

# The Role of GeoloT in Health and Care and Emerging Trends

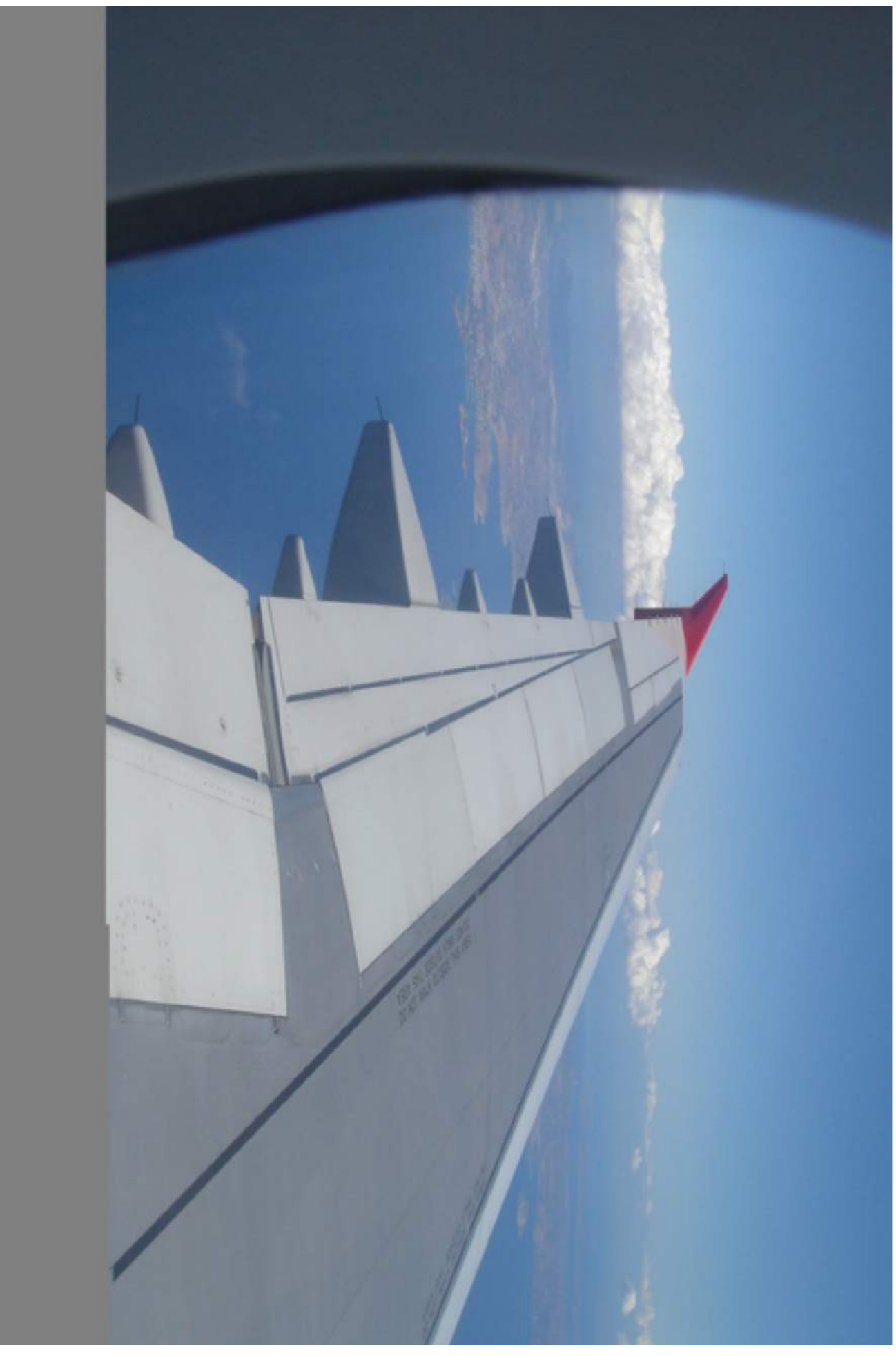
Dr Giuseppe Conti

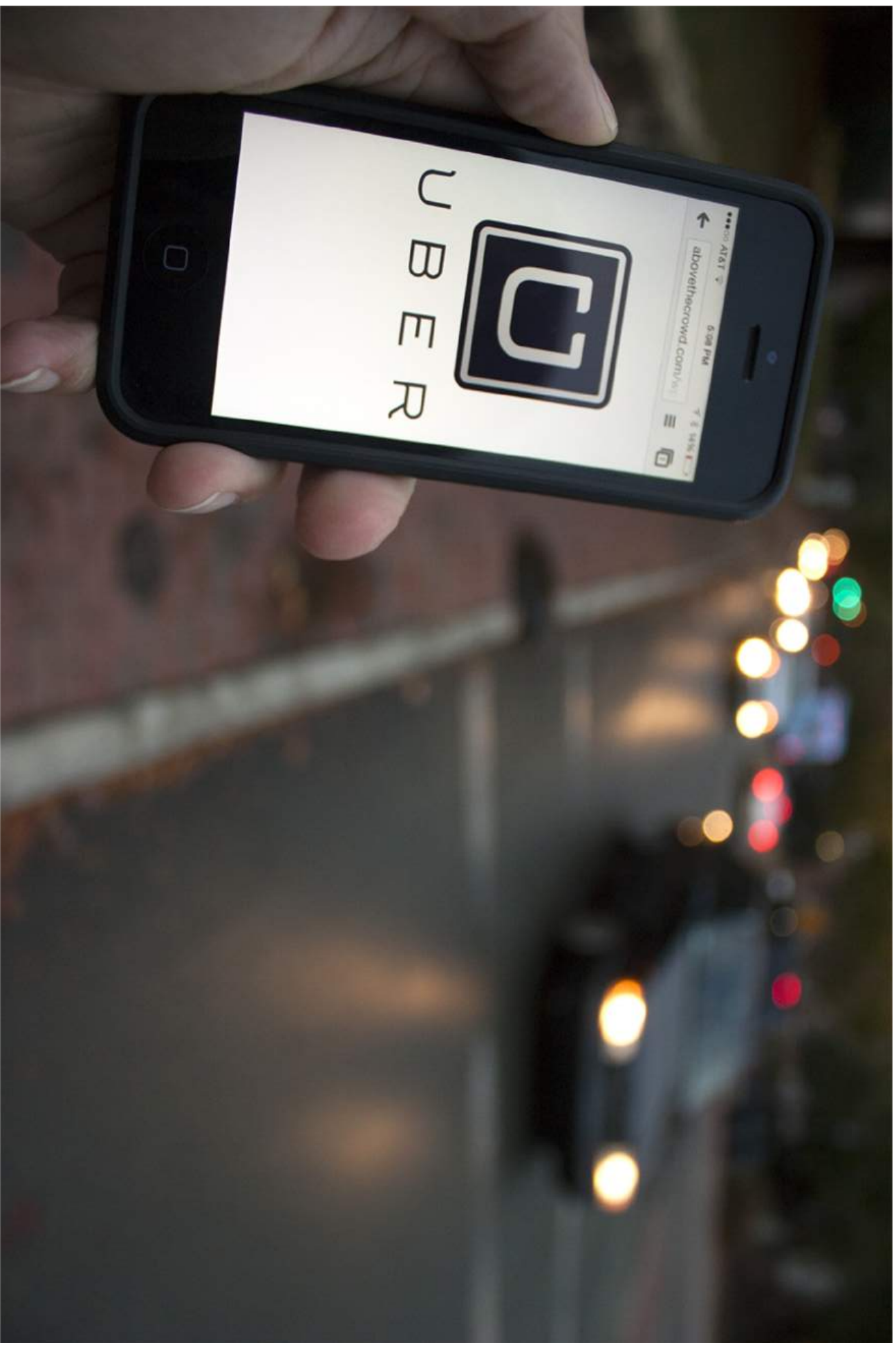
Nively – CTO



[conti@nively.com](mailto:conti@nively.com)

Twitter: @Nively\_sas







# WHICH MAJOR INDUSTRY WILL BE NEXT IN LINE FOR DISRUPTION?

“If you want to get a ride to the airport, you can whip out your phone (or give a voice command to a virtual assistant like Alexa) and hail an Uber.

But if you get sick, you probably still take off work and go to the doctor.

You probably don't consult with your physician via video chat or even email—even though these technologies have been mainstream for years.”

Source: [www.ioti.com](http://www.ioti.com)



INNOVATION IN HEALTHCARE IS ... HARD, VERY **HARD**



Credit: Freemages.com/ Bob Smith

# WHY INNOVATION IN HEALTH CARE IS SO HARD

“soaring cost of health care”

“horizontal integration is needed”

“The amount spent now [...] continues to grow much faster than the economy”

“Health care is still an astonishingly fragmented industry”

“The health care sector has many stakeholders, each with an agenda”

“Innovations in the delivery of health care can result in more-convenient, more-effective, and less-expensive treatments for today’s time-stressed and increasingly empowered health care consumers.

“Thus, it is important for innovators to understand the extensive network of regulations that may affect a particular innovation and how and by whom those rules are enacted, modified, and applied.”



POLICY

# Why Innovation in Health Care Is So Hard

by Regina E. Herzlinger

FROM THE MAY 2006 ISSUE

SUMMARY SAVE SHARE COMMENT 2 TEXT SIZE PRINT \$8.95 BL



**H**ealth care—in the United States, certainly, but also in most other developed countries—is ailing and in need of help. Yes, medical treatment has made astonishing advances over the years. But the packaging and delivery of that treatment are often inefficient, ineffective, and consumer unfriendly.

The well-known problems range from medical errors, which by some accounts are the eighth leading cause of death in the United States, to the soaring cost of health care. The amount spent now represents about one-sixth of the U.S. gross domestic product; it

## WHAT TO READ NEXT



The Strategy That Will Fix Health Care

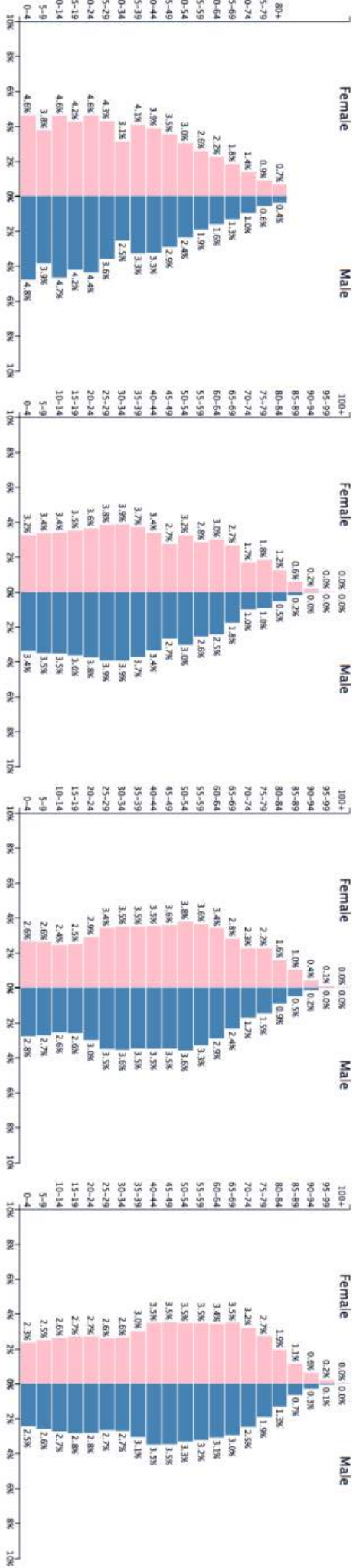


BUT...SOMETHING IS CHANGING

(LET'S SEE WHY)



# POPULATION PYRAMID IN EUROPE



1950

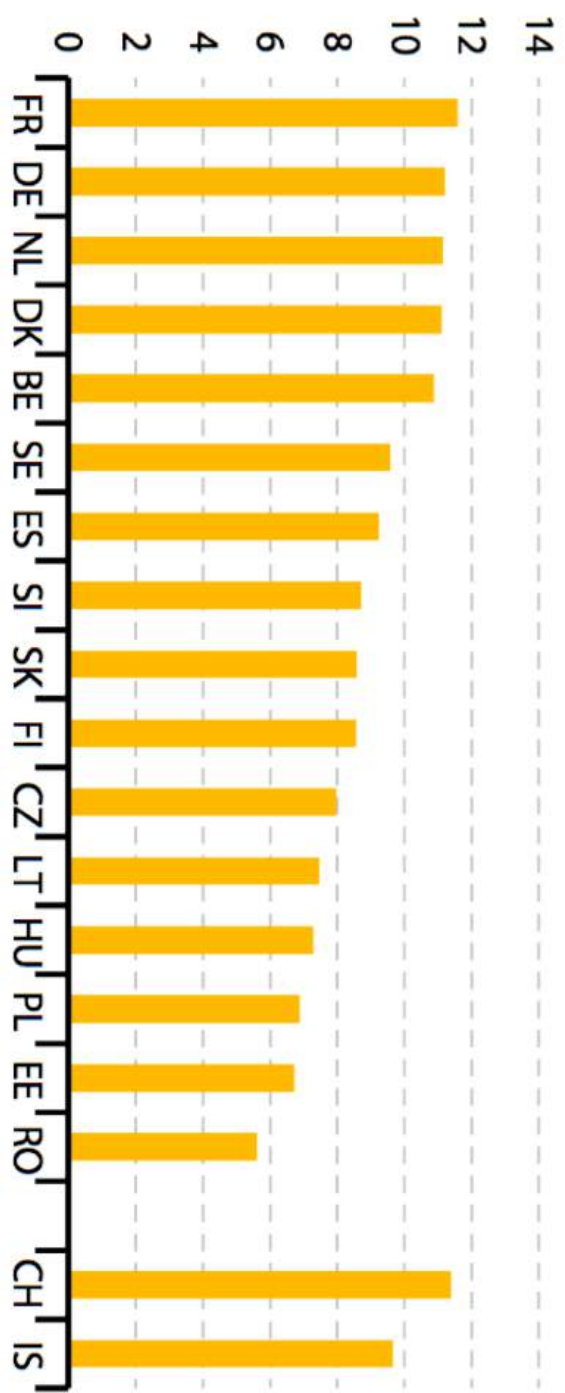
1990

2015

2030

..AND AGE IS DIRECTLY RELATED TO MULTI-  
MORBIDITY AND CRONICITY

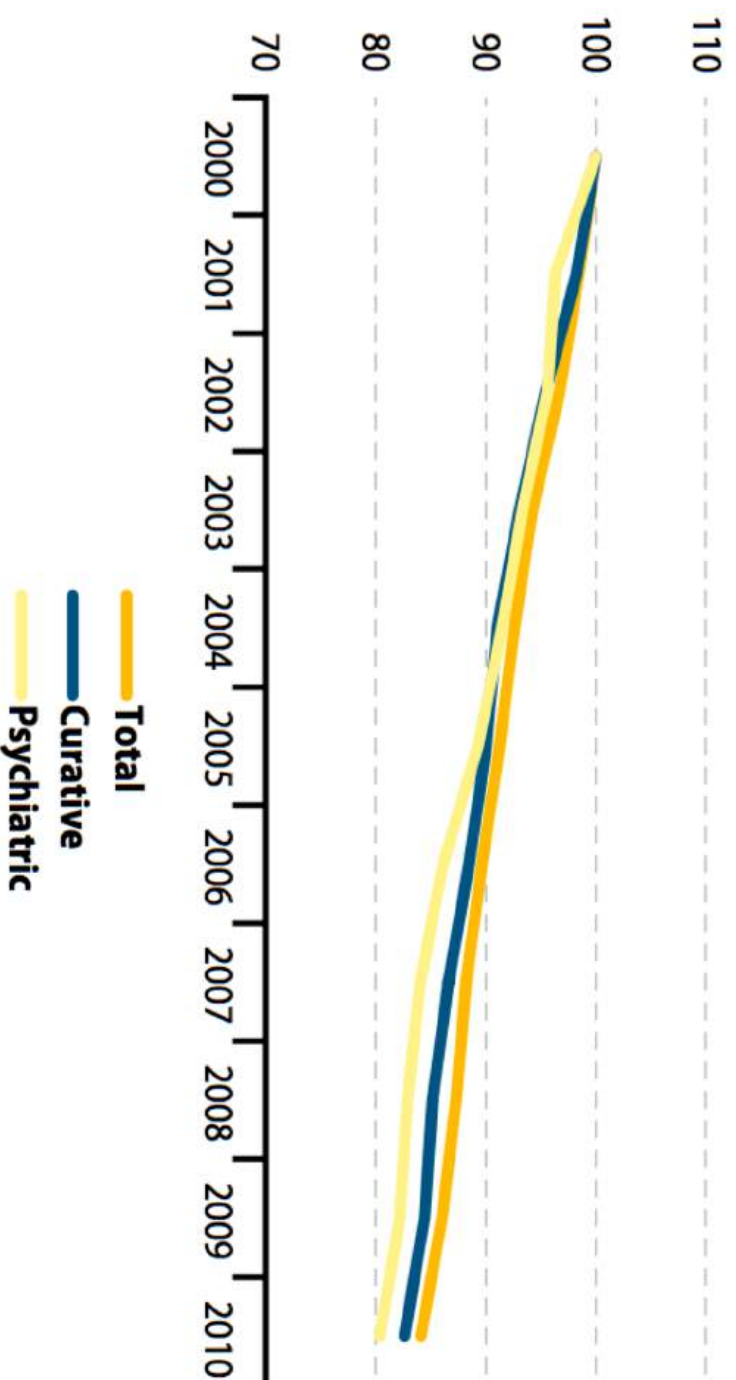
# CURRENT HEALTHCARE EXPENDITURE (% OF GDP)





National health expenditures in the US  
accounted for **\$3.2** trillion in 2015 or  
**18%** of the GDP.

