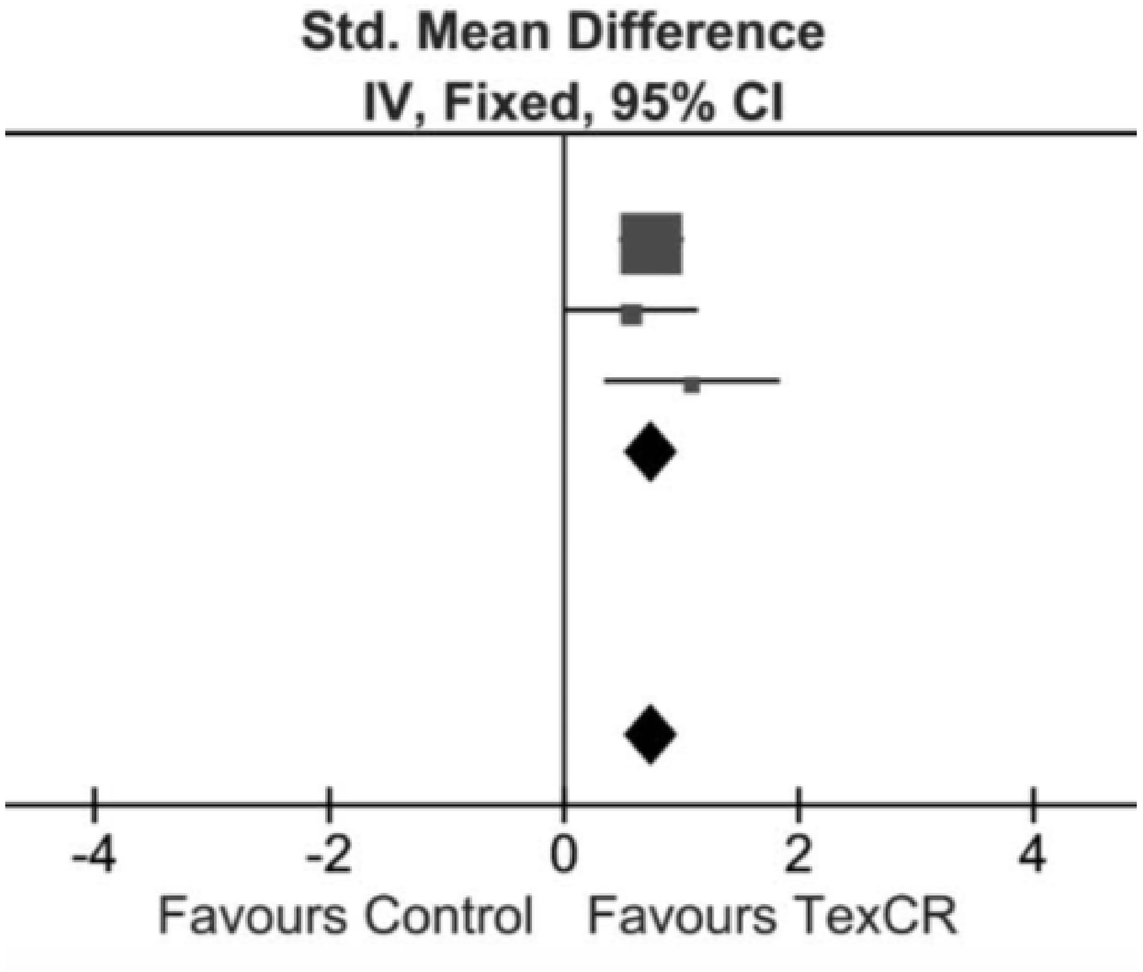
The effects



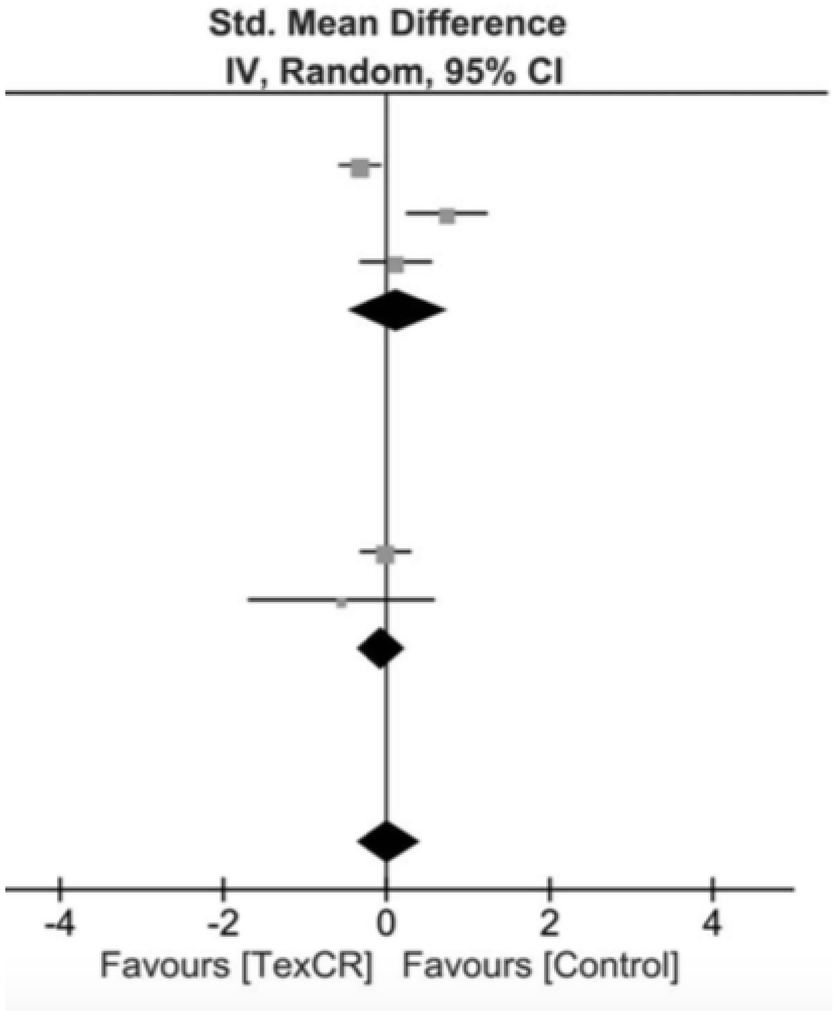
maximal aerobic exercise capacity.



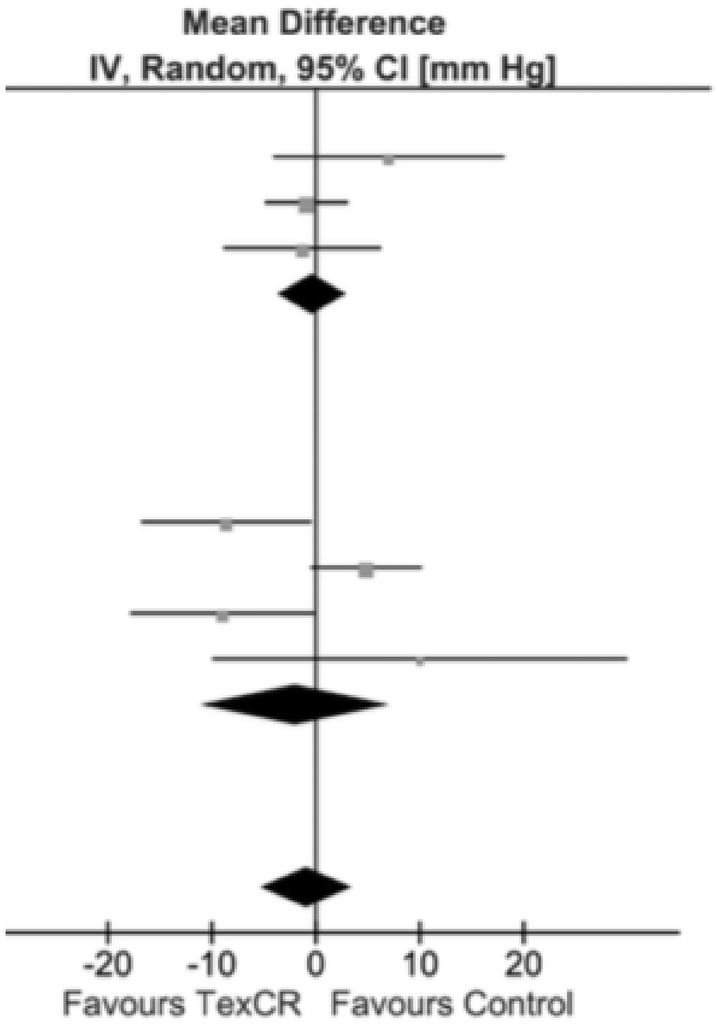
physical activity level



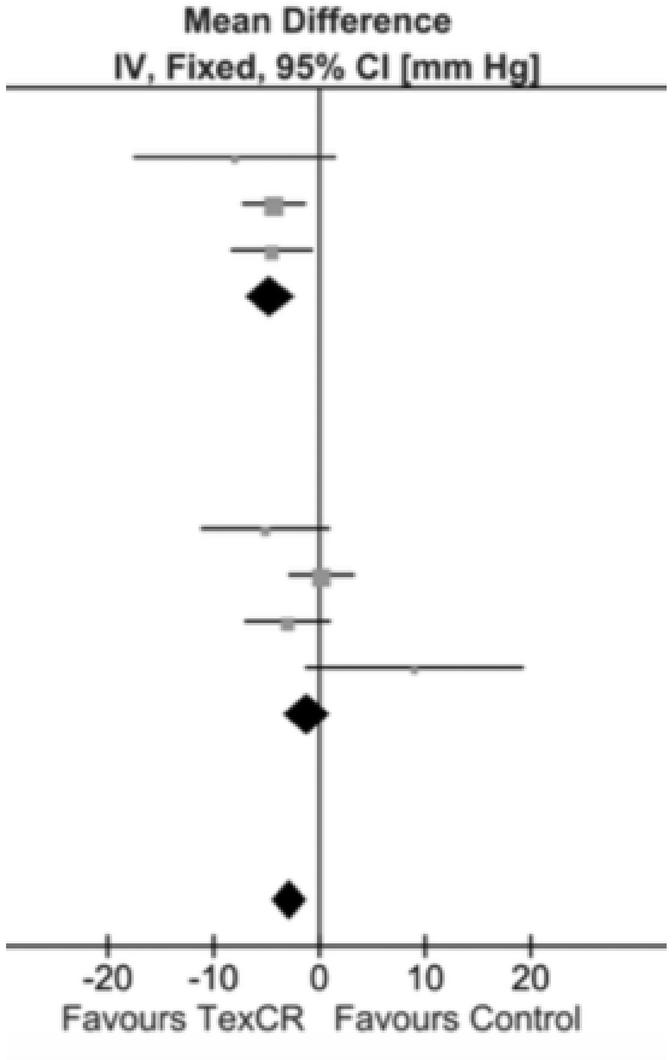
exercise adherence



body composition



systolic blood pressure.



diastolic blood pressure.

Effects and costs of home-based training with telemonitoring guidance in low to moderate risk patients entering cardiac rehabilitation: The FIT@Home study

Jos J Kraal[1*], Niels Peek[1], M Elske van den Akker-Van Marle[2] and Hareld MC Kemps[1,3]

Method

- Low to moderate risk CR patients were randomised to a 12-week home-based training (HT) programme or a 12-week centre-based training (CT) programme.
- both groups, training was performed at 70–85% of maximal heart rate (HRmax) for 45–60min, 2–3 times per week.
- The HT group received three supervised training sessions, before commencing training with a heart rate monitor in their home environment. These patients received individual coaching by telephone weekly, based on training data uploaded on the Internet.
- The CT programme was performed under the direct supervision of a physical therapist. Exercise capacity and health-related quality of life were assessed at baseline and at 12 weeks.

Results

- CT (n = 25) and HT (n = 25) both showed a significant improvement in peak oxygen uptake (peak VO2) (10% and 14% respectively) and quality of life after 12 weeks of training, without significant between-group differences.
- The average training intensity of the HT group was 73.3 +/- 3.5% of HRmax.
- Training adherence was similar between groups.

