



An importance of m-Health (Mobile Health) for the reforms in modern medicine

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Average Healthcare Spend as % of Gross Domestic Product for Member States in Study

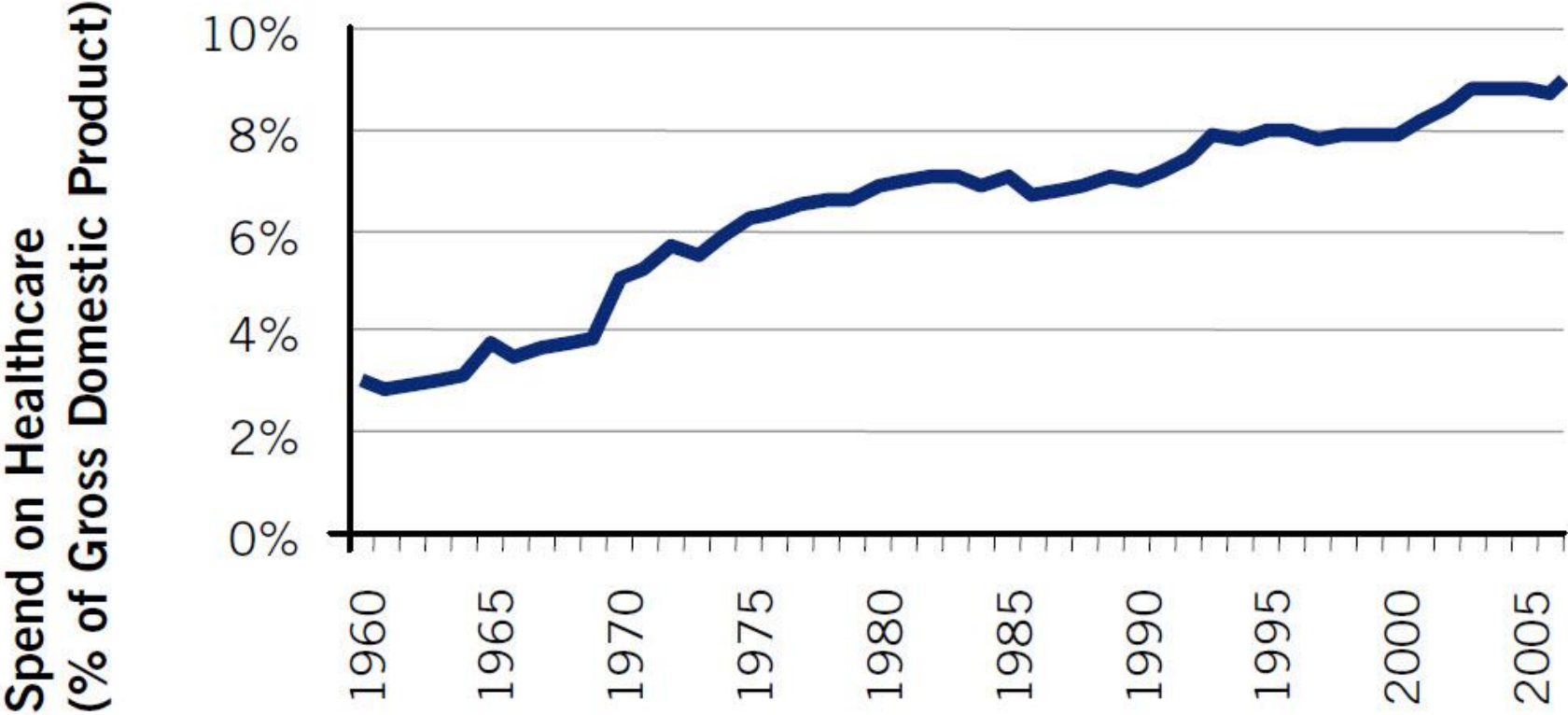
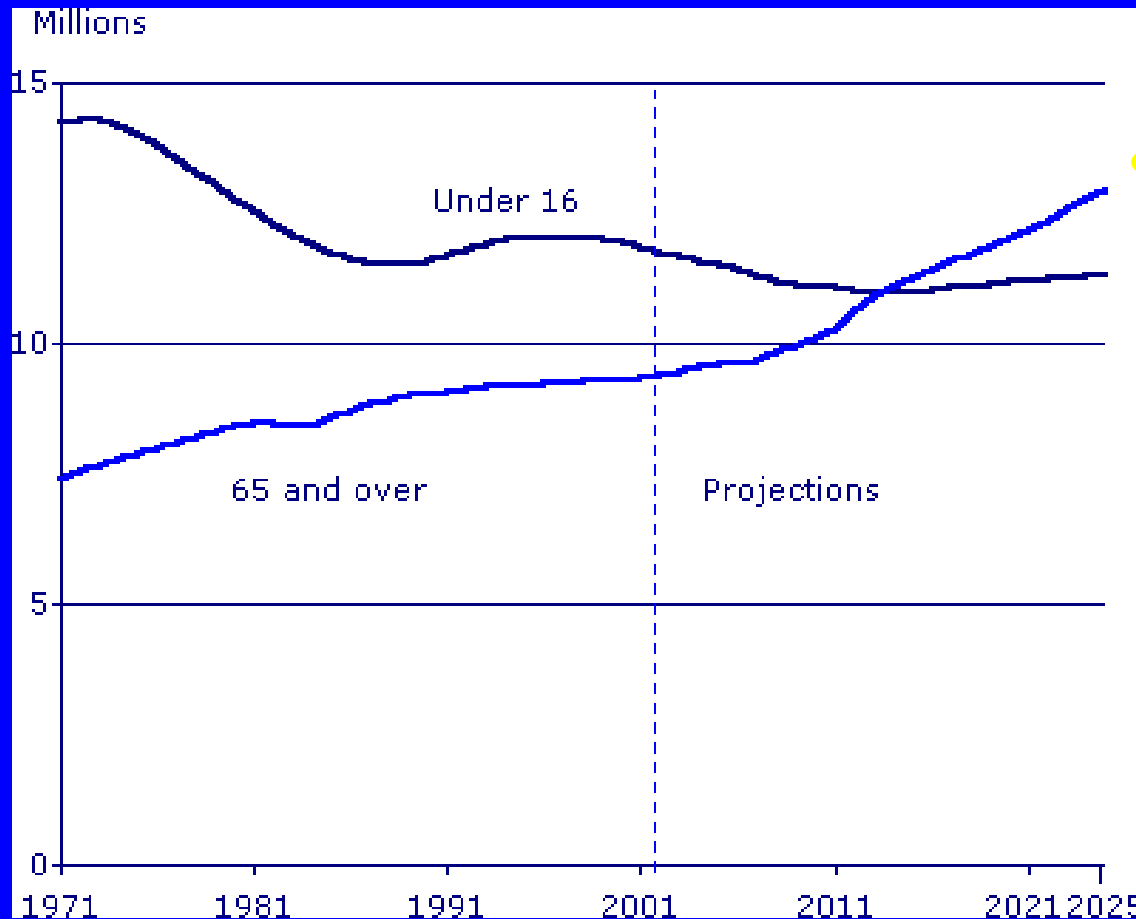


Figure 1. Healthcare Spend for Member States in Study

Problems of the Health Care

1. Increase in costs
2. Aging of population
3. Increased demands for higher quality of treatment and decrease in medical errors
4. Demand for the access to medical data and medical help from different locations

Demographic changes (UK)

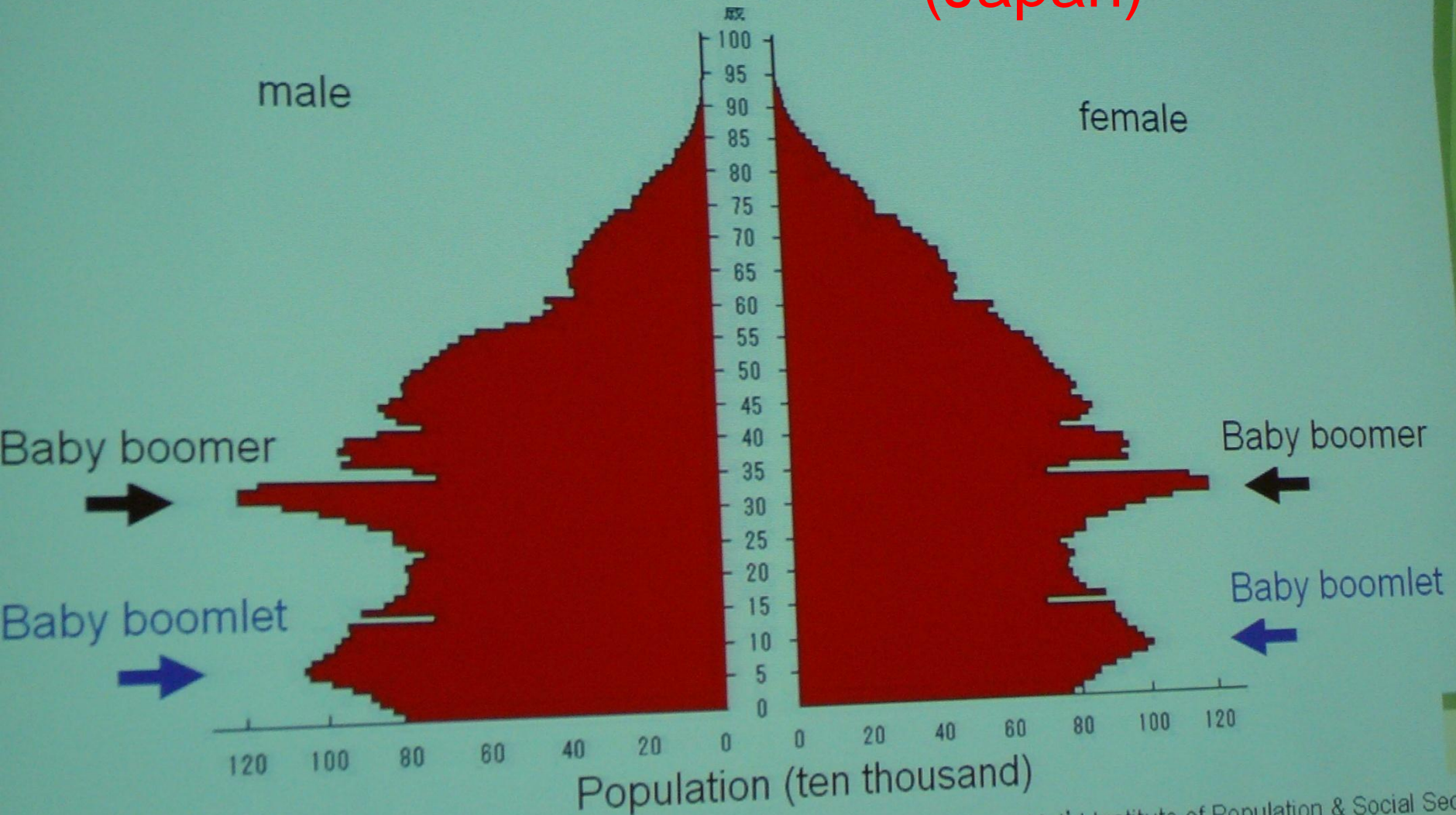


Projections suggest that the number of people aged 65 and over will exceed the numbers aged under 16 by 2014. By 2025 there will be more than 1.6 million more people over the age of 65 than people under 16.

Population pyramid

1980

(Japan)



Population pyramid

2050

Projection

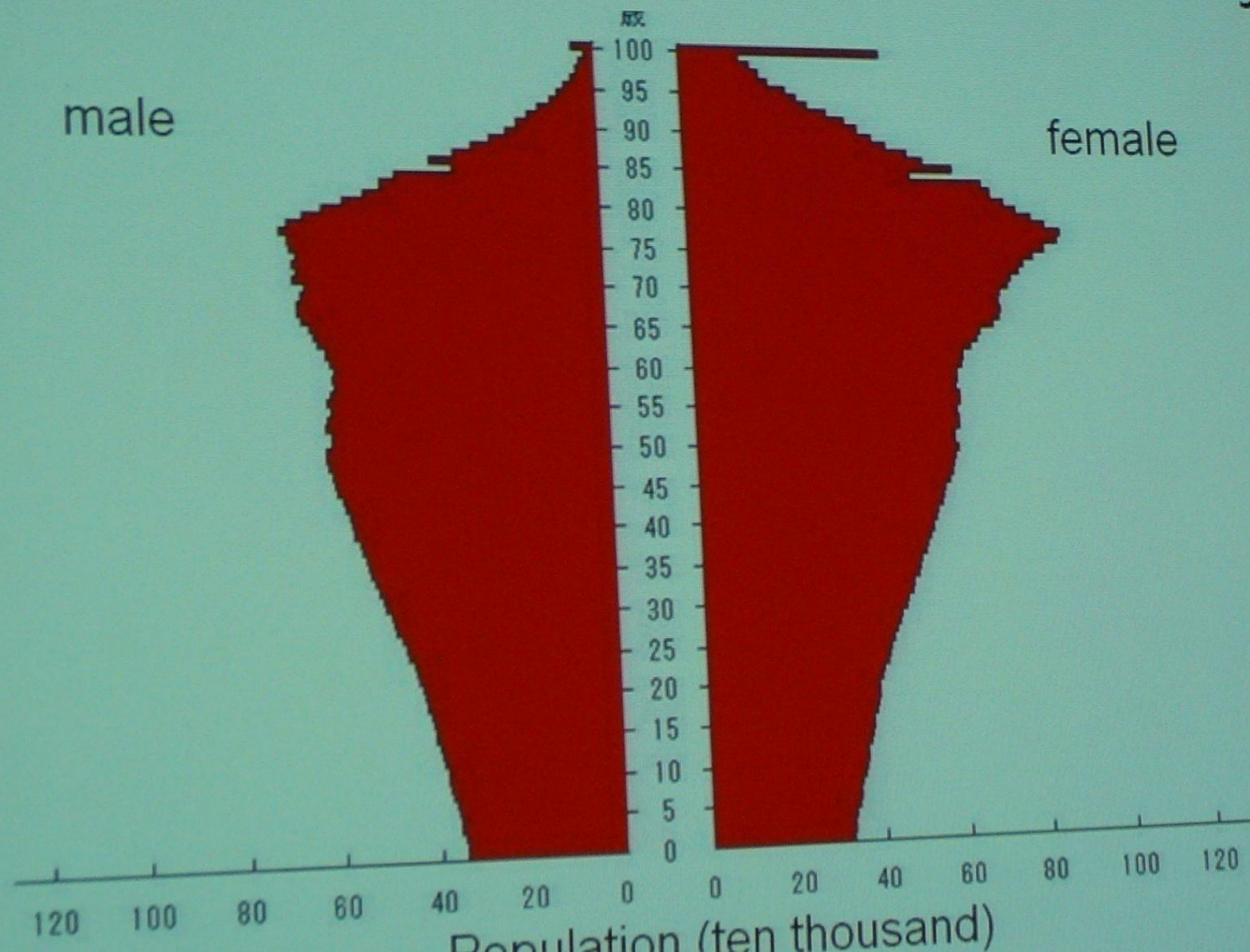
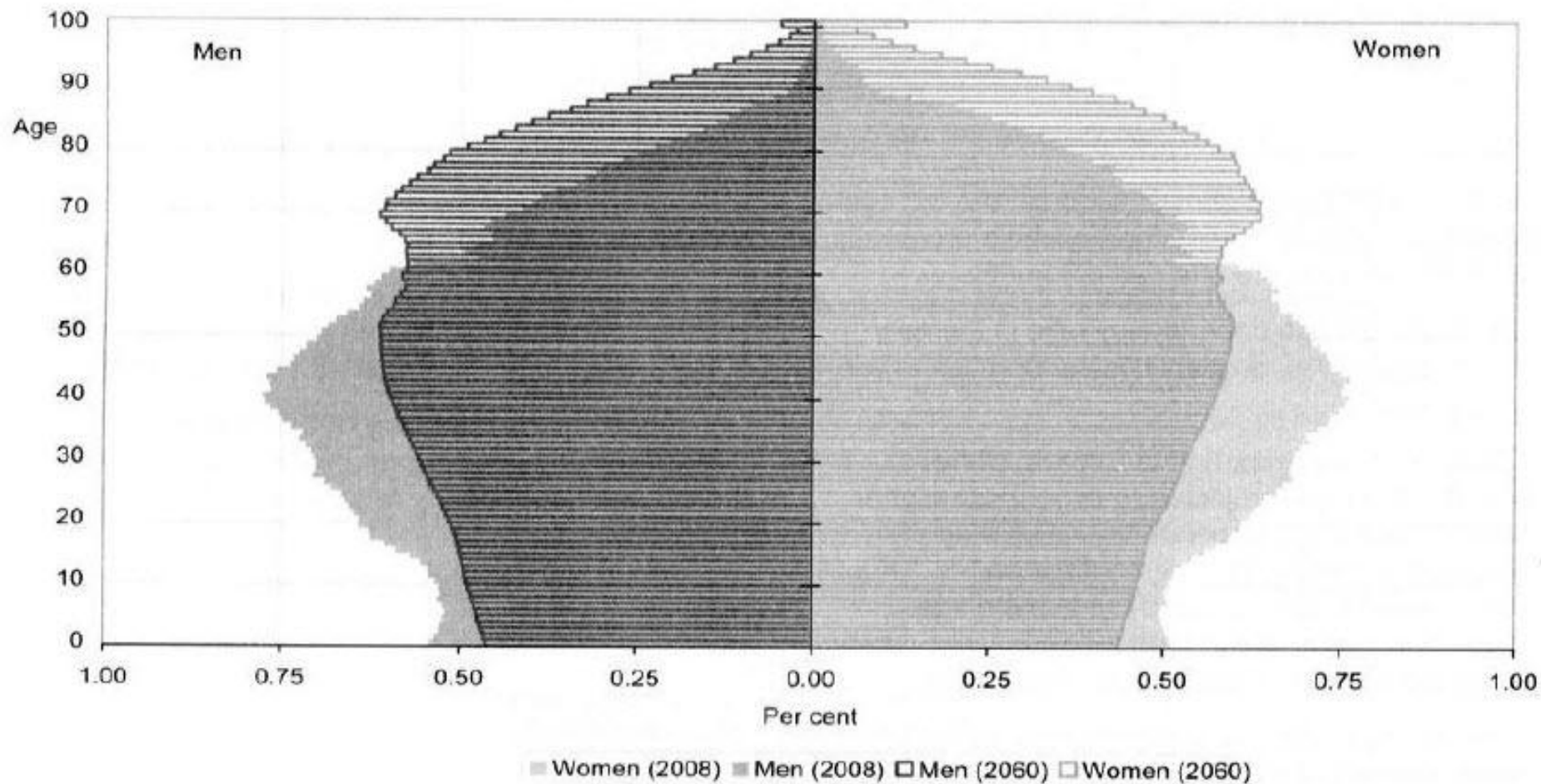
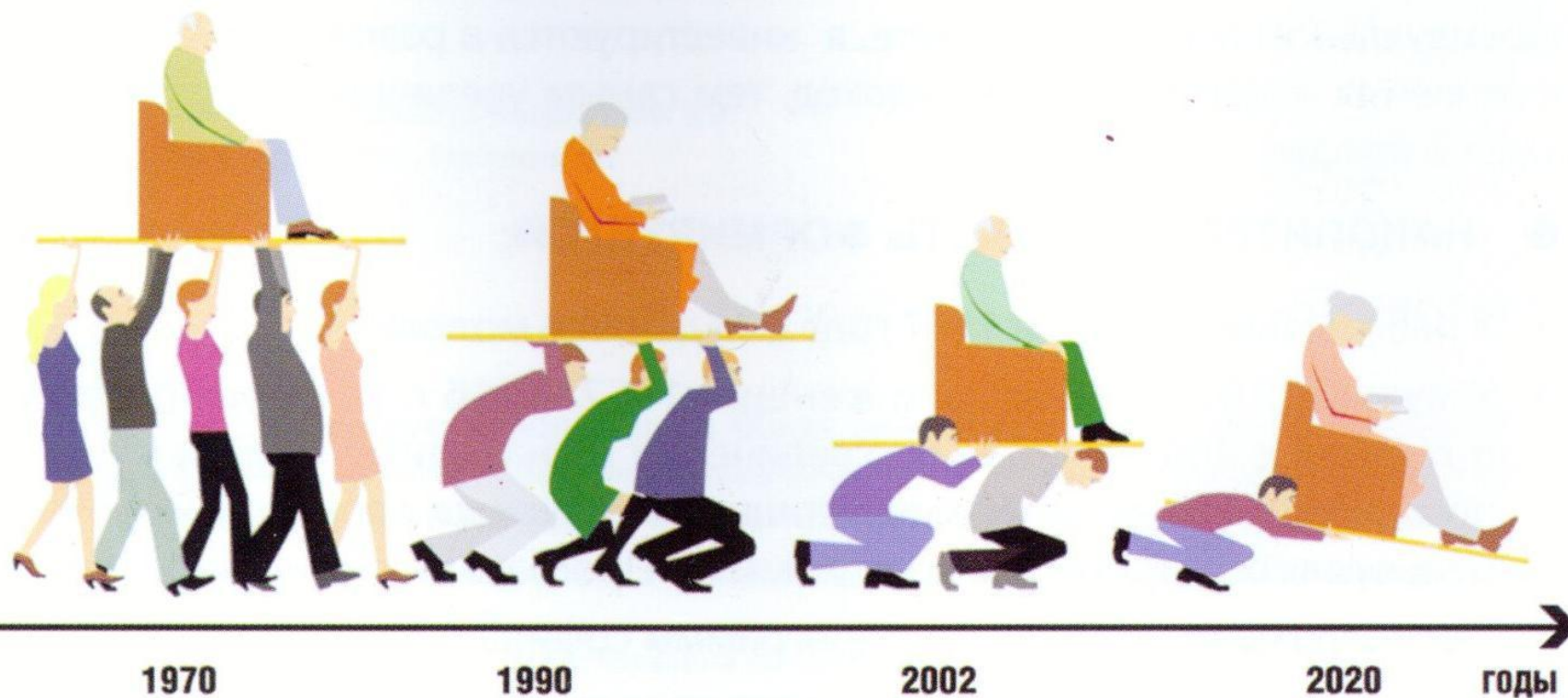