# NUMBER OF HOSPITAL BEDS PER 100 000 INHABITANTS, EU-27



UNSUSTAINABLE

## MARKET OUTLOOK



Market  
Research.com

The healthcare Internet of  
Things market will grow to  
**\$117 billion** by **2020**

The IoT Healthcare market is

expected to grow with a **CAGR**  
of **43.01%** during the **2016-**  
**2022** period



MARKET  
WIRED

## MARKET OUTLOOK



**4 million** patients globally  
will remotely monitor their health  
conditions by **2020**

The number of fitness devices will  
grow **5X** until 2020. Today **57%** of  
US users access PHR and uses Internet  
to get information on healthcare  
(symptoms, etc)

 **accenture**  
High performance. Delivered.

## MARKET OUTLOOK

**Gartner**<sup>®</sup>

Some **6.4 Billion** connected things [...] by the end of 2016, with some **5.5 million** new things getting connected **every day**.

The number of connected devices in the healthcare sector globally is expected to reach **1.2 billion** by **2024** according to Machina Research.

**Machina  
Research**

## IoT in Healthcare: What's in Store?

Redefining healthcare with the potential of IoT



**44%**  
of mobile users have seen  
medical professionals  
using a mobile device.



Total global worth of IoT  
technology expected to be  
**\$6.2 trillion**  
by **2025**

**\$2.5 trillion**  
is the expected value  
from devices in  
healthcare



**\$117 billion**  
expected growth of IoT in  
the healthcare sector by  
**2020**



**\$59.7 billion**  
expected valuation of the global  
wireless health market by the end of  
**2018**



Wearables market  
expected to generate  
**\$14 Billion**  
in revenue by **2016**



mHealth technologies expected to be a  
**\$15 billion** industry  
by **2017**

Source: Gartner

# HOT SCENARIOS



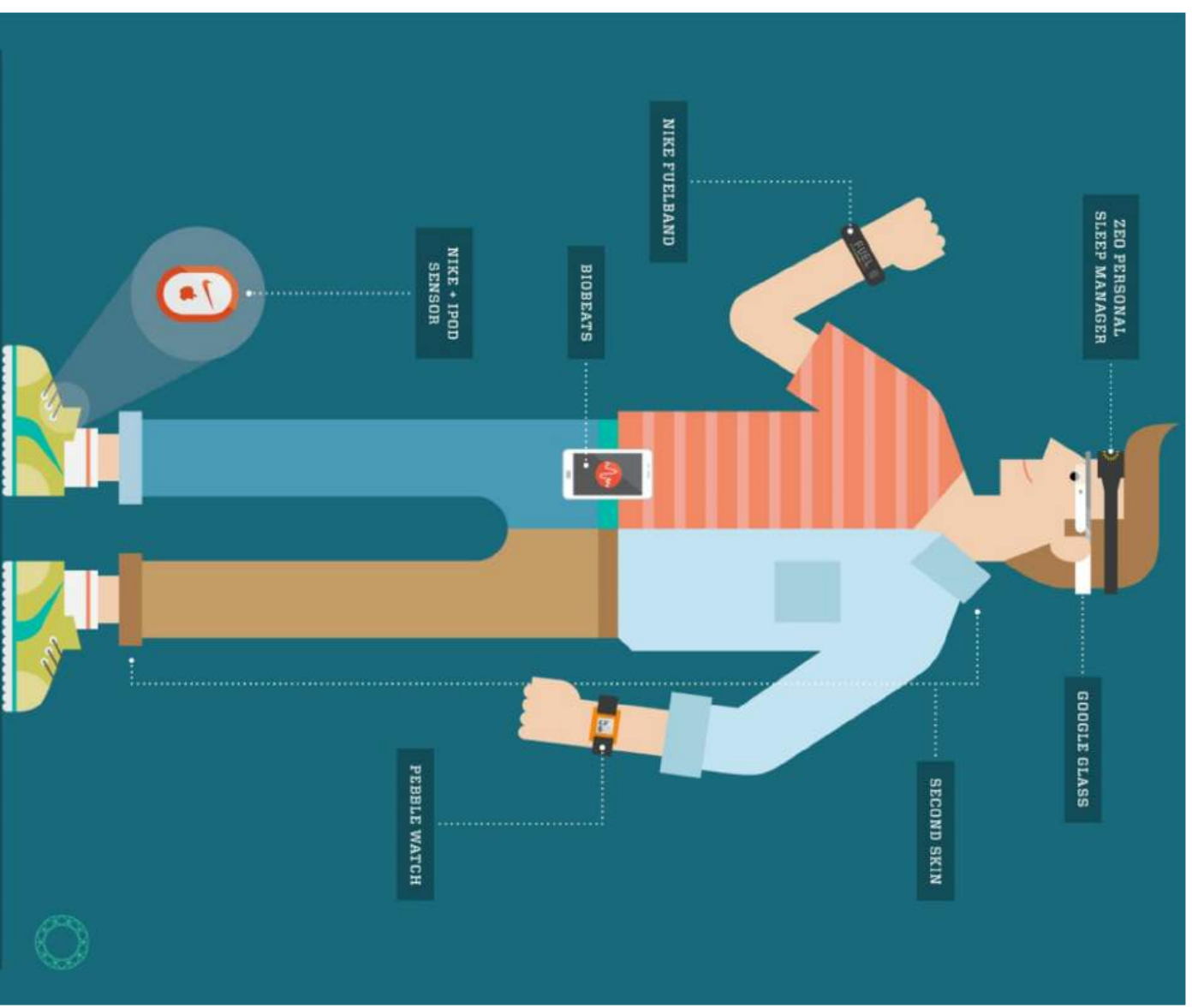
Credit: [Freemages.com](https://www.freemages.com/)/ Lotus Head

## SCENARIO # 1: HEALTH & WELLBEING

# HEALTH & WELLBEING



Market forecast at **\$19 billion** by **2018** of which **61%** of devices will be sport and fitness trackers



Source: Futuresport.co

# WEARABLE FOR MONITORING OF SPORT ACTIVITY



Source: [www.sportsthinktank.com](http://www.sportsthinktank.com)

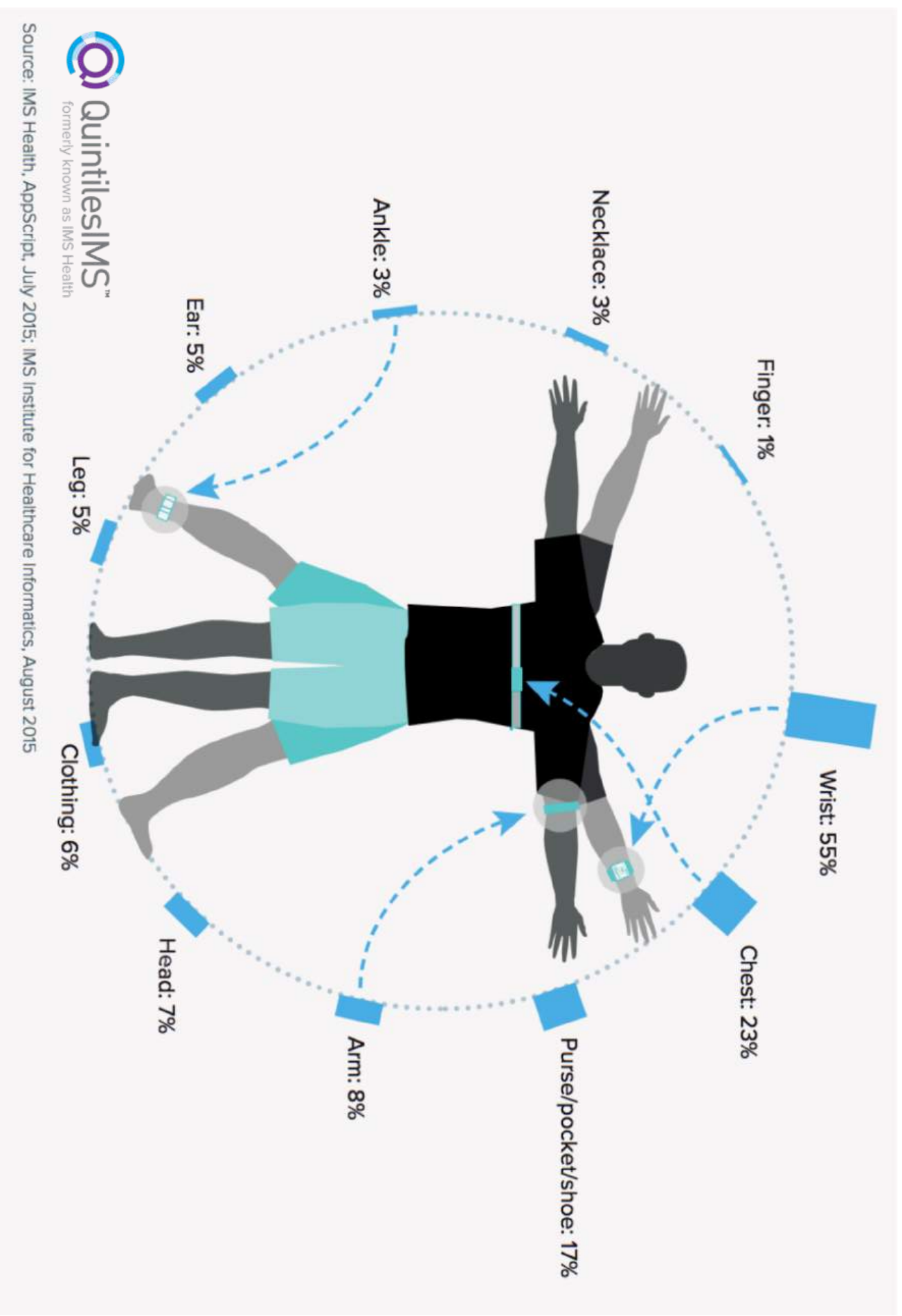
# WEARABLE FOR CARE/CURE

WEARABLE INTENSIVE  
NERVE STIMULATION  
(MINS) SOLUTION BY  
QUELL



Source: [www.queell.com](http://www.queell.com)