European Journal of Preventive Cardiology
2014, Vol. 21(2S) 26–31

HEART FAILURE

Telemonitoring in heart failure

Jillian P Riley,[1] Martin R Cowie[2]

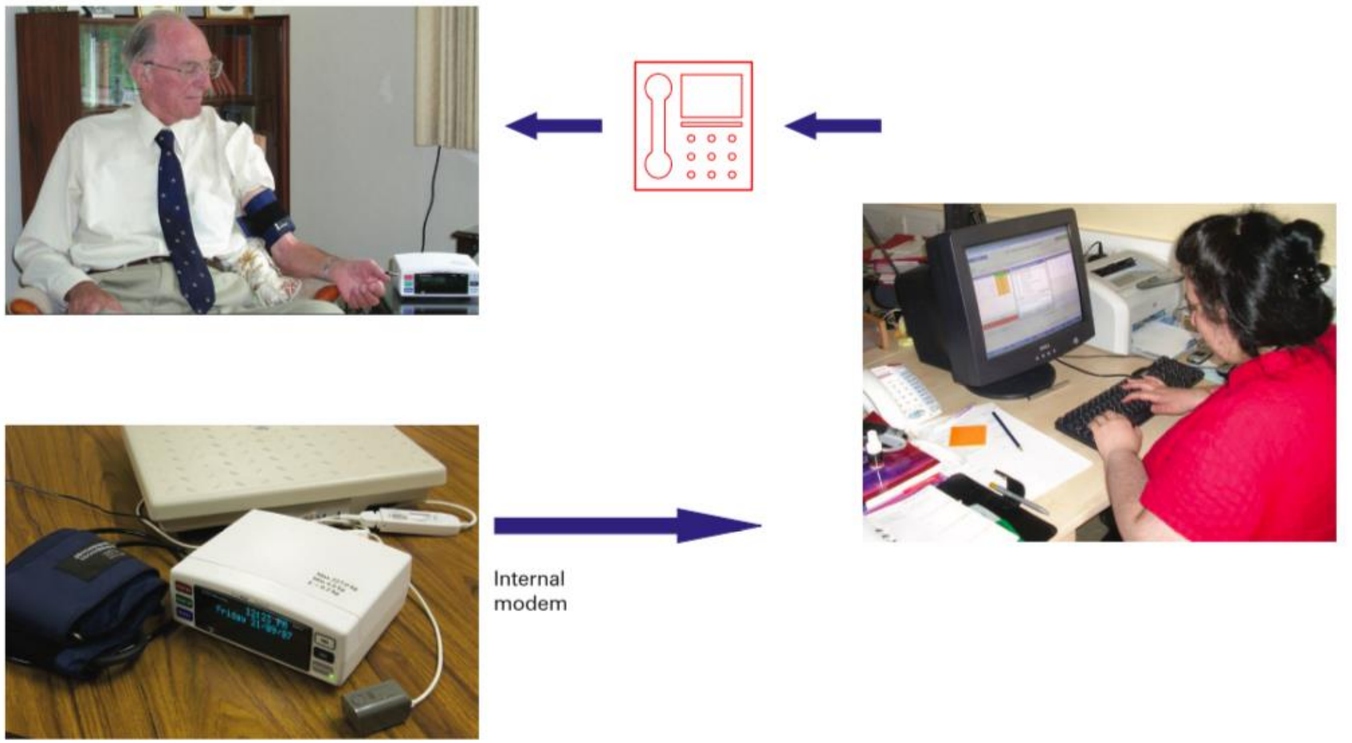


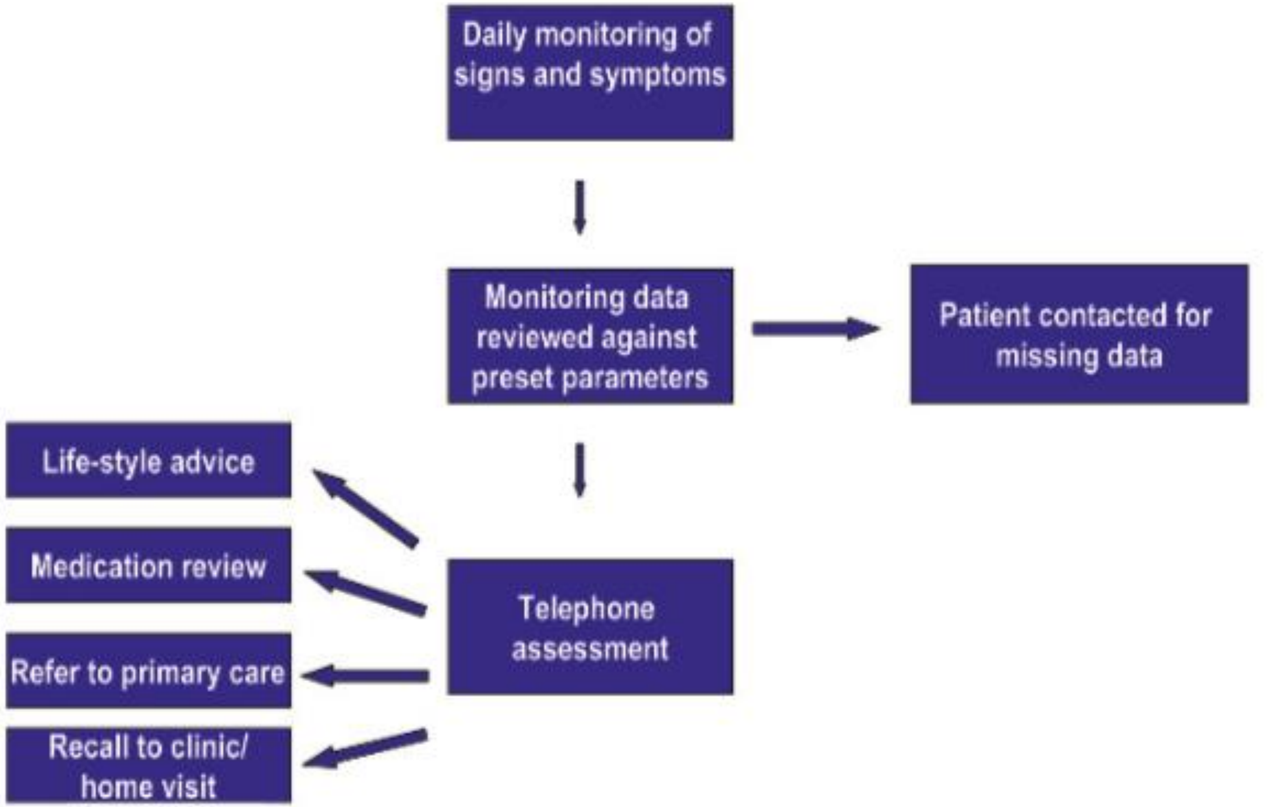
Figure 1 The telemonitoring cycle.

Heart 2009;95:1964–1968.

HEART FAILURE

Telemonitoring in heart failure

Jillian P Riley,[1] Martin R Cowie[2]



Heart 2009;95:1964–1968.

HEART FAILURE

Telemonitoring in heart failure

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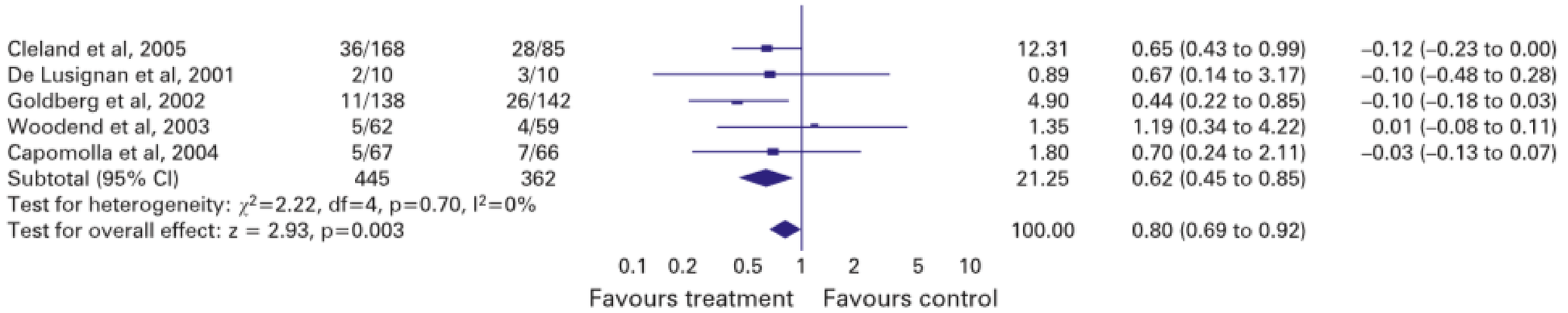

Figure 3 Meta-analysis of clinical effectiveness of telemonitoring on all cause mortality. Modified from Clark *et al*,[8] with permission.

Heart 2009;95:1964–1968.

Value of Telemonitoring and Telemedicine in Heart Failure Management

Gian Franco Gensini,[1] Camilla Alderighi,[2] Raffaele Rasoini,[2] Marco Mazzanti[3] and Giancarlo Casolo[4]

1. Digital SIT (Italian Telemedicine Society); 2. Fiorentino Institute of Care and Assistance (IFCA), Florence, Italy; 3. International Research Framework on Artificial Intelligence in Cardiology, Royal Brompton Hospital and Harefield NHS Foundation Trust, London, UK; 4. Cardiology Unit, New Versilia Hospital, Lido di Camaiore (LU), Italy

- Purposes and goal
- Sensors and devices and system monitoring
- Patient selection
- Barriers to implementation
- Cost and sustainability

CARDIAC FAILURE REVIEW
\Access at: www.CFRjournal.com

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Review of tele-health monitoring

- **Wearable technology**
- **Smart phone**
- **Mobile ECG monitoring**

Types of sensor

- Type of Sensors
  - ECG or Heart sensor: Electrocardiography measures the electrical activity of the heart by using electrodes placed on the skin
  - PPG or light sensor: Photoplethysmography measures the volumetric change of the heart by measuring light transmission or reflection.
- Light wavelength (RED VS GREEN)
  - Green light is suitable for the measurement of superficial blood flow in skin.
  - Light with wavelengths between 500 and 600 nm (the green-yellow region of the visible spectrum) exhibits the largest modulation depth with pulsatile blood absorption.
  - IR or near-IR wavelengths are better for measurement of deep-tissue blood flow
- Number of sensors: the more is good but consume more power

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Wellograph Fitness Tracker Watch Review: Beauty Is Skin Deep

by **MIKE PROSPERO** Nov 24, 2014, 9:14 AM

WELLOGRAPH FITNESS TRACKER WATCH

THE GOOD

- Good battery life
- Attractive design
- Heart-rate monitor

THE BAD

- Not many features for the price
- Basic interface
- No sleep tracking

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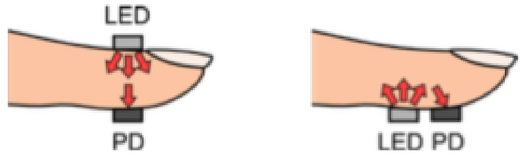
Factors Affecting PPG Recordings

- the measurement(i.e., probe, PPG and PD attachment site)
- the contact force
- mechanical movement artifacts
- subject posture, and breathing
- ambient temperature.



Settle of technologies

- Green for general measurement
- Red for precise and more variable measurement
- 3 LED
- The right algorithms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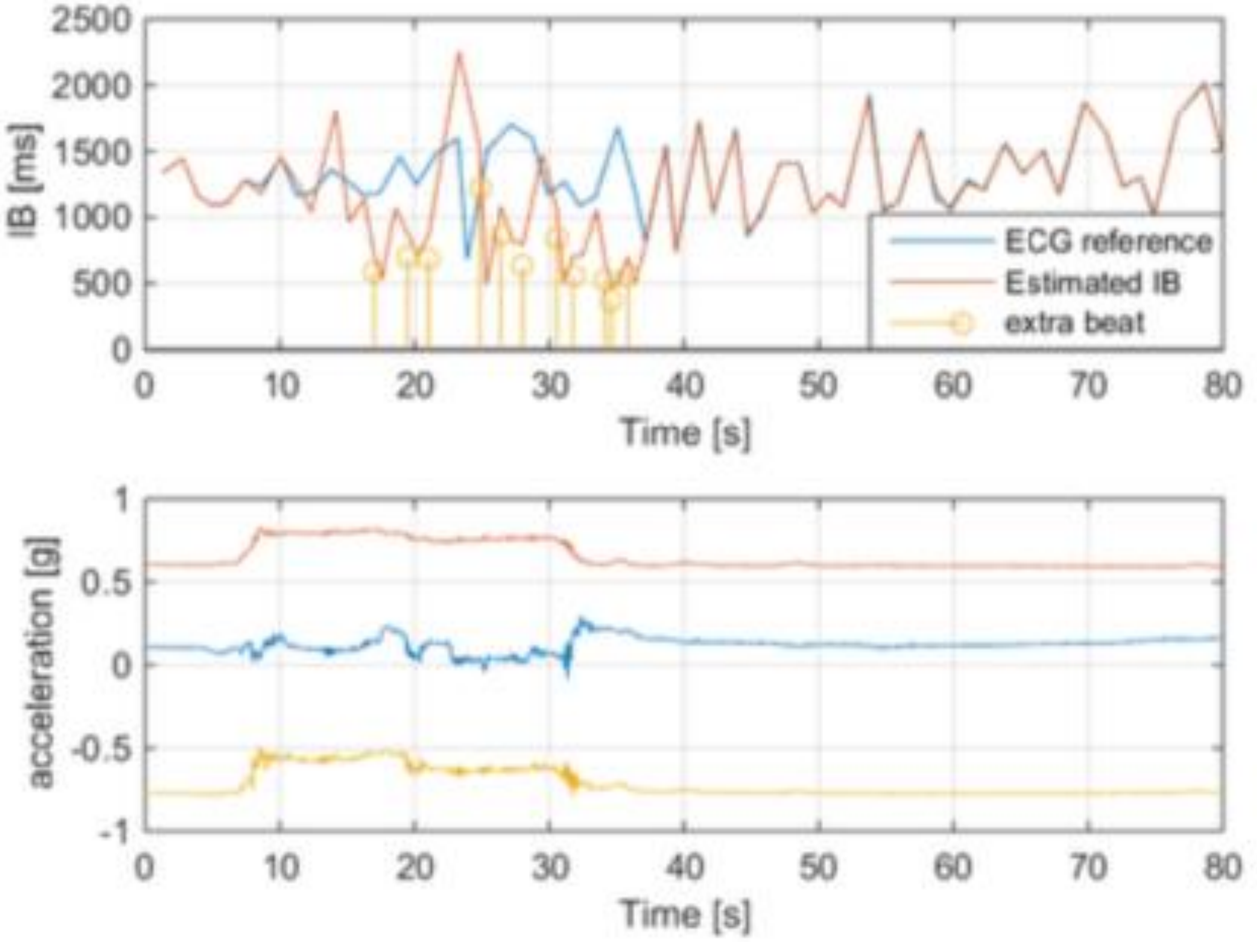
2018 IEEE EMBS International Conference on Biomedical & Health Informatics (BHI)
4-7 March 2018
Las Vegas, Nevada, USA