Figure 5: Population pyramids, EU27, 2008, 2060



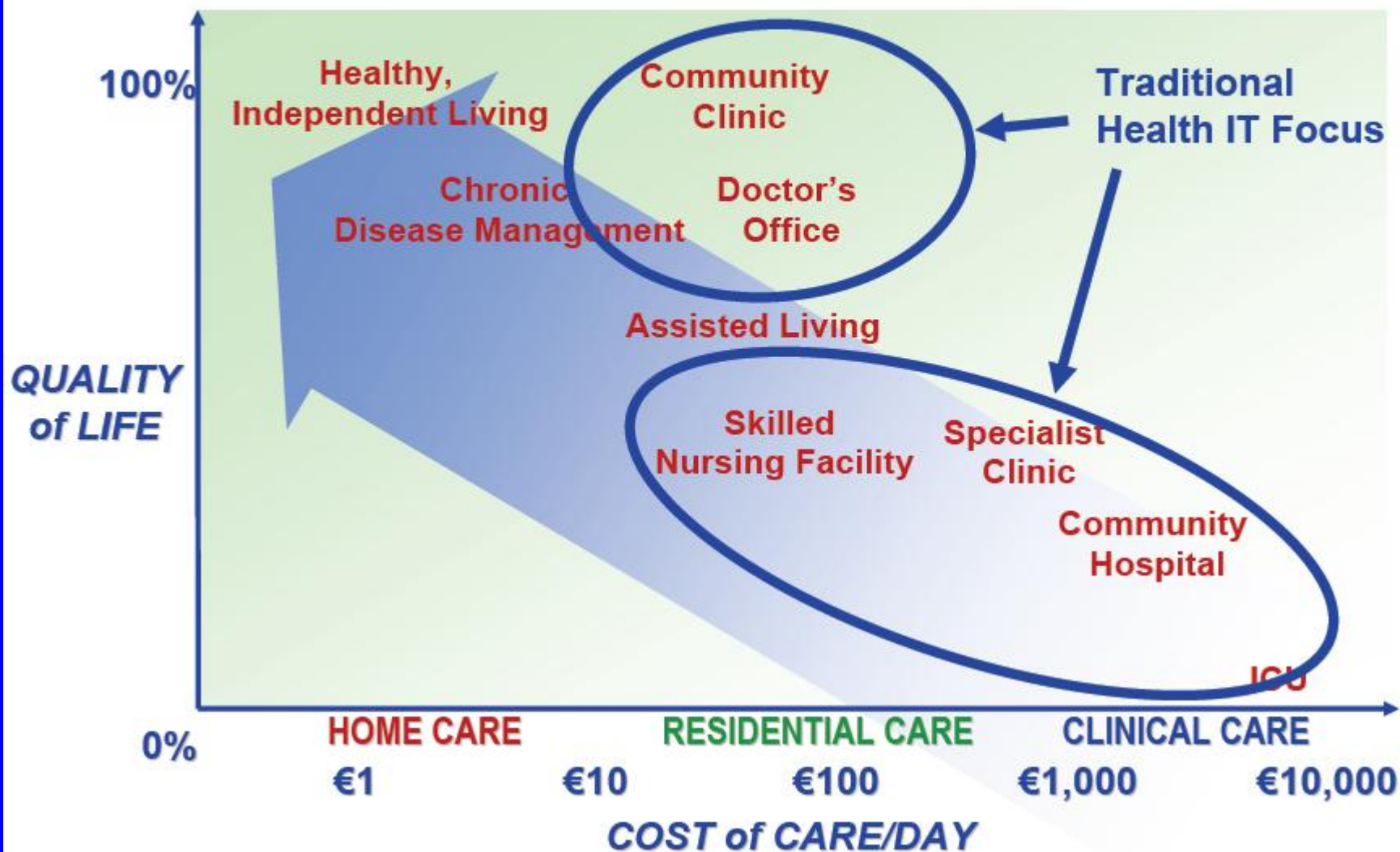
Source: Eurostat, EUROPOP2008 convergence scenario

Соотношение трудоспособного населения и пенсионеров



Именно поэтому в 2002 году в нашей стране стартовала пенсионная реформа,

Health and Social Care Costs

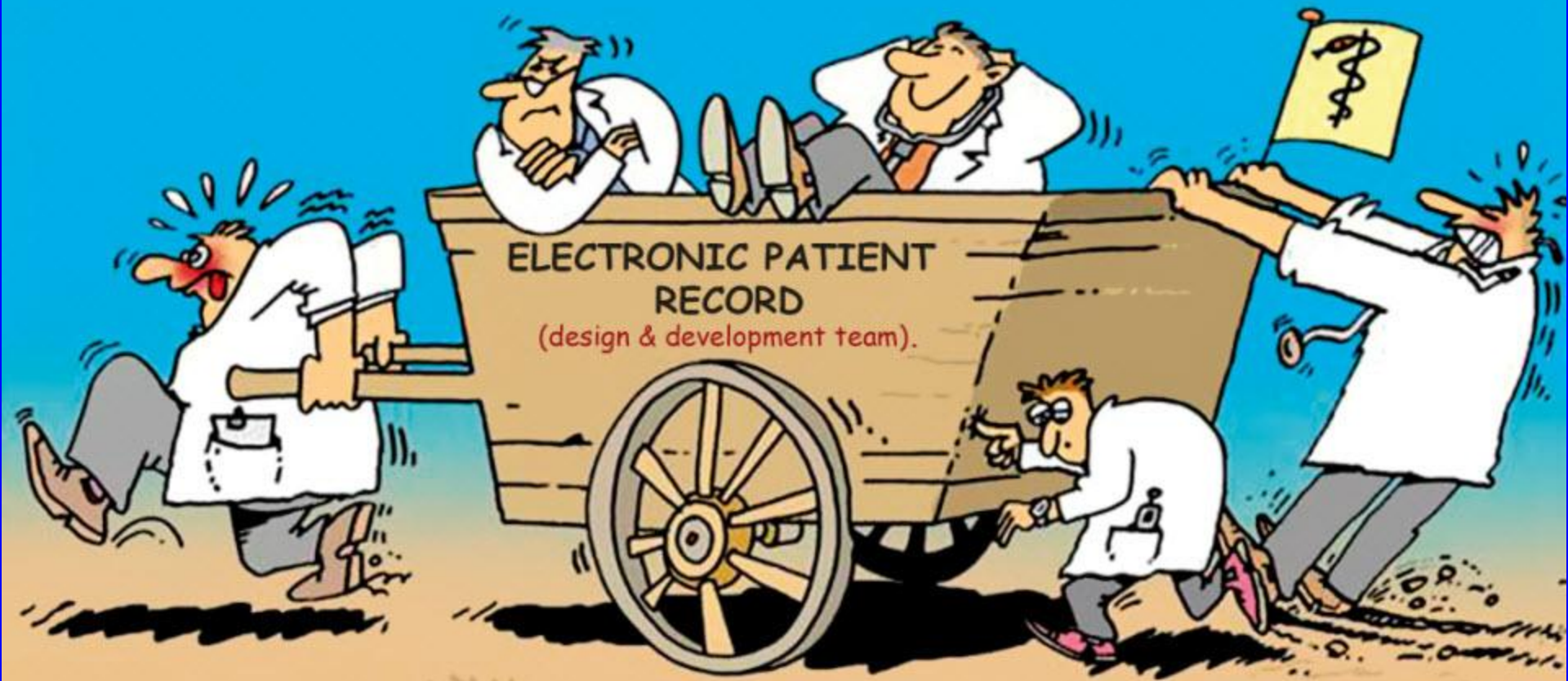


The Traditional Model of Care

- One Patient at a time
- Only Know about patients who appear in your office
- No use of IT
- Limited use of extenders

New Model Elements

- Accountability for panel/population
- Transparency
- **Use of EMR, registries, internet**
- Moving care out of the Dr. office



What does m-Health mean?



Introduction

- **mHealth** is the use of mobile communication technologies as an integral part of healthcare delivery.
- **mHealth** is part of eHealth and therefore it carries all of its promises and concerns-plus. mHealth has to be part of an architecture and not another silo in the eHealth arena.
- **Mobile phone** is one of the fastest growing telecommunication infrastructure at both national and global levels. ITU predicts an estimate of 4.6 billion subscriptions globally by end of 2009. It is expected that 45 % of traffic on mobile networks will be data.
- **mHealth** aims to improve healthcare delivery through eCare, eServices, eSurveillance and eLearning.



Global Observatory for eHealth:mHealth

- Measure trends and up take of eHealth at global level;
- Second Survey completed in 2009. Focused on mHealth as an emerging eHealth application:
- The following mHealth services were identified by 115 countries as related to public health:
 1. Emergency toll-free telephone services;
 2. Community mobilization / health promotion campaigns;
 3. Awareness raising;.
 4. Emergencies;
 5. Health surveys;
 6. Surveillance.



World Bank mHealth Summit (October 2009)

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m-Health: From Policy to Implementation

The World Bank Day @ mHealth Summit

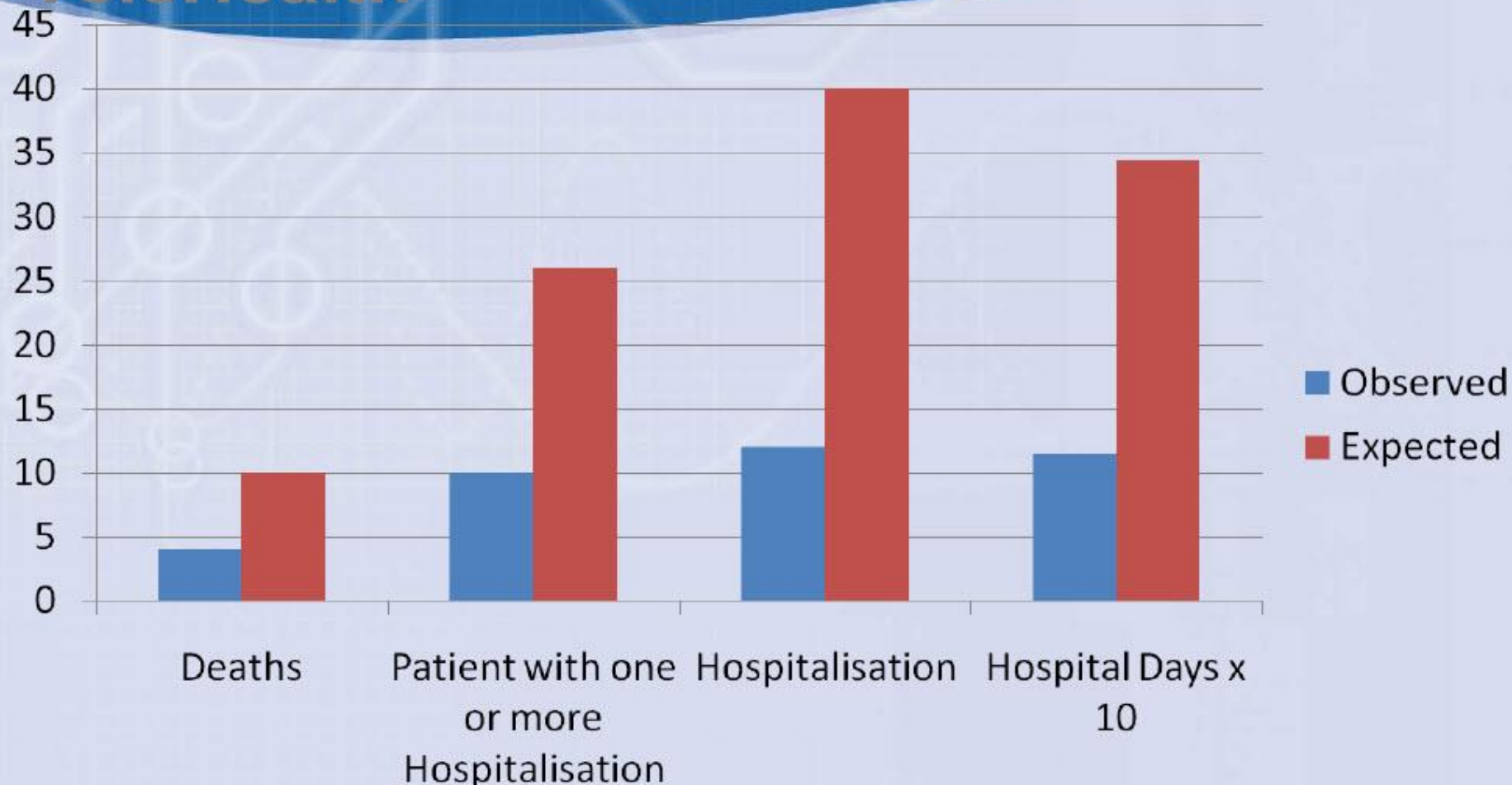
<http://go.worldbank.org/MP5IY2CJA0>



Photo credit: Text to Change

October 28th, 9:00 a.m. - 5:30 p.m. Washington DC time
Venue: 2121 Pennsylvania Ave., IFC Auditorium

Outcome of Patients Enrolled in TeleHealth



Economical benefits of remote patient monitoring (RPM)

Heart Failure Care Comparison:
RPM vs. Standard Care and Disease Management, Per Patient Per Year

	Management Cost	Average Readmissions	Cost of Readmissions ^{##}	Gross Savings v. RPM	Net Savings v. RPM
RPM	\$2,052 - Technology* \$2,082 - Technology & DM [†]	0.552 [§]	\$5,632		
Disease Management	\$750 [†]	1.116 ^{**}	\$11,387	\$5,755	\$3,703
Standard Care	0	1.320 ^{††}	\$13,468	\$7,836	\$5,034

New England Healthcare Institute, 2009
Remote Physiological Monitoring

Friday, February 23, 2007

Mayo Clinic Health Software for Mobile Phones

Filed under: [Telemedicine](#)

The Mayo Clinic and Garmin are teaming up to provide up to date health information on your cell phone. In addition to a symptom checker and first-aid tips, their software will help you find the nearest ER or urgent care center.

