Smartphones for health: Tools not toys

Mark-Eric Jones
CEO, Leman Micro Devices SA

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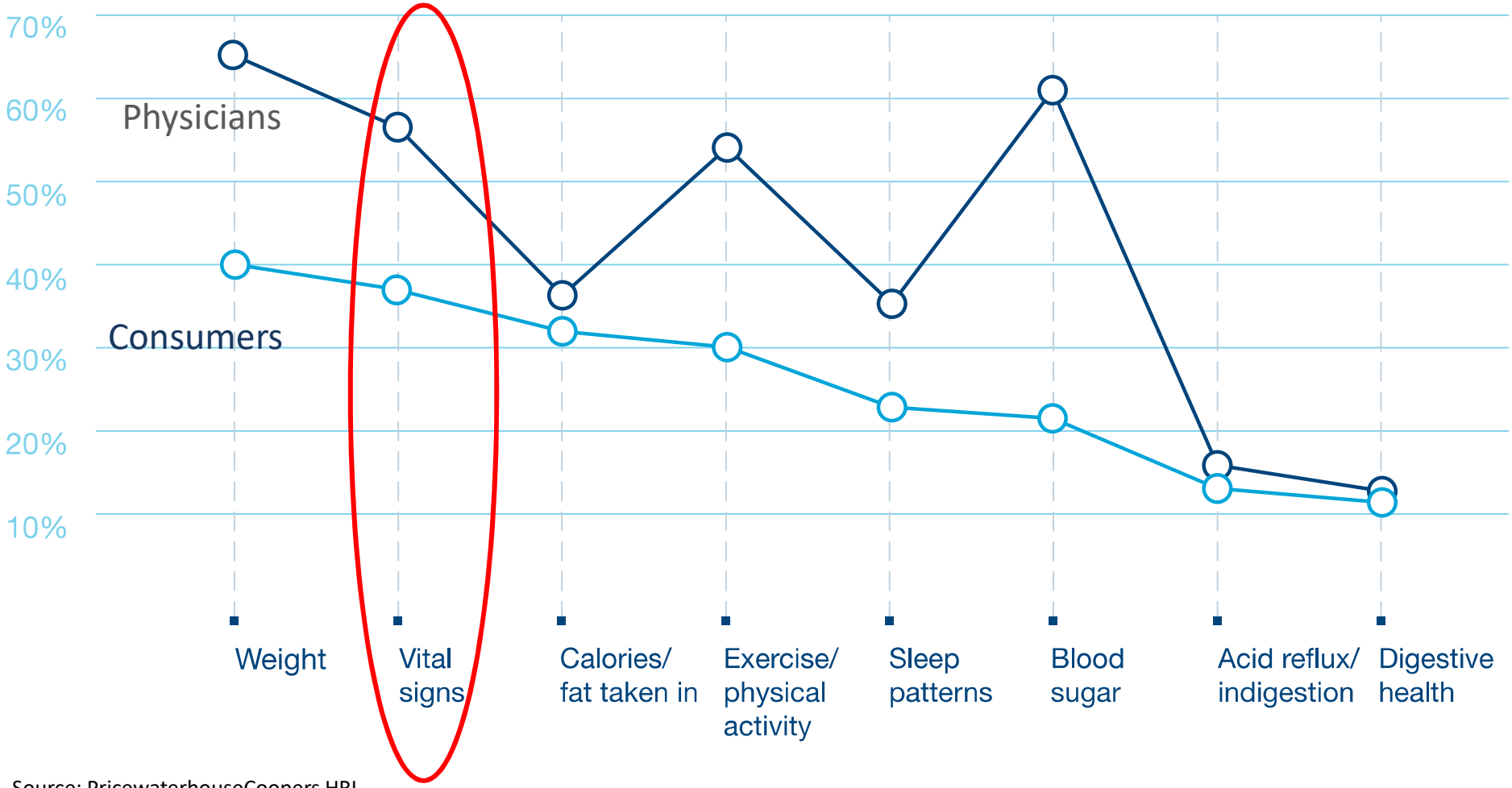
Convenience

- Technology has enabled a wave of change delivering **convenience** to consumers
- Consumers now expect to use their smartphones to access quality information, products and services **anywhere** and **anytime**
- This wave has already dramatically changed the **"how"** of communications, banking, dating, taxis, …
- Now is the time for convenience in one of the most important aspects of our life: Our **health**

Apple CEO, Tim Cook (2016):

"Healthcare may make Smartphone market look small"