Detection of Beat-to-Beat Intervals from Wrist Photoplethysmography in Patients with Sinus Rhythm and Atrial Fibrillation after Surgery

Adrian Tarniceriu, Jarkko Harju, Antti Vehkaoja, Jakub Parak, *IEEE Student Member*, Ricard Delgado-Gonzalo, Philippe Renevey, Arvi Yli-Hankala, and Ilkka Korhonen, *IEEE Senior Member*

***Abstract*— Wrist photoplethysmography (PPG) allows unobtrusive monitoring of the heart rate (HR). PPG is affected by the capillary blood perfusion and the pumping function of the heart, which generally deteriorate with age and due to presence of cardiac arrhythmia. The performance of wrist PPG in monitoring beat-to-beat HR in older patients with arrhythmia has not been reported earlier. We monitored PPG from wrist in 18 patients recovering from surgery in the post anesthesia care unit, and evaluated the inter-beat interval (IBI) detection accuracy against ECG based R-to-R intervals (RRI). Nine subjects had sinus rhythm (SR, 68.0y ± 10.2y, 6 males) and nine subjects had atrial fibrillation (AF, 71.3y ± 7.8y, 4 males) during the recording. For the SR group, 99.44% of the beats were correctly identified, 2.39% extra beats were detected, and the mean absolute error (MAE) was 7.34 ms. For the AF group, 97.49% of the heartbeats were correctly identified, 2.26% extra beats were detected, and the MAE was 14.31 ms. IBI from the PPG were hence in close agreement with the ECG reference in both groups. The results suggest that wrist PPG provides a comfortable alternative to ECG and can be used for long-term monitoring and screening of AF episodes.**



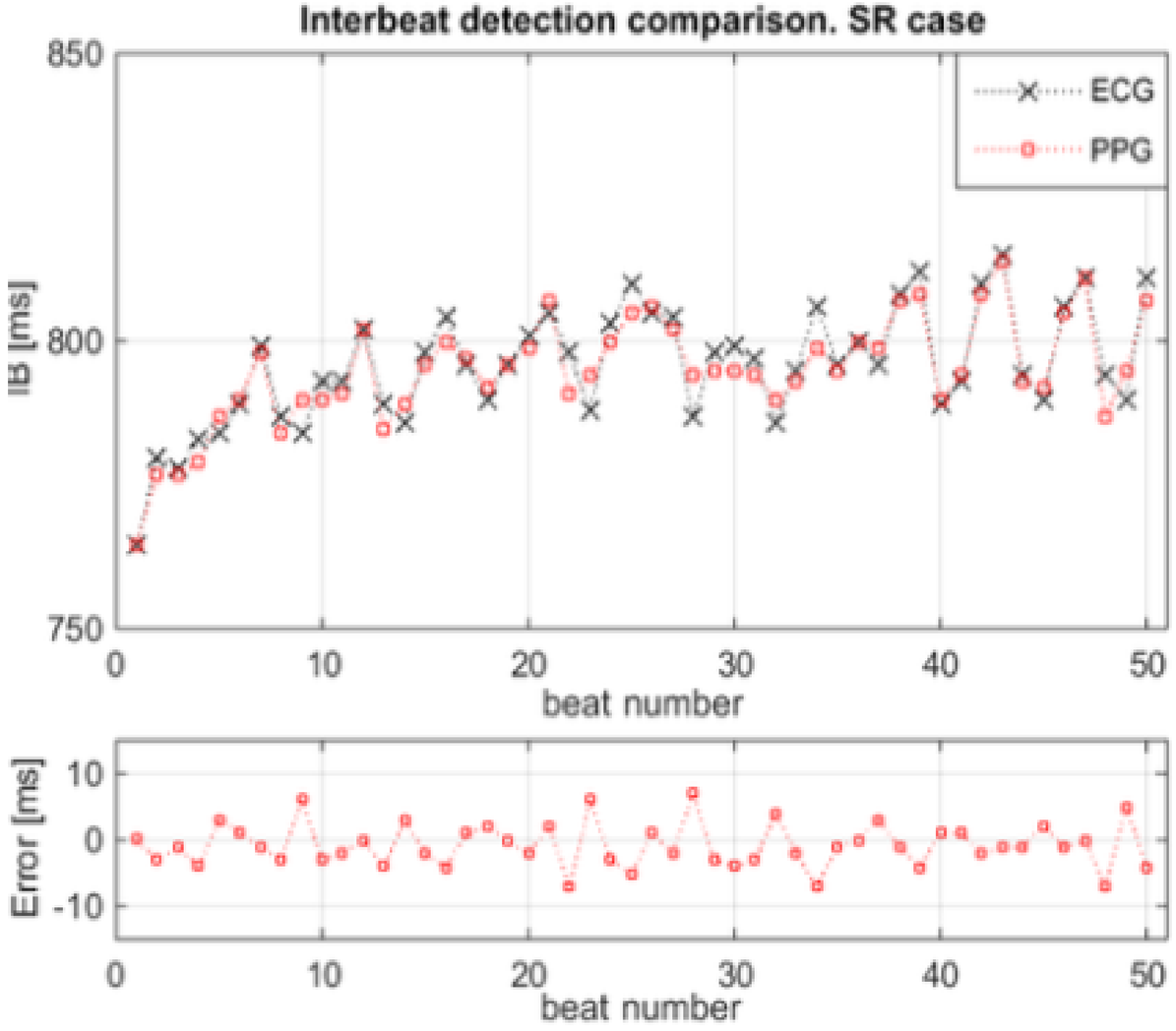


Figure 3. Example of IBI and RRI time series in a SR case. The lower panel shows the instantaneous error between RRI and IBI

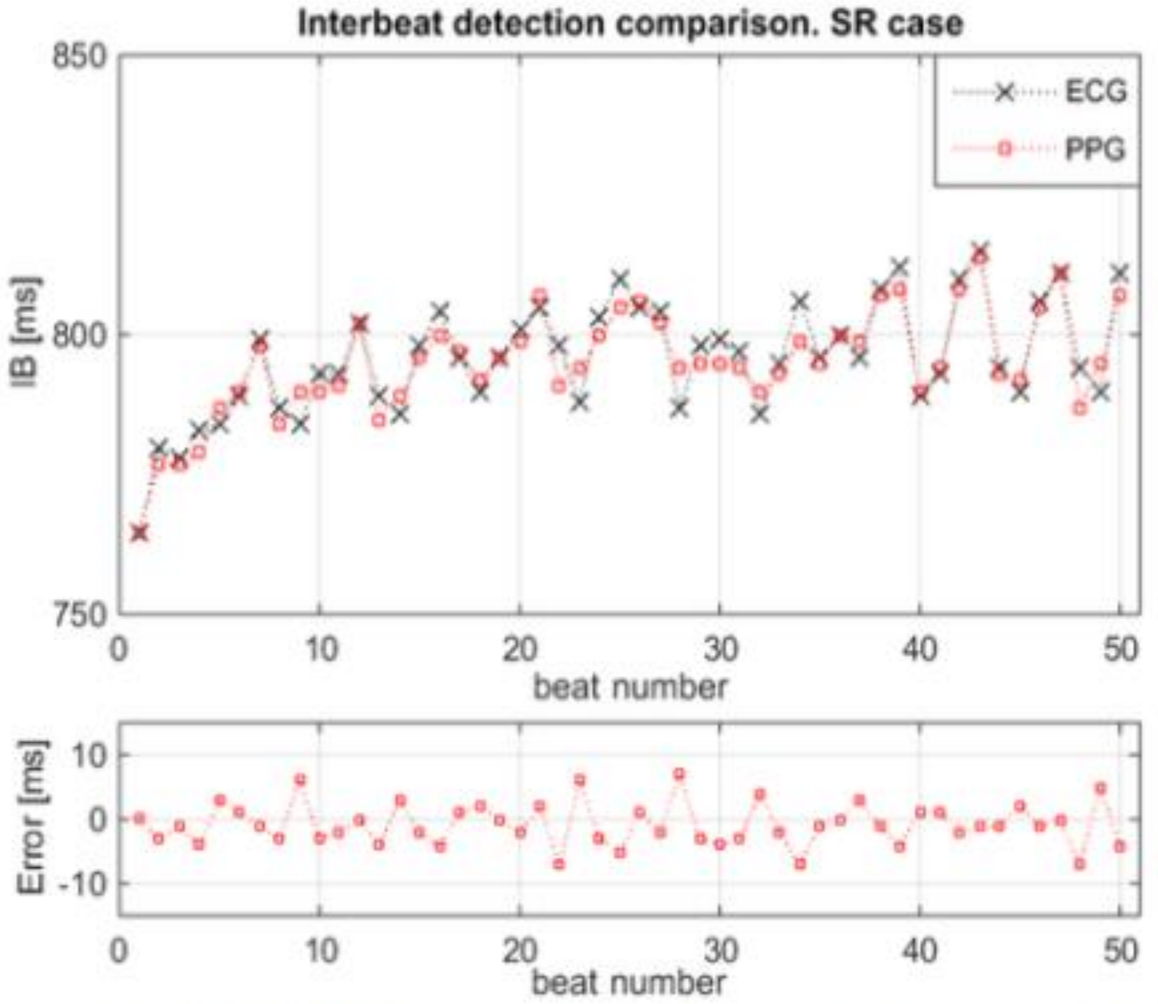


Figure 3. Example of IBI and RRI time series in a SR case. The lower panel shows the instantaneous error between RRI and IBI

RESEARCH Open Access

Highly wearable cuff-less blood pressure and heart rate monitoring with single-arm electrocardiogram and photoplethysmogram signals

Qingxue Zhang[1*], Dian Zhou[1,2] and Xuan Zeng[2]

*Correspondence:
qingxue.zhg@gmail.com
[1] Departpment of Electrical Engineering, University of Texas at Dallas, 800 W Campbell Rd, Richardson, TX 75080, USA
Full list of author information

Abstract

Background: Long-term continuous systolic blood pressure (SBP) and heart rate (HR) monitors are of tremendous value to medical (cardiovascular, circulatory and cerebro-vascular management), wellness (emotional and stress tracking) and fitness (performance monitoring) applications, but face several major impediments, such as poor

BioMed Eng OnLine (2017) 16:23

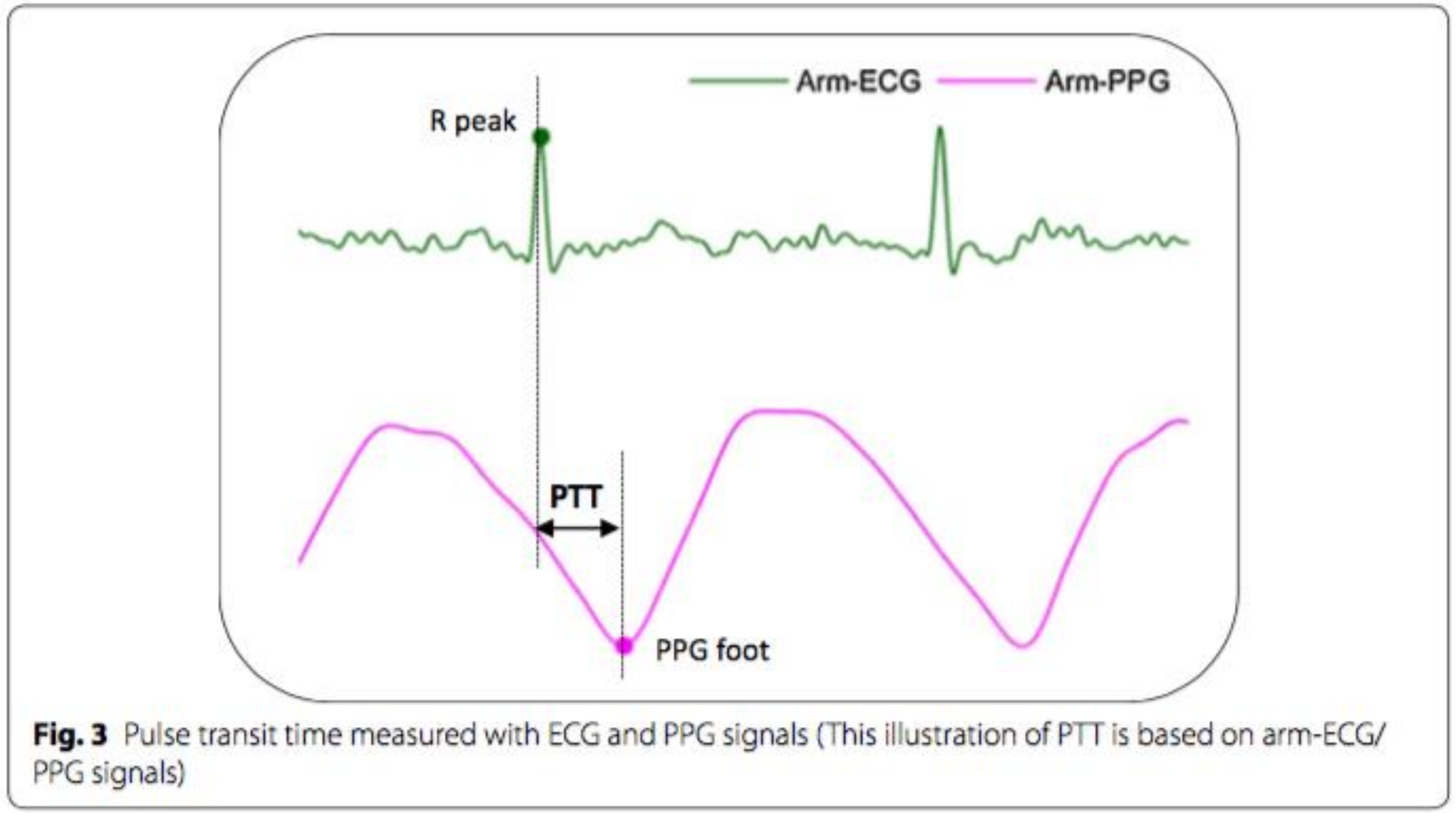


Fig. 3 Pulse transit time measured with ECG and PPG signals (This illustration of PTT is based on arm-ECG/PPG signals)

BioMed Eng OnLine (2017) 16:23

RESEARCH Open Access

Feasibility study for the non-invasive blood pressure estimation based on ppg morphology: normotensive subject study

Hangsik Shin[1] and Se Dong Min[2*]

*Correspondence:
sedongmin@sch.ac.kr
[2] Department of Medical IT Engineering, College of Medical Science, Soonchunhyang University, 22, Soonchunhyang-ro, Eumnae-ri, Sinchang-myeon, Asan-si, Chungcheongnam-do, Republic of Korea
Full list of author information is available at the end of the article

Abstract

Background: Blood pressure is a critical bio-signal and its importance has been increased with the aged society and the growth of cardiovascular disease population. However, most of hypertensive patients have been suffered the inconvenience in monitoring blood pressure in daily life because the measurement of the blood pressure depends on the cuff-based technique. Nowadays there are many trials to measure blood pressure without cuff, especially, photoplethysmography (PPG) based research is carried out in various ways.