February 23, 2007 Mayo Clinic and Digital Cyclone (a subsidiary of Garmin) have collaborated to develop a software application that delivers an array of health information and tools directly to cellular phones. The Mayo Clinic InTouch wireless health program

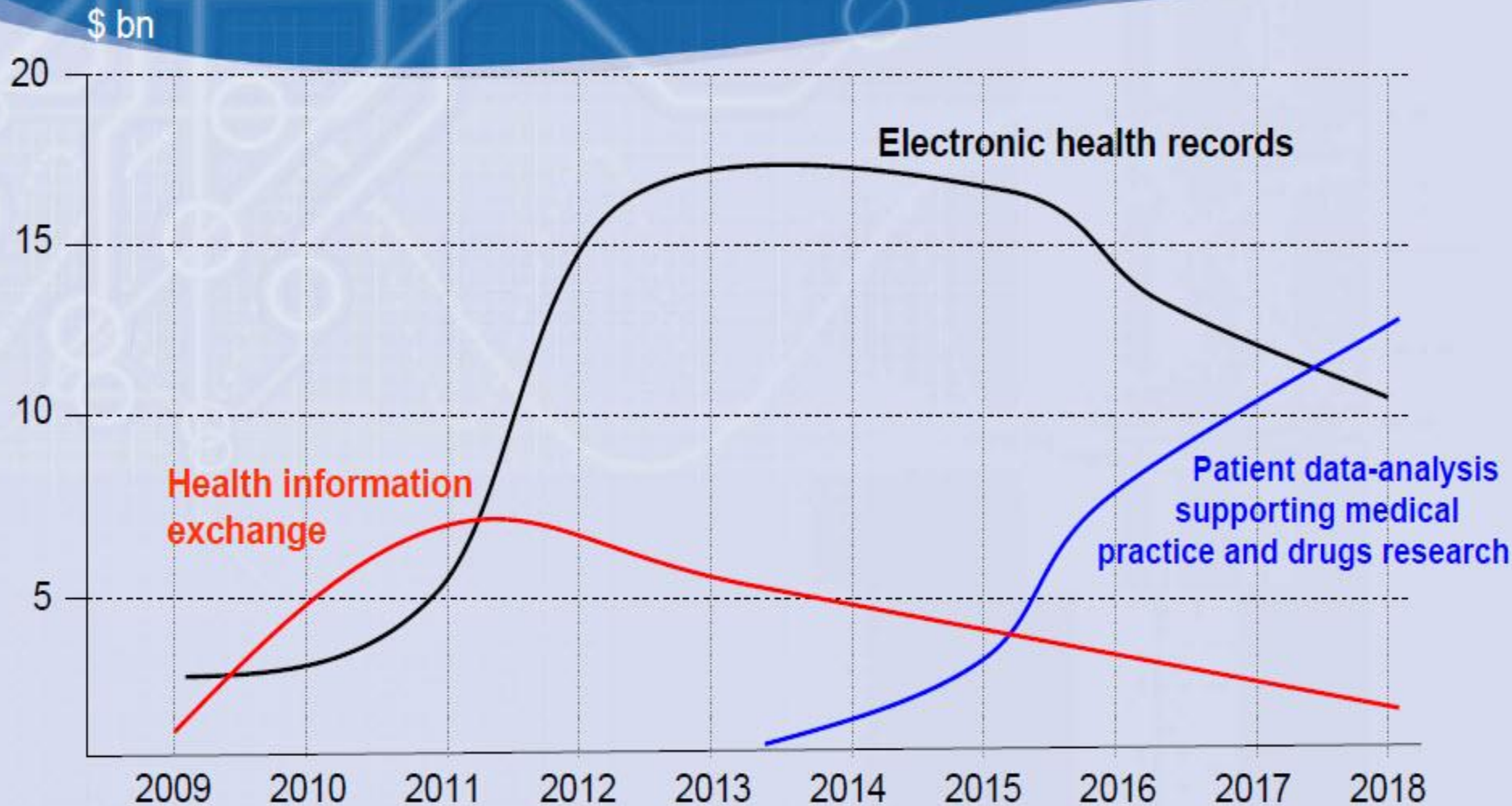


The New Model

Involve patient and family



Investment forecast in health information technology



CSC Healthcare. *The Economist*, April 18th 2009

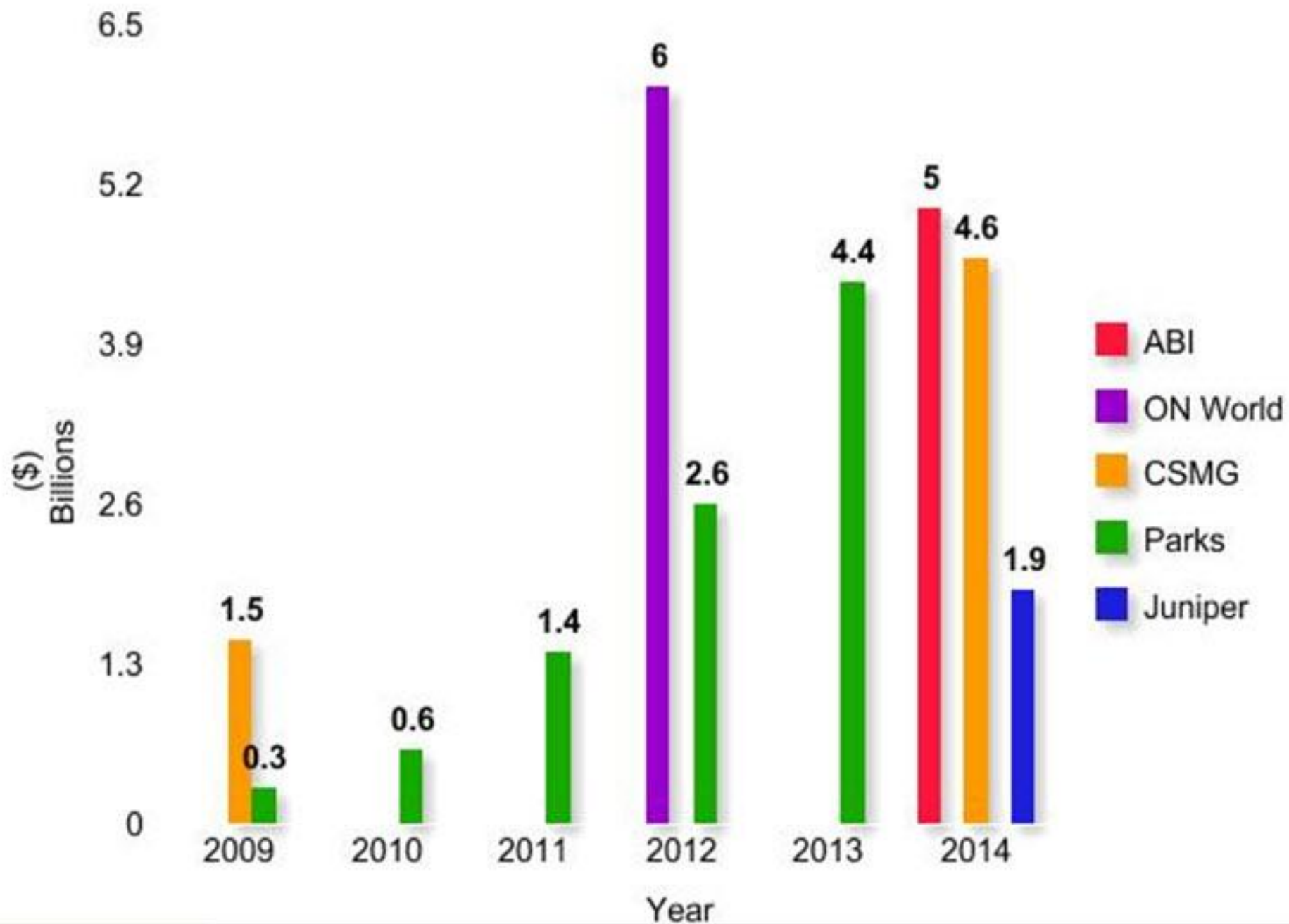


IT Spending in U.S. hospitals

Hospital IT Spend (in Billions)			
	Operating	Capital	Total Budget
2010			
Low Forecast	\$17.94	\$10.09	\$28.03
High Forecast	\$18.84	\$10.60	\$29.43
2011			
Low Forecast	\$19.73	\$11.10	\$30.83
High Forecast	\$20.72	\$11.65	\$32.37
2012			
Low Forecast	\$22.69	\$12.76	\$35.46
High Forecast	\$23.83	\$13.40	\$37.23
2013			
Low Forecast	\$26.10	\$14.68	\$40.78
High Forecast	\$27.40	\$15.41	\$42.82
2014			
Low Forecast	\$29.60	\$15.25	\$44.85
High Forecast	\$31.08	\$16.01	\$47.10
2015			
Low Forecast	\$32.27	\$16.62	\$48.89
High Forecast	\$33.88	\$17.45	\$51.34
Five-year CAGR		10.28%	

- Projected 2009 spending:
 - \$27.5B - \$30.41B
- Actual 2009 spending:
 - \$28.03B

Mobile Health Revenue Predictions



FP7 Objective 3.5.1.1 – Personal Health Systems for Monitoring and Point of Care diagnostics

- **Focus on:**

- a1) Chronic disease management**

- intelligent closed-loop approaches
 - detect and assess trends and episodes
 - facilitate adaptive care
 - remote management, avoiding hospitalisation
 - promote doctor-patient interaction
 - potential for integration in the healthcare process

- a2) Preventive monitoring for people at risk**

- identify evolving patterns/trends in health & lifestyle parameters
 - indicate elevated risks of disease development
 - reveal episodes at early stages
 - facilitate personalised guidance
 - encourage citizen compliance
 - prompt for early medical intervention

FP7 Objective 3.5.1.1 – Personal Health Systems for Monitoring and Point of Care diagnostics

- **When :** Call 1
- **Budget :** 72 M€
- **Instruments:**
 - (a) Personalised Monitoring : IPs
 - (b) Point of Care diagnostics : IPs
 - 70.5 M€ for (a) and (b)
 - (c) Coordination and Support Actions: CSAs
 - 1.5 M€ max for (c) [3 x 0.5 M€ max per topic]

<http://www.itu.int/ITU-D/ict/publications/idi/2009/index.html>



**International
Telecommunication
Union**

Measuring the Information Society

Уровень развития ИТ в странах мира

Economy	Rank 2007	IDI 2007	Rank 2002	IDI 2002
Sweden	1	7.50	1	6.05
Korea (Rep.)	2	7.26	3	5.83
Denmark	3	7.22	4	5.78
Netherlands	4	7.14	6	5.43
Iceland	5	7.14	2	5.88
Norway	6	7.09	5	5.64
Luxembourg	7	7.03	21	4.62
Switzerland	8	6.94	7	5.42
Finland	9	6.79	8	5.38
United Kingdom	10	6.78	10	5.27
Hong Kong, China	11	6.70	12	5.10
Japan	12	6.64	18	4.82
Germany	13	6.61	14	5.02
Australia	14	6.58	13	5.02
Singapore	15	6.57	16	4.83
New Zealand	16	6.44	19	4.79
United States	17	6.44	11	5.25
Ireland	18	6.37	26	4.36
Canada	19	6.34	9	5.33
Austria	20	6.32	20	4.64
Chile	48	4.00	45	2.97
Uruguay	49	3.88	46	2.90
Russia	50	3.83	52	2.71
Ukraine	51	3.80	59	2.50
Malaysia	52	3.79	50	2.74
Jamaica	53	3.78	48	2.79

Your Next Computer

There are 1.5 billion mobile phones in the world today. Already you can use them to browse the Web, take pictures, send e-mail and play games. Soon they could make your PC obsolete

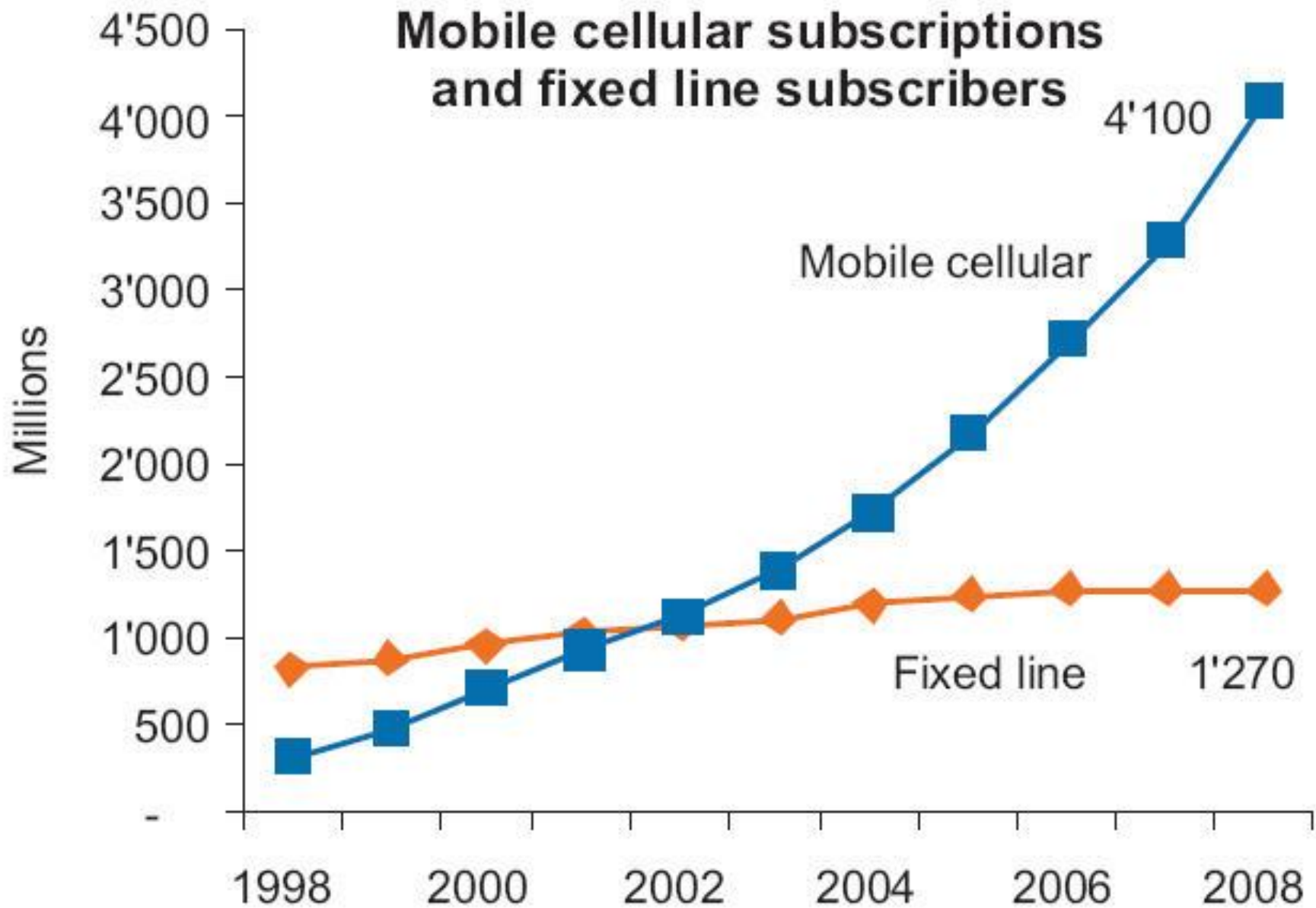


Misty Keasler for Newsweek

**Сотовый телефон -
Ваш следующий мобильный
компьютер**

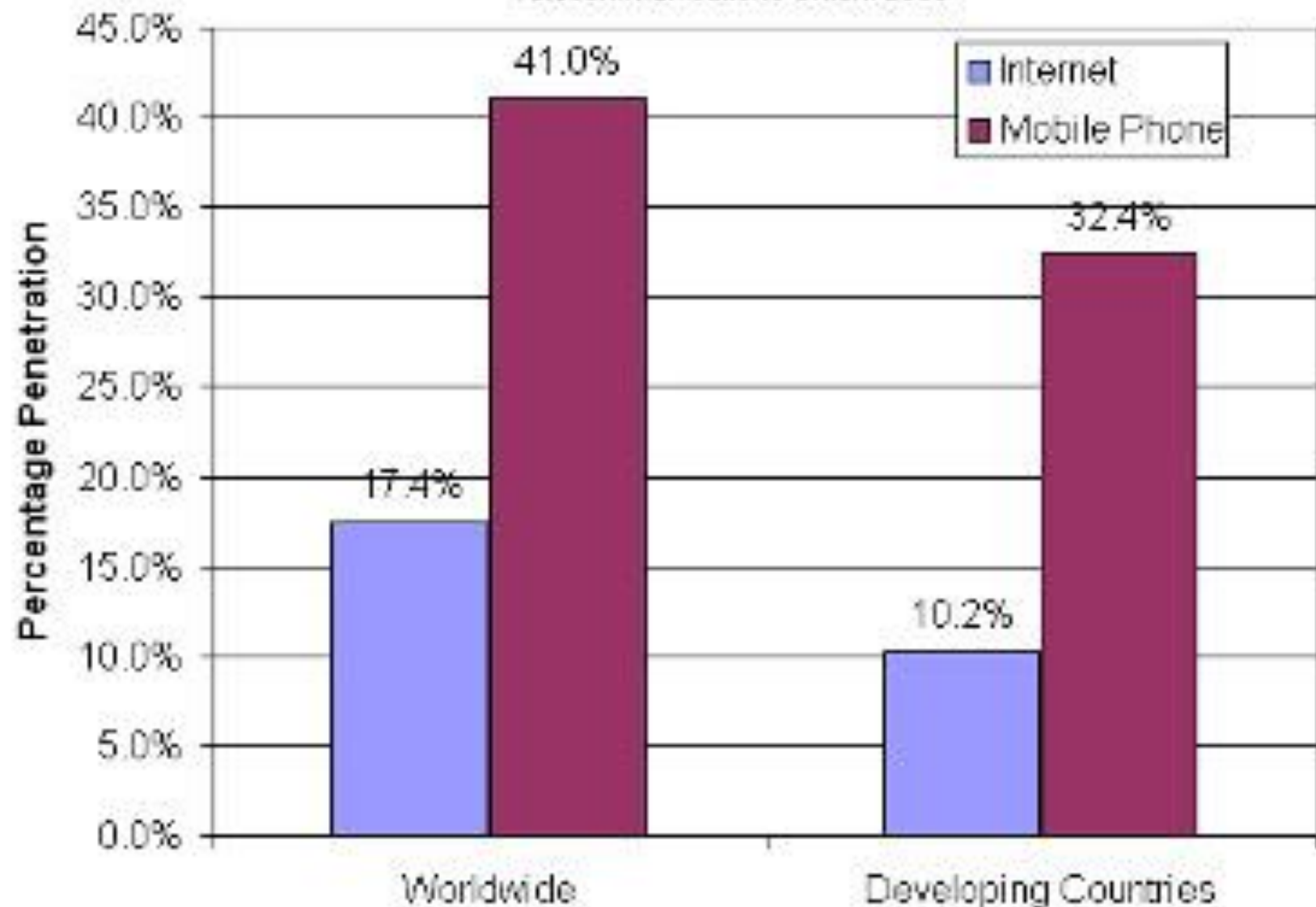
В корпусе сотового телефона «мозг» ноутбука