# BODY PART INVOLVED



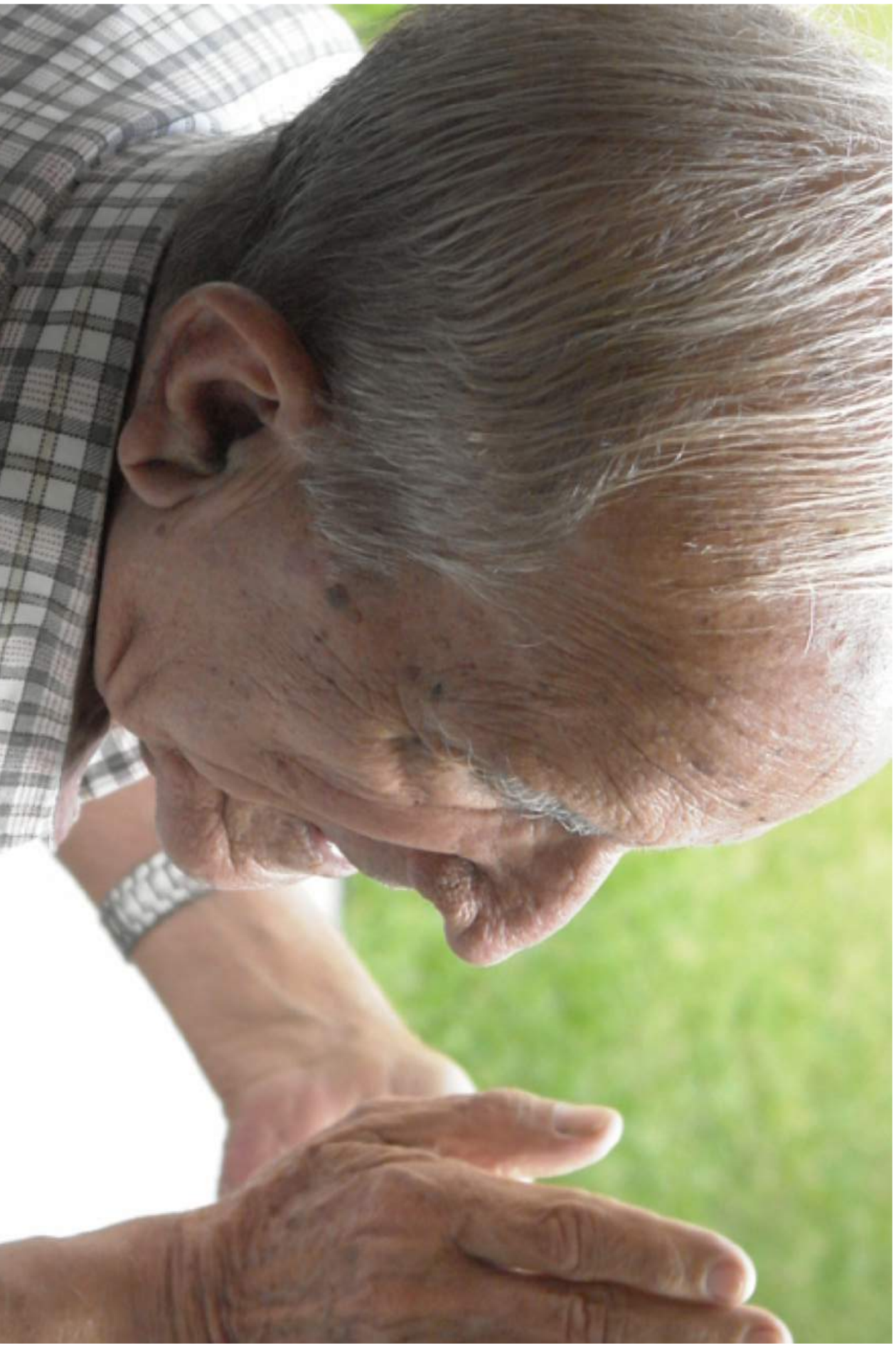
Source: Quintiles IMS

# MONITORING OF SENIORS



Credit: Freemages.com/ Lotus Head

# MONITORING OF SENIORS



Credit: Freepress.com/ C B

# NIGHT WANDERING



Copyright nively.com

# WAKE UP ALERT



Copyright nively.com

# ABNORMAL PERMANENCE IN TOILET



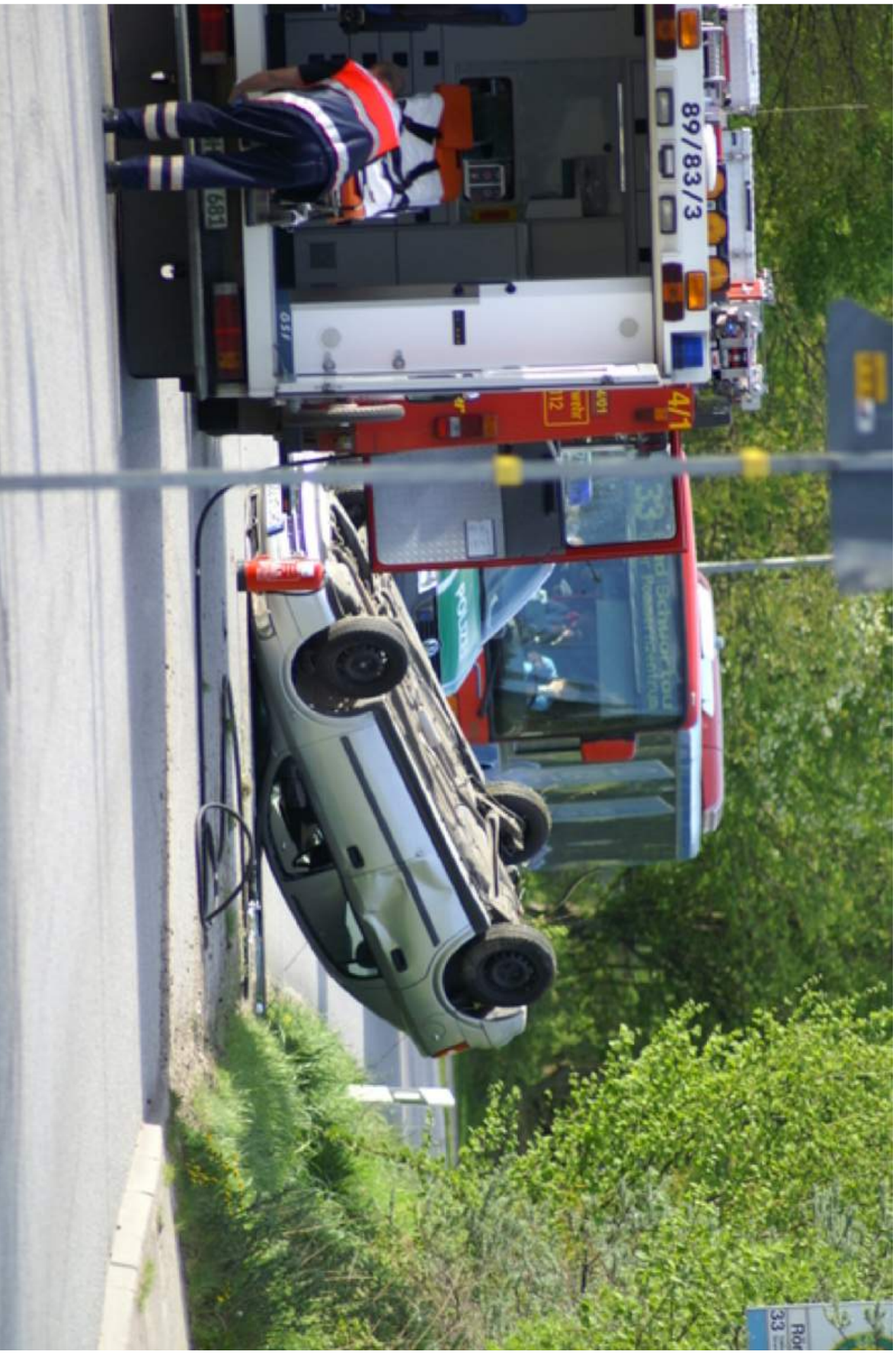
Copyright nively.com

# FALL DETECTION



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FALLS ARE THE GREATEST CAUSE OF DEATH AMONG THOSE AGED 65+



# REACTIVE SCENARIOS

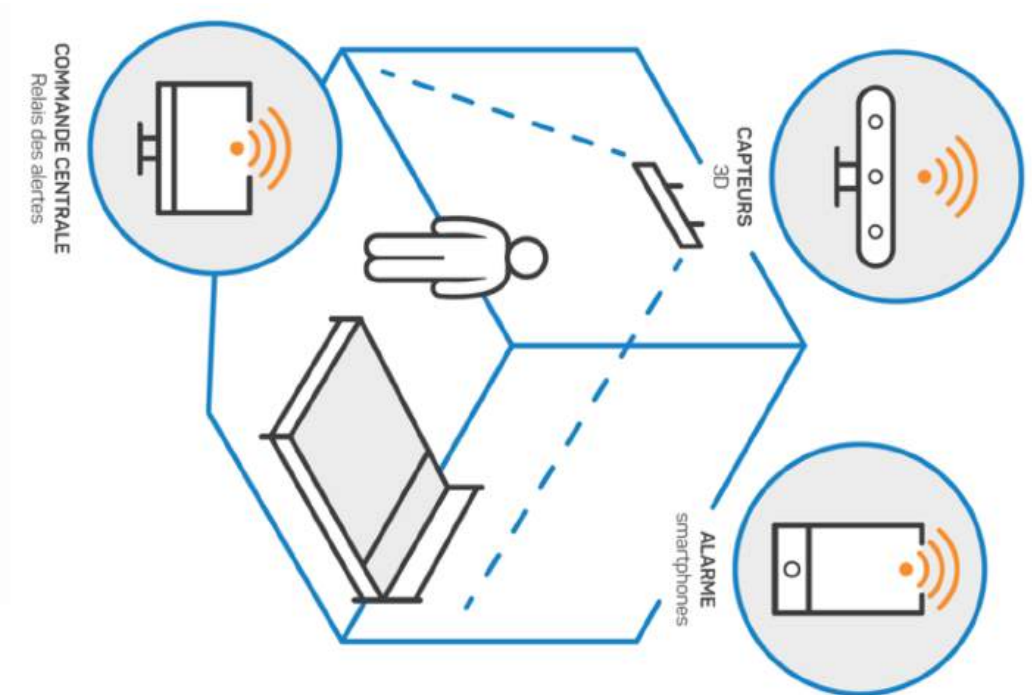


Copyright nivelly.com

# THE PRODUCT: MENTORAGE®

Multiple dangers detected

MORE THAN A SIMPLE FALL DETECTION



FALL



PROLONGED  
PERMANENCE  
IN A ROOM



EXITING  
FROM  
ROOM



NIGHT  
WANDERING



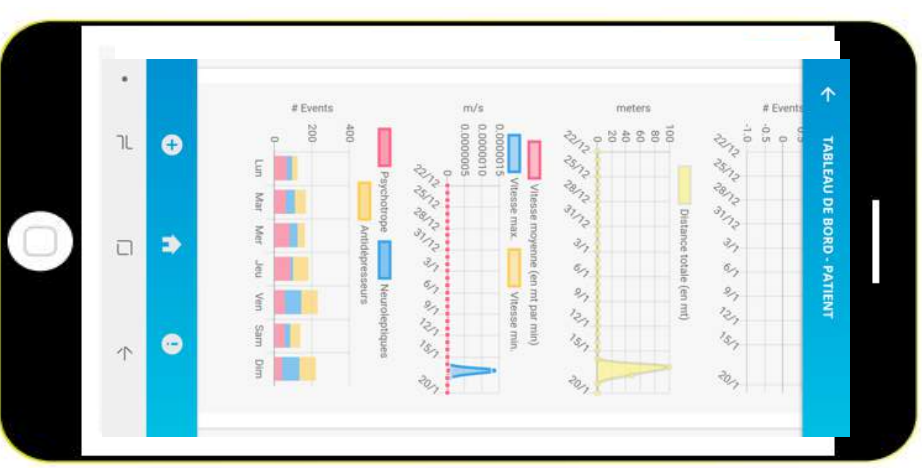
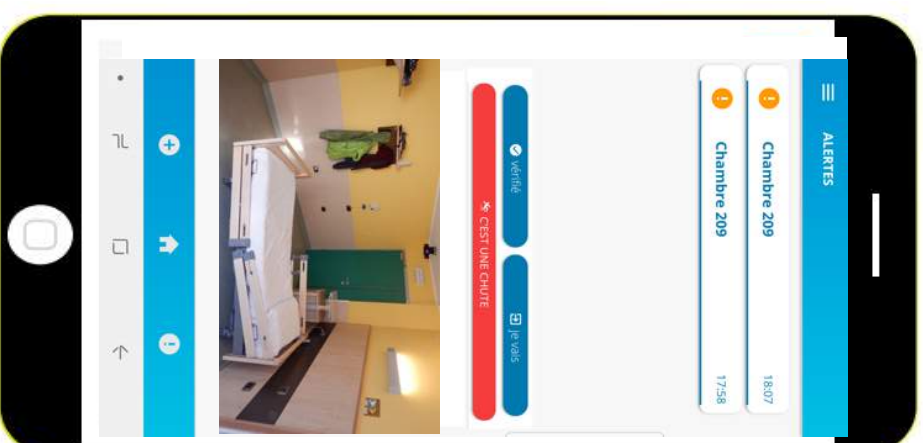
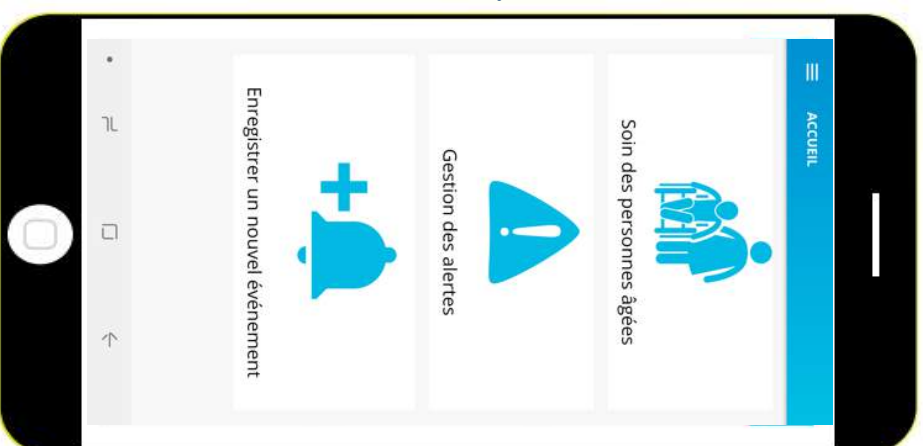
RISING FROM  
BED



SMART DATA  
ANALYSIS

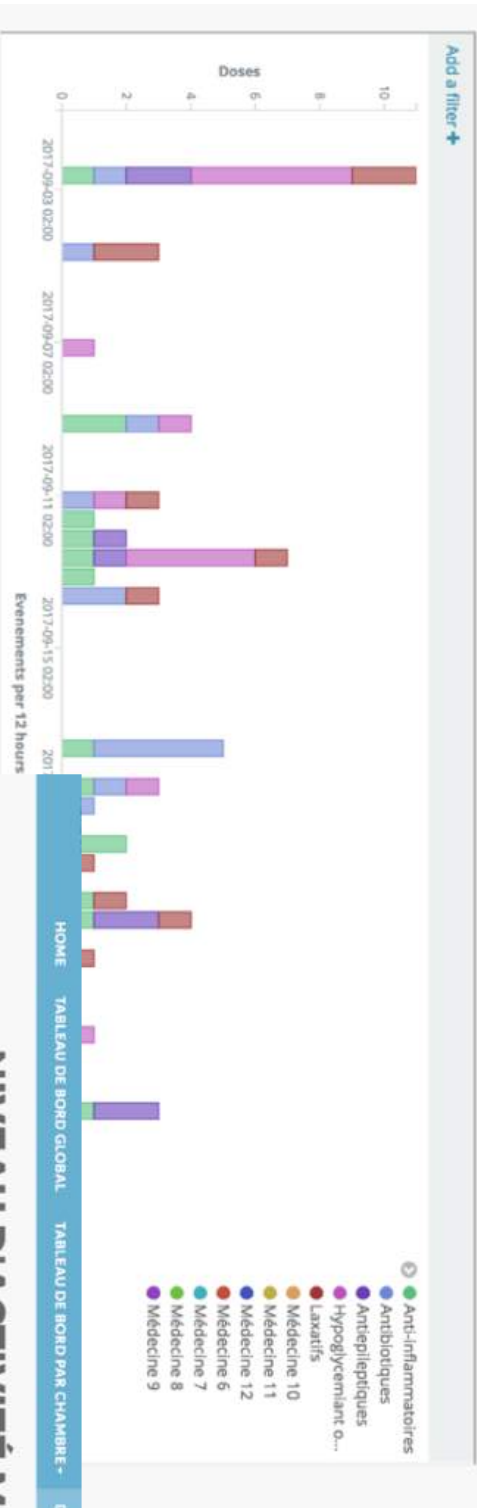
# THE PRODUCT: MENTORAGE®

## Images of the App

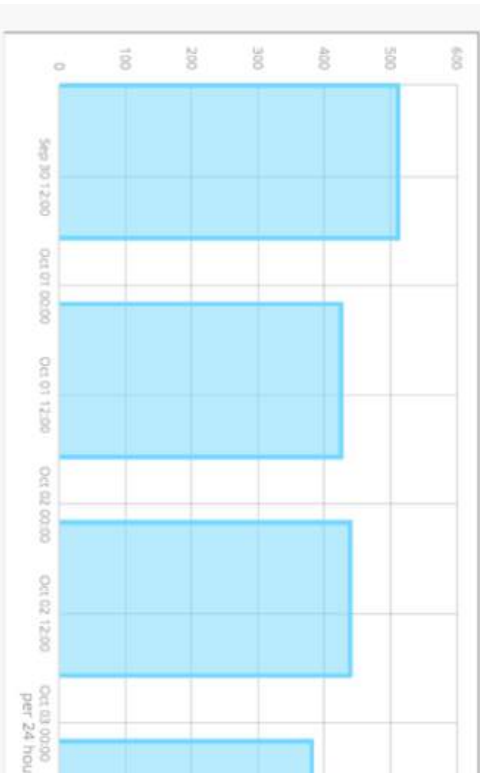


# THE PRODUCT: MENTORAGE®

Smart data analysis



NIVEAU D'ACTIVITÉ HEBDOMADAIRE: DÉMARI



## NIVEAU D'ACTIVITÉ MENSUEL

CHAMBRE 01



NIVEAU D'ACTIVITÉ MENSUEL: DÉMARCHE (FRÉQUENCE QUOTIDIENNE)