Methods: Our research is designed to hypothesis the relationship between vessel wall movement and pressure-flow relationship of PPG and to validate its appropriateness by experimental methods. PPG waveform is simplified by approximate model, and then it is analyzed as the velocity and the acceleration of blood flow using the derivatives of

BioMed Eng OnLine (2017) 16:10

Conclusions:

- Current study can estimate only the relative variation of blood pressure but could not find the absolute pressure value. Moreover, proposed index has the limitation of diastolic pressure tracing. However, the result shows that the proposed PI(pressure index) is statistically significantly correlated with blood pressures, and it suggests that the proposed PI as a promising additional parameter for the cuffless blood pressure monitoring.

BioMed Eng OnLine (2017) 16:10

Published in final edited form as:

Conf Proc IEEE Eng Med Biol Soc. 2014 ; 2014: 5264–5267. doi:10.1109/EMBC.2014.6944813.

Challenges in Wearable Personal Health Monitoring Systems

Insoo Kim [EMBS Member],
Pennsylvania State University, University Park, PA, and he is now with the Samsung Research America – Dallas, Richardson, TX 75082 USA

Po-Hsiang Lai [IEEE Member],
Samsung Research America – Dallas, Richardson, TX, USA

Ryan Lobo [IEEE Member], and
Samsung Research America – Dallas, Richardson, TX, USA

Bruce J. Gluckman [EMBS Member]
Pennsylvania State University, University Park, PA 16802 USA

Conf Proc IEEE Eng Med Biol Soc. 2014 ; 2014: 5264–5267

Abstract

Wearable sensors give the users convenience in daily health monitoring, though several challenges in such sensor systems should be overcome. This paper discusses the challenges in wearable health monitoring sensors and solutions for multi-modal and multi-functional wrist-worn devices based on novel circuit design techniques to reject DC offset. Furthermore, this paper also presents a novel sophisticated algorithm to reject motion artifacts. The system has the capability to simultaneously acquire several bio-signals (i.e. electrocardiogram, PPG, and body-electrode impedance). The system can also help patients who want to monitor their psychological signals to mitigate health risks.

Conf Proc IEEE Eng Med Biol Soc. 2014 ; 2014: 5264–5267

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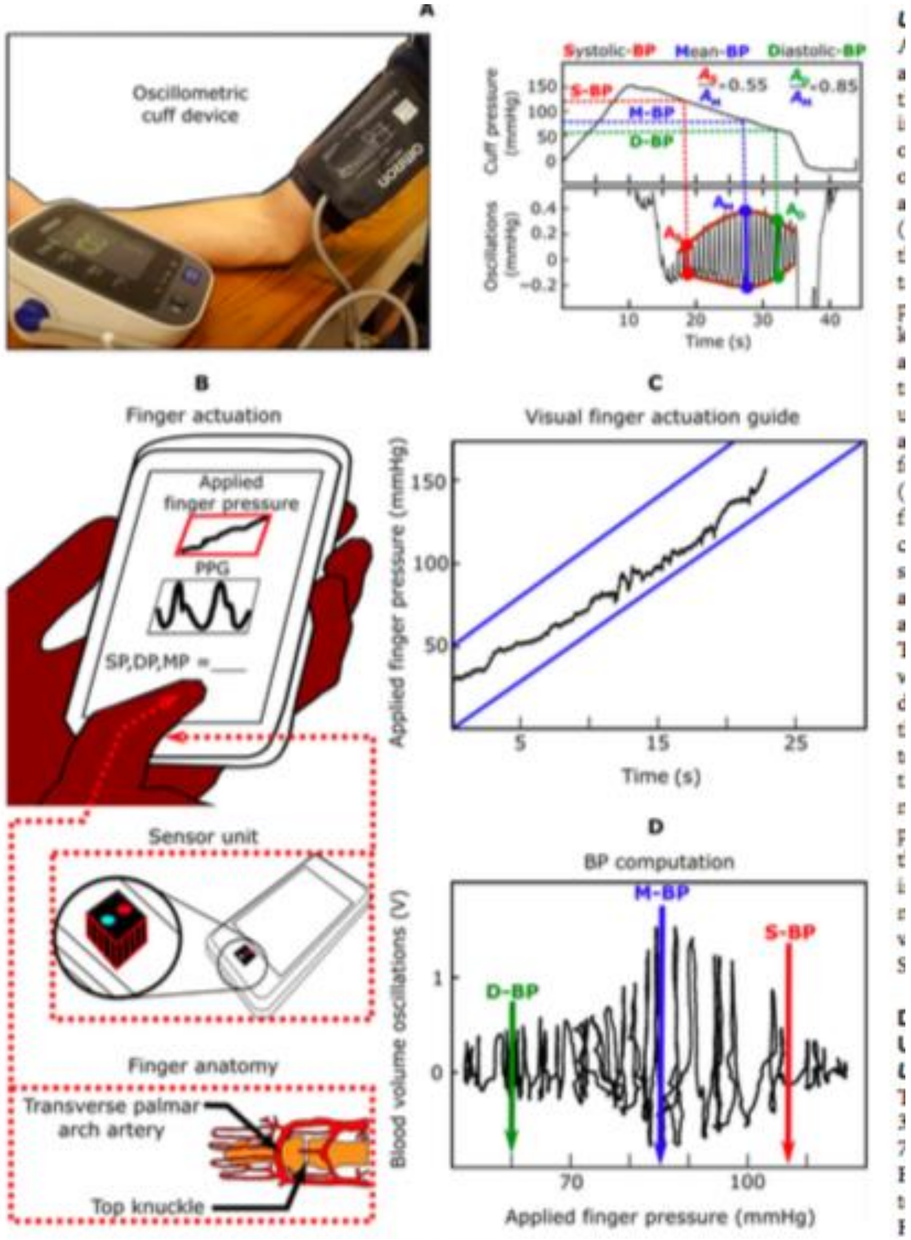
CARDIOVASCULAR HEALTH

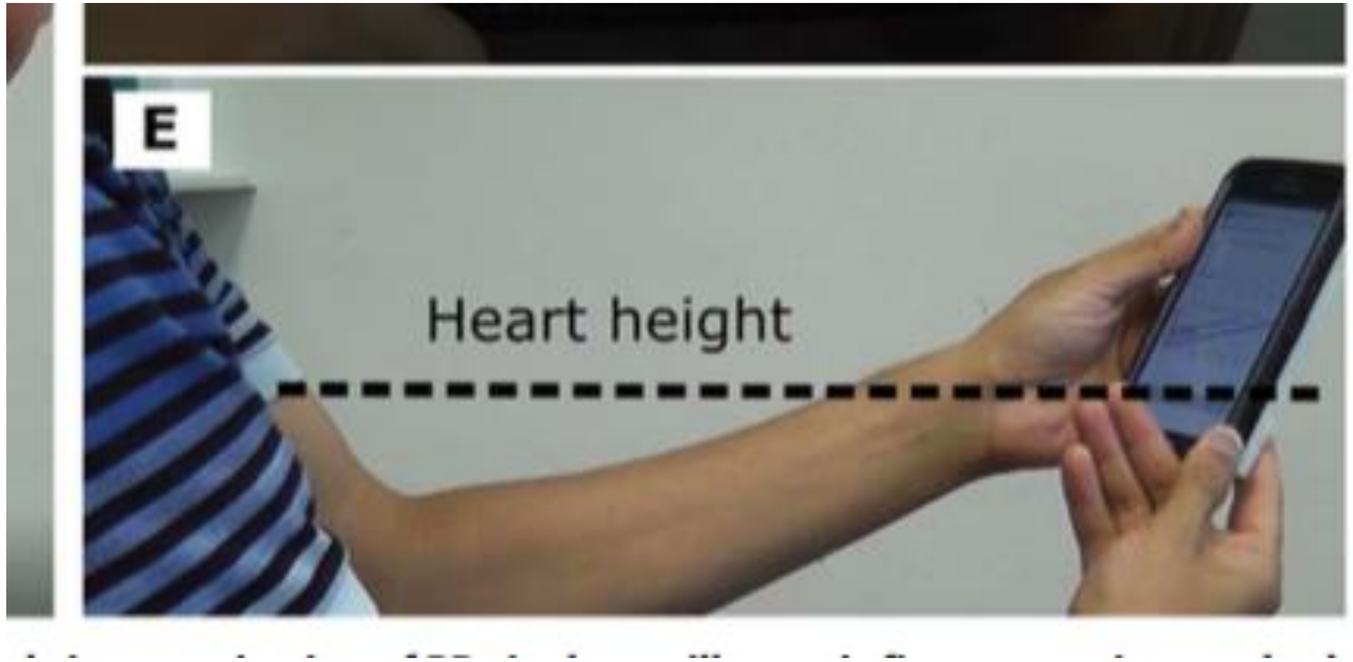
Smartphone-based blood pressure monitoring via the oscillometric finger-pressing method

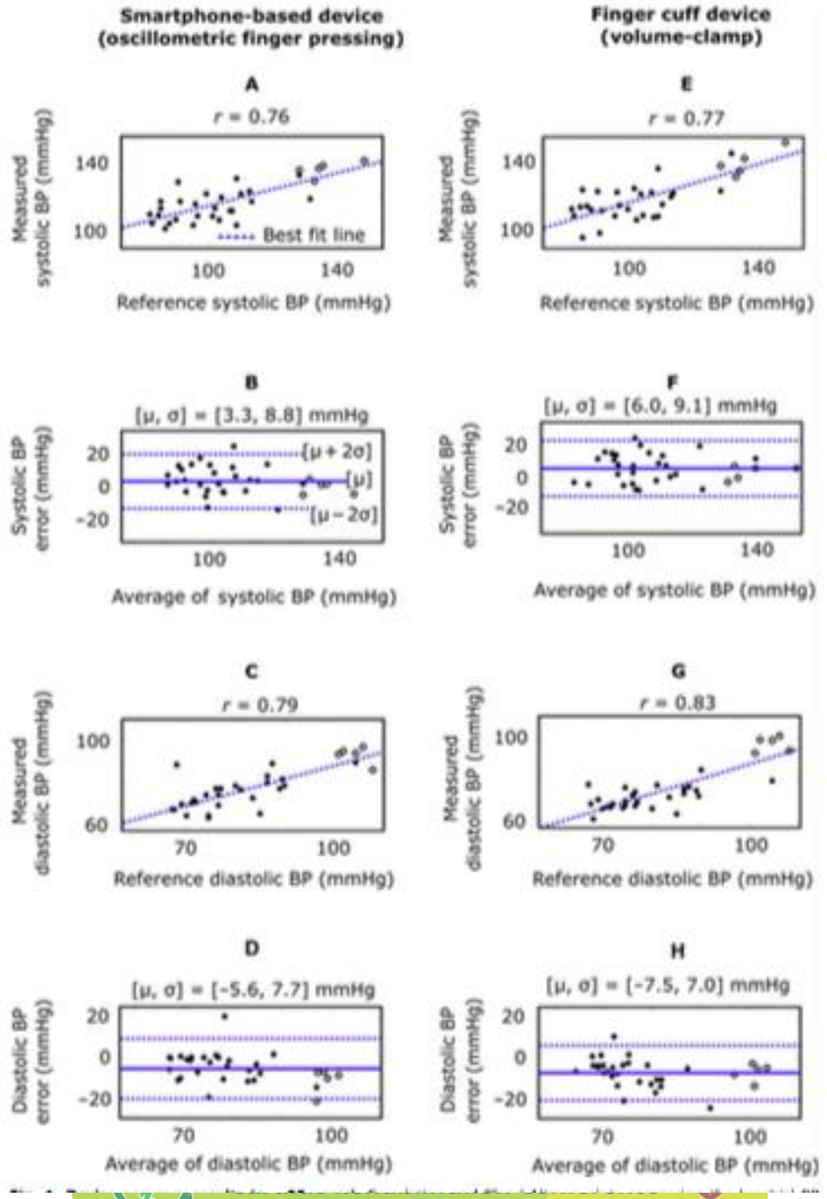
Anand Chandrasekhar,[1] Chang-Sei Kim,[2,3] Mohammed Naji,[1] Keerthana Natarajan,[1] Jin-Oh Hahn,[2] Ramakrishna Mukkamala[1]*

High blood pressure (BP) is a major cardiovascular risk factor that is treatable, yet hypertension awareness and control rates are low. Ubiquitous BP monitoring technology could improve hypertension management, but existing devices require an inflatable cuff and are not compatible with such anytime, anywhere measurement of BP. We extended the oscillometric principle, which is used by most automatic cuff devices, to develop a cuff-less BP monitoring device using a smartphone. As the user presses her/his finger against the smartphone, the external pressure of the underlying artery is steadily increased while the phone measures the applied pressure and resulting variable-amplitude blood volume oscillations. A smartphone application provides visual feedback to guide the amount of pressure applied over time via the finger pressing and computes systolic and diastolic BP from the measurements. We prospectively tested the smartphone-based device for real-time BP monitoring in human subjects to evaluate usability (n = 30) and accuracy against a standard automatic cuff-based device (n = 32). We likewise tested a finger cuff device, which uses the volume-clamp method of BP detection. About 90% of the users learned the finger actuation required by the smartphone-based device after one or two practice trials. The device yielded bias and precision errors of 3.3 and 8.8 mmHg for systolic BP and −5.6 and 7.7 mmHg for diastolic BP over a 40 to 50 mmHg range of BP. These errors were comparable to the finger cuff device. Cuff-less and calibration-free monitoring of systolic and diastolic BP may be feasible via a smartphone.