Mobile cellular subscriptions and fixed line subscribers



Internet Connectivity vs. Mobile Connectivity

Source: International
Telecommunications Union, 2006



ВСЕГДА НА СВЯЗИ

Сейчас в России

Мобильных
абонентов

96559532

Интернет-
юзеров

18344368

Источник: прогноз АС&М

Gartner: Global Phone Sales on the Rise Again

Categories: Cell Phones & Smartphones

Tags: Apple, iPhone, LG, Motorola, Nokia, Palm, RIM, Samsung, smartphones, Sony Ericsson, Symbian

Company	2009 Market		2008 Market	
	2009 Units	Share (%)	2008 Units	Share (%)
Symbian	80,878.6	46.9	72,933.5	52.4
Research In Motion	34,346.6	19.9	23,149.0	16.6
iPhone OS	24,889.8	14.4	11,417.5	8.2
Microsoft Windows Mobile	15,027.6	8.7	16,498.1	11.8
Linux	8,126.5	4.7	10,622.4	7.6
Android	6,798.4	3.9	640.5	0.5
WebOS	1,193.2	0.7	NA	NA
Other OSs	1,112.4	0.6	4,026.9	2.9

Telemonitoring strongly depends on what has to be transmitted

- Continuous measurements
 - ECG
 - Respiration
- Discrete measurements
 - Oximetry
 - Skin temperature
 - Blood pressure
 - Spirometry, etc.
- Events
- Alarms



technologies for innovation **csem**

Luprano, 2003

Nokia 5500 Sports Pedometer

By James Alan Miller

May 10, 2006

I



[Click to View](#)

Most people leave their [phone](#) home when they go out for a jog. With the introduction of the new mid-range 5500 Sport phone, [however](#), [Nokia](#) would like to give folks an extra incentive to carry a [mobile](#) handset along with them when they exercise.

Chest belt for pulse transmission via BlueTooth



Join your Body - **Blatand Body Networking.**



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Bluetooth Heart Rate Monitor.

"People who are really serious about software should make their own hardware." - Steve Jobs quotes Alan Kay at the MacWorld 2007.

Blatand offers a worldwide unique chest strap for heart rate monitoring. The chest strap communicates via Bluetooth short distance radio with your mobile phone or other end devices, e. g., the Bluetooth access point at a gym, a home computer or the rehab staff's PDA.

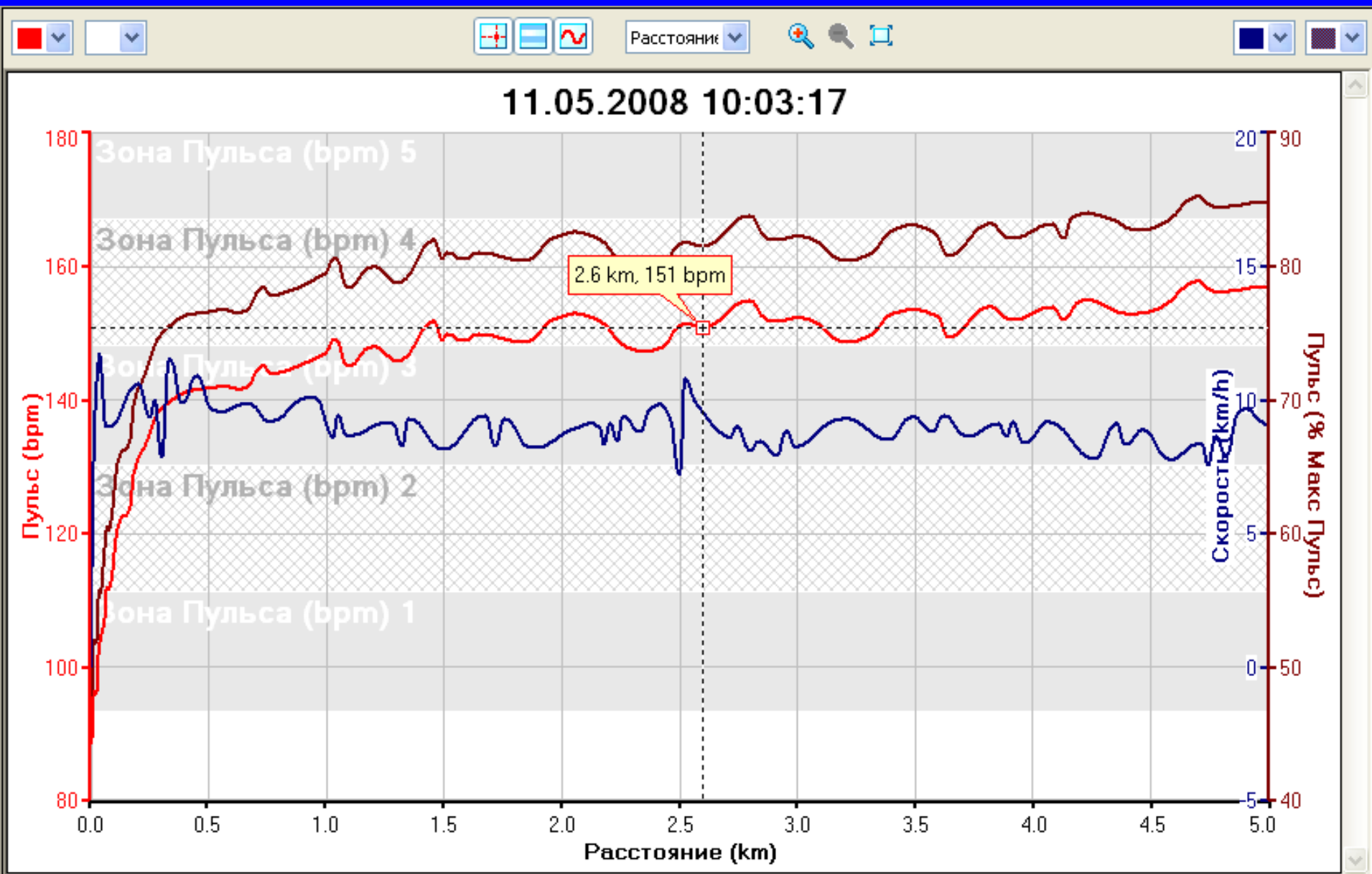
It is convenient, persistent, interference-proof, tap-proof and less expensive than conventional products.

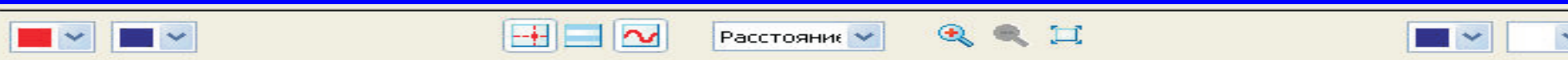


Heart rate monitor and GPS receiver by Garmin

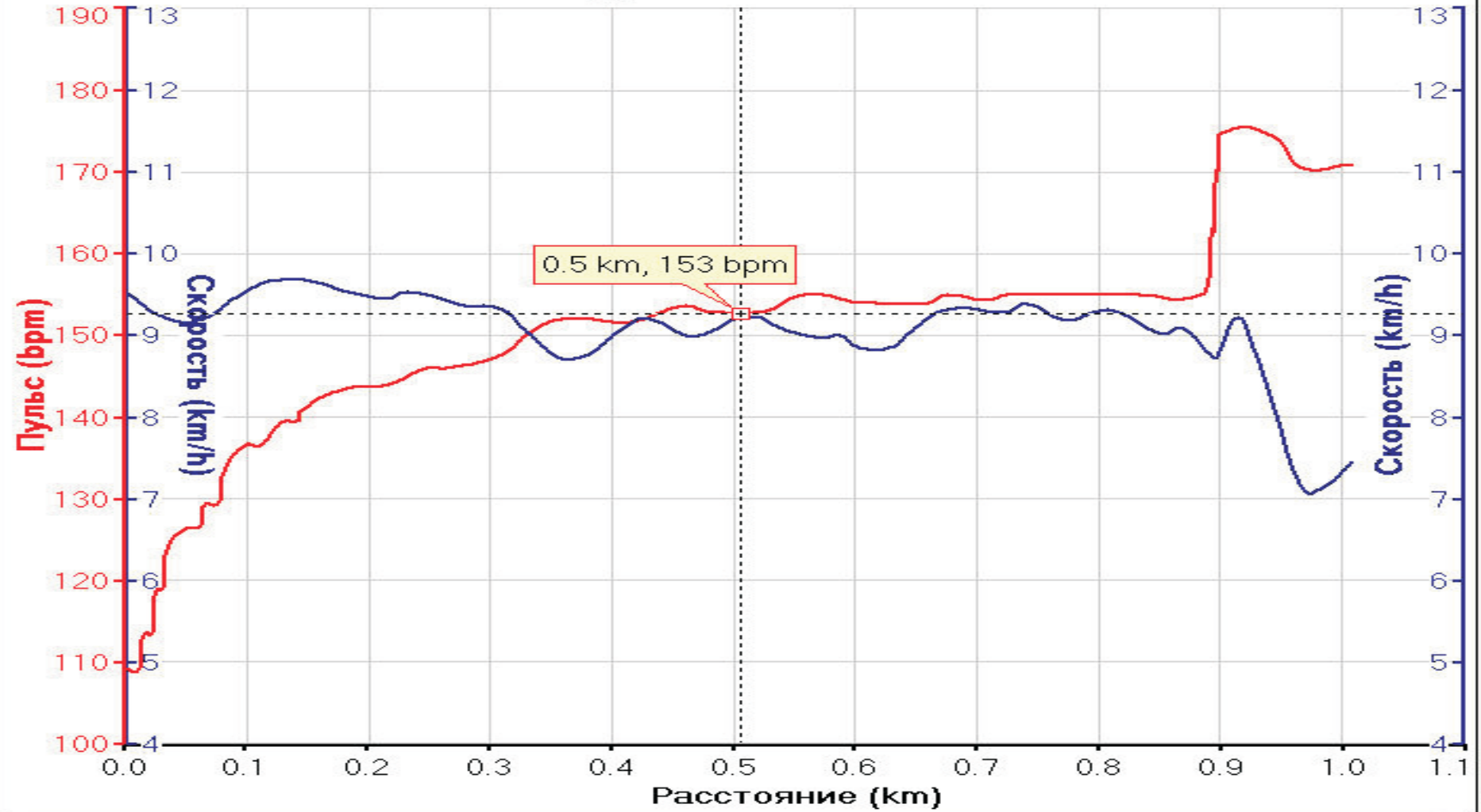


Recordings from Garmin Monitor





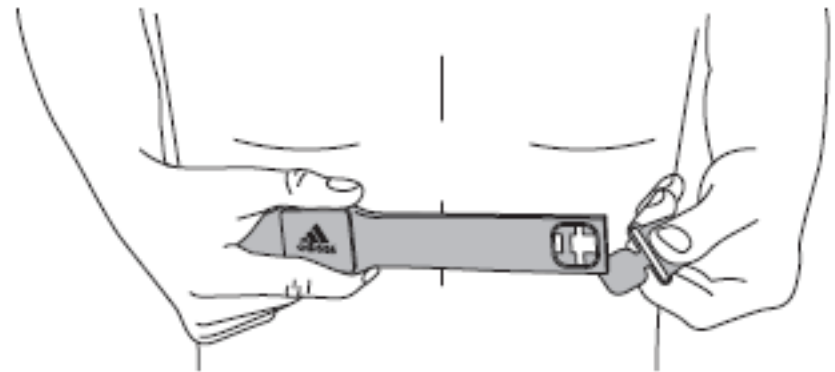
Круг3 - 10:55:41



Heart rate monitor by Samsung+Adidas

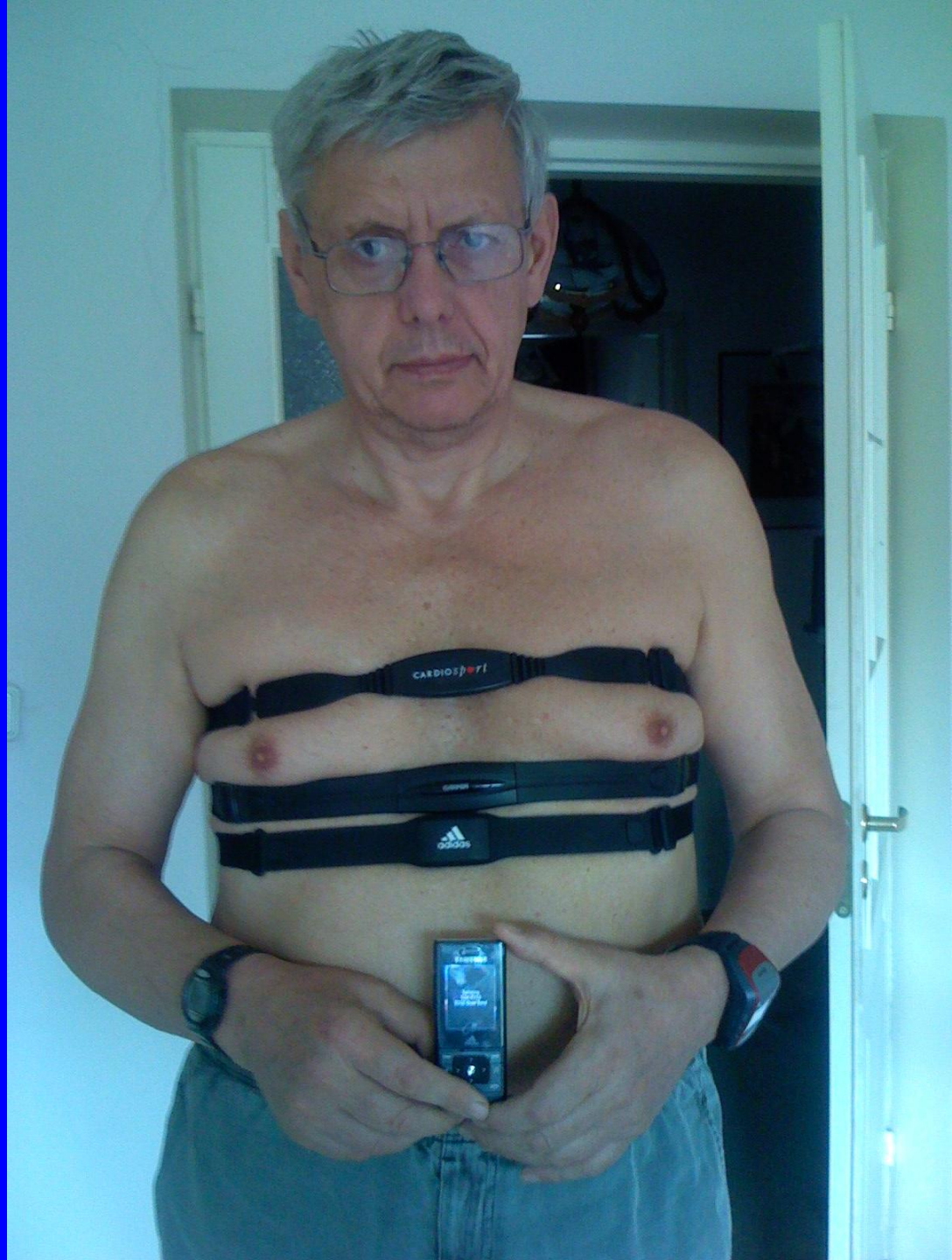


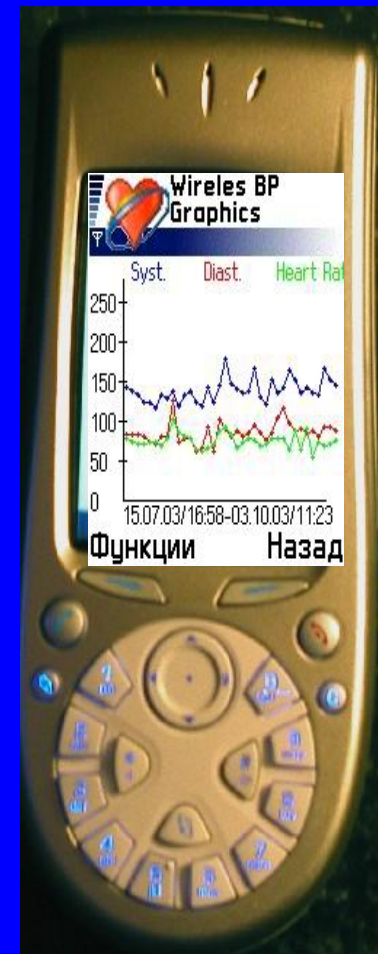
(см. Рис. 1)



(см. Рис. 2)







**Audio and
Visual Reminders**

Reminders on Pills

**Physician's access to
Patient data on Server**

Cellular Phone at the center

IEICE Transactions on **I**nformation and Systems 2006 E89-D(5):1702-1711; doi:10.1093/ietisy/e89-d.5.1702

Copyright © 2006 The **I**nstitute of Electronics, **I**nformation and Communication **E**ngineers

Regular Section -- Papers -- Human-computer **Interaction**

A Mobile-Care System **Integrated with Bluetooth Blood Pressure and Pulse Monitor, and Cellular Phone**

Ren-Guey LEE¹, Chun-Chieh HSIAO², Chun-Chung CHEN¹ and Ming-Shiu LIU¹

¹ The authors are with NTUT, Taipei, Taiwan, ² The author is with LHU, Taoyuang, Taiwan. E-mail:

Portable personal ECG monitor from VitaPhone (Germany)

Vitaphone Tele-ECG-Card 100 IR

Up to the minute ECGs with diagnostic quality at your fingertips

Indications Patients with cardiac arrhythmias who suffer from symptoms such as weakness, tachycardia, gallop rhythm or syncopes of unknown origin.