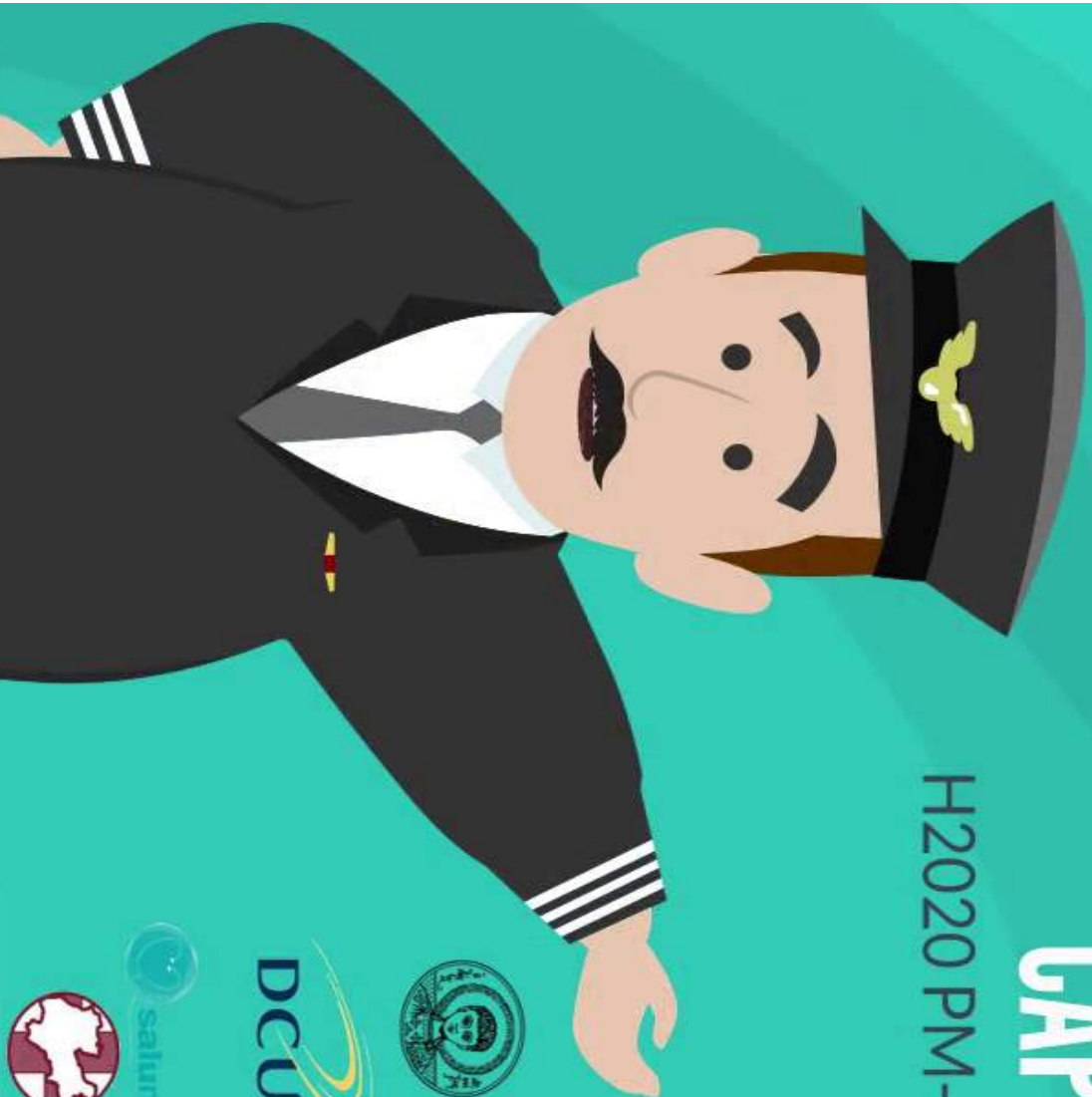
# SMART ENVIRONMENTS AND COACHING



Credit: Freemages.com/ Lotus Head

# CAPTAIN

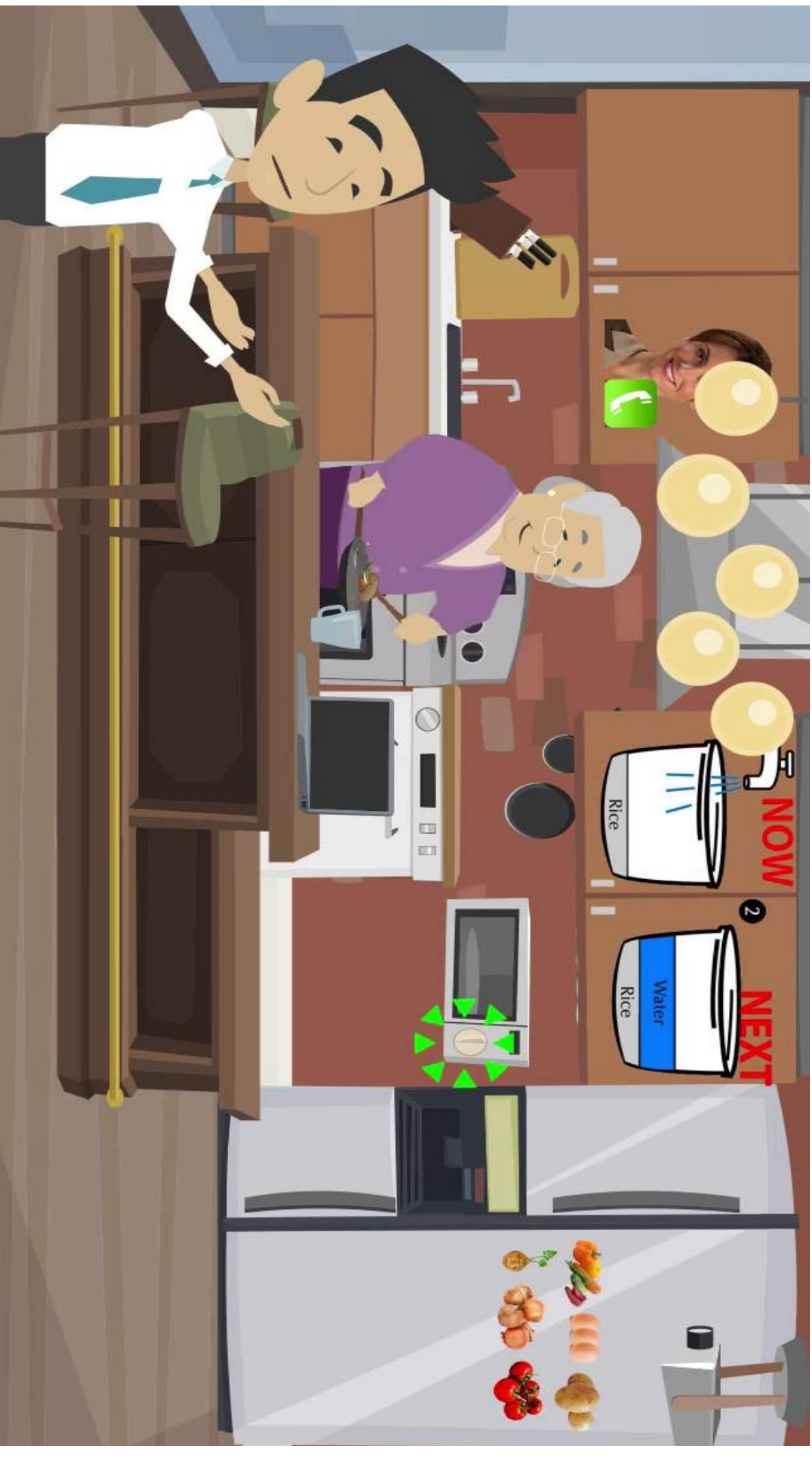
H2020 PM-15 project

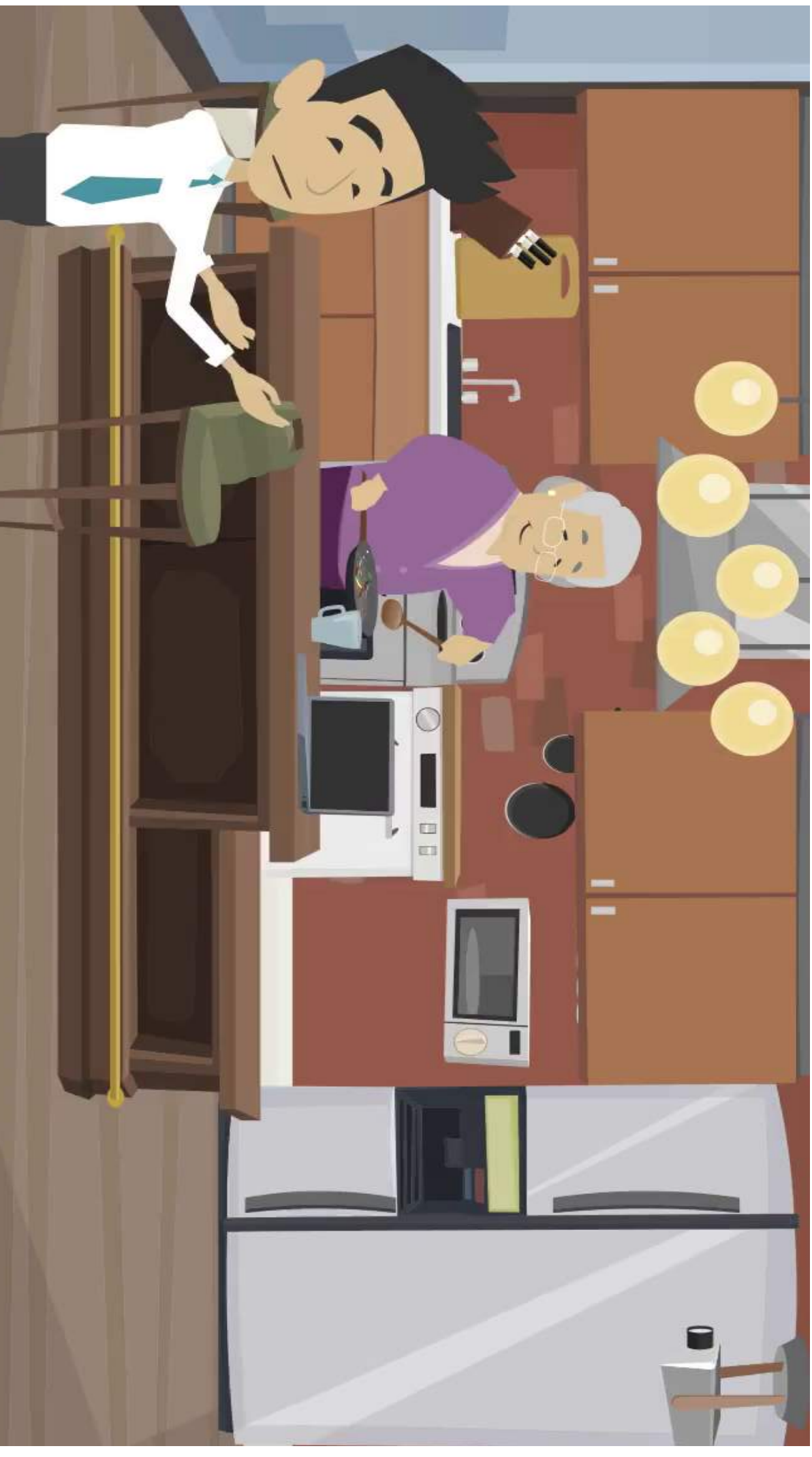


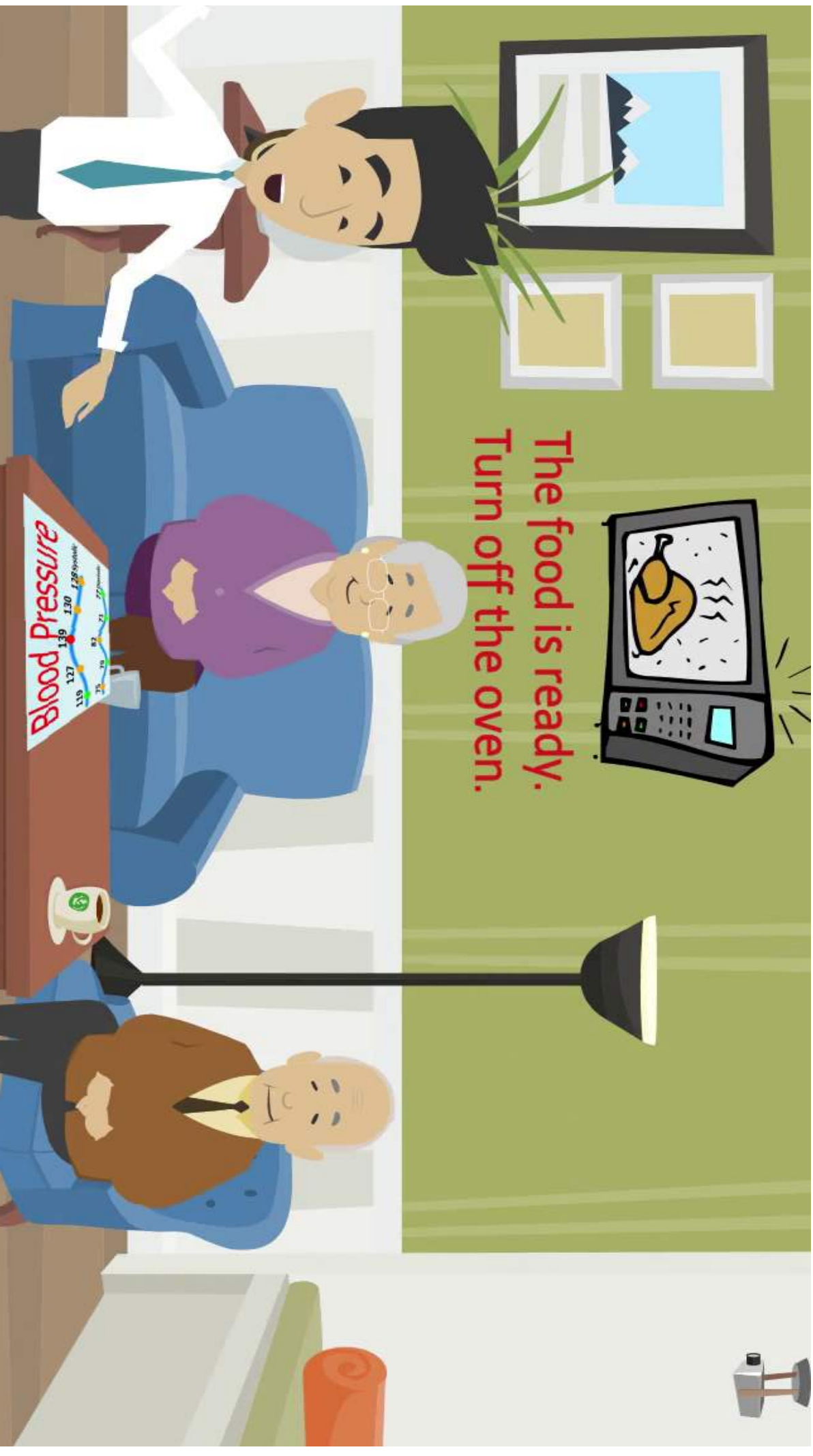


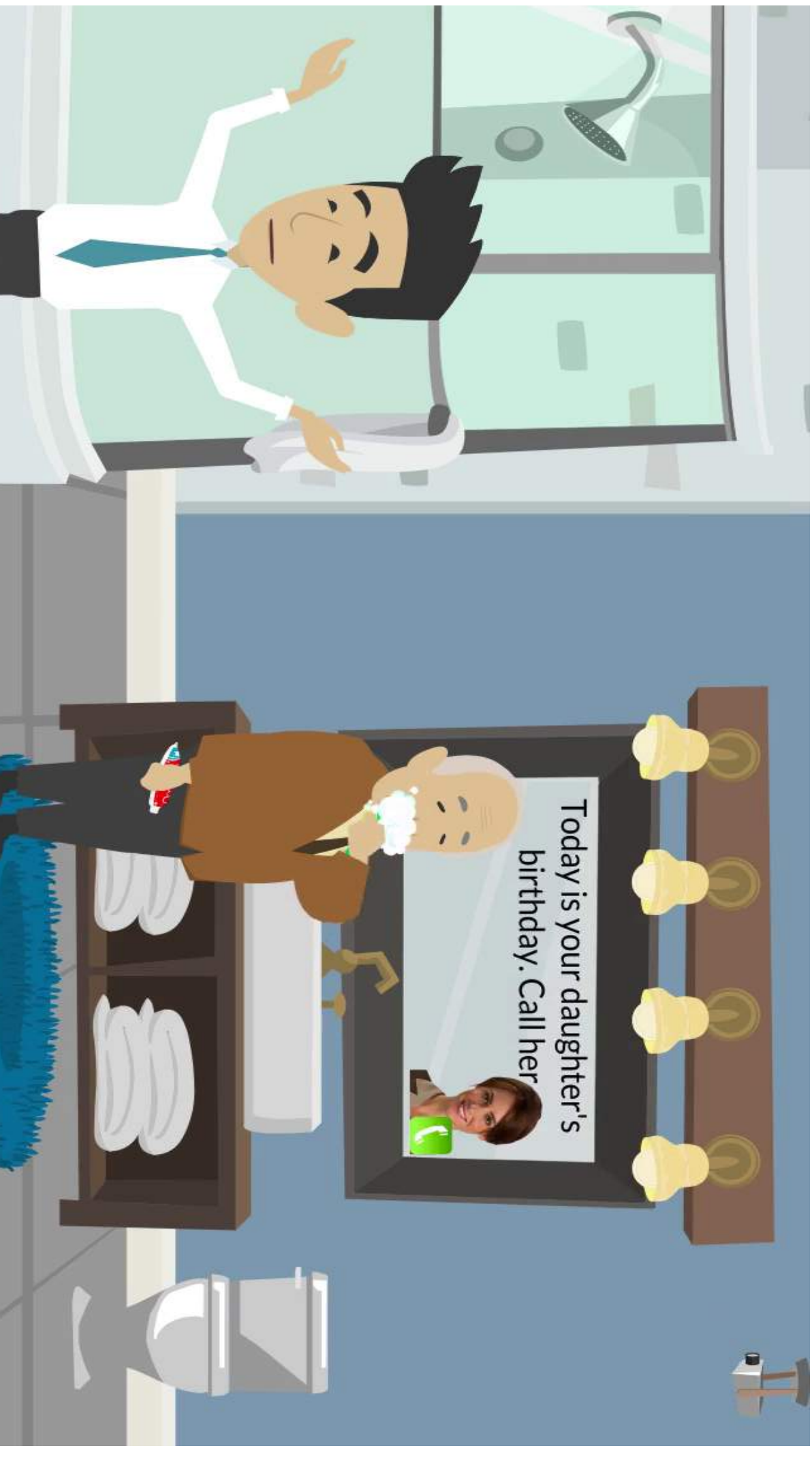
# video

- <https://www.youtube.com/watch?v=3gu01JbC7VY>



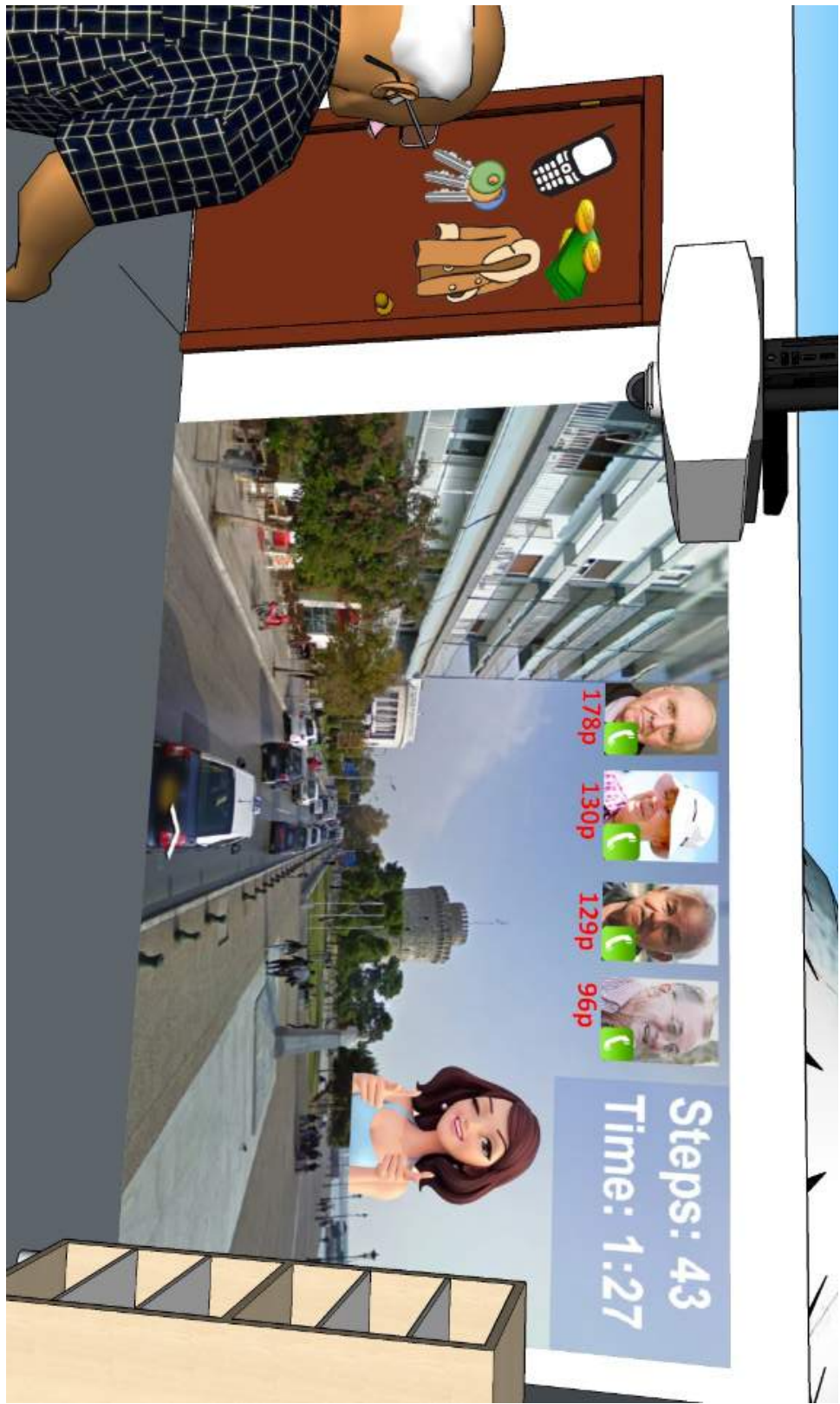








Maria had a stroke and needs to be reminded to do her exercises every day

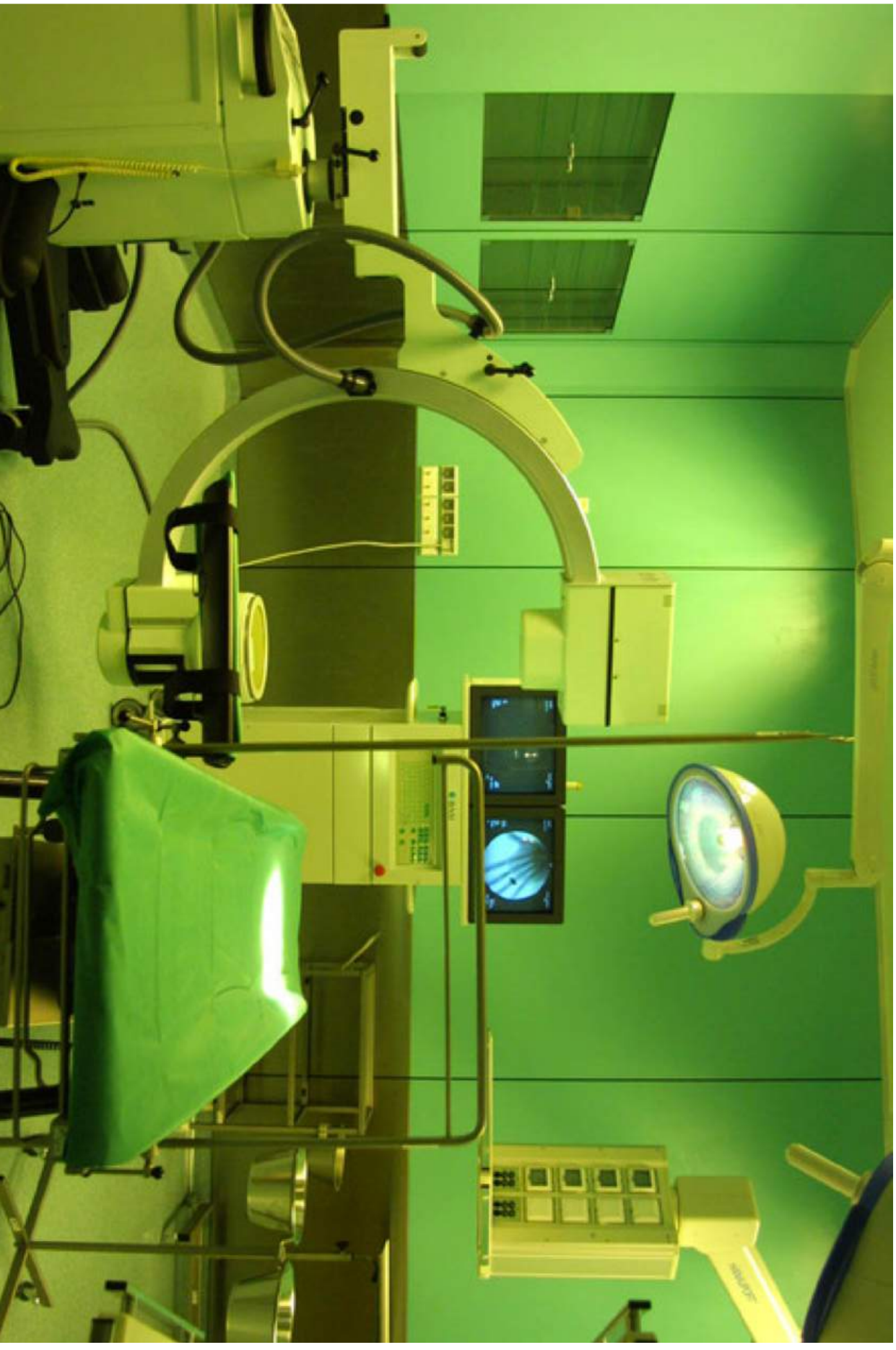