Chandrasekhar et al., Sci. Transl. Med. 10, eaap8674 (2018) 7 March 2018


A
Oscillometric cuff device
Systolic-BP
Mean-BP
Diastolic-BP
S-BP
M-BP
D-BP
Cuff pressure (mmHg)
Oscillations (mmHg)
Time (s)
B
Finger actuation
Applied finger pressure
PPG
SP,DP,MP = ___
Sensor unit
Finger anatomy
Transverse palmar arch artery
Top knuckle
C
Visual finger actuation guide
Applied finger pressure (mmHg)
Time (s)
D
BP computation
M-BP
S-BP
D-BP
Blood volume oscillations (V)
Applied finger pressure (mmHg)


E
Heart height


Smartphone-based device
(oscillometric finger pressing)
Finger cuff device
(volume-clamp)
A
r = 0.76
Measured systolic BP (mmHg)
140
100
Best fit line
100
140
Reference systolic BP (mmHg)
E
r = 0.77
Measured systolic BP (mmHg)
140
100
100
140
Reference systolic BP (mmHg)
B
[μ, σ] = [3.3, 8.8] mmHg
Systolic BP error (mmHg)
20
0
-20
[μ + 2σ]
[μ]
[μ − 2σ]
100
140
Average of systolic BP (mmHg)
F
[μ, σ] = [6.0, 9.1] mmHg
Systolic BP error (mmHg)
20
0
-20
100
140
Average of systolic BP (mmHg)
C
r = 0.79
Measured diastolic BP (mmHg)
100
60
70
100
Reference diastolic BP (mmHg)
G
r = 0.83
Measured diastolic BP (mmHg)
100
60
70
100
Reference diastolic BP (mmHg)
D
[μ, σ] = [-5.6, 7.7] mmHg
Diastolic BP error (mmHg)
20
0
-20
70
100
Average of diastolic BP (mmHg)
H
[μ, σ] = [-7.5, 7.0] mmHg
Diastolic BP error (mmHg)
20
0
-20
70
100
Average of diastolic BP (mmHg)

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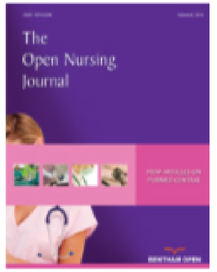

REVIEW ARTICLE

Wearable Devices for Caloric Intake Assessment: State of Art and Future Developments

Maria Laura Magrini[1], Clara Minto[1], Francesca Lazzarini[1], Matteo Martinato[2] and Dario Gregori[1,*]

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Received: February 15, 2017 Revised: May 15, 2017 Accepted: July 07, 2017

Abstract:

The Open Nursing Journal, 2017, 11, (Suppl-1, M7) 232-240

device caterries

- Devices capturing the gestures related to nutrition, such as arm and wrist movements;

- Devices capturing sounds and vibrations from chewing and/or swallowing;

- Devices that identify the kind and the amount of food analyzing food digital images.

Calorie Counting Made Easy

Bite TECHNOLOGIES

- Home
- Solutions
- Store
- Apple Watch
- Technology
- Accuracy
- Specifications
- FAQs
- Support
- Events & News
- About us
- Contact us

What is a Bite Counter?

- comfortable watch
- tracks wrist motion to count bites and estimate calories
- provides real-time feedback on amount consumed
- stores long-term log
- includes pedometer for daily step counting

Buy Now

Intake monitoring made easy

- simple, easy-to-use tool for weight loss/maintenance
- helps with portion control and sustained self-monitoring
- feedback during eating, as opposed to end of day
- long term observation of eating activity for personal health or research

Table 2. Accuracy of the Bite counter in bite detection [5].

Food (utensil)	Accuracy
Meat (fork and knife)	127%
Sides (fork)	82.6%
Soup (spoon)	60.2%
Pizza (hands)	87.3%
Soda (hands)	81.7%
Smoothie (straw)	57.7%
Total	81.2%

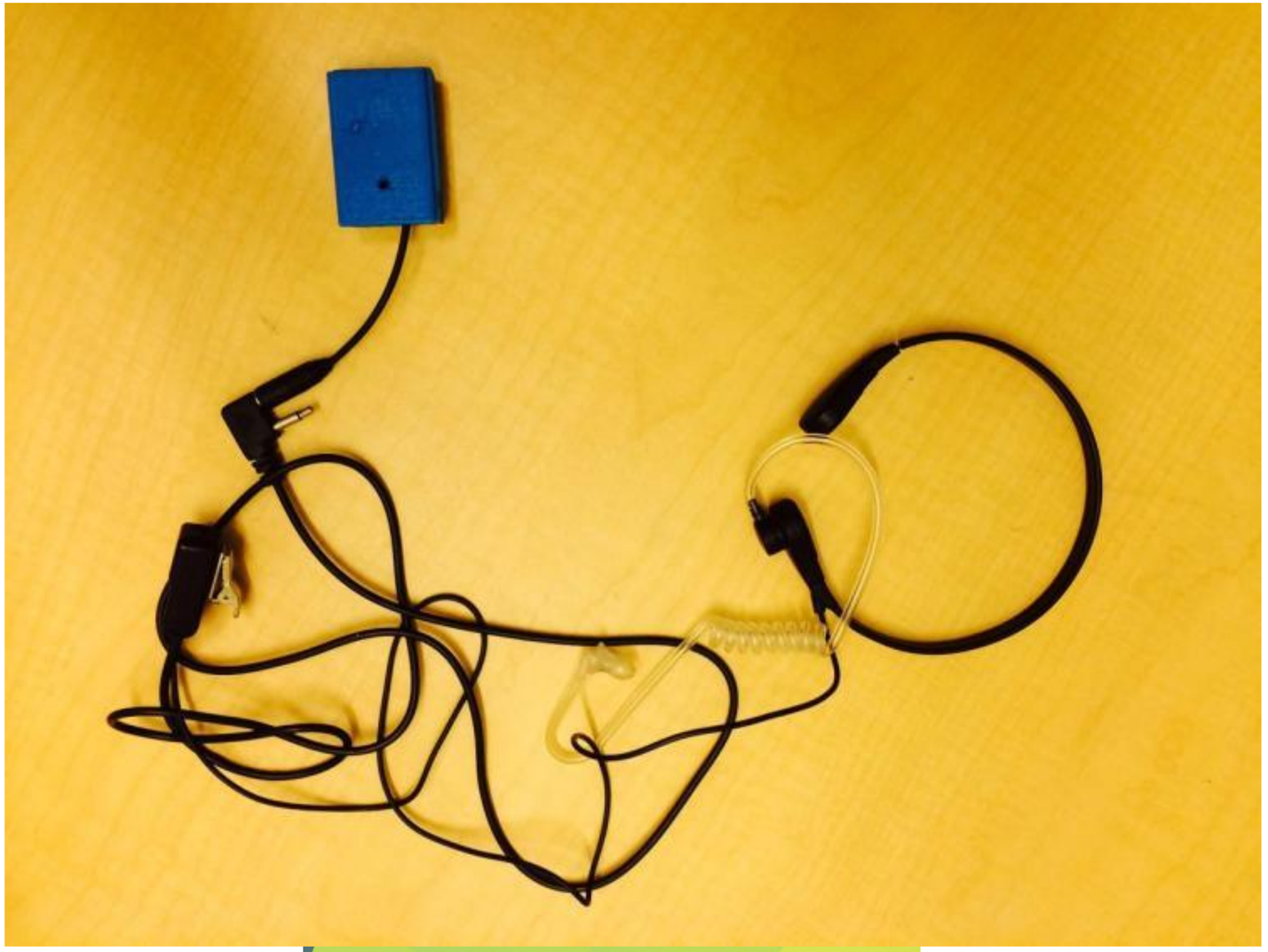


Table 3. Accuracy of Autodietary in food recognition [13].

Event/food	Accuracy
Chewing-swallowing	86.6%
Apple	86.3%
Carrot	84.9%
Biscuit	82.9%
Chips	87.7%
Walnuts	75.5%
Peanuts	83.4%
Water	93.3%

HEALTH

Smart Necklace Analyzes What Goes Down Your Throat

Sensors gauge food intake as you swallow

Nsikan Akpan *March 5, 2015*

Table 4. Accuracy of piezoelectric sensor-based necklace with accelerometer in food recognition [8].

Food	Accuracy
Water	81.4%
sandwich	84.5%
Chips	85.3%

iCare Health Monitor (BP & HR)

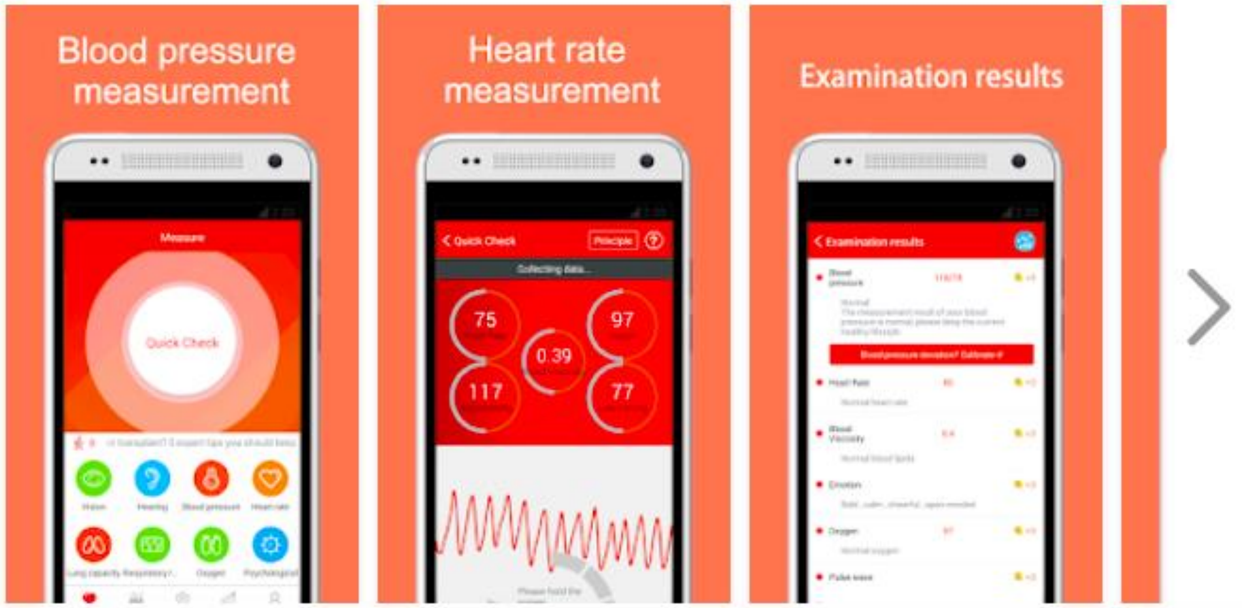
iCare Fit Studio Health & Fitness ★★★★½ 71,259