Important Functions

- recording and transmission (by phone) of short ECG-segments
- simple handling (2 buttons)
- recording available as fax or e-mail
- acoustic feedback



 [Technical details \(pdf\)](#)

➤ [Information for professionals](#)

➤ [Cardiac Arrhythmias](#)



Mobile Cardiac Monitoring

Bluetooth® ECG and Activity Monitor

Applications

- Cardiac Rehab
- Cardiovascular Screening
- Home Monitoring
- Disease Management
- Atrial Fibrillation Screening
- Mobile Telemedicine
- Activity Monitoring
- Falls Monitoring
- Fitness Monitoring
- Sports Training



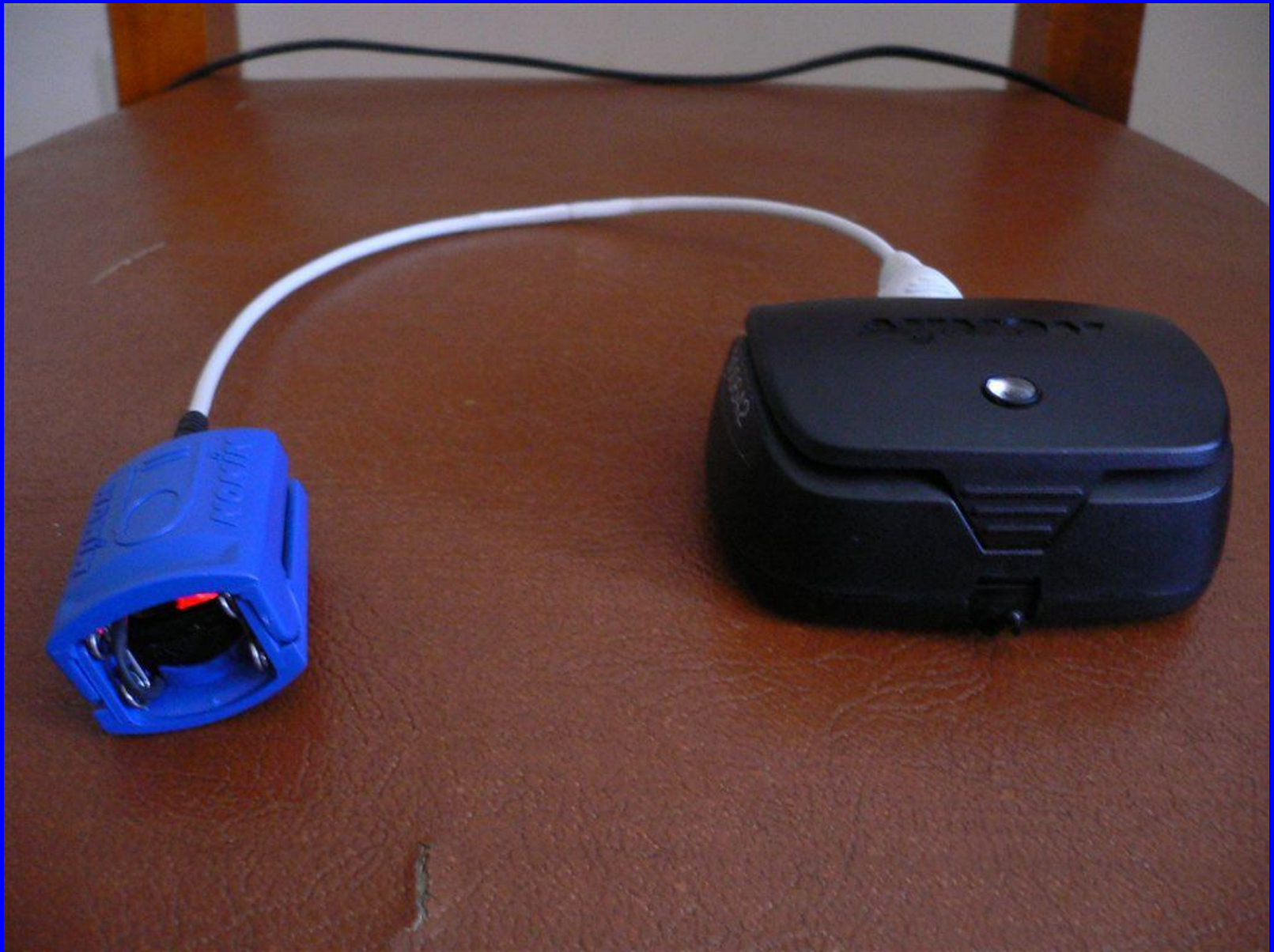
ECG recording on smartphone



The CardioPocket™ is an elegant leather wallet suitable for carrying bills, credit cards, identification cards and the like. In addition, it serves as a 1-lead (rhythm strip) ECG transmitter for diagnosing heart rhythm disturbances. The ECG transmitter inside the wallet encourages the subscriber to contact the Monitor Center immediately when discomfort occurs. By simply placing the wallet against the chest and using any telephone or cellular



Pulse-Oxymeter Nonin with BlueTooth



Nonin Onyx 2 9560 Bluetooth Wireless Finger Pulse Oximeter with **FREE** case!!



9560
Onyx II

The first wireless fingertip pulse oximeter

Oximetry Unplugged – Revolutionizing Disease Management. With the increased need for remote disease management, there is an opportunity to provide oximetry monitoring solutions to simplify the exchange of secure information.

Consumer-side Component

❖ Blood-Glucose Device

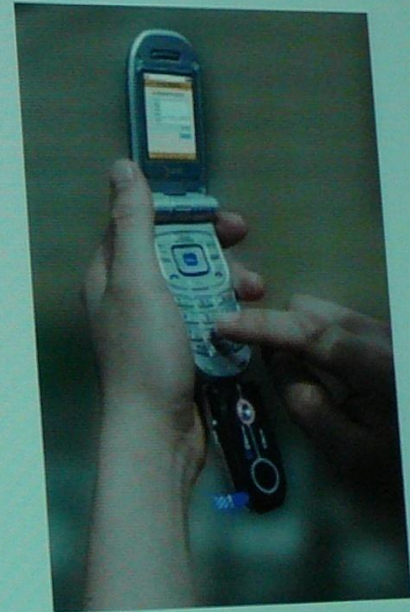
- Cellular phone attaching type
- Measuring glucose and the number of walking
- Small size : 31*60*14(mm)
- Low power-consumption
- Supports RS232C communication



Consumer-side Component

❖ Mobile Measurement

- Mobile program Auto-run by plug and play function
- Visualization of step of measurement through phone LCD



Tuesday, August 14, 2007

Reach Out And Prick Someone



Amy at [DiabetesMine](#) brings us the [story on the GlucoPhone](#) -- once considered vaporware, it's been quietly introduced by **HealthPia**:

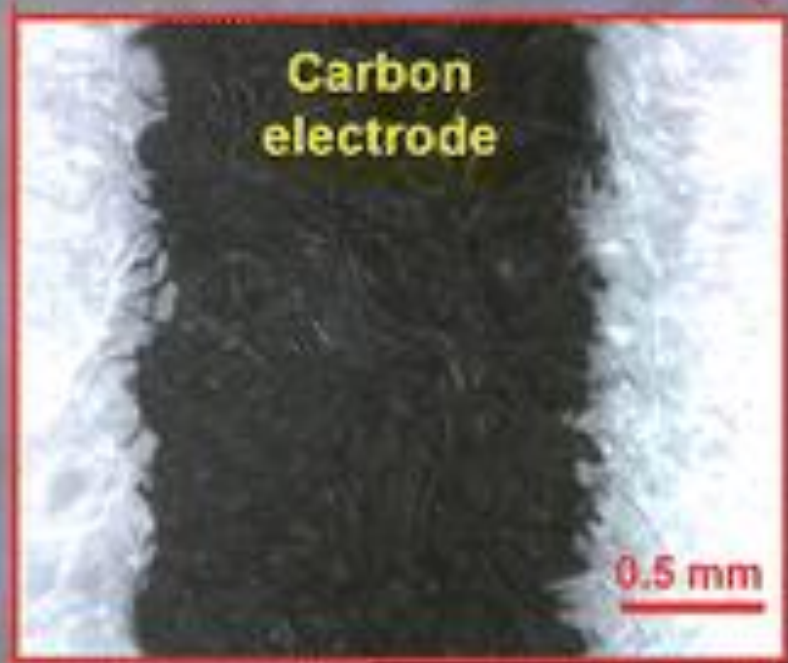
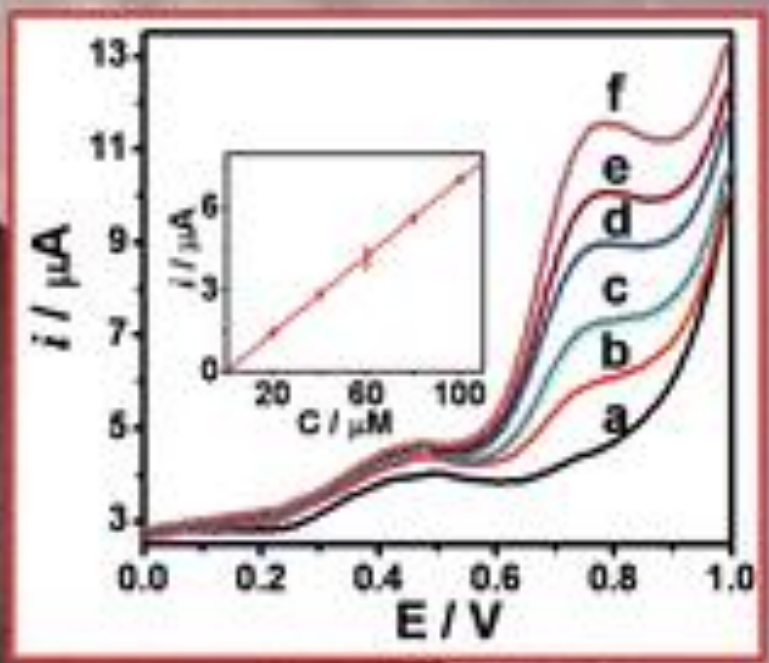
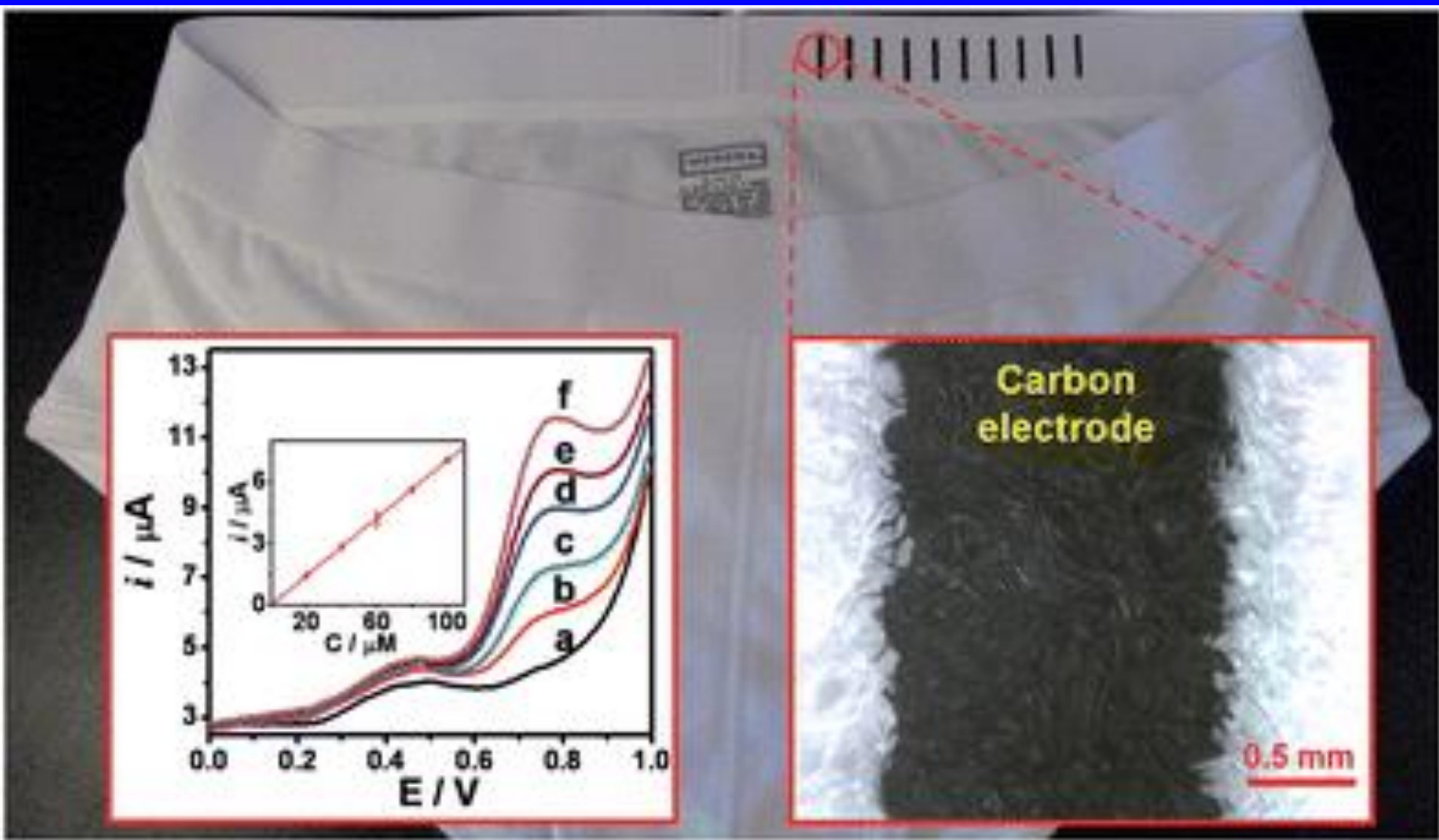




Nokia has partnered with **Entra Health Systems** to allow linking of a Bluetooth wireless enabled glucose meter with more than 50 models of mobile phones. Customers of Nokia can now download the app from the [Ovi Store](#) and keep track of their readings on mobile phones. Seems like it's time to get rid of that redundant screen on the blood glucose meter and make it into a purely test and transmit device.

Features of the MyGlucoHealth Diabetes app on Nokia:







Future Sensors for Monitoring

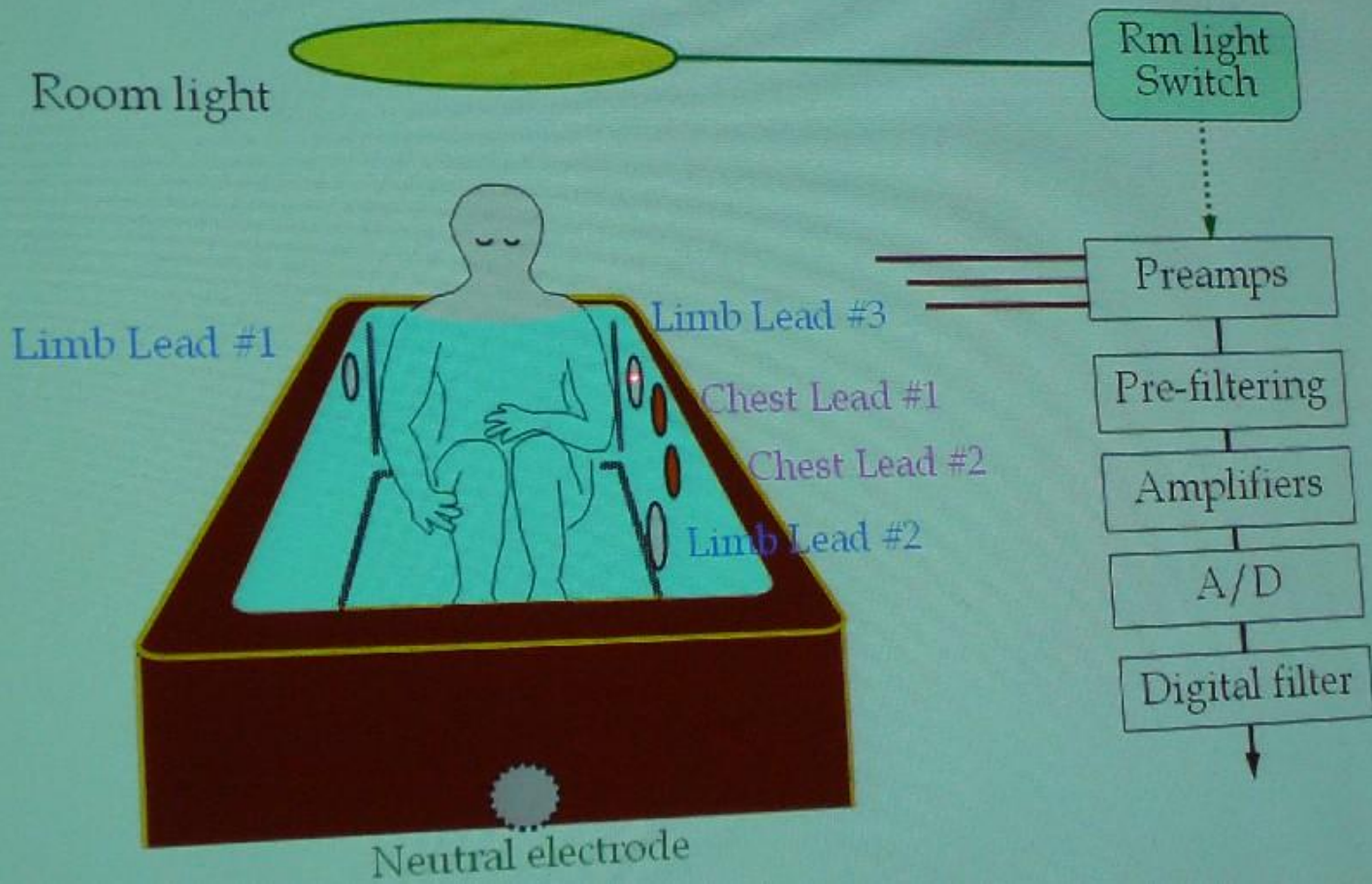
1. Today – contact, wearable sensors
2. Tomorrow – contactless sensors imbedded into surrounding objects
3. The day after tomorrow – sensors, implantable into the body