# PEOPLE AND DEVICE MANAGEMENT (HOSPITAL)

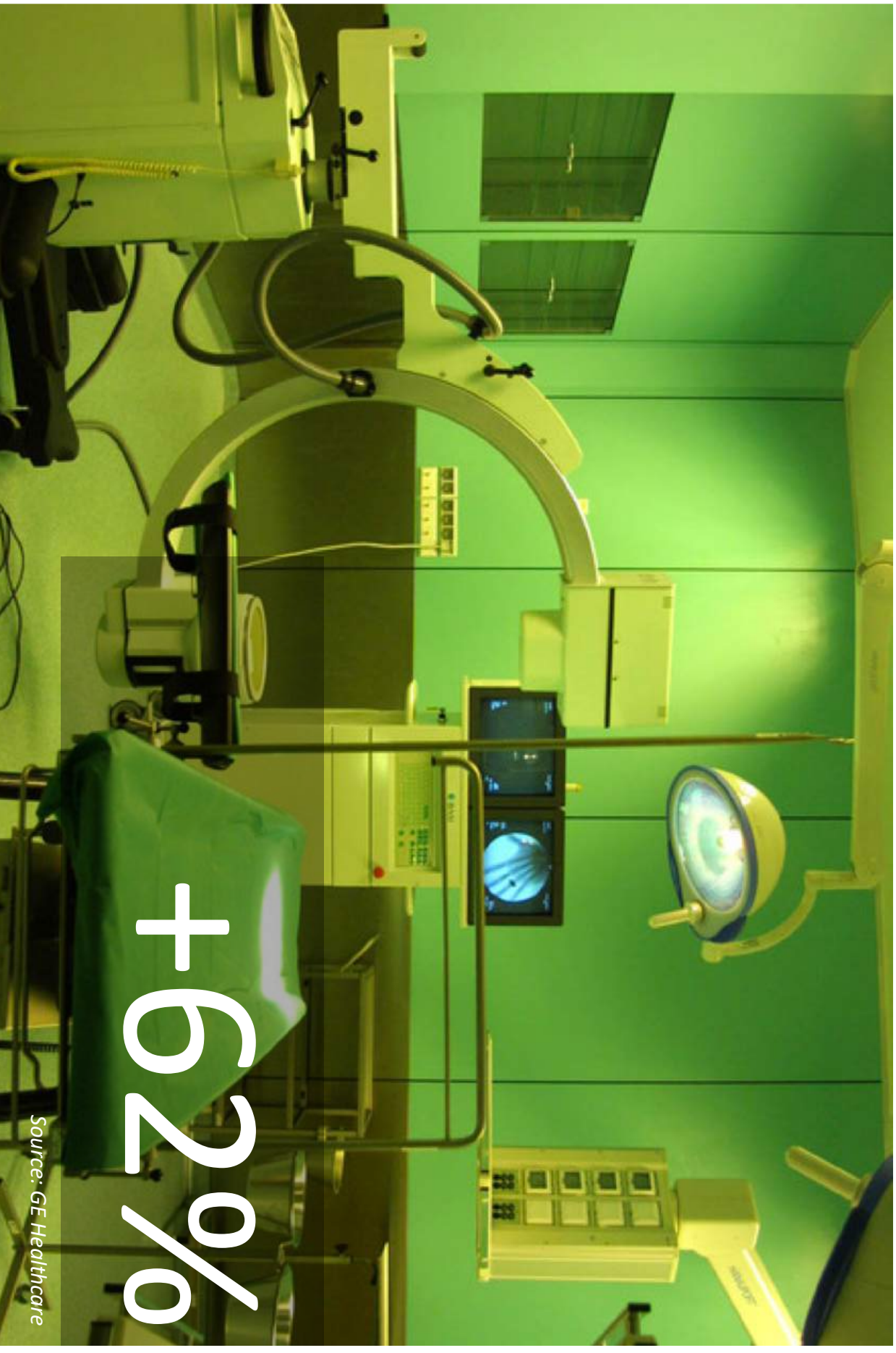


Credit: Freemages.com/ Lotus Head

# SMART TRACKING OF MEDICAL DEVICES



## INCREASING NUMBER OF MOBILE MEDICAL DEVICES PER BED



Source: GE Healthcare

# SIGNIFICANT INCREASE IN SERVICE AND MAINTENANCE COSTS



Source: GE Healthcare

Credit: Freemages.com/ Keith Syvinski

# INCREASING “INVISIBILITY” OF PORTABLE MEDICAL EQUIPMENT

(PORTABLE MEDICAL EQUIPMENT IS STOLEN OR LOST EVERY YEAR WITHIN HOSPITAL )