What Consumers and Physicians want to track

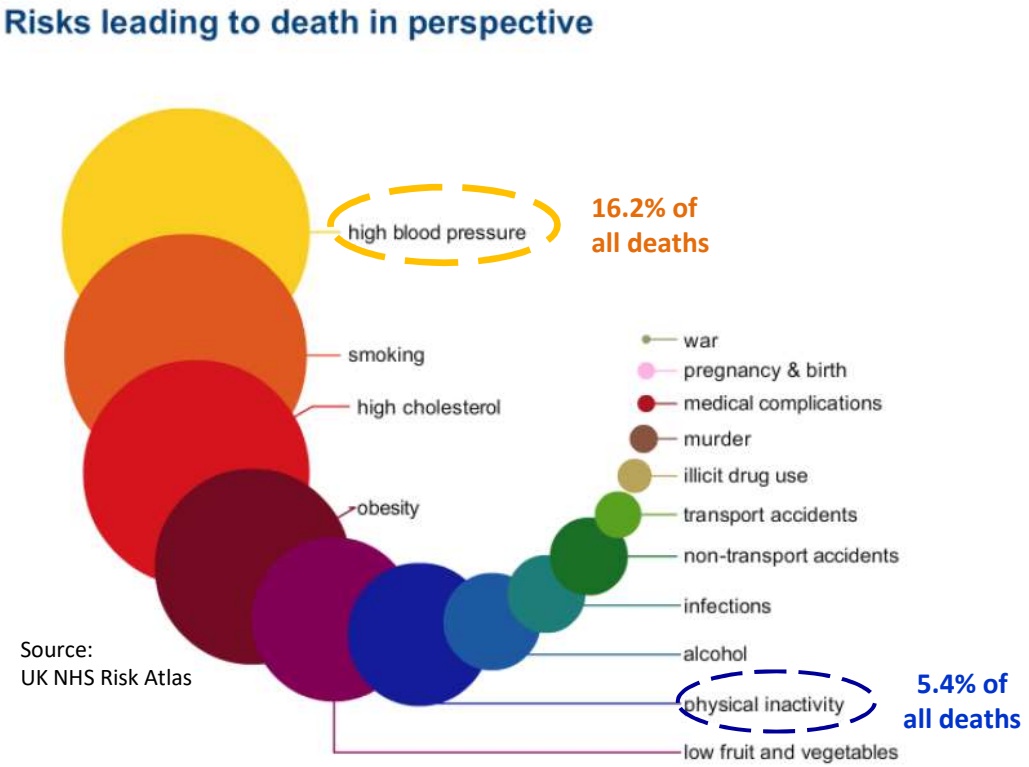


Source: PricewaterhouseCoopers HRI Physician and Consumer Surveys, 2010

Medical Importance

- Vital signs (Blood pressure, temperature, heartrate, respiration rate and blood oxygen) recognized by doctors as starting point for diagnoses
- Blood pressure is the #1 risk factor for early death and causes 51% of stroke and 45% of coronary heart disease deaths (WHO Global Health Observatory 2012)
- High blood pressure affects 27% of worldwide population ranging from 23% in the Americas to 37% in Africa (WHO World Health Report 2008)
- Diagnosis is the key to managing high blood pressure since there are often no symptoms and drugs to treat it are both effective and low cost

Measure Health not Activity



- High blood pressure is 3x higher risk factor than lack of physical activity
  - Physical activity (e.g. Daily Step Count) = Effort
  - Health (e.g. Blood Pressure) = Results

Health not Fitness

- USA spends 18% GDP on Health
  - Infrastructure 2.4%, Military 3.2%, Education 5.4%
  - Over **100 x** more than Fitness (incl. Gyms + Exercise machines)

The Smartphone Health Sensor Gap

- Digital Health Market > $ 230B by 2020
- Over 250,000 Health Apps now
- ~1B Health sensors built in Smartphones already

- **No sensors available today with medical accuracy (FDA, CE … approvals)**

- Less than 10% of health apps use phone sensors

Stakeholders

Smartphone Companies

End Users

Doctors

Differing motivations:

Drive Upgrades

Convenience

Accuracy & Productivity

Building the Tool

e-Checkup™

Service with medical regulatory approvals

Hardware

Under $1 in 3 years
Smartphone-compatible
Ready for volume

Production

Fast ramp to 100Ms of units / year
Top tier suppliers
Custom factory test

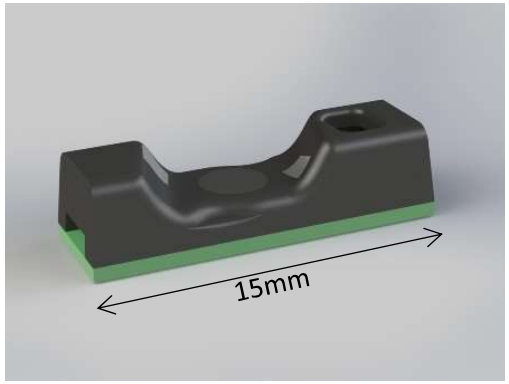
Software

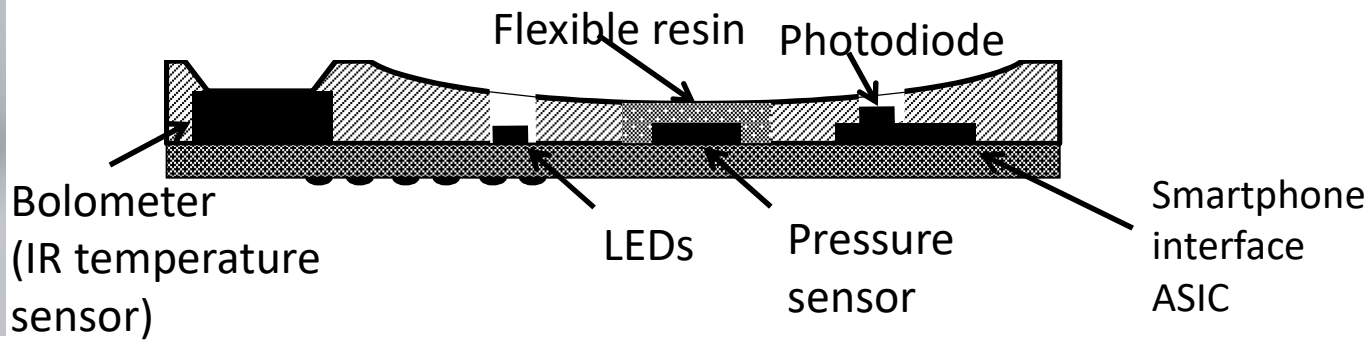
Gamification
User-friendly app
OS driver
Analysis

Database

Secure
Cloud-based
Scalable
Structured

V-Sensor - Principles of operation





Uses well-proven science for measurement of each Vital Sign:

- Arterial occlusion (Riva-Rocci) for blood pressure (1896)
- Infra-red bolometry for non-contact temperature (1878)
- Photo plethysmography (PPG) for heart and respiration rates (1938)
- Pulse oximetry for blood oxygen (1972)

LMD's innovation is using established science in phone-compatible solution

Satisfying the Stakeholders

- End Users:
  - Convenience and trust
    - Always with you
    - No additional device purchase
    - Medical accuracy using an easy, gamified app
- Smartphone Companies:
  - Differentiation
    - Small and cheap enough to include in all phones
    - Phone not a regulated medical device
    - Easy integration
- Doctors and Nurses:
  - Accuracy and productivity
    - Five medically-recognised Vital Signs
    - Regulatory approvals for safety and accuracy
    - Well-proven science and techniques

Regulator: Friend, not foe

bsi. ISO 13485 Medical Devices Quality Management

swissmedic

- Regulated Medical Device
  - Certification with 14 medical regulators around the world
    - Covers 97% of smartphone market
  - Clinical quality and accuracy
  - Can be trusted by physicians and consumers
  - Designed to be operated by consumers, not trained experts

Medical Accuracy

- Tested to meet the same standard of accuracy as a traditional upper-arm cuff used to measure blood pressure
  - ISO81060-2 and ESH 2010

- For the other Vital Signs use the trusted medical accuracy standards:
  - Pulse rate: ISO80601-2-61
  - Blood Oxygen (SpO2): ISO80601-2-61 and FDA1605
  - Body Temperature: ISO80601-2-56 and ASTM1965

- Sensor and software will be a regulated medical device meeting all the safety and other standards for such devices

Market Evolution

Service	When	Basis	Participants	Value Propositions
Vital Signs Measurement	2019	e-Checkup	End Users	“Cool Gadget” then Convenience
			Smartphone Companies	Drive device upgrades + Gain market share
			Doctors	More data to help diagnose
Medical Data Collection	2019/2020	e-Checkup + Ecosystem Partners	End Users	Convenience + Insights
			Smartphone Companies	Extend brand into new market
			Doctors	Remote screening
Health Monitoring	2020+	e-Checkup + Ecosystem Partners + Massive Usage	End Users	Convenience + Insights + Peace of mind
			Smartphone Companies	Build business in health market
			Doctors	Remote screening + Calibrated data for AI-based diagnosis

Smartphone vs. Standalone

- The smartphone's built-in camera replaced dedicated cameras because:-
  - Good quality: Tool, not Toy
  - Cheap enough to be standard in all smartphones
  - Always with you
  - No additional purchase
  - Nothing else to carry
  - Occasional, on-demand use

- Health sensing has very similar characteristics

Summary

- The main driver for users is convenience
- Other stakeholders (smartphone, medical) have different requirements
- Challenging to meet requirements of all stakeholders
  - BUT worth it:
    - Financially: Huge market
    - Ethically: Save huge number of avoidable deaths every year