Prof. Masa Ishijima, Japan



ECG recording in the bath

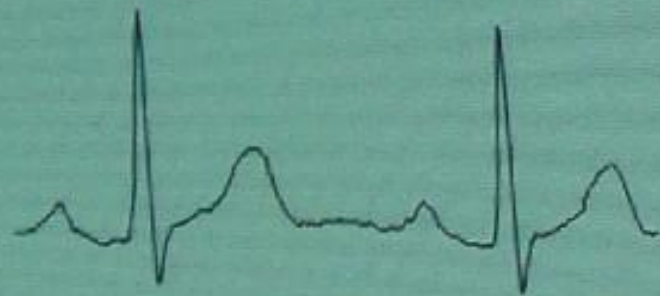
Bathtub ECG (2)



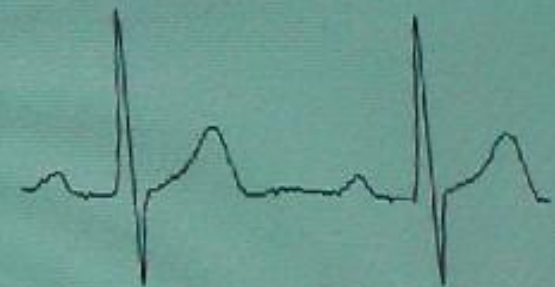
Bathtub ECG (3)



Lead I



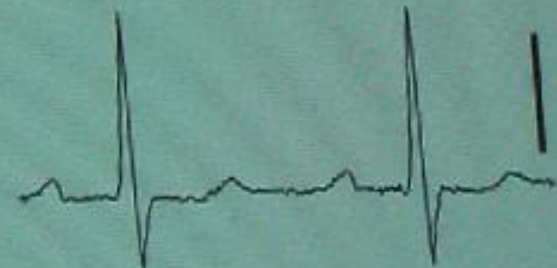
Lead II



1mV



Lead III

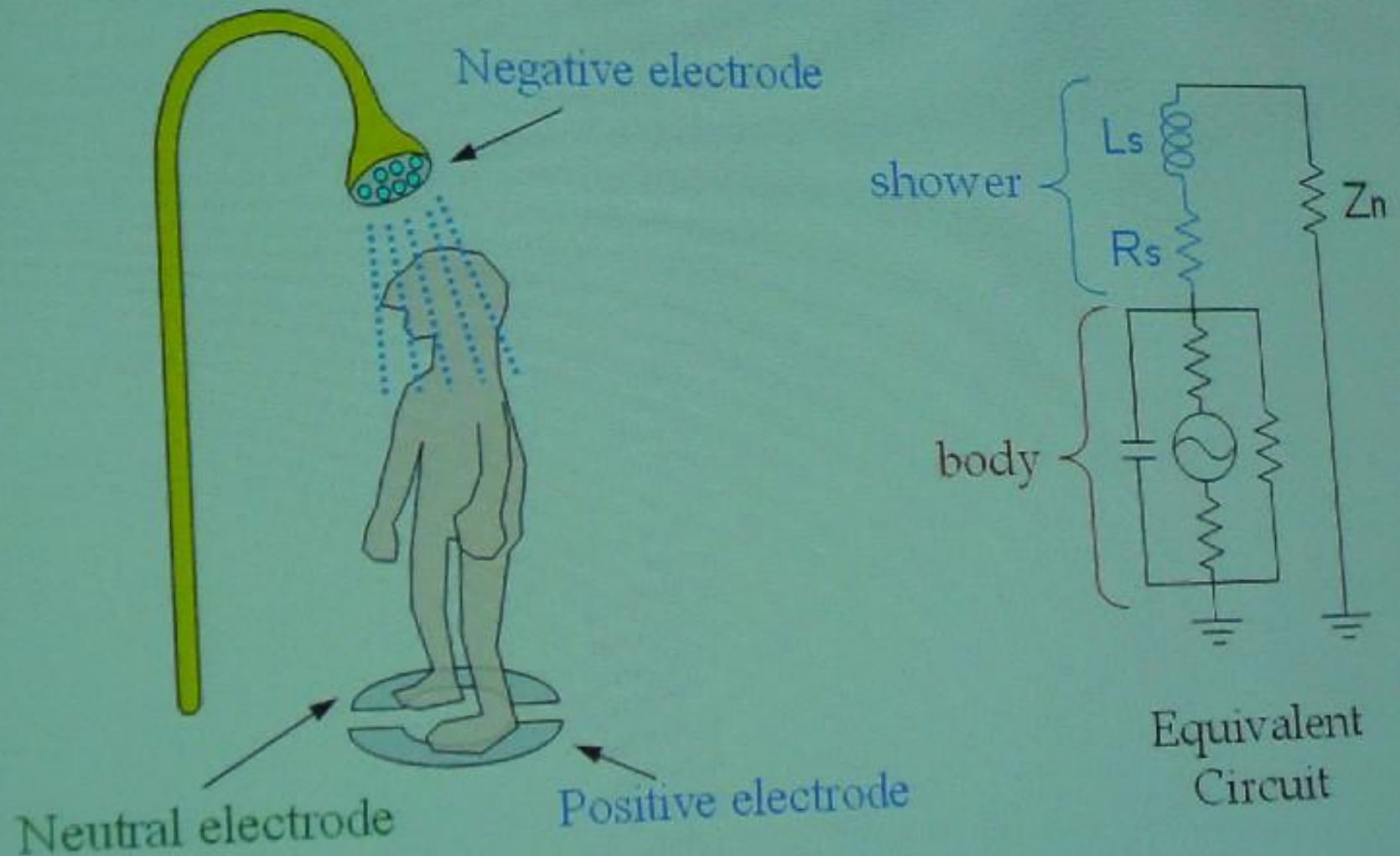


0.2mV

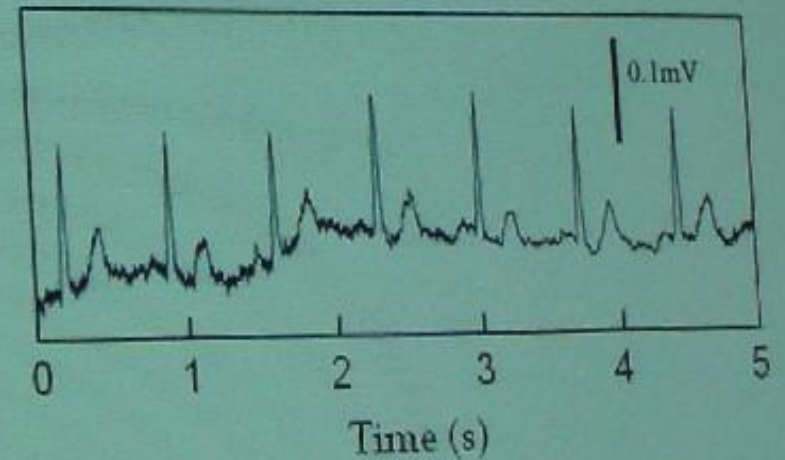
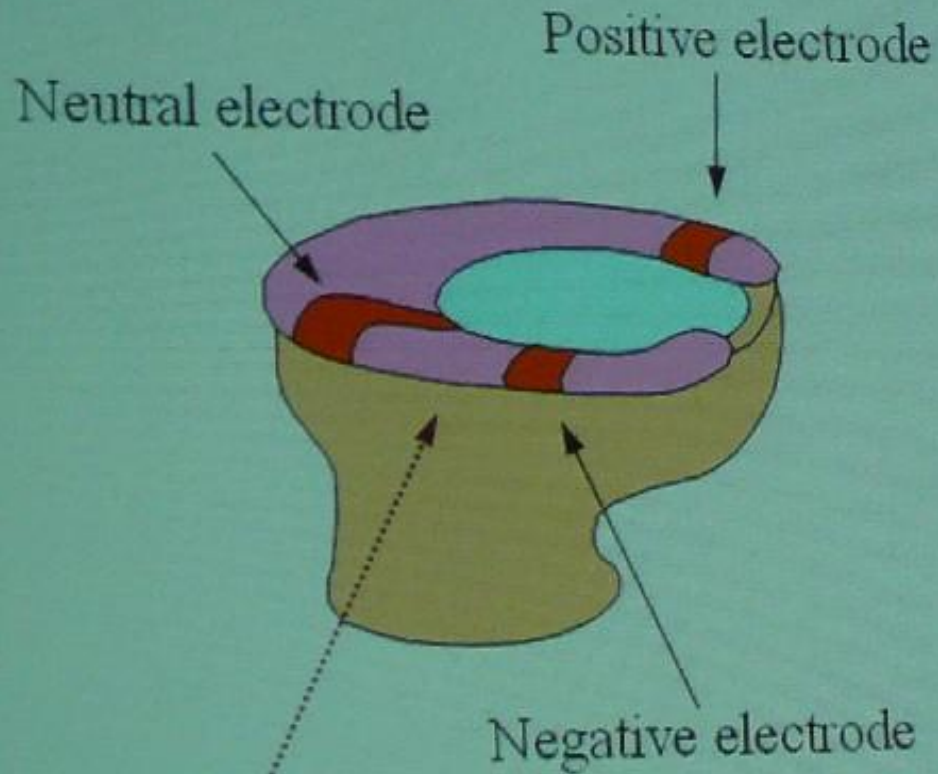
Limb Lead System

Bathtub Lead System

Shower ECG (1)

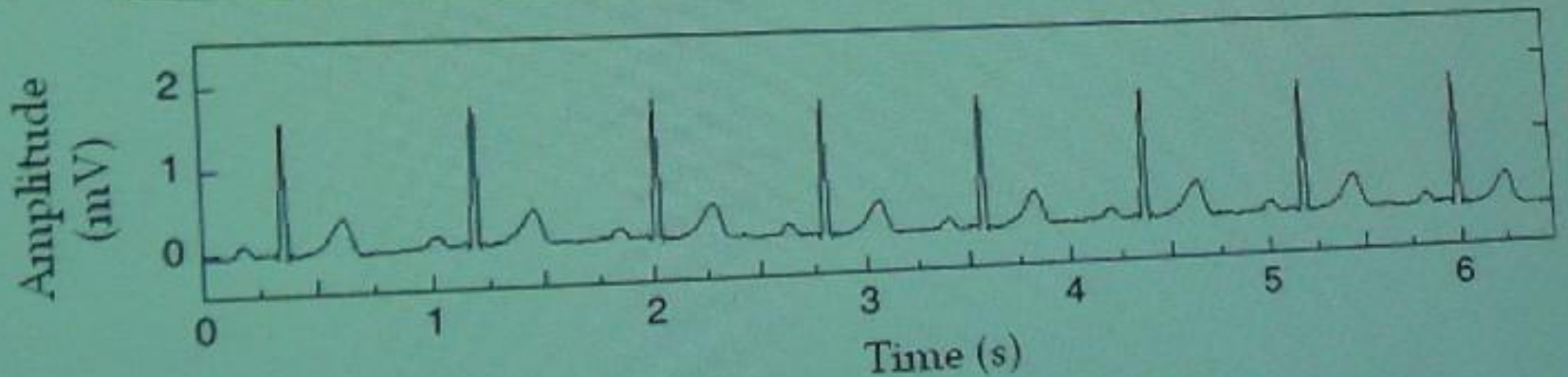
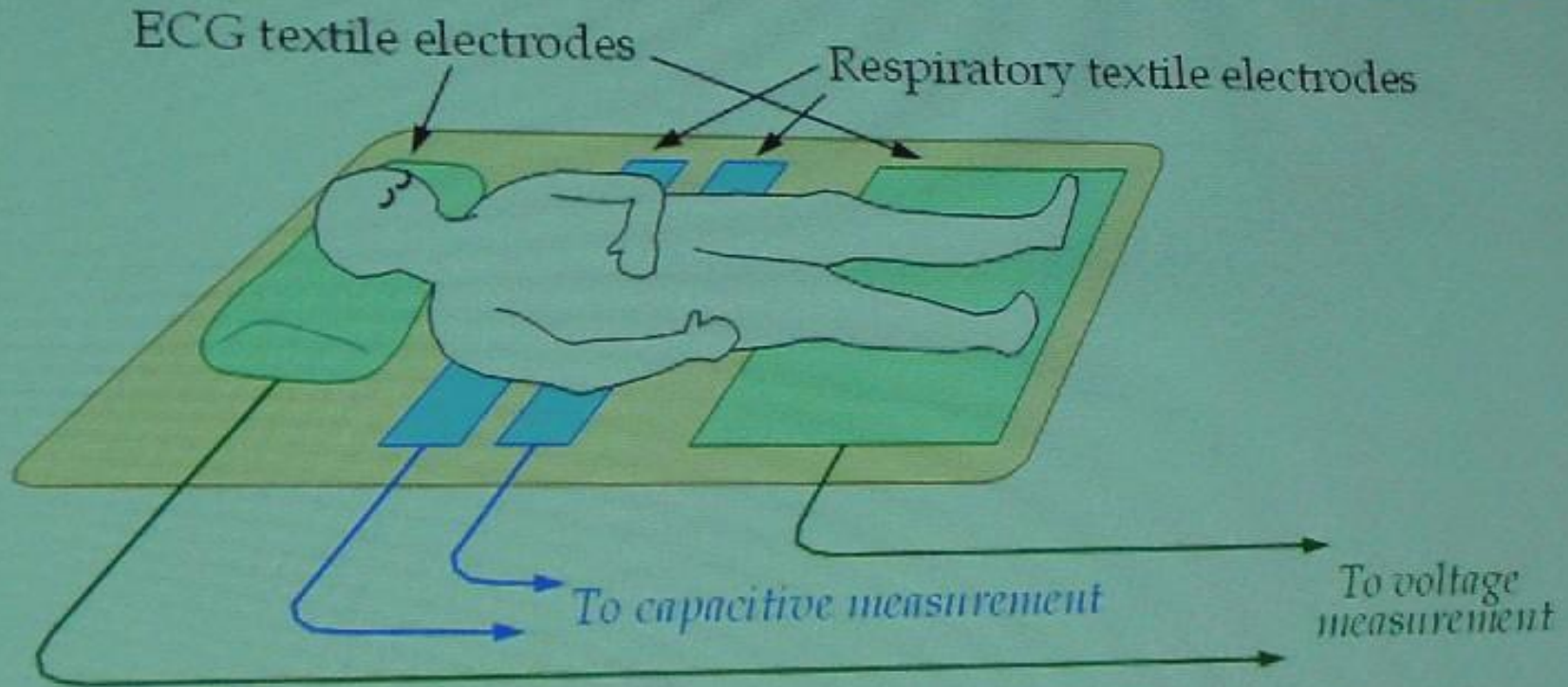


Stool ECG (1)



Auto-recording
Pressure Switch

Bed ECG (1)



Implantable monitors (with batteries)

New Diagnostic Tool - Reveal? Insertable Loop Recorder



(Medtronic, 2006)

The *New York Times* is [reporting](#) that Medtronic's new heart monitor, the Chronicle, is likely to be rejected by the FDA. Why? Because it's not keeping patients out of the hospital -- it's main selling point:

The device's manufacturer, Medtronic, has been developing wireless data-gathering technology for implanted



Can Sensors Make a Home in the Body?

at is fully
promises
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and become dislodged, it with coating the outside

9 AUGUST 2002 VOL 297 SCIENCE

About SMSI®

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Products

[SMSI® Oxygen Sensor](#)



See the

light
reveal the data

SMSI® Glucose Sensor
Personal Glucose Monitoring

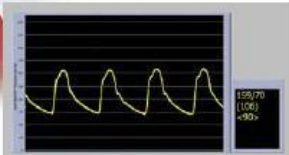
Implantable sensors without batteries (RFID - NFC)



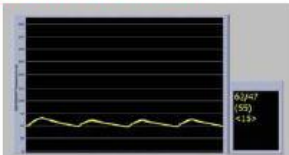
of the Sensor

- Radiopaque markers clearly define the Sensor location within the sac between the stent graft and aorta

Pre-exclusion Measurement



Post-exclusion Measurement



Pressure waveform attenuation confirms angiographic findings of sac exclusion

Compact. Convenient.