Source: GE Healthcare

# 10-15%

Credit: Freemages.com/ Fernando AUDIBERT

## NURSES STAFF TIME SPENT LOOKING FOR PORTABLE MEDICAL EQUIPMENT



10-30%

21 min. per shift

*Source: GE Healthcare*

Credit: Freemages.com/ Fernando AUDIBERT

## NURSES STAFF TIME SPENT LOOKING FOR PORTABLE MEDICAL EQUIPMENT



# 10-30%

# 21 min. per shift or 75% for maintenance staff

Source: GE Healthcare

EFFECT: OVER-PROCUREMENT IF COMPARED TO REAL REQUIREMENTS



Source: GE Healthcare

Credit: Freemages.com/ Fernando AUDIBERT

MOBILE CLINICAL ASSET (INFUSION PUMPS ETC.) UTILISATION LEVEL IS LOW



*Source: GE Healthcare*

Credit: Freemages.com/ Fernando AUDIBERT

## RETURN ON INVESTMENT OF ASSET MANAGEMENT + RTLS



Source: GE Healthcare

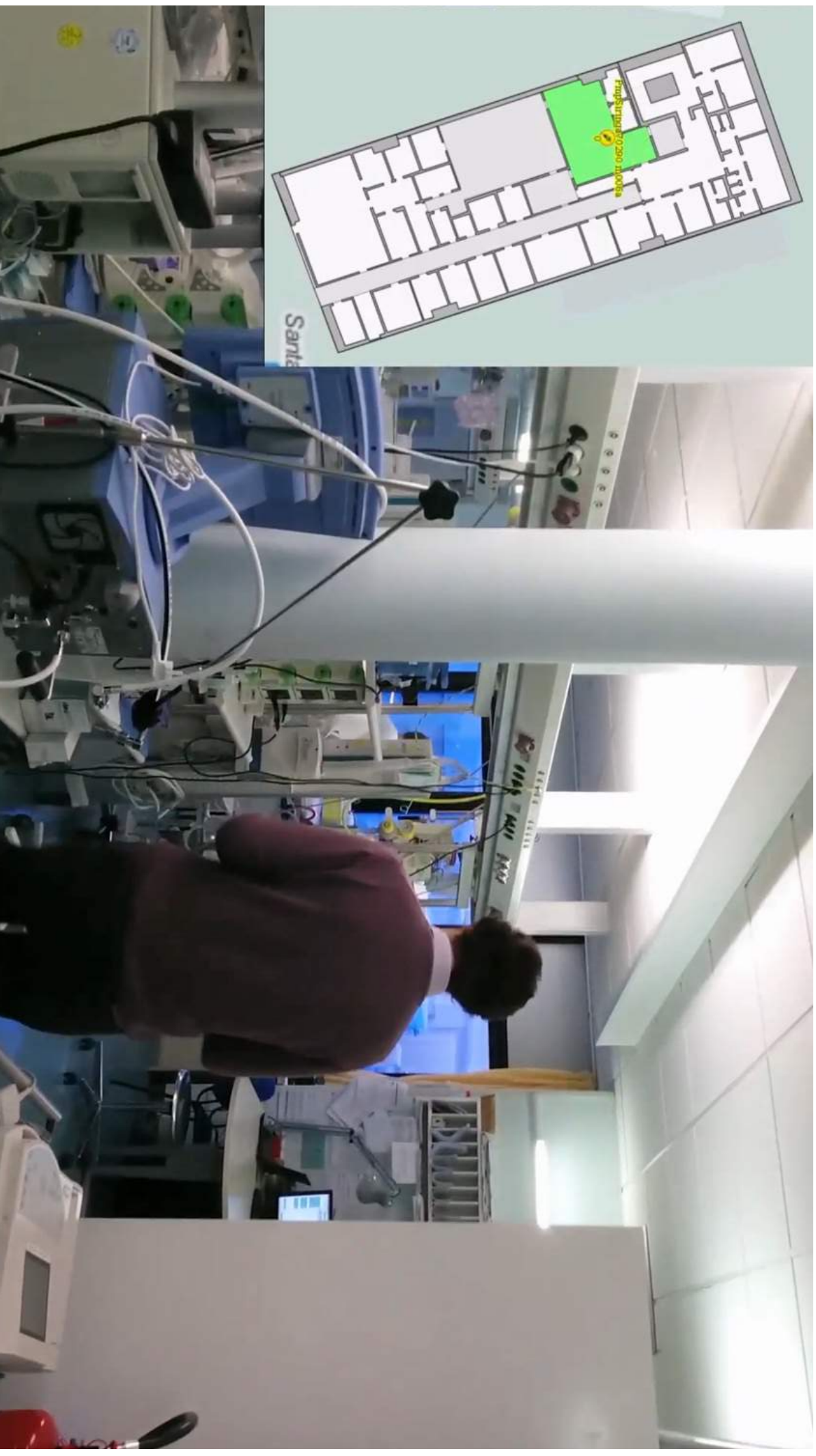
## TYPICAL USE CASES



## TYPICAL USE CASES



# EXAMPLE IN NEONATOLOGY





# AssetTrace

nively

nively

EXAMPLES IN THE MARKET



**VERSUS**  
Locating Advantages for Healthcare™



**XeroScout**



**AirFinder**





**ekahau**





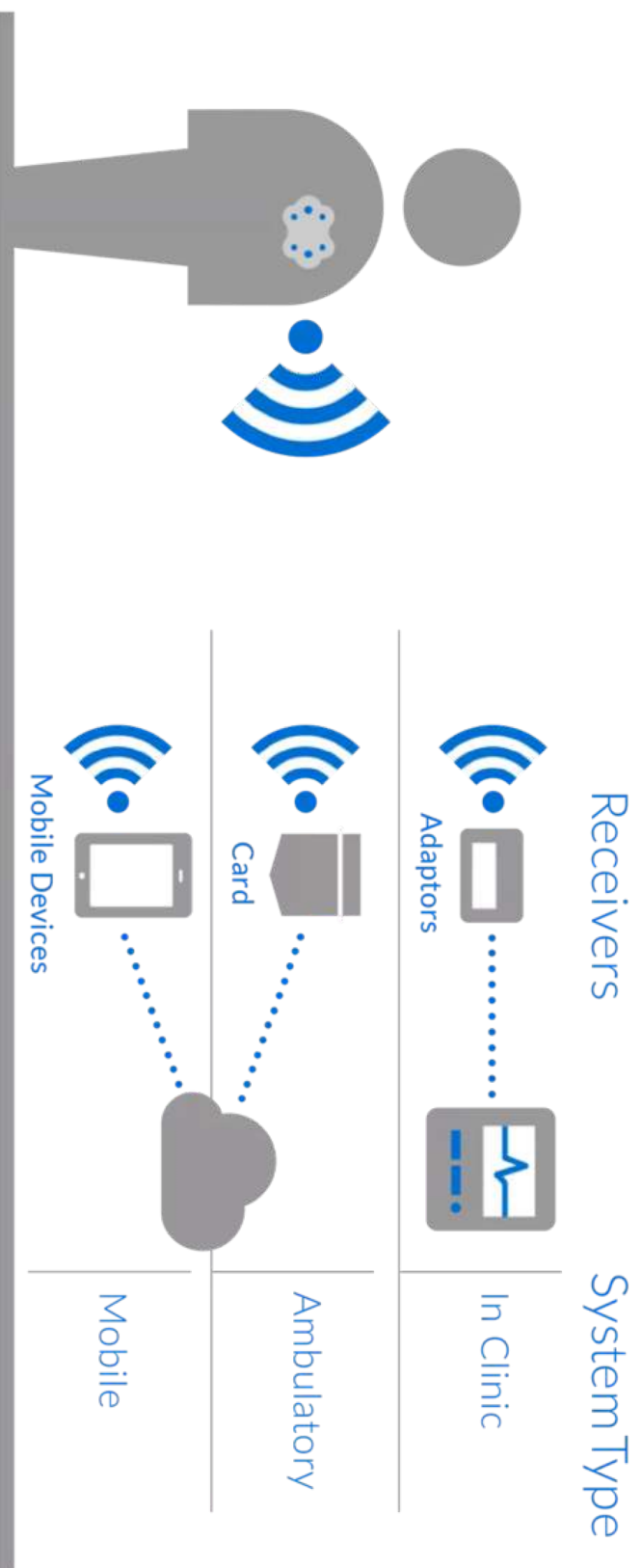


**OLEDCOM**  
LIZ

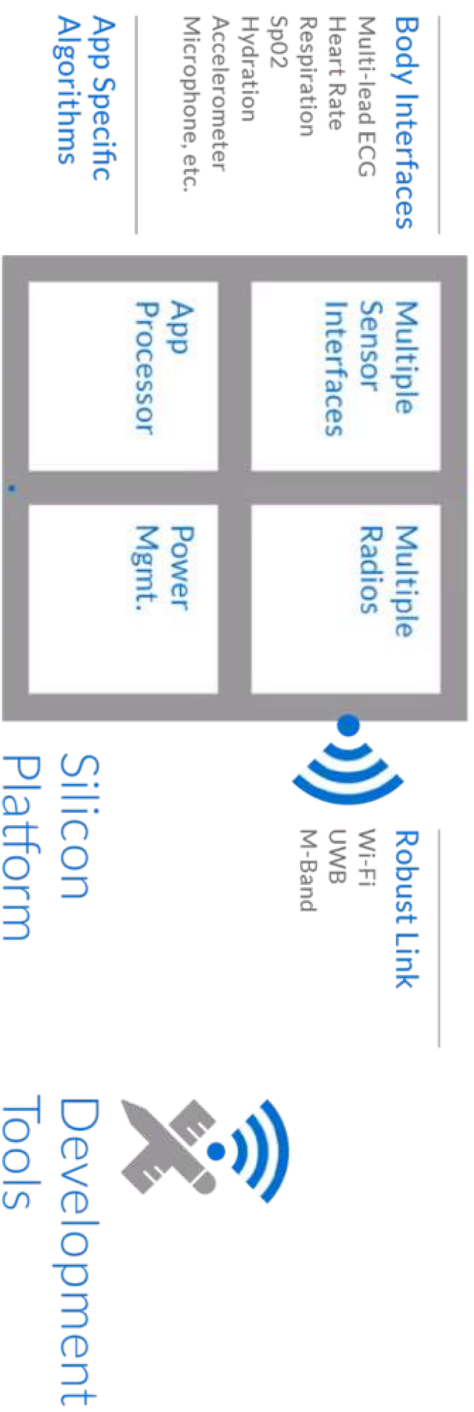
# CLINICAL GRADE MONITORING

(PRE/DURING/POST HOSPITALISATION)





Enabled By



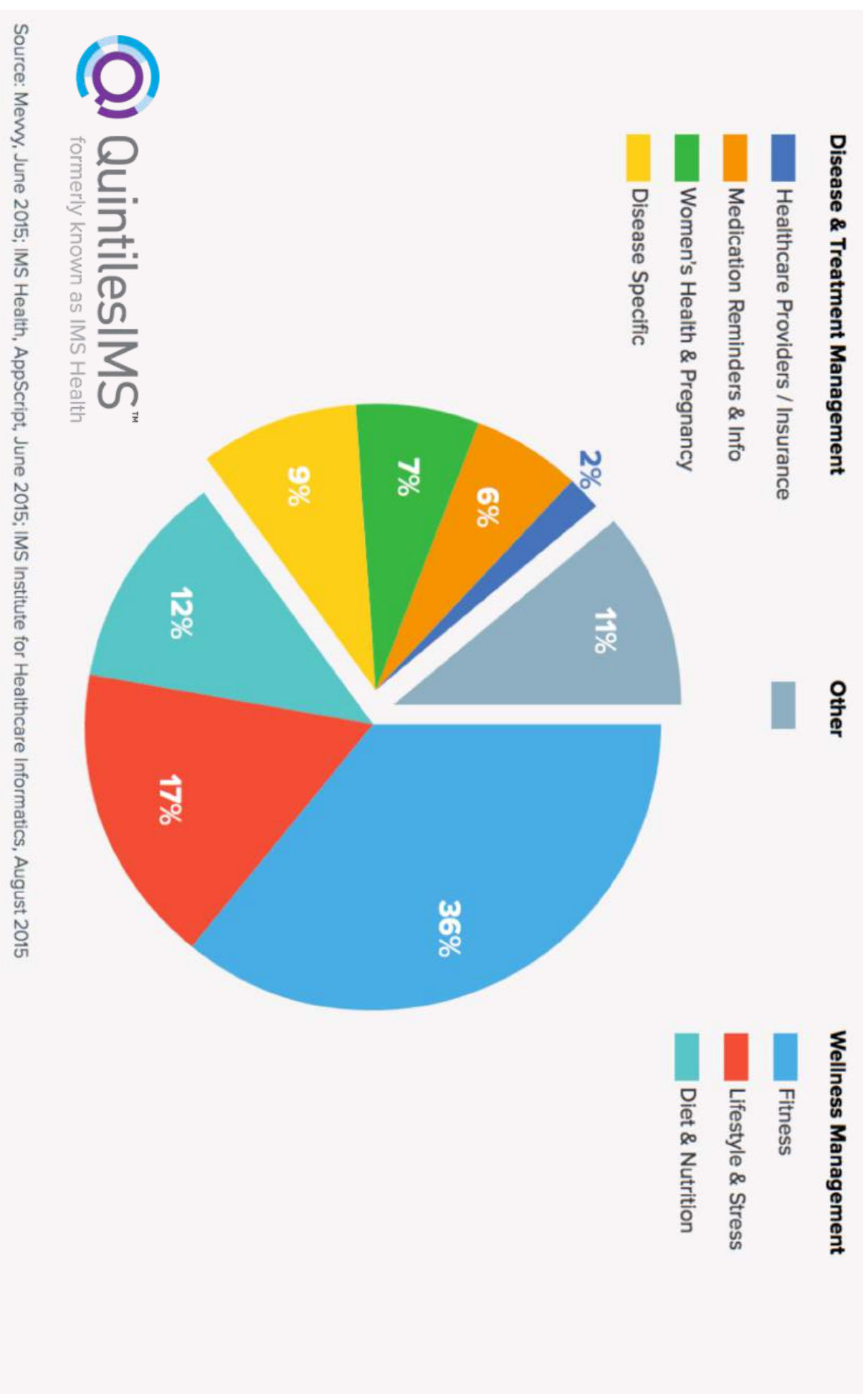


“HC1100 embeds three ultra-low-power radios for Wi-Fi, Ultra-wideband and Medical Band (MBAN) transmissions and has the capacity to support the monitoring of multi-lead ECG, heart rate, blood oxygen levels and respiration of 50 to 60 wirelessly-linked patients within a 25-meter perimeter, while continuously transmitting for up to five days at wire-grade link quality on low-cost Zn-Air coin batteries.

In addition, MEMS microphones and motion sensors can detect patient behavior.”



# APPS BY CATEGORY





# CONSUMERISATION + SAVVY USE OF LOCATION + PATHOLOGY-RELATED

## Drivers:

- increase self management (healthcare) process at HOME
- Chronic-disease management and home care
- *“Consumers utilizing home health technologies will increase from 14.3 million worldwide in 2014 to 78.5 million by 2020”*

*“Within five years, the majority of clinically relevant data . . . will be collected outside of clinical settings.” (2011)*

(source: Gregory Abowd, keynote address, American Medical Informatics Association 35th Annual Symposium, October 24, 2011, [www.amia.org/amia2011/keynotes](http://www.amia.org/amia2011/keynotes), accessed June 15, 2015)



IBM Center for Applied Insights  
Discover and apply new ideas

# DEVICE INTEROPERABILITY AND DATA INTEGRATION



# TELEMEDICINE



"back in 2015, 80% of doctors surveyed said telemedicine is a better way to manage chronic diseases than the traditional office visit.

Why? Telemedicine offers patients and health care providers both a new wave of freedom and accessibility.

For the first time, a patient's care options are **not limited by geographic location.**"

# A VARYING VALUE PROPOSITION ACCORDING TO THE PATIENT’S STATE

Care Setting	Prevention and Wellness	Chronic Care	Acute Care	Post-Acute Care
IoT Type	Wearable's	Wearable's, Attachables & Implantables	In-hospital Attachables	Wearable's, Attachables & Implantables
Value Creation Constraint	Massive data generation in diverse formats	Diverse formats and lack of standard communication channels	Massive data to be analyzed in real time	Due to lack of devices compatible to management of a given disease in post-acute setting, data generation is a key constraint
Challenge	Processing	Communication and Processing	Processing and Feedback	Generation

## A VARYING VALUE PROPOSITION ACCORDING TO THE PATIENT'S STATE

*"The value of improved health of chronic disease patients through remote monitoring could be as much as \$1.1 trillion per year in 2025."*

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Discover and apply new ideas

## WITH LONG-TERM CARE (LTC) AS PRIME TARGET



Example: Italy

- in 2014 the cost was **0.84%** of GDP and **12%** of healthcare cost while by 2016 was already **1.26%** of GDP
- Growth of cost by **6 billion euro** by 2060

# HEALTHCARE AS A SERVICE



# ARTIFICIAL INTELLIGENCE + BIG DATA + PATIENT CENTERED ANALYTICS + FOG COMPUTING\*

\* ANALYTICS AT THE POINT OF DATA COLLECTION

The system of wearables, sensors, software capable to generate medical report or indicators



# LPWA TECHNOLOGIES TAKE OFF IN HEALTHCARE



Low-Power Wide-Area Network (e.g. LoRa and Sigfox) and...

- Narrowband IoT (NB-IoT)
- LTE-M (Long Term Evolution for Machines)



LABORATOIRE D'ELECTRONIQUE  
ANTENNES ET TELECOMMUNICATIONS



Smart geolocation technology



PAPIoT : Position and Activity monitoring Platform based on IoT technology

LEAT – Abeeway - Nively



LABEX





# GLOBAL LABORATORY TEST THROUGHPUT

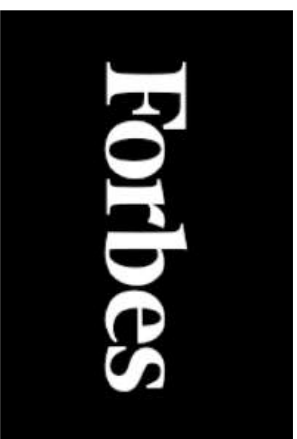


“IoT-Enabled connectivity within hospital labs will increase total global laboratory test throughput by more than 3.02 billion diagnostic tests over the next 5 year.”

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Discover and apply new ideas

## EMPOWERED PATIENTS CONSUMERS



"patients are now in the driver's seat, with better access to higher-quality doctors, and higher satisfaction rates overall. It's a healthy new way to look at health care"

# SYSTEM-LEVEL REQUIRED INNOVATION



BYOD (ECGs, DIY blood tests, etc.) + self-management at pharmacies or supermarkets



# BUSINESS RELATED TO COMPLIANCY WITH REGULATORY FRAMEWORKS (E.G. GDPR)



## CHALLENGES ?

FOR INSTITUTIONAL SCENARIOS WITH A CLEAR ROI IS TO BE  
DEMONSTRATED

Today's unsustainable system **Vs** "Population-based evidence creation"

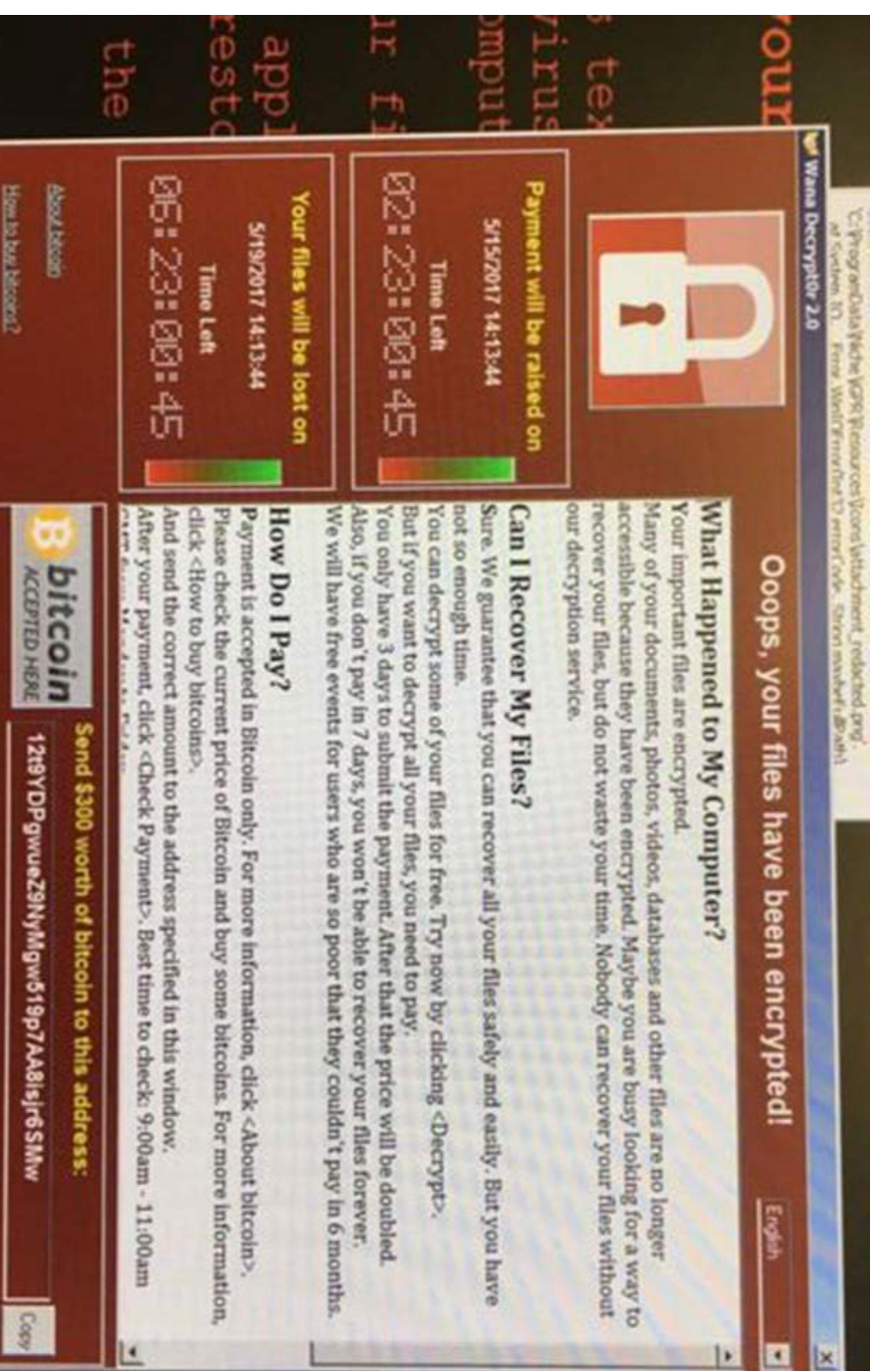
**Deloitte**

# SECURITY, WHERE ARE THOU ?



# THREAT

The **WannaCry** ransomware hit **300,000** machines in **150** countries including **48** U.K. medical facilities (plus other worldwide)