12+

Contains ads

You don't have any devices

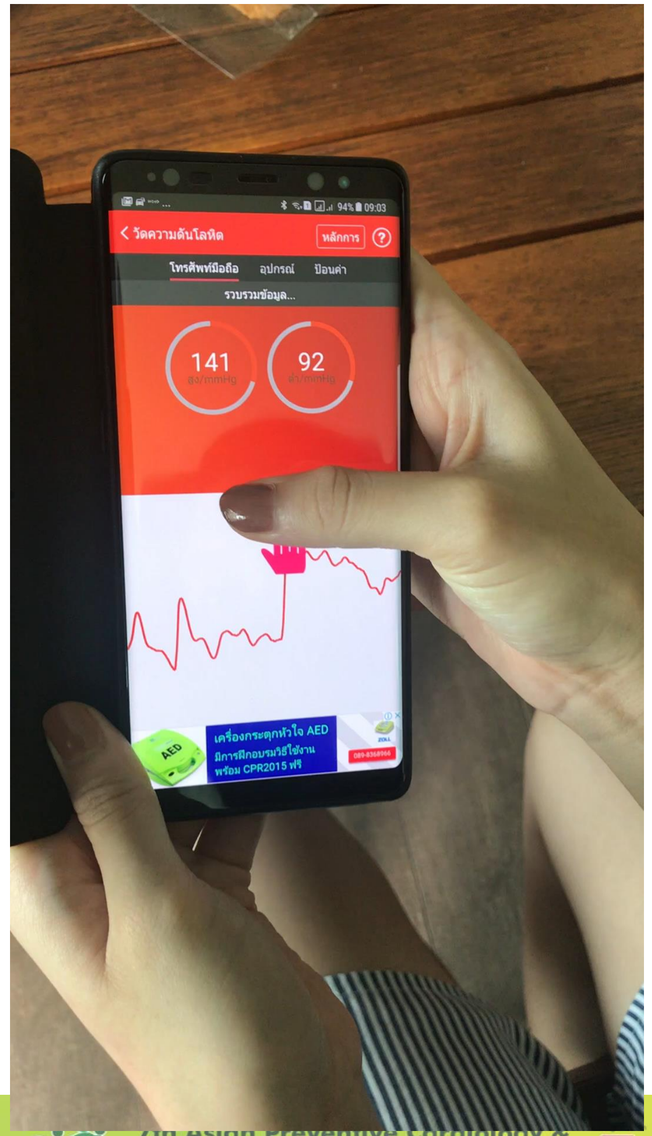
Add to Wishlist Install

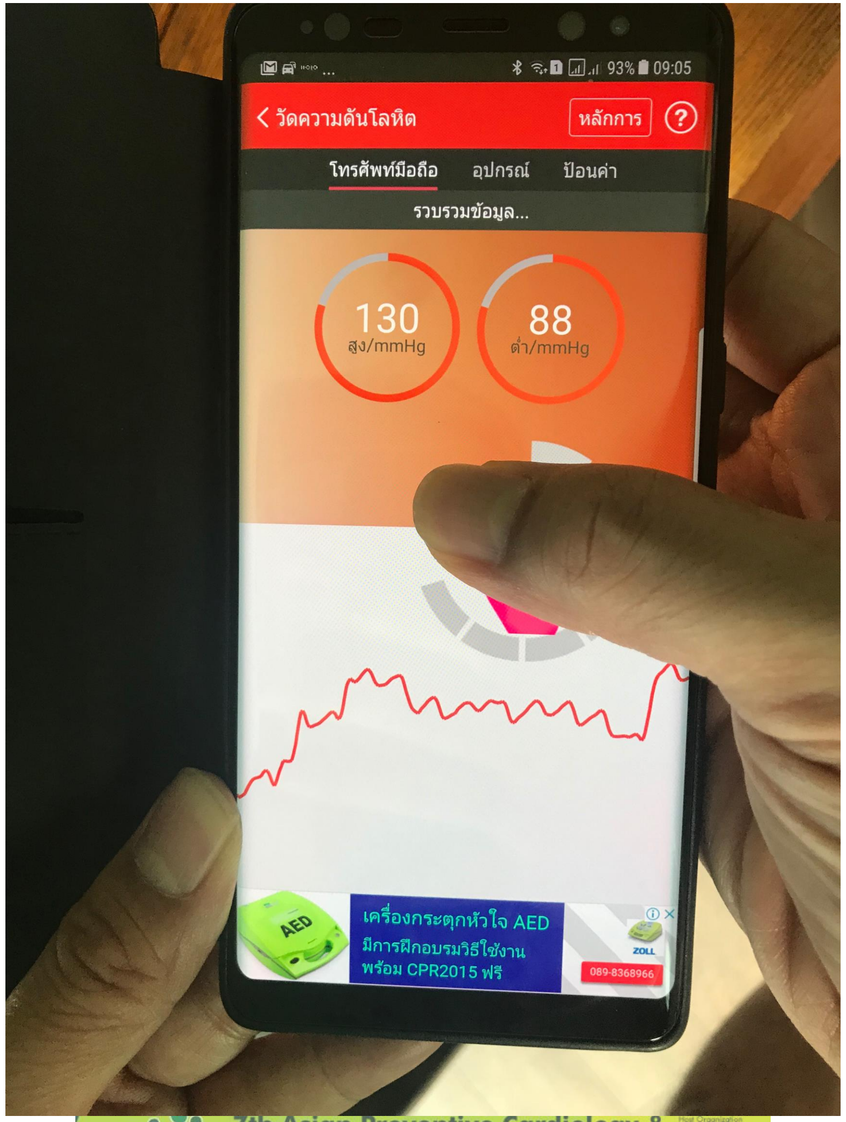


iCare Health Monitor could measure blood pressure,heart rate,vision,hearing,SpO2,breath rate by the phone.

MAIN FEATURES:

- ▶ **Blood pressure measurement**
- ▶ **Heart rate measurement**
- ▶ **Blood oxygen measurement**
- ▶ Respiratory rate measurement
- ▶ Vision measurement / Eye Test
- ▶ Hearing measurement / Hearing Test
- ▶ Lung capacity measurement
- ▶ Real-time photoplethysmogram (PPG) graph
- ▶ Autism-spectrum Test
- ▶ Pedometer
- ▶ Vision Care
- ▶ HIIT Workout
- ▶ ABS workout
- ▶ Leg workout
- ▶ Butt workout
- ▶ Unlimited data storage and tags
- ▶ Export data for registered users





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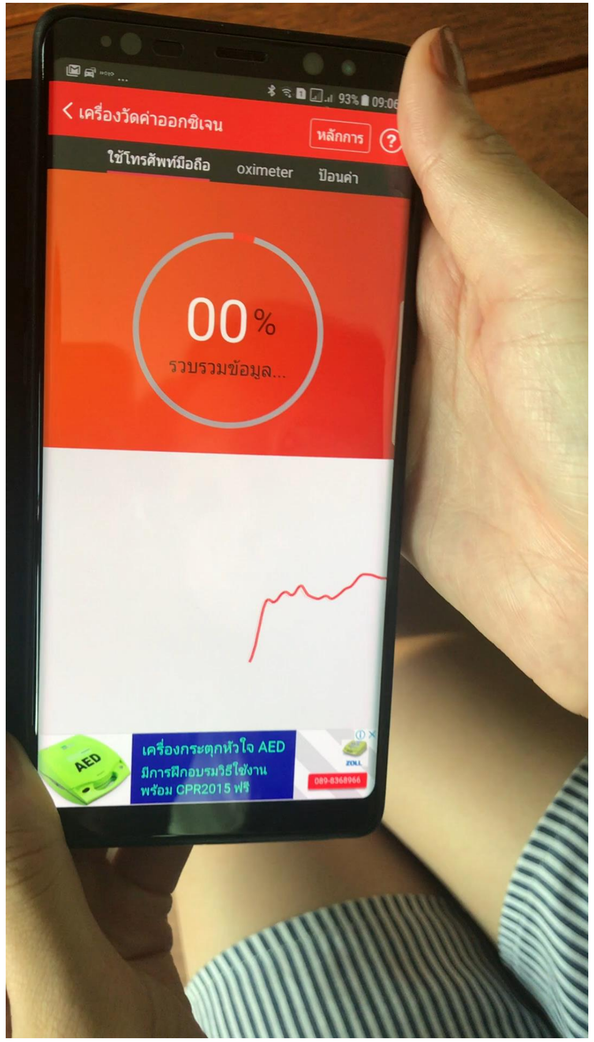

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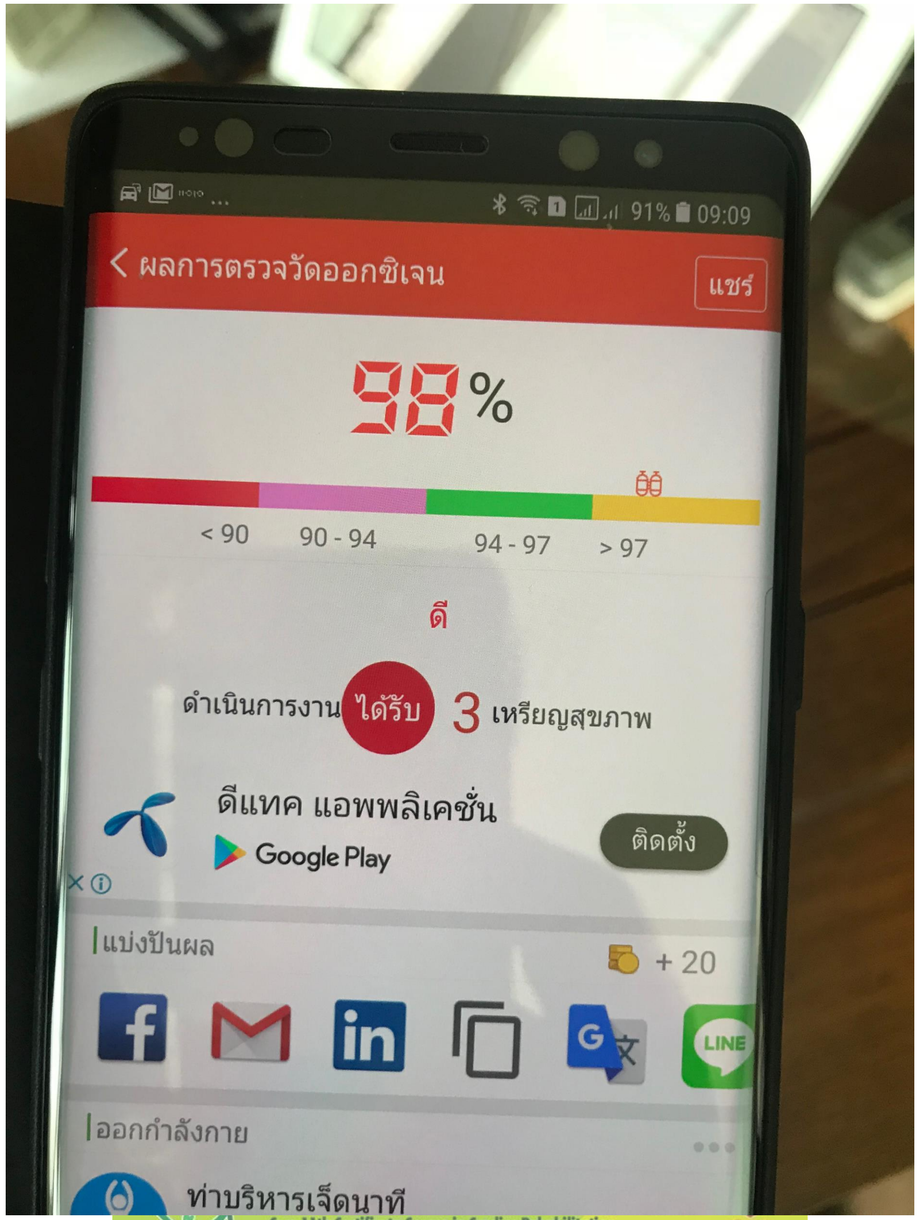
91% 09:09
ผลการตรวจวัดออกซิเจน
แชร์
98%
< 90
90 - 94
94 - 97
> 97
ดี
ดำเนินการงาน ได้รับ 3 เหรียญสุขภาพ
ดีแทค แอพพลิเคชั่น
Google Play
ติดตั้ง
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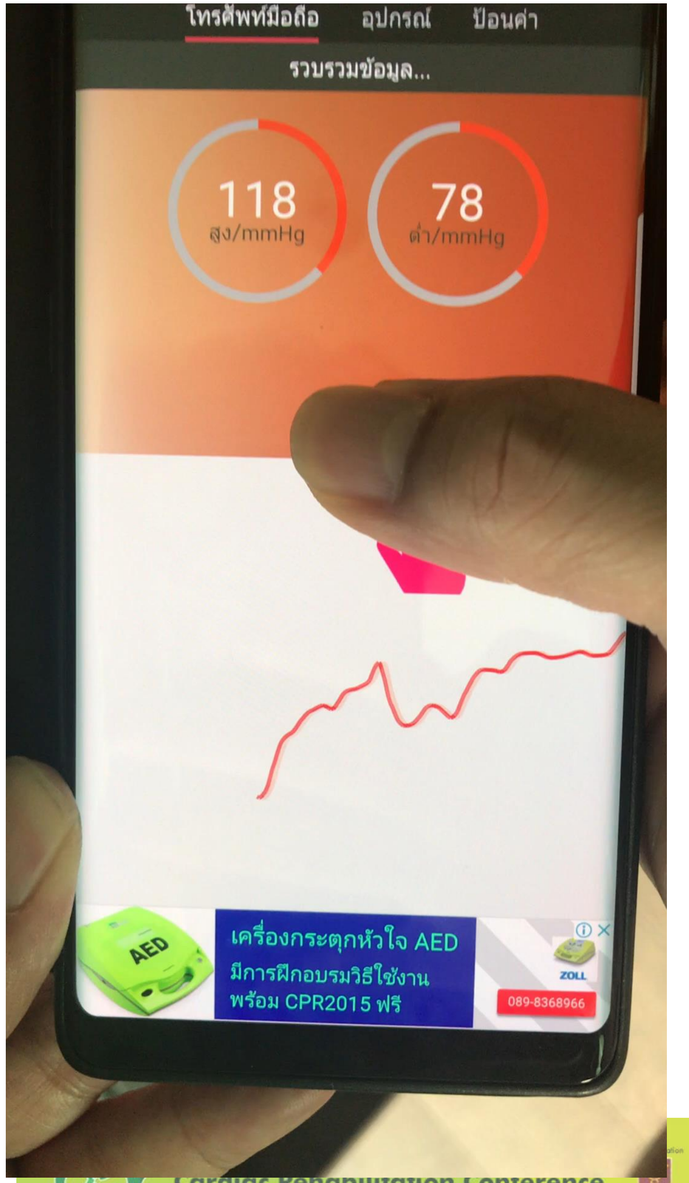
+ 20
LINE
ออกกำลังกาย
ท่าบริหารเจ็ดนาที



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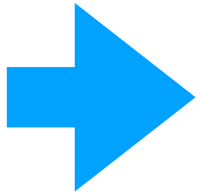