Width: 5 mm
Length: 30 mm
Thickness: 1.5 mm

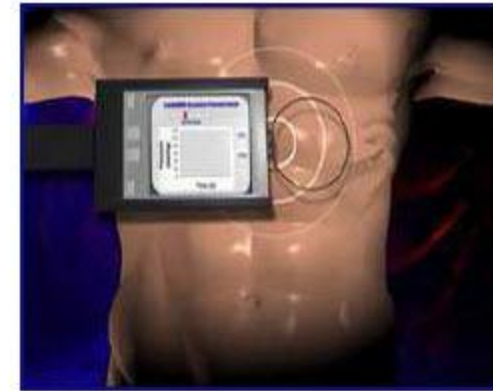


low-power, RF energy

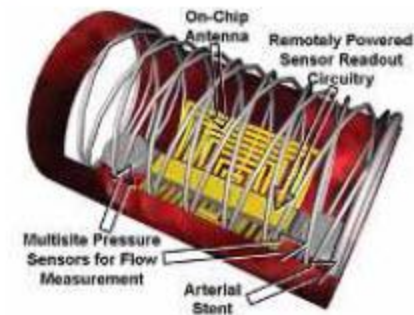


RF-Sensors on / in body

- Functions:
 - Measure pressure/load
 - Measure bacterial activity
 - Measure temperature
 - Drug delivery
- RF-powerless (Senstenna)
- Flat, reading outside body (frequency up to 400 MHz)



in body sensors



RFID readers, present & future

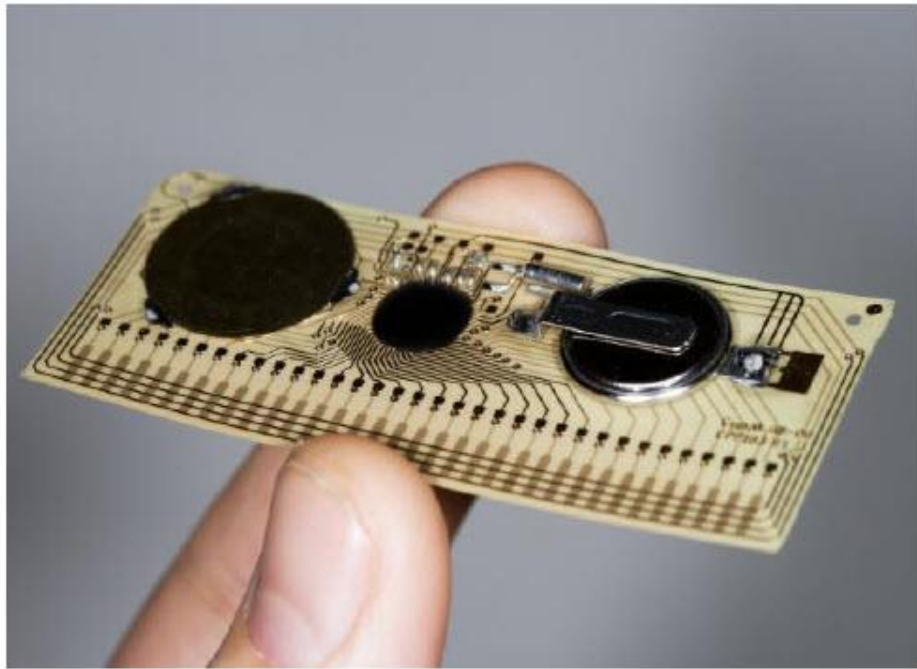
- RFID coupler chipset in mobile phones:
R2R, Reader to Tag (for payment, access control, info etc.)
- NFC chip in NOKIA-phone
- Credit card sized microreaders for consumers with display, battery



CYPAK

smart, secure and connected

Standard solution for medication monitoring



The CEM083 is a designed as a single component for inclusion in pharmaceutical

Configuration and self-test

Configuration is done by software which is programmed into the chip using the RFID capabilities of the CPK082. Customization may be done either during manufacture and/or prior to use by a pharmacist or care provider.

The module provides a self-test capability that may be used in manufacturing and in the market to ensure that it is functioning correctly.

RoHs

The CEM083 is RoHs compliant.

Applications

Smart ECG monitor from VitaPhone

Vitaphone Tele-ECG-Loop-Recorder 3300 BT

Automatic 3-channel recording and transmitting of ECGs; convenient and precise detection of cardiac events

Indications

Patients with asymptomatic cardiac arrhythmias as well as patients with arrhythmias that cause symptoms such as weakness, tachycardia, gallop rhythm or syncope of unknown origin.

Important Functions

- 3-channel ECG recording
- detection of tachycardia, bradycardia, atrial fibrillation as well as rhythm pauses
- events saved automatically
- automatic event transmission via Bluetooth link
- detection of electrode malfunction
- detection of electrode malfunction
- display and acoustic feedback



[Technical details \(pdf\)](#)

Wireless System for Blood Pressure Monitoring

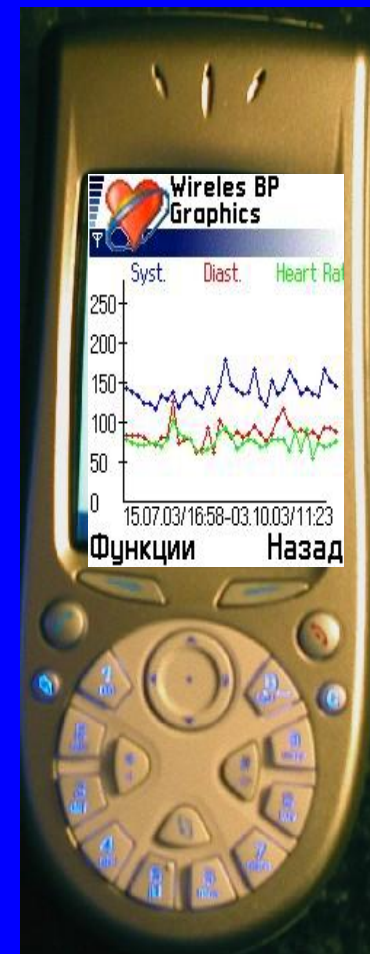




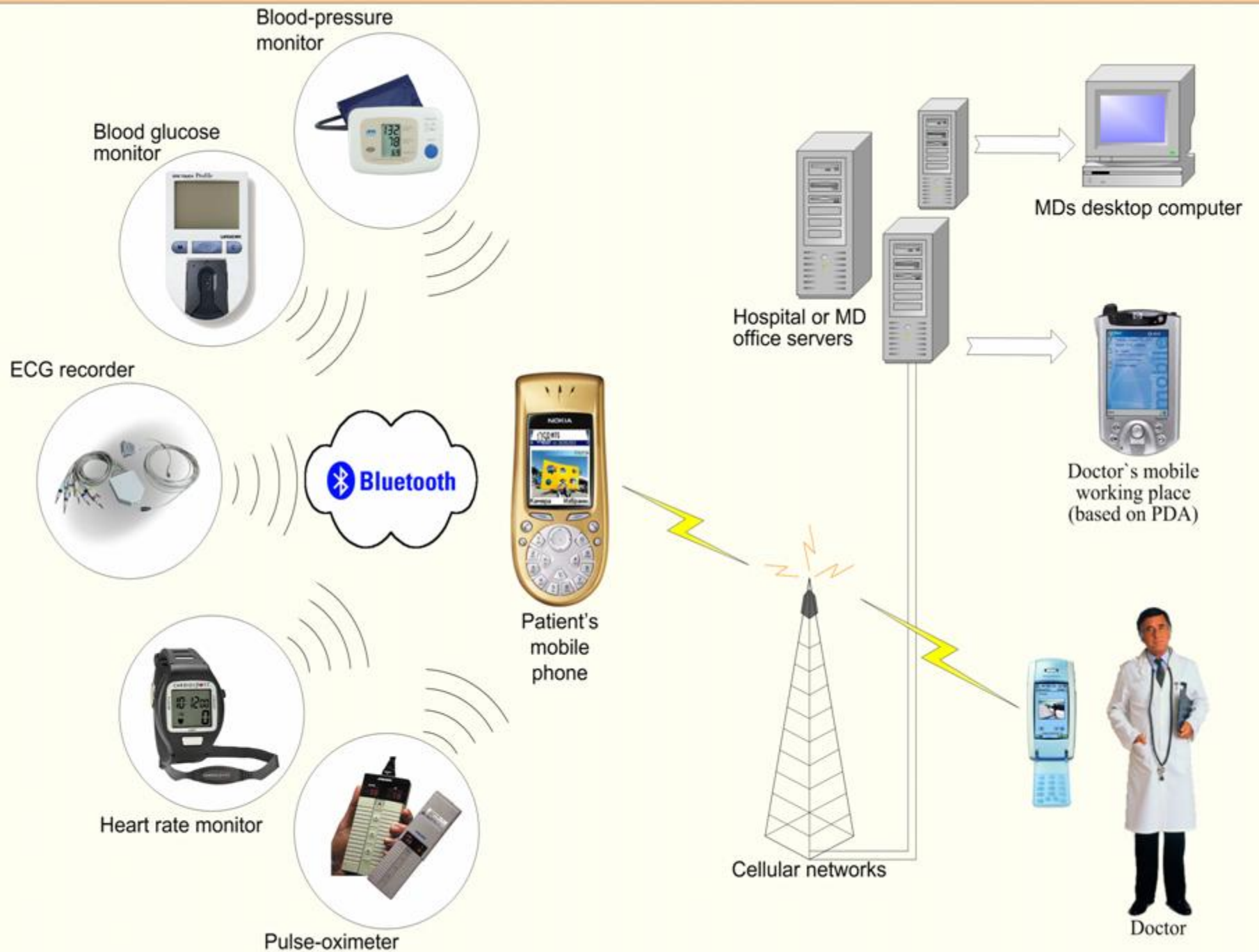
Текстовые и голосовые
напоминания

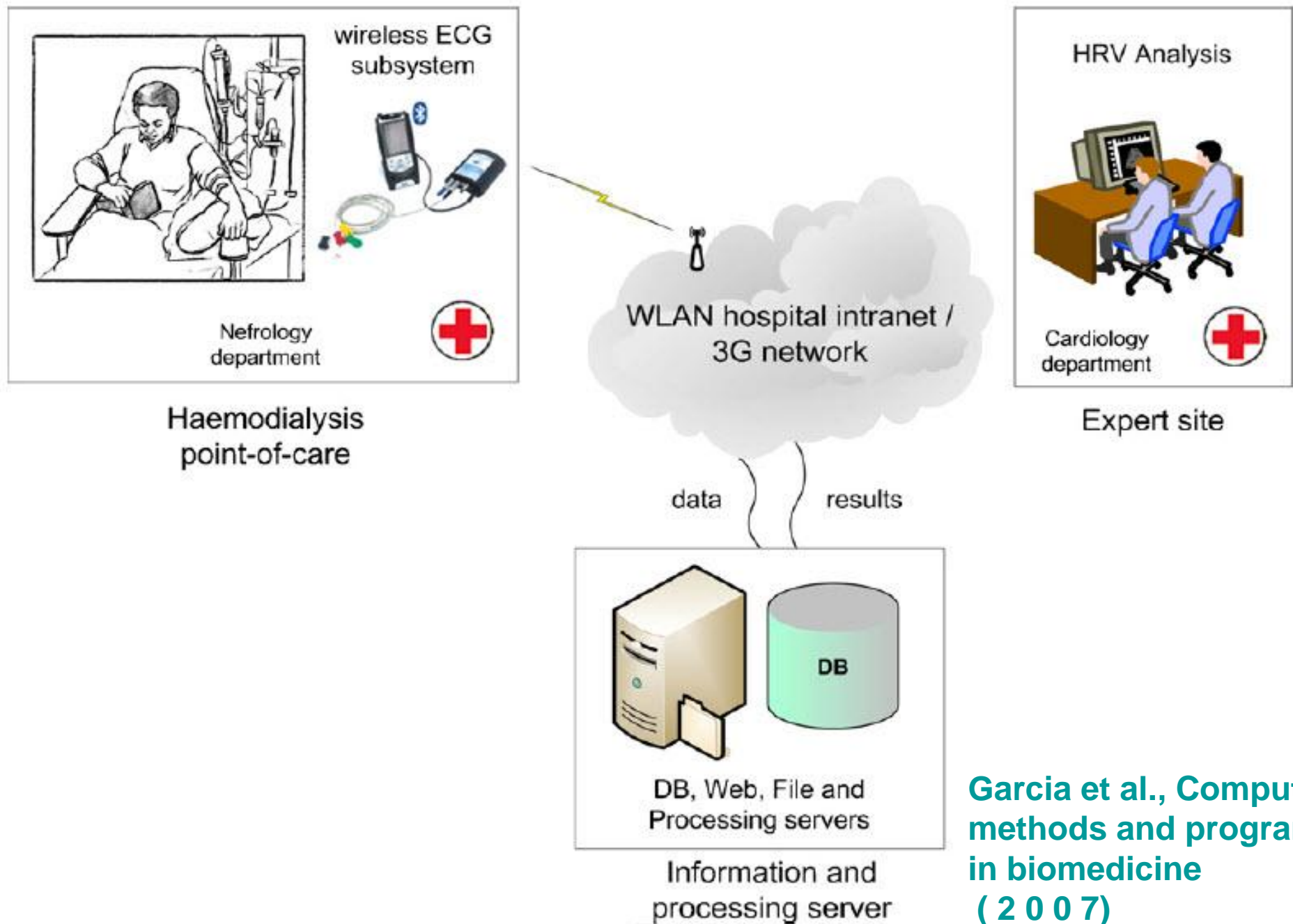


Напоминания о
приеме лекарств
(с подтверждением
о выполнении)



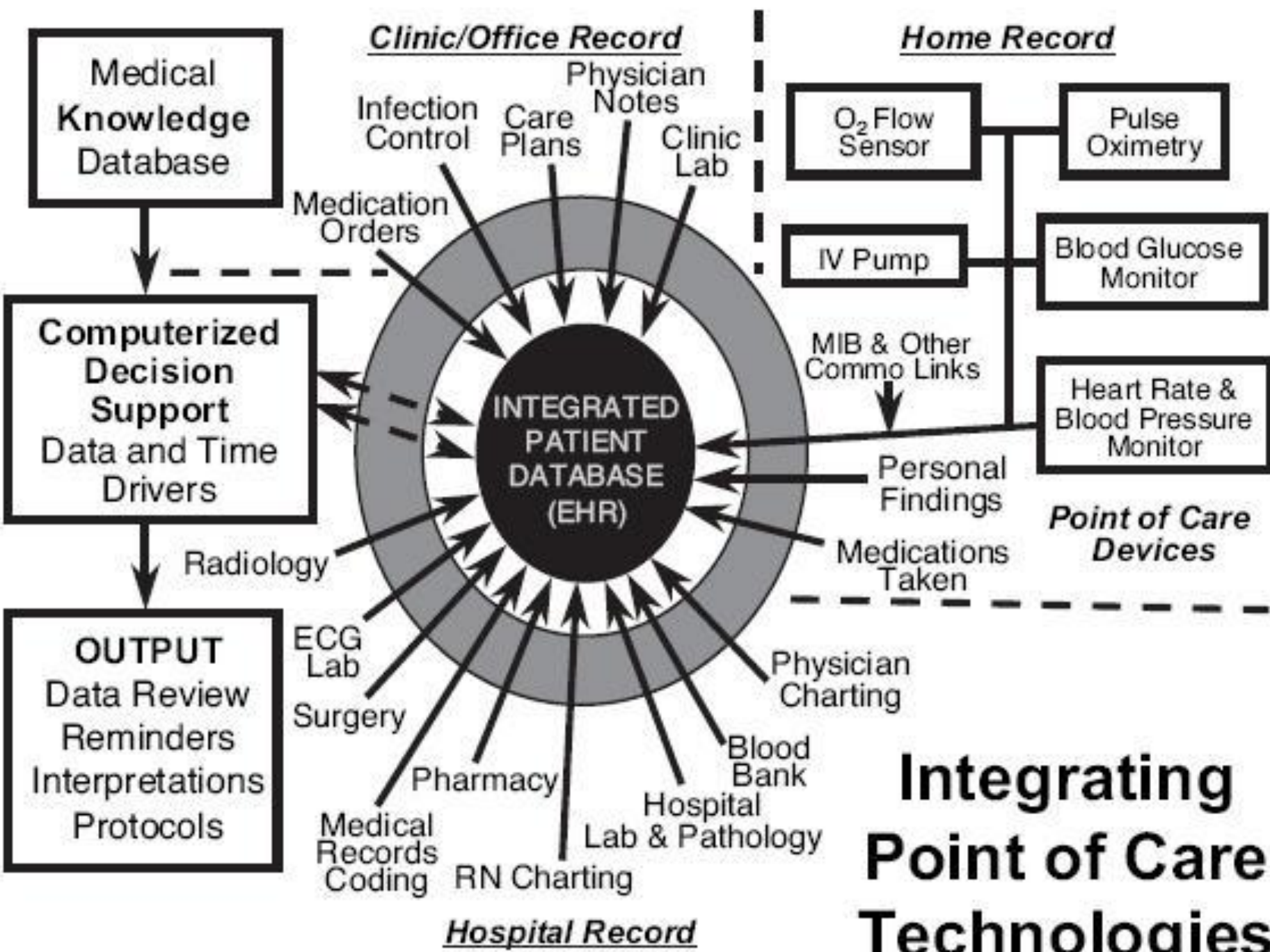
Динамика изменения
мониторируемого
параметра во времени





Garcia et al., *Computer methods and program in biomedicine* (2007)

Fig. 1 – HRV-based wireless telecardiology system.



Integrating Point of Care Technologies

What to do in order to decrease traffic via cellular networks?

- To compress raw data on the phone
- To analyze raw data on the phone before transmitting to the healthcare provider

Enhanced Real-Time ECG Coder for Packetized Telecardiology Applications

Álvaro Alesanco, Salvador Olmos, *Member, IEEE*, Robert S. H. Istepanian, *Senior Member, IEEE*, and José García

Abstract—A new real-time compression method for electrocardiogram (ECG) signals has been developed based on the wavelet transform approach. The method is specifically adaptable for packetized telecardiology applications. The signal is segmented into beats and a beat template is subtracted from them, producing a residual signal. Beat templates and residual signals are coded with a wavelet expansion. Compression is achieved by selecting a subset of wavelet coefficients. The number of selected coefficients depends on a threshold which has different definitions depending on the operational mode of the coder. Compression performance has been tested using a subset of ECG records from MIT-BIH Arrhythmia database. This method has been designed for real-time packetized telecardiology scenarios both in wired and wireless environments.

a heart attack in progress and preserving heart muscle function [5]. Although store-and-forward ECG transmission is also possible from the ambulance to the hospital, real-time ECG monitoring by a cardiologist in a hospital would be more convenient because it allows a reduction in the time needed for patient's evaluation once it arrives to the hospital. These effects are specially crucial in cases where the transportation time is long [6], [7].