"Many people don't realize that healthcare hardware -- like MRI machines, ventilators, and some types of microscopes -- are actually computers"



"if it ain't broke, don't fix it" mentality  
can't be applied to computer systems



REUTERS

HEALTH HEALTH NEWS

HEALTH CARE DIET & FITNESS MENTAL HEALTH MEN'S HEALTH WOMEN'S HEALTH

HEALTH OCT 4 2016, 11:15 AM ET

# Insulin Pump Vulnerable to Hacking, Johnson & Johnson Warns

by REUTERS

SHARE

Johnson & Johnson is telling patients that it has learned of a cyber security bug in one of its insulin pumps that a hacker could exploit to overdose diabetic patients with insulin, although it describes the hacking risk as low.

Medical device experts said they believe it was the first time a manufacturer had issued such a warning to patients about a cyber vulnerability, a hot topic in the industry following revelations last month about possible vulnerabilities in pacemakers and defibrillators.



J&J executives told Reuters they knew of no examples of attempted attacks on the device, the J&J Animas OneTouch Ping insulin pump. The company is nonetheless warning customers and providing advice on how to fix the problem.

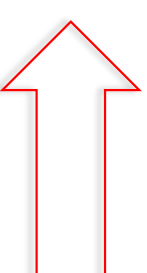
**Related: Remote Control on Insulin Pump is Weak Point**

The OneTouch Ping Insulin Pump and Meter  
Animas Corp.

"The probability of unauthorized access to the OneTouch Ping system is extremely low," the company said in letters mailed out on Monday to doctors and about 114,000 patients in the United States and Canada who use the device. A copy of the text of the letter was made available to Reuters.

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4772

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COMMENT  
24

EMAIL

KIM ZEITER SECURITY 06.08.15 7:00 AM

## HACKER CAN SEND FATAL DOSE TO HOSPITAL DRUG PUMPS



Hospira's drug infusion pumps include a serial cable (the wide grayish-white cable with the single red stripe on one edge) that connects the communications module to the main pump board.  BILLY RIOS

**WHEN SECURITY RESEARCHER** Billy Rios reported earlier this year that he'd found vulnerabilities in a popular drug infusion pump that would allow a hacker to raise the dosage limit on medication delivered to patients, there was little cause for concern.

# WIRED



# Private Industry Notification

FEDERAL BUREAU OF INVESTIGATION, CYBER DIVISION

26 October 2016

PIN Number

161026-001

Please contact the FBI with any questions related to this Private Industry Notification at either your local Cyber Task Force or FBI CyWatch.

Local Field Offices:

[www.fbi.gov/contact-us/field](http://www.fbi.gov/contact-us/field)

E-mail:

[cwatch@ic.fbi.gov](mailto:cwatch@ic.fbi.gov)

Phone:

1-855-292-3937

## Distributed Denial of Service Attack Against Domain Name Service Host Highlights Vulnerability of "Internet of Things" Devices

The exploitation of the "Internet of Things" (IoT) to conduct small-to-large scale attacks on the private industry will very likely continue due to the open availability of the malware source codes for targeting IoT devices and insufficient IoT device security.

### Summary

On 21 October 2016, a domain name service (DNS) host and Internet management company for more than 80 Web sites experienced at least two waves of a distributed denial of service (DDoS) attack by botnets<sup>a</sup> comprised of Internet of Things<sup>b</sup> (IoT) devices believed to be infected with a variation of the Mirai malware. Despite certain groups claiming responsibility in open source, the FBI does not have any confirmation of a group or individuals responsible for the DDoS.

### Malware Source Code Availability Enables IoT DDoS Attacks

In late September 2016 the hacker operating the Mirai botnet released its source code online - leading to the use of the malware by cyber actors to create botnets and launch independent DDoS attacks. The Mirai malware primarily targets the IoT devices such as routers, digital video records, and webcams/security cameras by exploiting their use of default usernames and passwords and coordinating them into a botnet used to conduct DDoS attacks.

<sup>a</sup> A botnet is a network of compromised computers controlled remotely by an attacker.

<sup>b</sup> The "Internet of Things" is defined as the internetworking of physical devices, vehicles, buildings, and other items (often referred to as "smart devices"), embedded with electronics, software, sensors, actuators, and network connectivity that enable these objects to collect and exchange data.

A report by FBI and US Dept of Homeland Security highlight the threat (DDoS) through IoT devices

## ...AND PRIVACY

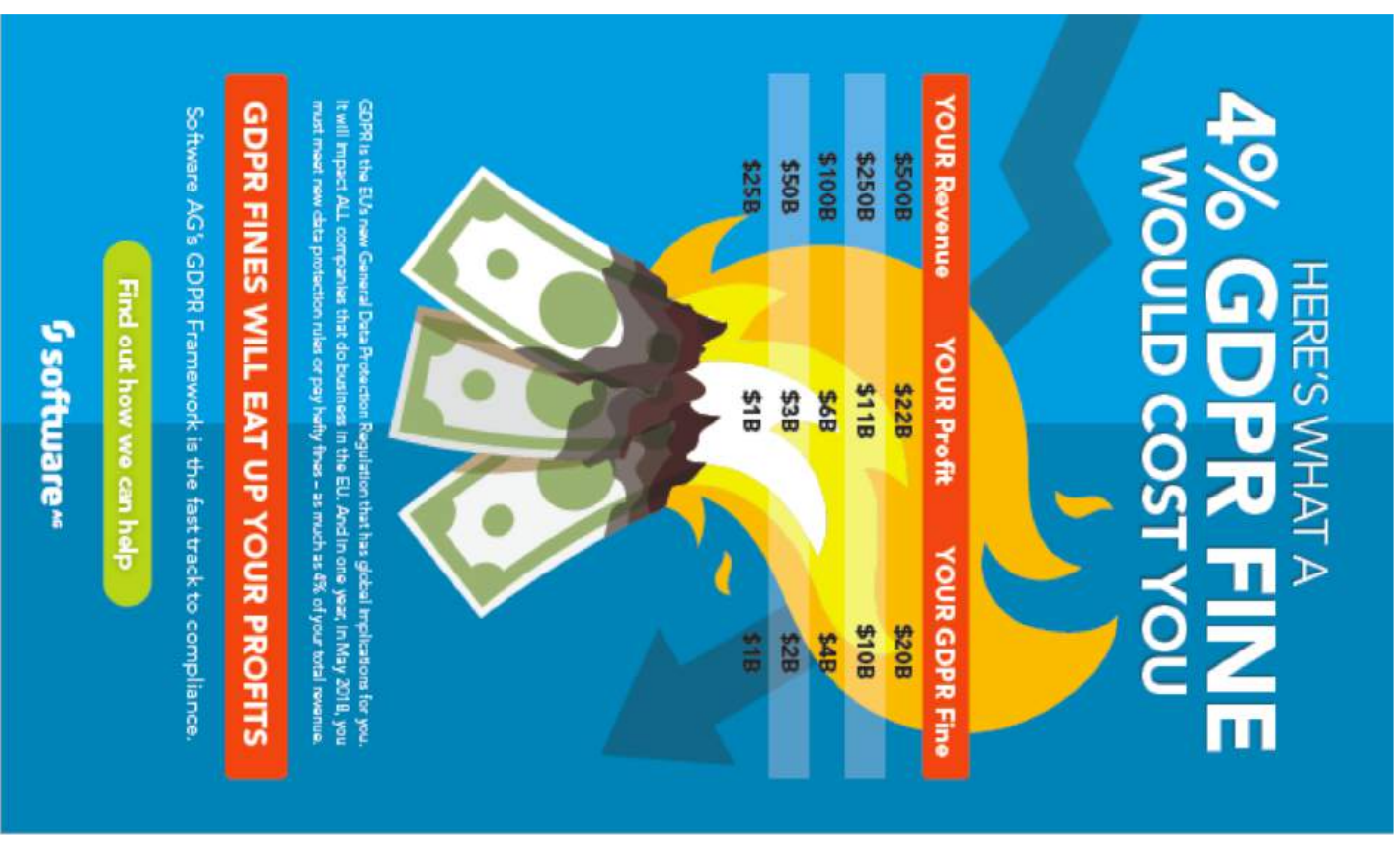


# ...THE GDPR - GENERAL DATA PROTECTION REGULATION IS ARRIVING...ARE YOU READY?



A **regulation** (adopted in April 2016)  
not just a directive

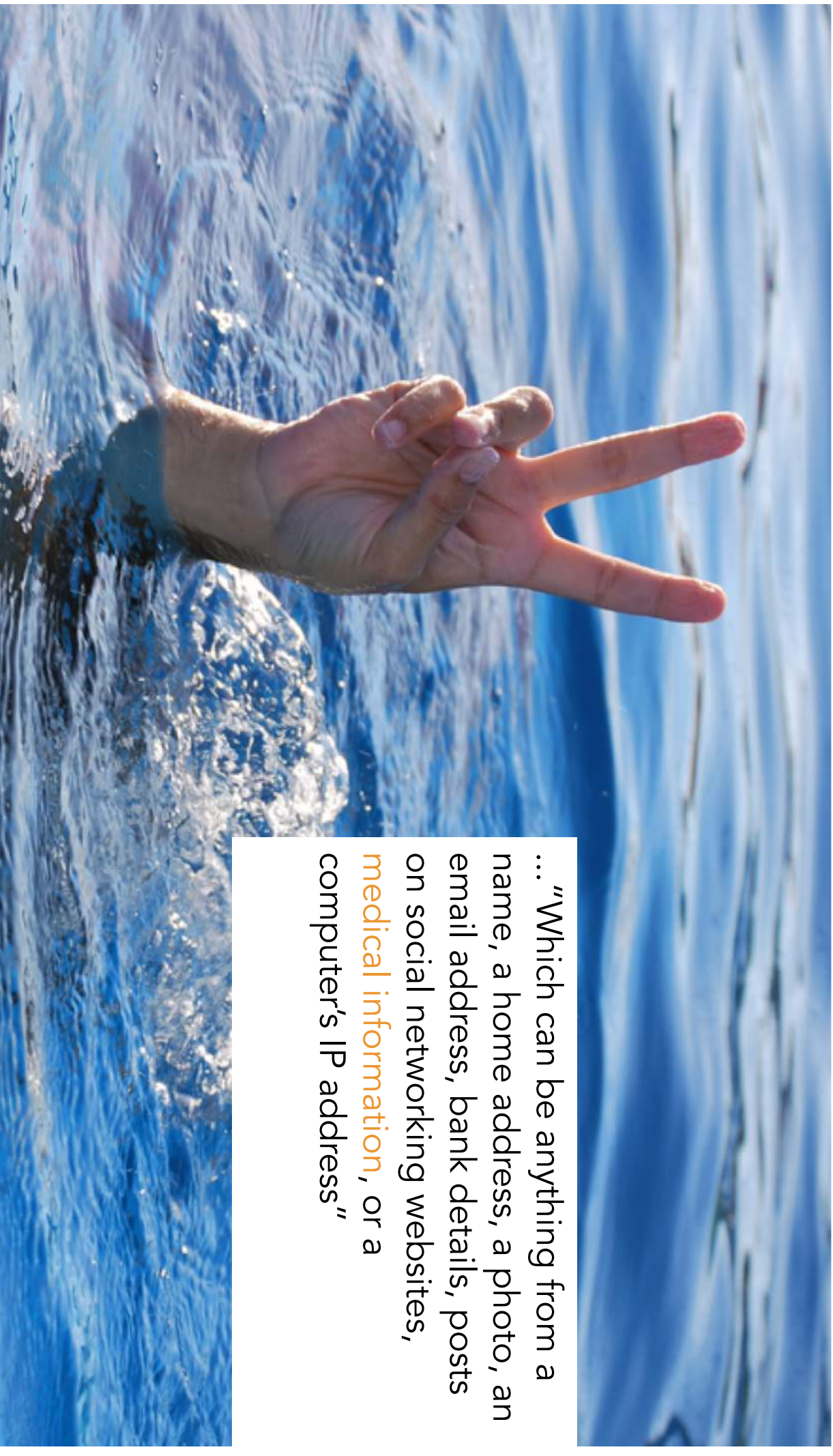
According to Gartner 50%+ of  
companies will not be in full  
compliance with the GDPR by  
May 2018.



# POWER TO THE PEOPLE

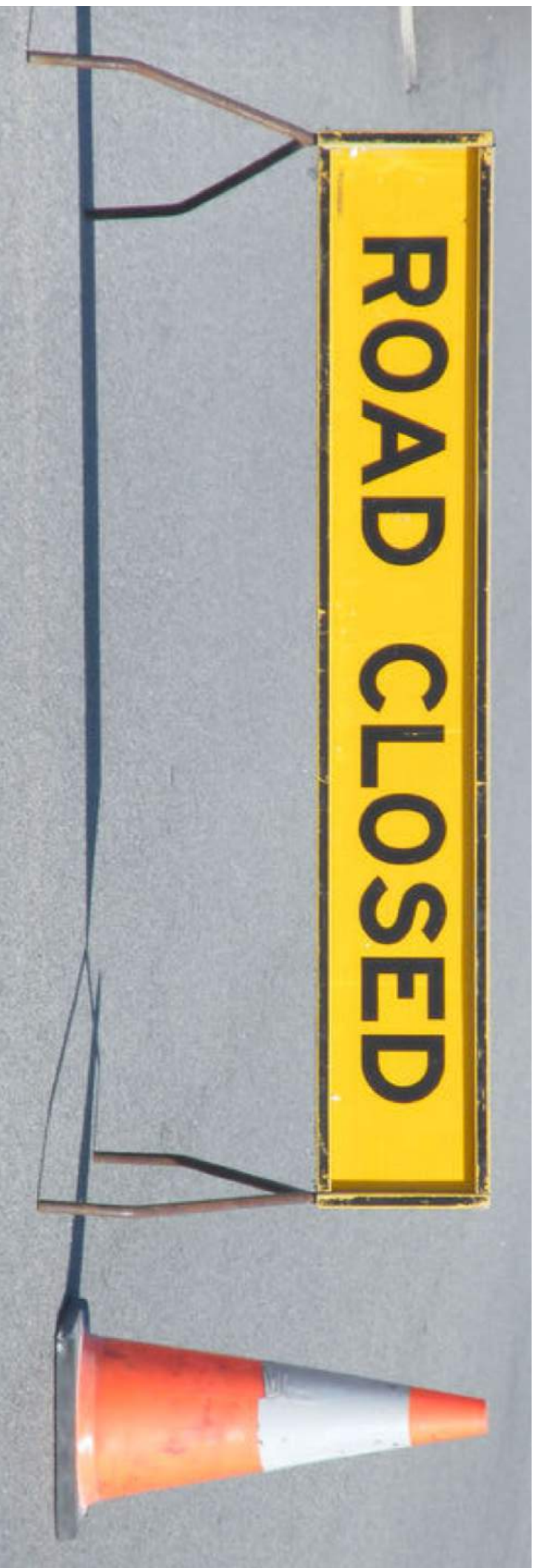
*The GDPR give control to citizens and residents over their personal data...*

... “Which can be anything from a name, a home address, a photo, an email address, bank details, posts on social networking websites, **medical information**, or a computer’s IP address”



BARRIERS ?