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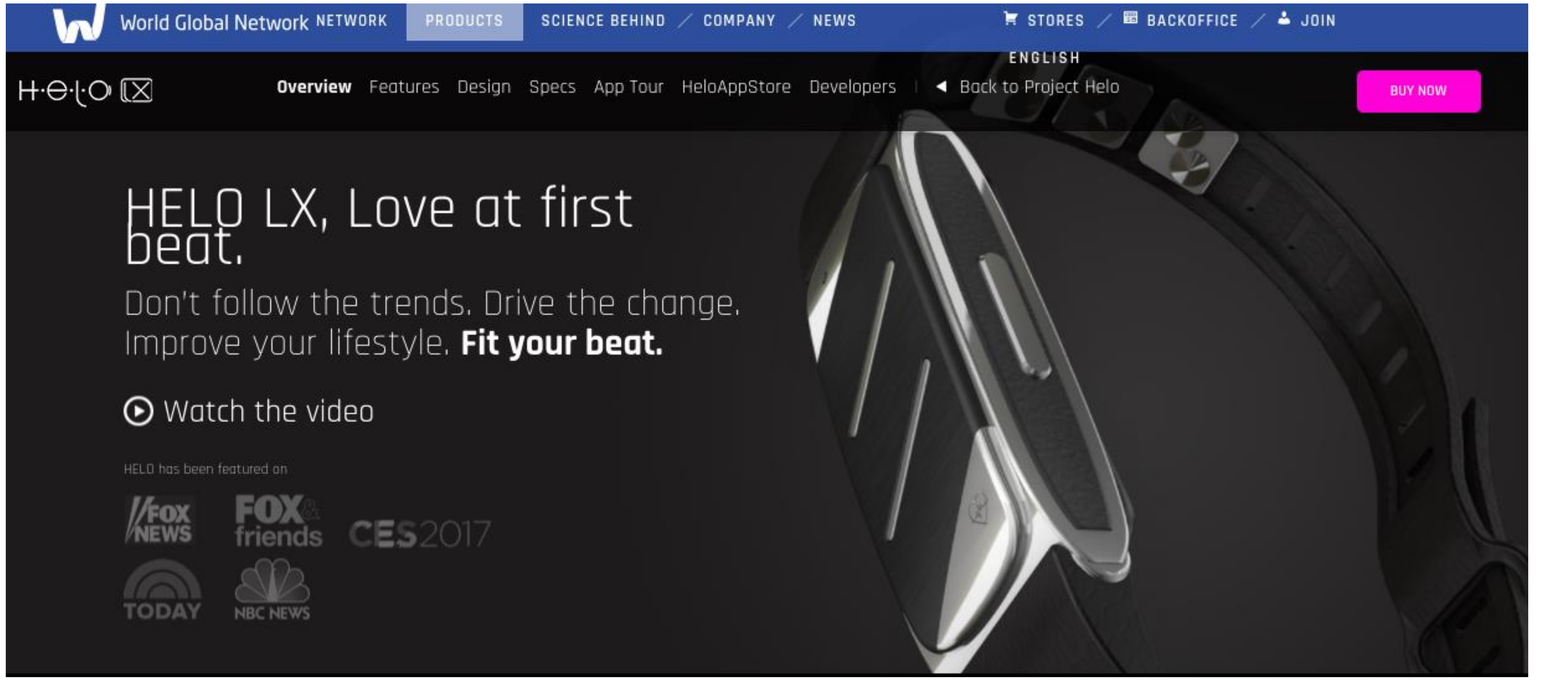
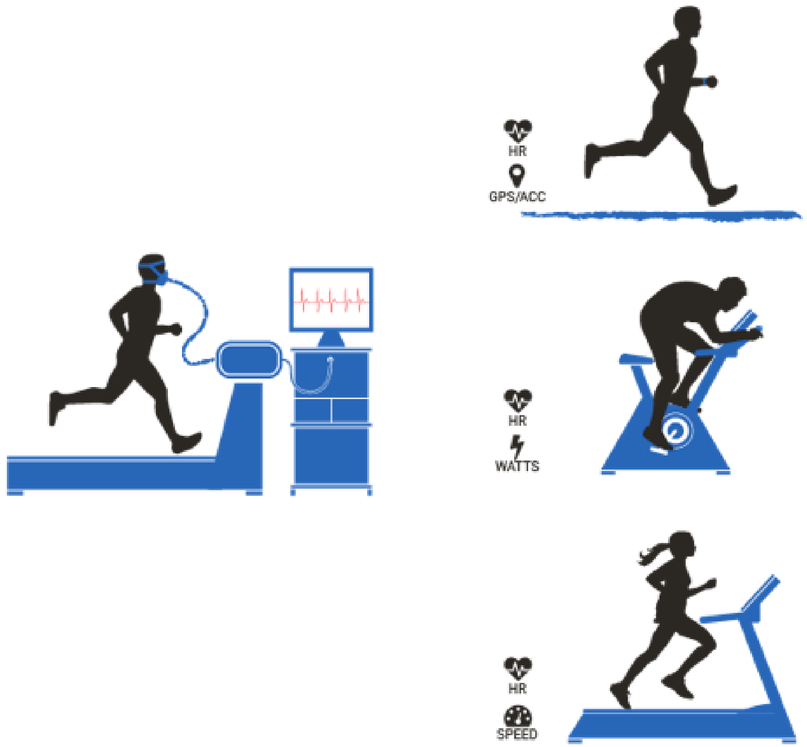


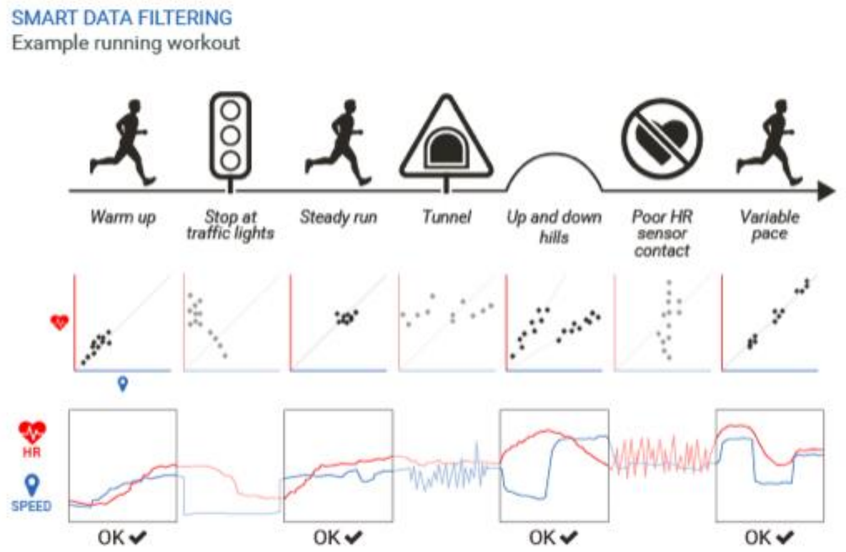
Helo

Maximum oxygen measurement



Direct measurement of VO2max requires monitoring oxygen consumption using metabolic cart during maximal exercise on a treadmill. Firstbeat can estimate your VO2max during any freely performed walk, run or ride with 95% accuracy.

Maximum oxygen measurement



The Firstbeat analytics engine automatically filters incoming signals to ensure only representative data is used in the detection of user VO2max fitness levels. This enhances both accuracy and reliability.

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etc.

Garmin

tactix Charlie

Rugged tactical GPS watch with advanced training analytic capabilities

12 Firstbeat features

Read more

Garmin

Forerunner 645 Music

Garmin Forerunner 645 Music is designed to give its user...

11 Firstbeat features

Read more

Suunto

3 Fitness

VO2max and sleep quality monitoring in a smart fitness watch

3 Firstbeat features

Read more

Huami

Amazfit Stratos

Premium multisport design meets advanced training analysis

8 Firstbeat features

Read more

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LUMO

ECG monitoring

- Single limb-lead ECG recording devices
- Chest-lead ECG devices
- Multi lead devices (Holter)

Cardiology Technology

Wearable ECG Monitor

เพื่อบันทึก ECG, อัตราการเต้นของหัวใจ, SPO2
ตลอดทุกสภาวะการทำงานของหัวใจตามที่แพทย์สั่ง
เพื่อตรวจจับอาการผิดปกติต่างๆ

Handheld/Pen ECG Event Recorder

เพื่อให้ผู้ป่วยบันทึก **ECG** ได้ทันท่วงทีและแม่นยำ
หน่วยความจำสามารถบันทึกอาการเสี่ยงโรคหัวใจได้ถึง **500** ครั้ง

Traditional ECG machine

เครื่องวัด **ECG** แบบดั้งเดิม ขนาดใหญ่ ใช้ในโรงพยาบาลเท่านั้น
อาจไม่สามารถตรวจอาการของผู้ป่วยได้ทันท่วงที

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Cardiology Technology

Portable “Energy” ECG recorder
(New ECG technology)

สามารถตรวจจับการเริ่มต้นความผิดปกติของหัวใจได้ล่วงหน้า ก่อนที่จะเกิดอาการ โดยตรวจจับ myocardium energy ในแต่ละ cardiac cycle, diastolic dysfunction, pathology change ได้ก่อนเครื่อง ECG แบบปกติ

เพื่อให้แพทย์ตรวจจับและบันทึกอาการผิดปกติของหัวใจของผู้ป่วยที่เกิดขึ้นได้ทันที รวดเร็วกว่าในอดีตเพื่อให้ผู้ป่วยใกล้ชิดกับแพทย์มากขึ้น อีกทั้งวิเคราะห์สังเกตุอาการผิดปกติล่วงหน้ามากขึ้นโดย engery ECG เทคโนโลยีใหม่ล่าสุด

CG Holter

าารเต้นของหัวใจ, SPO2

เชื่อมต่อ Wifi เพื่อสังเกตุอาการโดยแพทย์ได้ตลอด 24 ชั่วโมง

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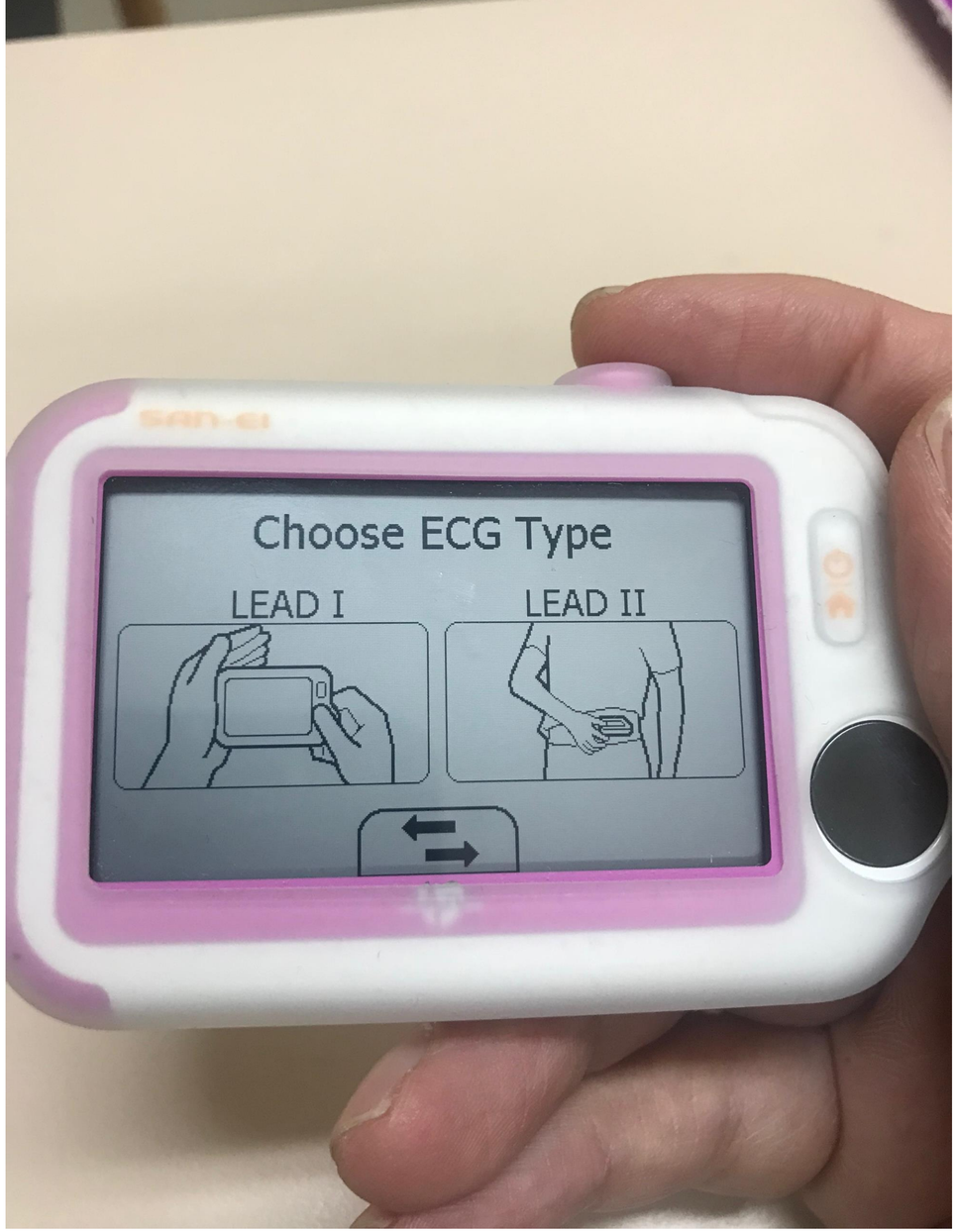