During the last years, the increasing popularity of Internet has made that the TCP/IP protocol stack has been implemented in the network and transport layers in almost every communication network [8]. Wireless networks which formerly were imple-

Smart Phone-Based Automatic QT Interval Measurement

ET Lim, X Chen, CT Ho, ZK Tin, M Sankaranarayanan

Institute for Infocomm Research, Singapore

Abstract

A smart phone-based automatic QT interval measurement system was developed. The system can assist pharmaceutical company in QT prolongation assessment prior to new drug approval. The ECG signal is captured by wearable sensor and processed on the smart phone. The processed results are sent using cellular network to the internet server. Cardiologist can quickly analyze the results. It shortens the time for data collection. Besides, it is convenient for the test subjects as they do not need to visit the lab frequently.

prior to new drug approval. The smart phone receives ECG data from a wearable ECG sensor via Bluetooth connection and calculate the QT interval in real-time. The results are sent using cellular network to the internet server. Cardiologist can quickly access the data through internet browser. It shortens the time for data collection. Besides, it is convenient to the test subjects as they do not need to visit the lab frequently.

2. Methods

The embedded algorithm on smart phone first detects QRS complex using slope method [3]. Based on the

Analysis of ECG on a Smartphone

CardioView

Иванов Иван Иванович...
14:26, 28.08.08

Иванов Иван Иванович...
14:16, 28.08.08

Байбаков Иван

Кардиограмма

Статистика

Длитель...	59 сек.
Средн....	77 уд./мин.
Мин. RR	0.695 сек.
Макс. RR	0.870 сек.
С.К.О.	48 мсек.
RMSSD	37 мсек.

Назад

Кардиограмма

25 мм/сек. 20 мм/мВ



Кардиограмма

Ритмограмма



263

131

0

Функции

Выйти

AliveECG :: Acceleration

00:00:42 bpm

25mm/s, 10mm/mV



Кардиограмма

Вар. пульсограмма



100

50

0

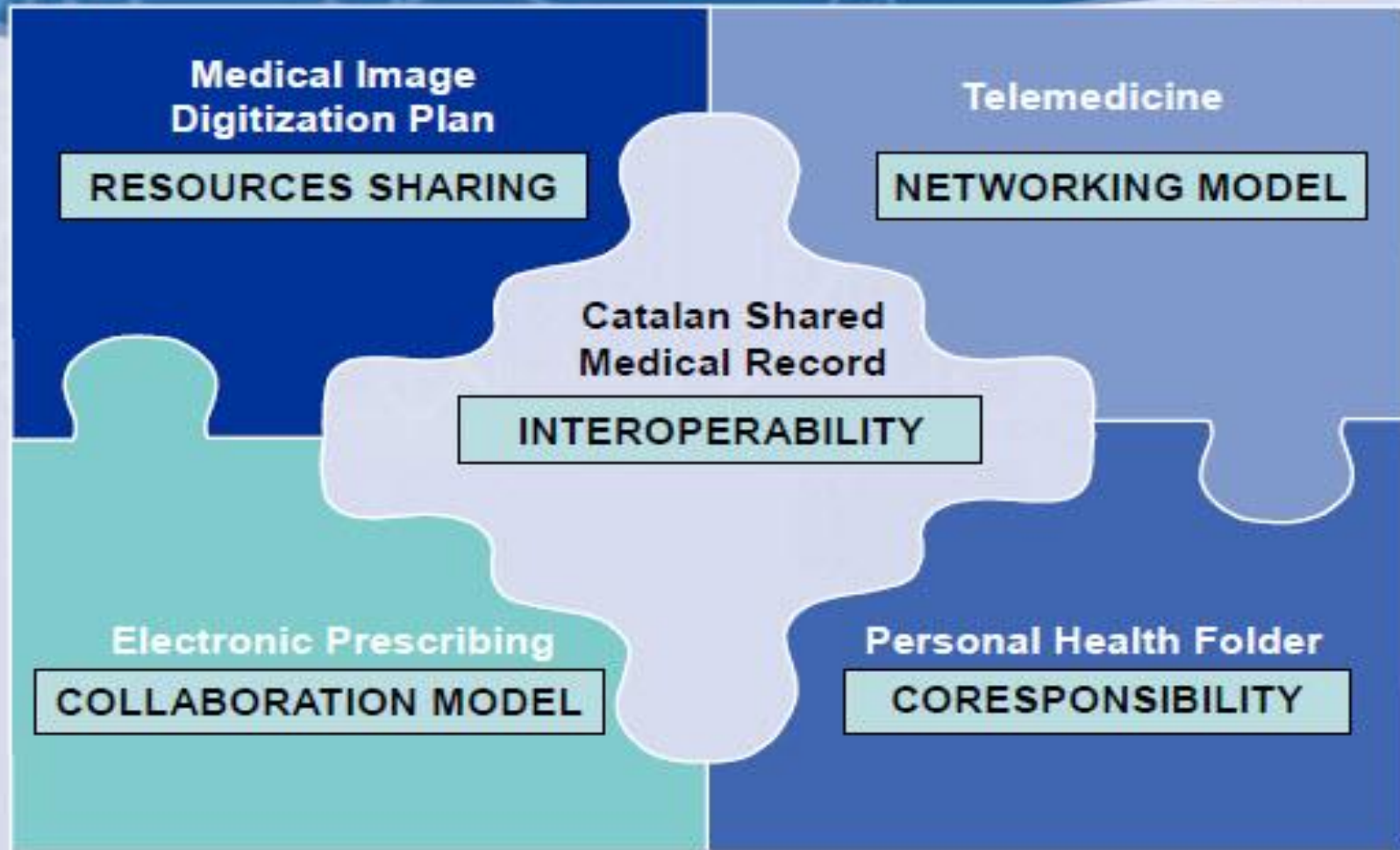
300 900 1500

Функции

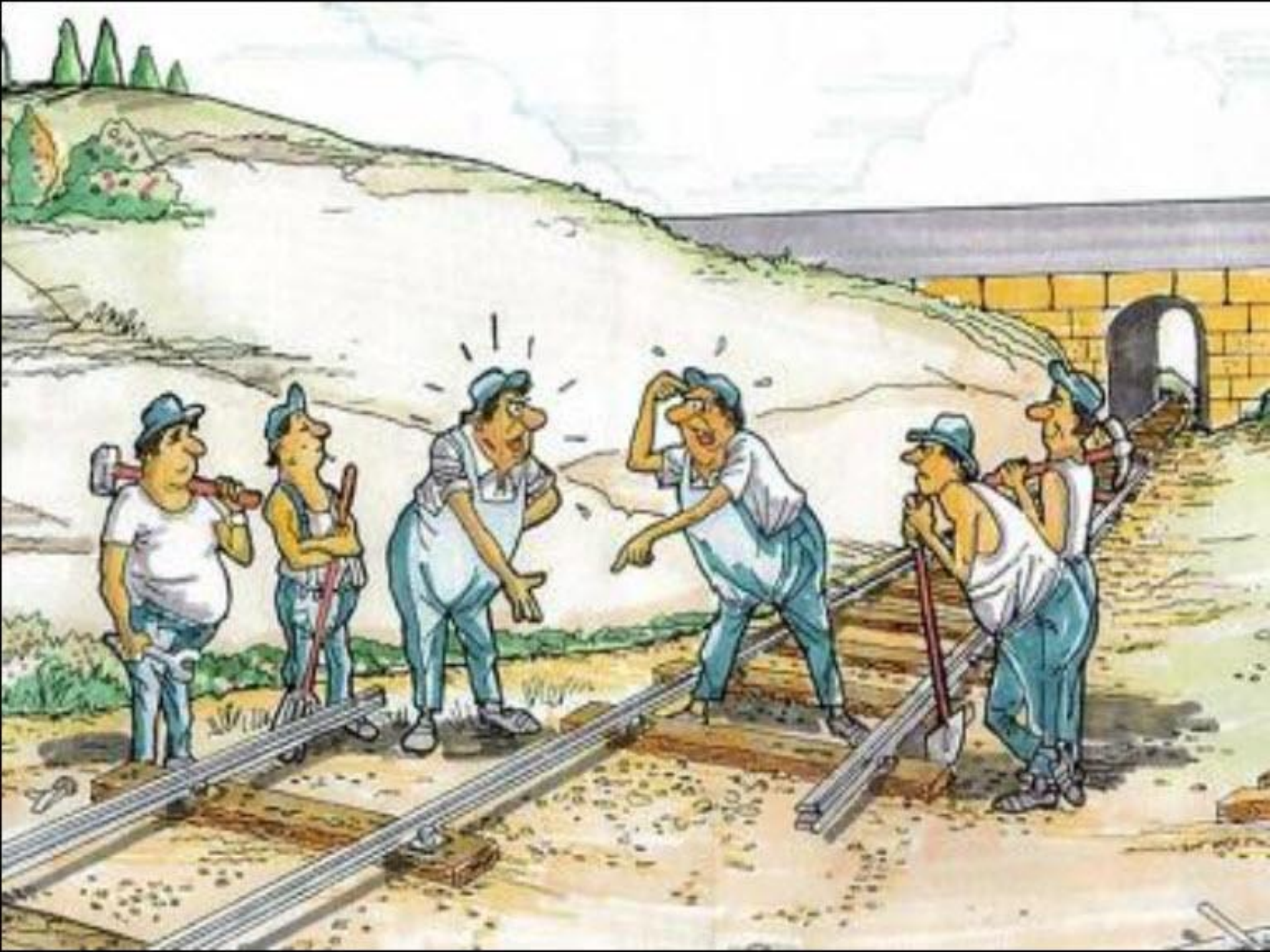
Выйти



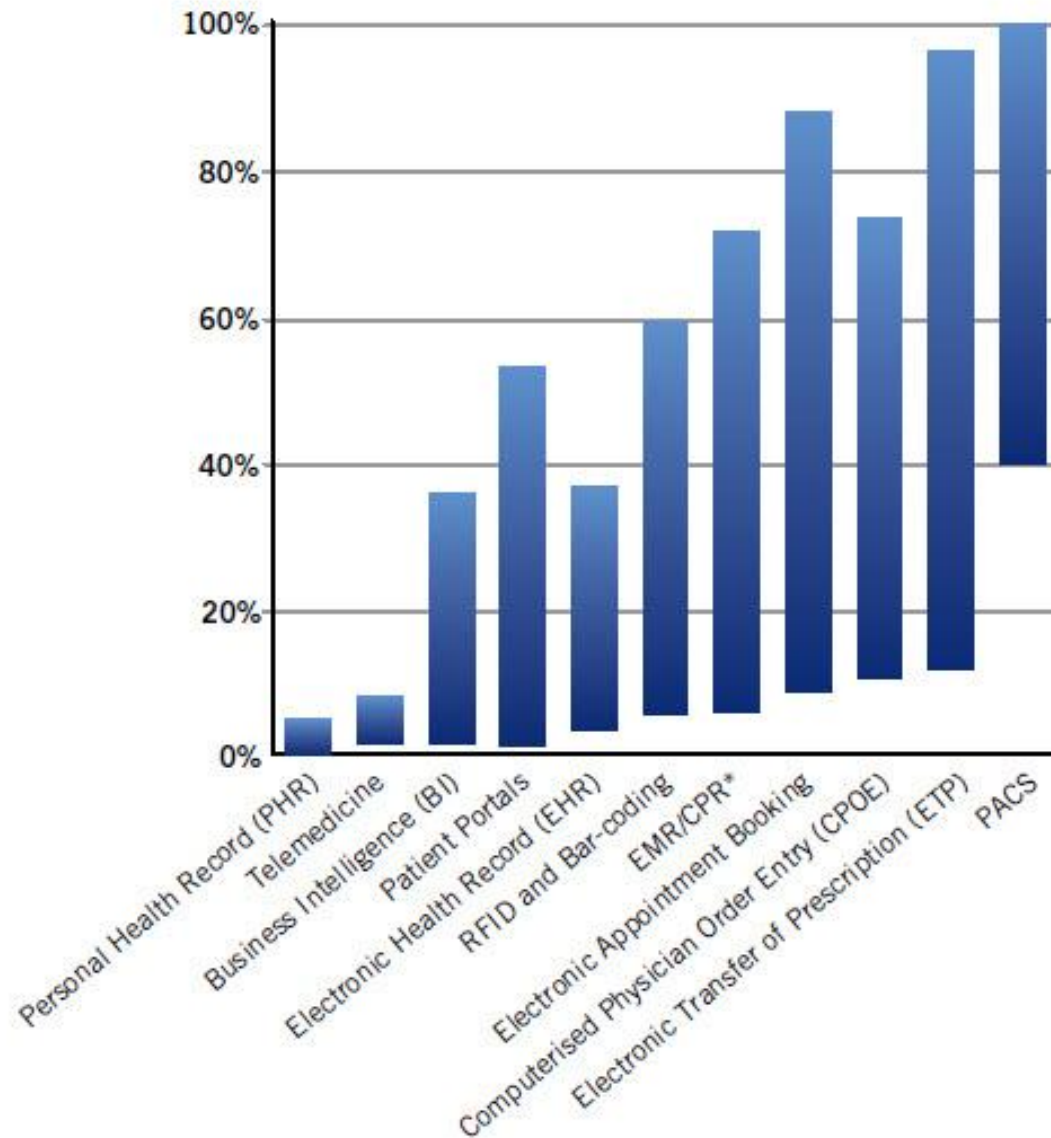
The ICT projects – GOVERNING CHARACTERISTICS



Dr. Guanyabens - Coordinator of Health IT
of the Catalan Department of Health



State of eHealth Adoption in the Six Member States



*Electronic Medical Record / Computer based patient record

Figure 10. eHealth Self Estimated Level of Adoption among the Six Member States



patient



Bluetooth enabled blood glucose meter

glucose measurement

better management through close telemonitoring

electronic diabetes logbook (medication, meals, sports, ...)

self-management, option to enable caregiver monitoring



healthcare professionals and other caregivers (e.g. family members)

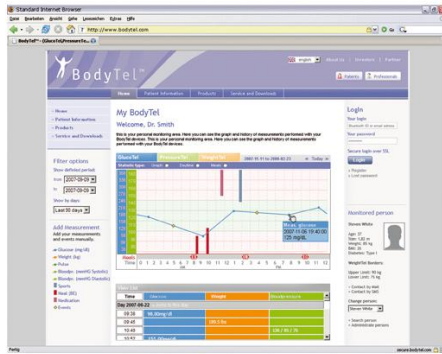
Bluetooth transmission



Bluetooth, Java and Internet enabled mobile phone

realtime data transmission

check patient data, alert functions, etc.



secure internet portal www.bodytel.com provides unique access for patients, healthcare professionals or family members

RADIO NEWS

REG. U.S. PAT. OFF.

25 Cents

April

1924

Over 200 Illustrations

Edited by H. GERNSBACK

THE RADIO DOCTOR—*Maybe!*

See Page 1400

IN THIS ISSUE:

Sir Oliver Lodge, F.R.S.
Dr. J. A. Fleming, F.R.S.
F. W. Dunmore and
F. H. Engel of
Bureau of Standards
Howard S. Pyle
Erinard Foote



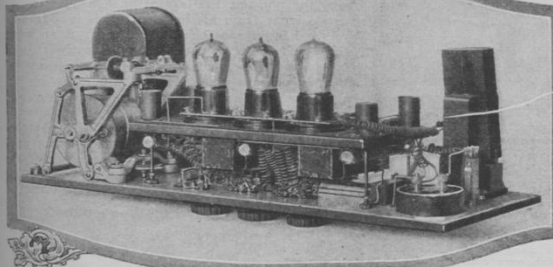
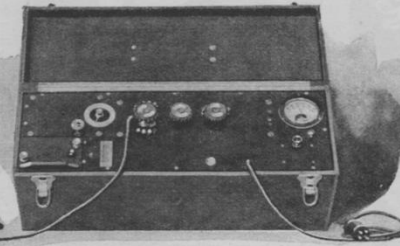
THE 100% RADIO MAGAZINE

1925

Portable Electrocardiograph



THE portable electrocardiograph recently demonstrated by the general engineering laboratory of the General Electric Co. is illustrated on this page. One of these devices could be used by the country physician in submitting a diagnosis by radio, in accordance with the apparatus depicted on the left hand page. The entire device weighs only 37 pounds and the power unit weighs 33 pounds. The apparatus open is shown at the right.

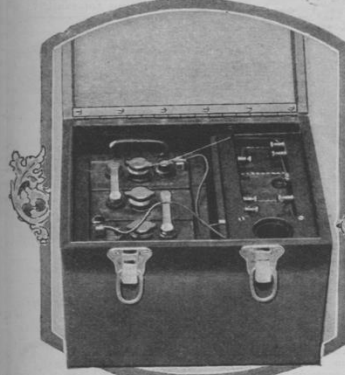


The photo above shows the portable electrocardiograph with the panel board inverted showing the vacuum tubes. In the old style cardiograph elaborate protection against vibration had to be made. Usually vibrations-proof foundations were used for the mountings of these instruments. The fragile metal quartz thread used in the former apparatus is dispensed with in this construction.



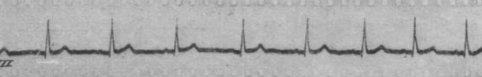
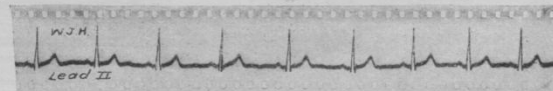
A patient having a cardiogram made is depicted in the above photo. Simple metal electrodes fastened to the arms and legs of the patient are used in place of the wet sponge electrodes formerly employed. The functioning of this instrument is not affected by skin resistance. The results could be transmitted by radio to a consulting physician, telephotographically.

Contraction of the heart muscles is accompanied by or preceded by an electrical manifestation. This electrical change is amplified by vacuum tubes. The voltage before and after the heart beat is in the neighborhood of one one thousandth of a volt.



The power unit for the electrocardiograph is illustrated above. At the right are three typical cardiograms used for diagnosing different kinds of heart trouble taken with three different leads. They are caused by a spot of light acting on a moving film strip.

Lead I





Questions ?

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