# MAIN BARRIERS TO BE OVERCOME



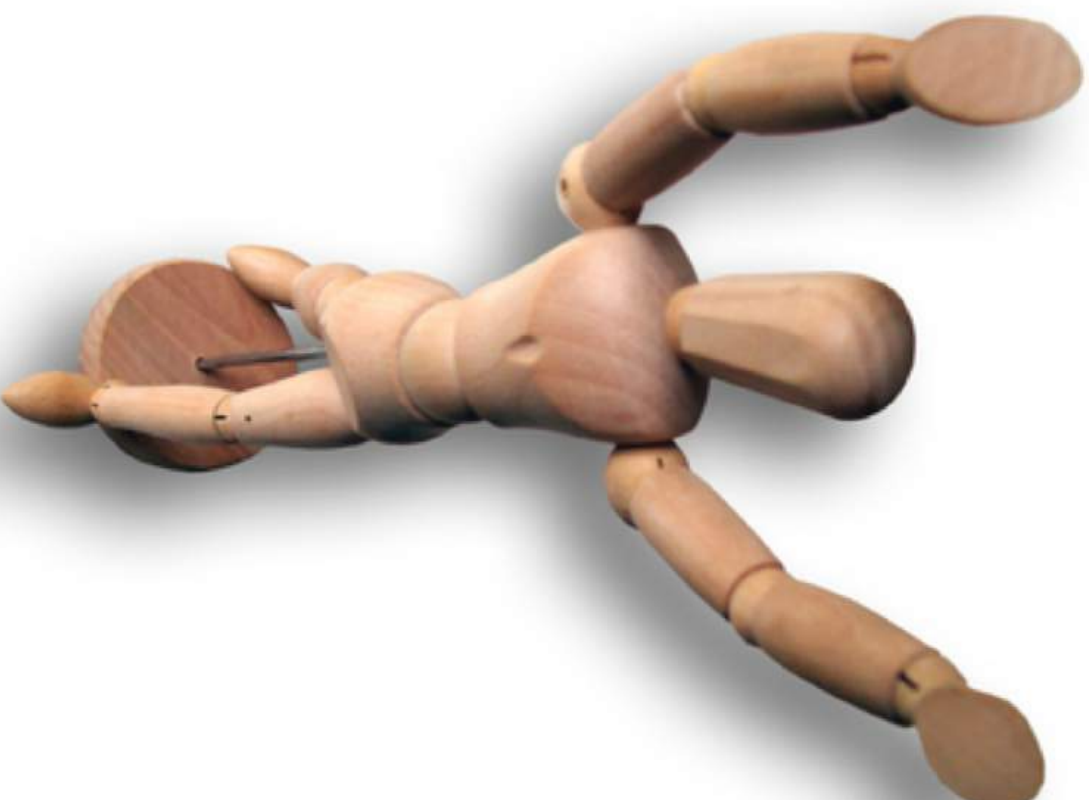
- Legacy systems
- Lack of strategy regarding IoMT (sensors and wearables)
- Cultural barrier
- Fragmented market
- Limited standards
- Patient engagement level
- Regulatory and reimbursement challenges linked to connected health programs

# LIMITED PATIENT ENGAGEMENT LEVEL



The  
Commonwealth  
Fund

This is a major bottleneck for mHealth  
applications

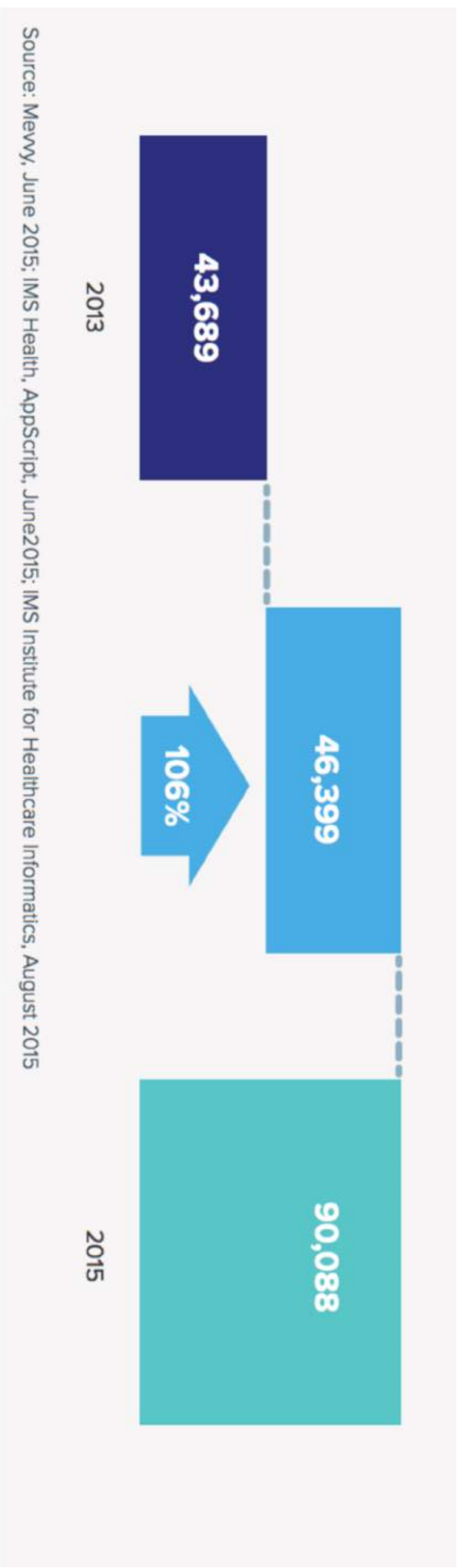


# CONSUMERISATION OF HEALTHCARE (PRO VS CONSUMERS)

Unclear distinction between wellness product and medical devices



# EXAMPLES OF IOS MHEALTH APPS



# FEW CLINICAL GRADE APPS

Limited “clinical grade” mobile applications that can connect devices for clinical use.

While there are over **165,000** mobile health apps available on iOS and Android, only **2%** of these apps can connect to a patient to a provider system.

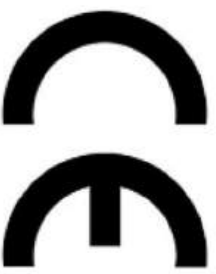


# CERTIFICATION AS MEDICAL DEVICE?

Plus:

- cybersecurity
- carrier certification (such as smartphones?)

**This product is a CE approved Class 1 Medical Device**



CE Marking on product is a Manufacturer's declaration that the product complies with the essential requirements of the relevant European health, safety and environmental protection legislation.



# EVOLVING LEGAL LANDSCAPE

In 2015 France Adopted a Law to Regulate Exposure to Radio Frequency Fields



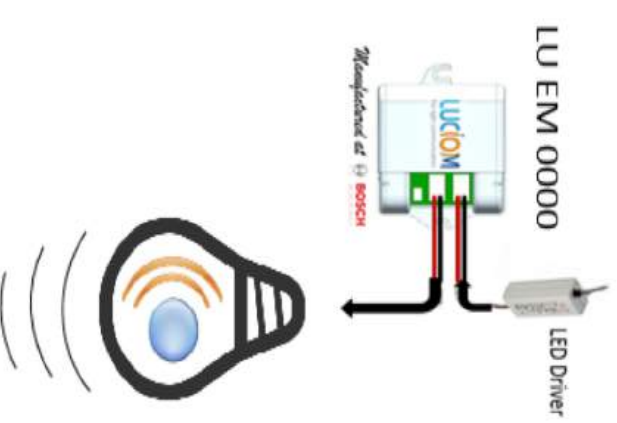
# VLC - VISIBLE LIGHT COMMUNICATION (VLC)

- light spectrum 1,000-10,000 x wider than the radio spectrum
- It could be faster than wifi moving from LEDs to laser diodes

Acquisition by Philips' Lighting



**luciom**  
For light communication



Source: [luciom.com](http://luciom.com)

OPPORTUNITIES ?

# CULTURAL CHANGE



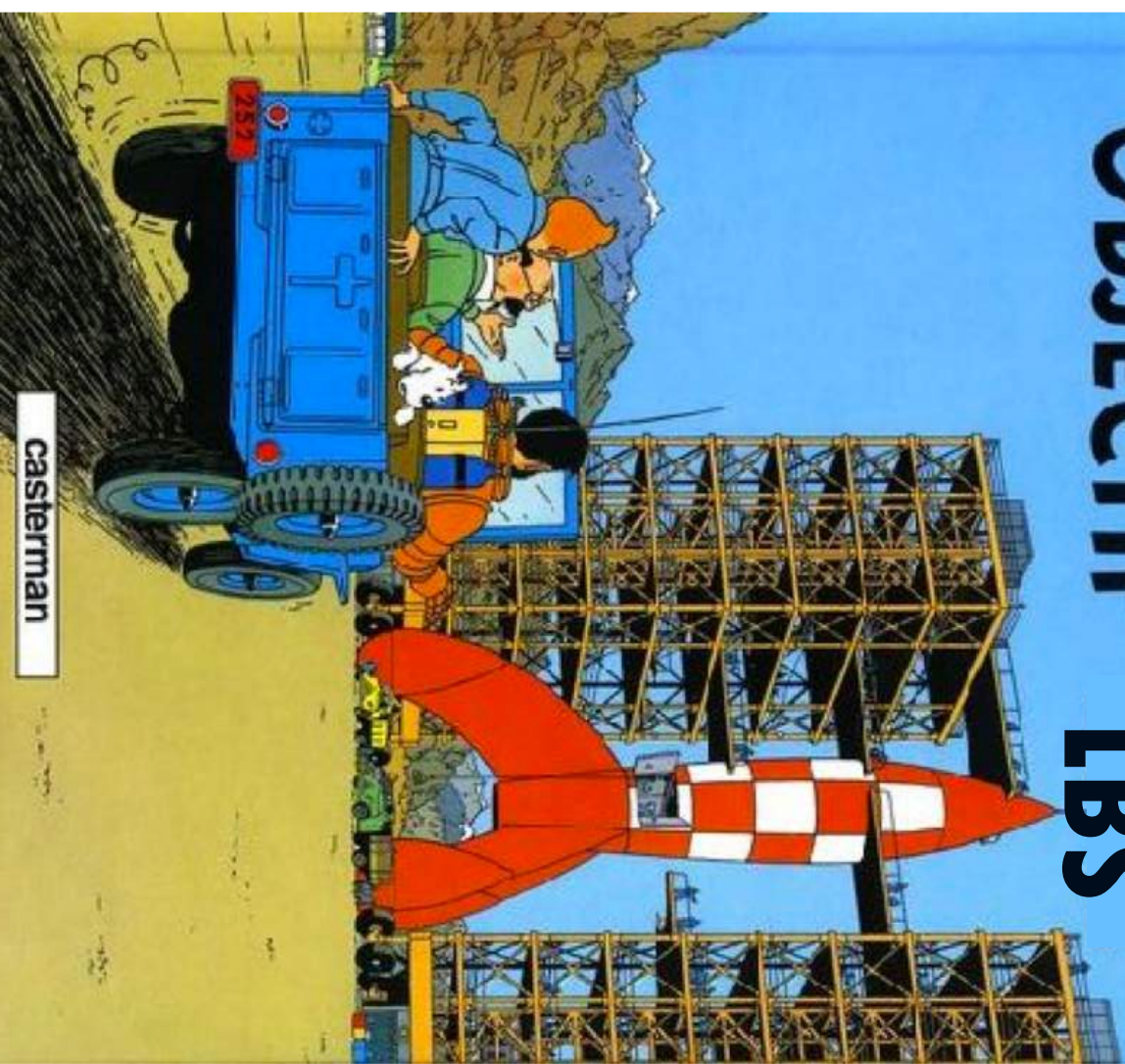
“The shift from episodic, in-person encounters between patients and providers to an ‘anytime, anywhere’ mode of care delivery”

A LAST NOTE.

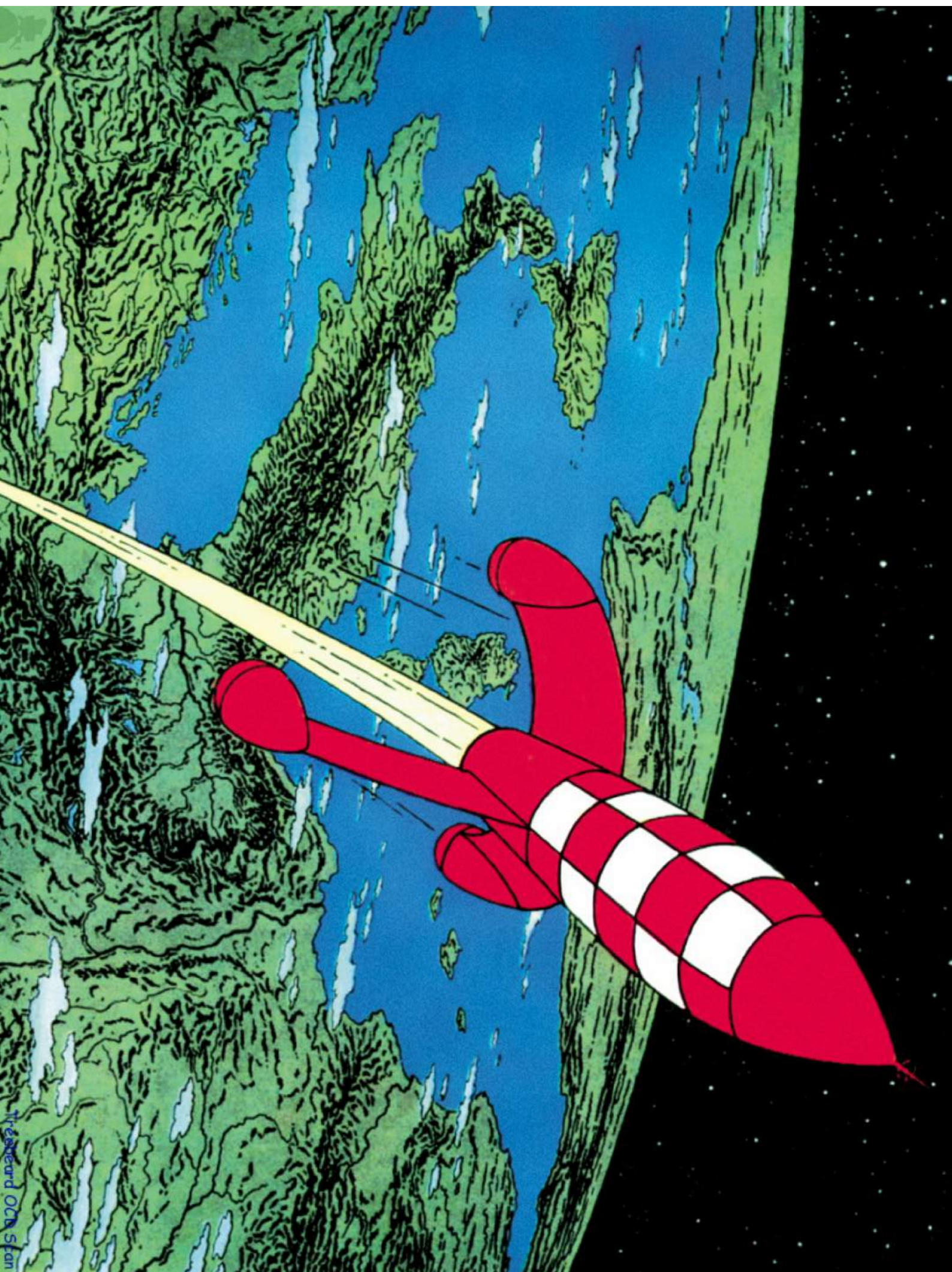
- HERGÉ -  
LES AVENTURES DE  
TINTIN

Healthcare

# OBJECTIF LBS



casterman





## Contact

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European Innovation  
Partnership on Active  
and Healthy Ageing  
PARTNER





- Call for submissions: Digital Health 2018 Innovation Prize
- Deadline: 26th March 2018 extended deadline to 3<sup>rd</sup> April
- celebrate the most successful businesses and projects in digital health

- [acm-digitalhealth.org](http://acm-digitalhealth.org)