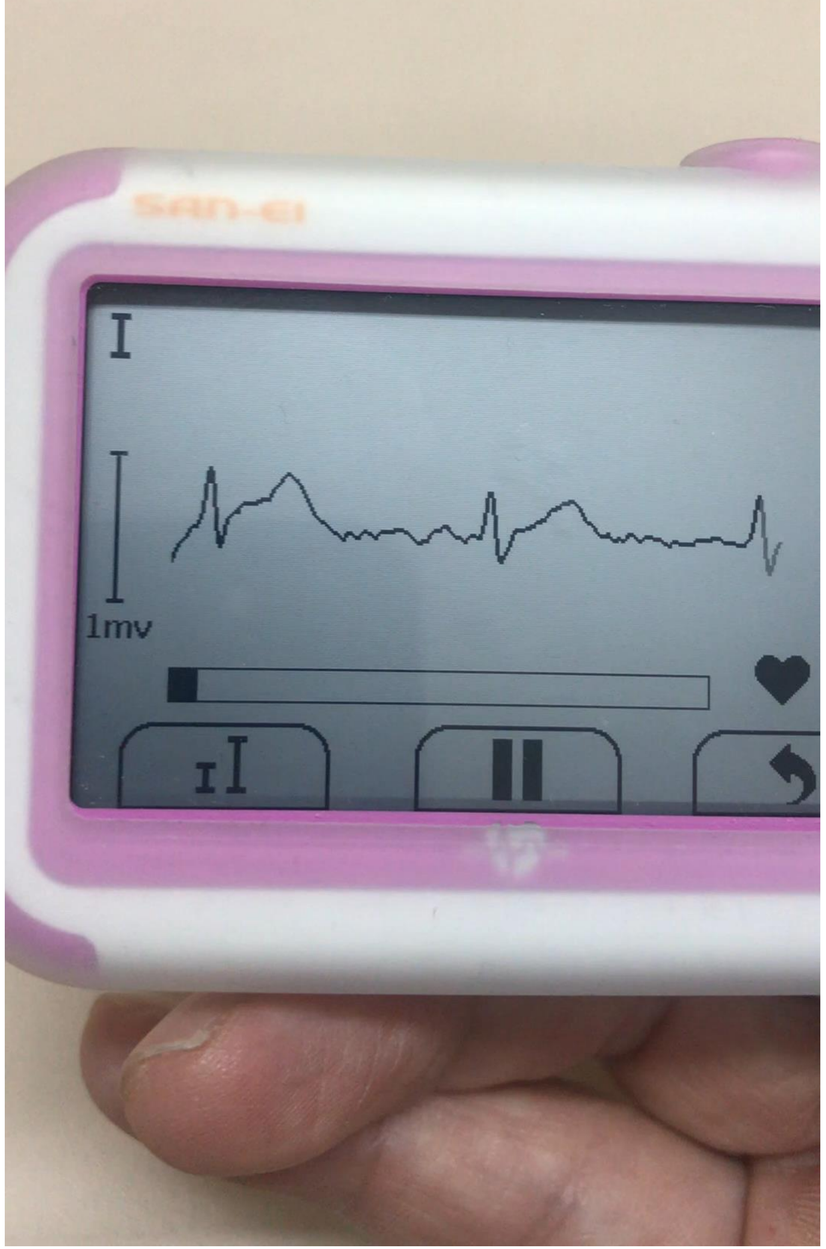

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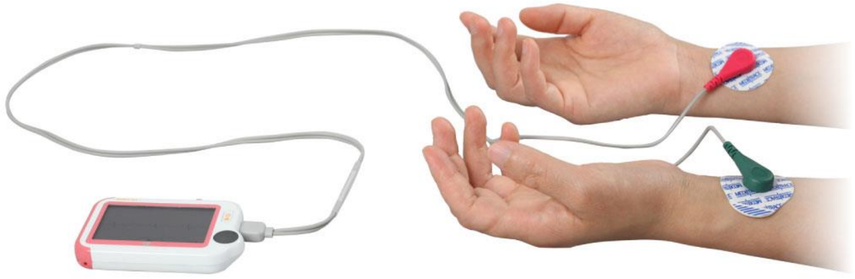
心電計

自覚症状が出たらすぐに測定

Lite Pro S

どこでも一緒のコンパクトサイズ



Pro S プロSでは心電コードを使用した測定も可能

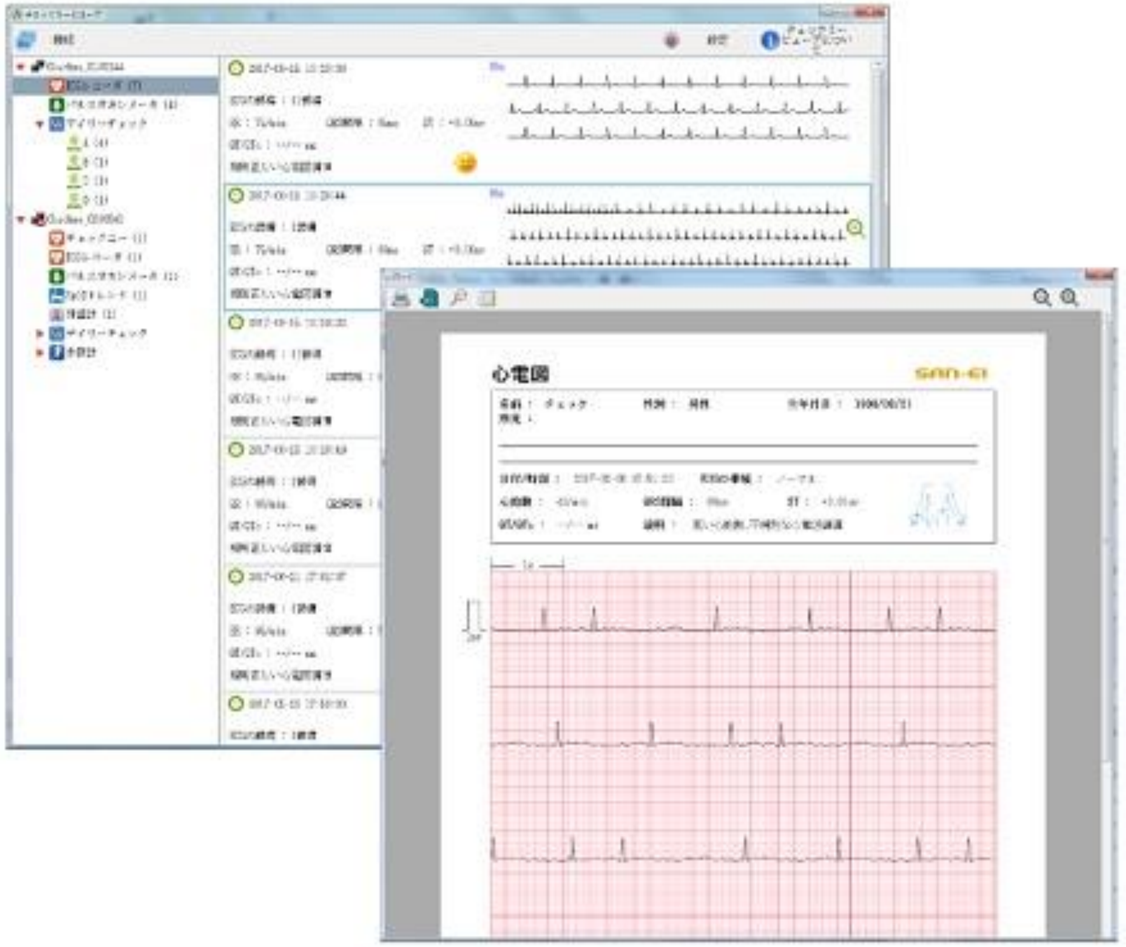
パルスオキシメータ

健康バロメータとなる動脈血酸素飽和度を測定

Lite Pro S

ストレスフリーの測定方法

Pro S プロSではSpO2外部センサーを
使用した測定も可能



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Received: 19 September 2017 | Accepted: 8 December 2017
DOI: 10.1002/joa3.12035

REVIEW ARTICLE

WILEY Journal of Arrhythmia

Portable out-of-hospital electrocardiography: A review of current technologies

Agam Bansal MBBS[1] | Rajnish JoshiMD, MPH, PhD[2]

- We conducted PubMed and Internet searches for "handheld" or "wearable" or "patch" electrocardiography devices to enlist available technologies. We also searched PubMed with names of individual devices to obtain additional citations. We classified available devices as a "single limb lead ECG recording devices" and chest-lead "ECG recording devices." If a device used more than three electrodes, it was defined as a conventional electrocardiography or Holter machine and was excluded from this review.

We identified a total of 15 devices. Overall, only six of these devices (five single lead and one chest lead) featured in published medical literature as identified from PubMed search. A total of 13 citations were available for the single limb lead ECG recording devices and 6 citations for the chest-lead ECG recording devices.

Journal of Arrhythmia. 2018;34:129–138

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- Al

Prevalence of atrial fibrillation-35.8%
Atrial fibrillation was defined as absent P wave and RR interval irregularity on ECG
Sensitivity-98% (89%-100%)
Specificity-97% (93%-99%)
Accuracy-97% (94%-99%)

Prevalence of AF-2.76%
Sensitivity-71.4% (51%-87%)
Specificity-99.4% (99%-100%)
PPV-76.9% (56%–91%)
NPV-99.2% (98%–100%)

Prevalence of AF-6.7%
Sensitivity-98.5% (92%-100%)
Specificity-91.4% (89%-93%)

Alivecor is accurate in measuring QTc interval ($P < .01$)

Journal of Arrhythmia. 2018;34:129–138

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REVIEW ARTICLE

WILEY Journal of Arrhythmia

Portable out-of-hospital electrocardiography: A review of current technologies

Agam Bansal MBBS[1] | Rajnish JoshiMD, MPH, PhD[2]

- Ziopatch

ZioPatch detected greater arrhythmia events compared to Holter monitor ($P < .001$)

Arrhythmia events were defined as detection of any 1 of 6 arrhythmias, including supraventricular tachycardia (>4 beats), atrial fibrillation/flutter (>4 beats), pause >3 s, atrioventricular block (Mobitz type II or third-degree atrioventricular block), ventricular tachycardia (>4 beats), or polymorphic ventricular tachycardia/ventricular fibrillation

Mean wear time was 7.6 ± 3.6 d

Diagnostic yield of arrhythmia detection by ZioPatch was greater when taken for the entire wear duration compared with the first 48-h Holter monitor ($P < .0001$).

Arrhythmias were defined as one of the following: atrial fibrillation, pause >3 s, second-degree Mobitz II or complete AV block, SVT, VT, and symptomatic bradycardia.

Mean monitoring period of 10.8 ± 2.8 d

Atrial fibrillation was defined as the absence of distinct P waves and irregular RR interval.

During first 24 h, mean atrial fibrillation detection by Holter and

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We identified a total of 15 devices. Overall, only six of these devices (five single lead and one chest lead) featured in published medical literature as identified from PubMed search. A total of 13 citations were available for the single limb lead ECG recording devices and 6 citations for the chest-lead ECG recording devices.

Journal of Arrhythmia. 2018;34:129–138

Received: 19 September 2017 | Accepted: 8 December 2017
DOI: 10.1002/joa3.12035

REVIEW ARTICLE

WILEY Journal of Arrhythmia

Portable out-of-hospital electrocardiography: A review of current technologies

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ชมรมป้องกันและฟื้นฟูหัวใจ

7th Asian Preventive Cardiology & Cardiac Rehabilitation Conference
Cum 11th Certificate Course in Cardiac Rehabilitation
8-11 November 2018 | Hong Kong Convention and Exhibition Centre
Host Organization

39th ANNIVERSARY สมิติเวช SAMITIVEJ

Our experience

- Patient report their own smartphone-based device, application
- Handheld ECG device for MET@Home project and active individual who want to return vigorous activities
- Setting the tele monitoring system with the property developer: SANSIRI

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Divine program

Divine
we define quality care

HOME DIVINE DIVINE CENTER HEALTH KNOWLEDGE NEWS

ถ้าความสมบูรณ์แบบ
ในชีวิตของคุณ ไม่ว่าจะ
เป็นเรื่องงาน เรื่องเงิน
ไลฟ์สไตล์ หรือครอบครัว
คุณได้เต็ม 100%

แล้วเรื่องสุขภาพ
คุณได้เท่าไหร่

DIVINE คือคำตอบของการดูแลสุขภาพแบบ EARLY DETECTION ในการวางแผนร่วมกันเพื่อการมีสุขภาพที่ดีในแบบของคุณ

ชมรมป้องกันและฟื้นฟูหัวใจ

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Cardiac telerehabilitation: current situation and future challenges

Ewa Piotrowicz[1] and Ryszard Piotrowicz[2]

- telemedical studies have mostly investigated electrocardiogram (ECG)-monitored exercise training at home and internet-based counseling for lifestyle modification in selected low-risk patients after an acute cardiac event. First reports of telerehabilitation in patients with heart failure are also promising. However, we need large scale prospective randomized studies to show that cardiac telerehabilitation is equally effective as it has been shown for exercise-based outpatient CR programs which are provided according to current standards and guidelines. Cardiac telerehabilitation is a promising new tool in particular to include patients in CR which are not living near a centerbased CR program or who are not able to attend such a program for various reasons and to improve long-term adherence to a healthy lifestyle after center-based CR.

European Journal of Preventive Cardiology 2013; 20(S2): 1–2

Are wearable tech the future of CR ?

The answer is YES YES YES

What next??

- Local centralised web-based program
- Standard protocol
- wearable as the medical appliance