

# MoSHCA

## My Smart Mobile Healthcare Assistant



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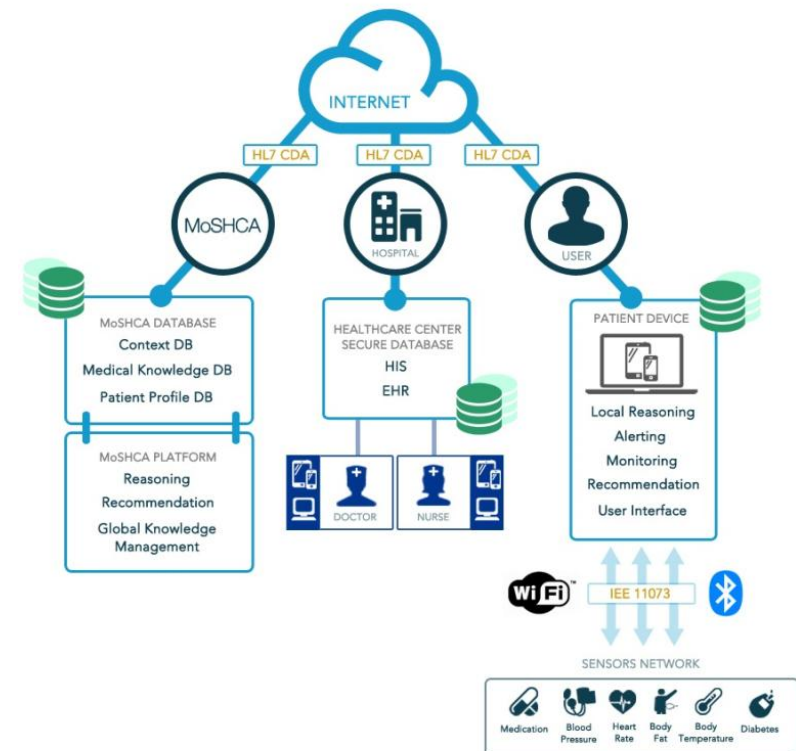
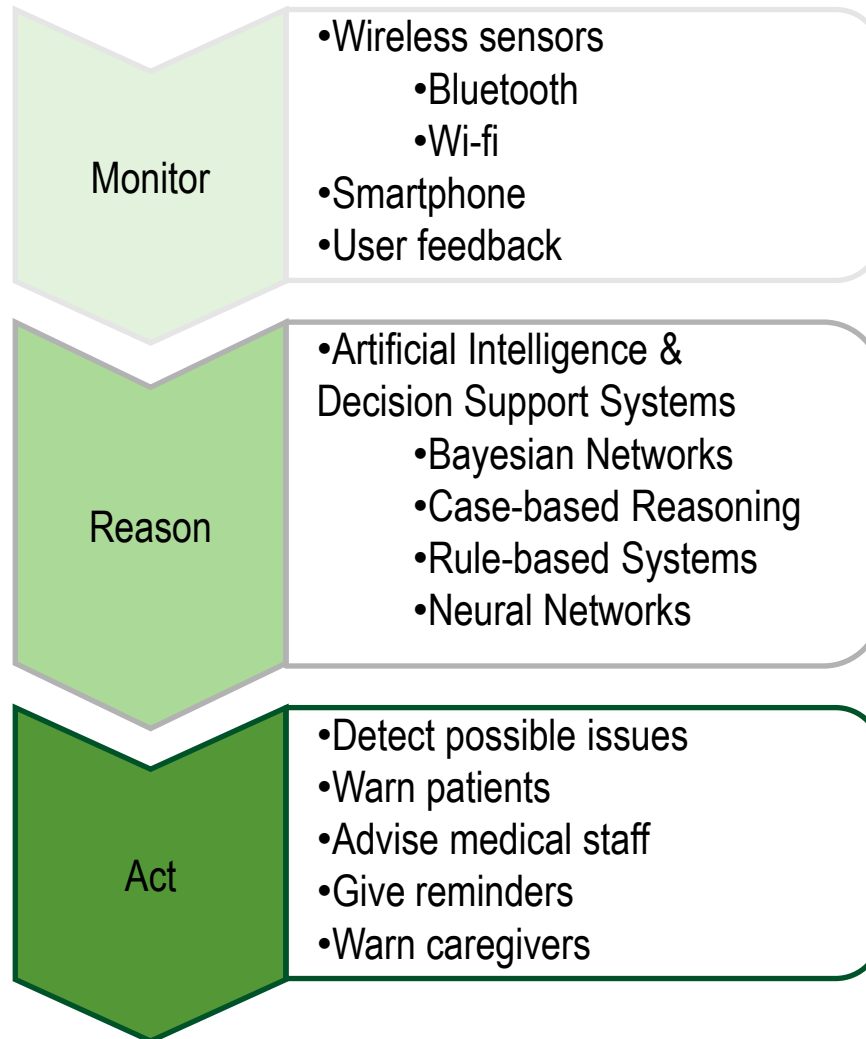


**610,000 Hip  
Fractures per Year**



**3% of Population**

# MoSHCA Methodology



## MoSHCA Objectives

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- Provide a better **patient-centred care** of chronic and acute diseases.
- Develop **intelligent** healthcare solutions for **smartphones** and other systems.
- Increase **patient wellbeing** and reduce the number of visits to hospitals.
- Facilitate **care-givers** task by providing smart tools.

## Innovative Aspects

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- User-friendliness
  - Mobile phones
  - Sensor usage
- Increased Intelligence
  - Objective data (Sensor inputs)
  - Subjective data (Patients' perception)
- Context-awareness
  - Environmental, sensor-related, etc.
- Interoperability - Standards
  - SNOMED CT
  - HL7



## MoSHCA Consortium

The Netherlands

**CLB**  
TECHNOLOGY WITH CARE

**Evalan**  
sound intelligence

**Radboud University**

Portugal

**it** Instituto de telecomunicações



South Korea

**ACROEM**  
(주)아크로엠

Luxembourg

**actimage**  
DIGITAL INTELLIGENCE

Spain

**OSWARE**

**Planet Media**  
Advanced IT Solutions

**Universitat de Girona**

**IDIBGi**  
Instituto de Investigación en Diagnóstico e Investigación Biomédica de Girona



# MoSHCA Use cases



Mobility Rehabilitation



Pregnancy



General Health



Epilepsy



Premature Babies



Hypertension



Chronic Obstructive  
Pulmonary Disease





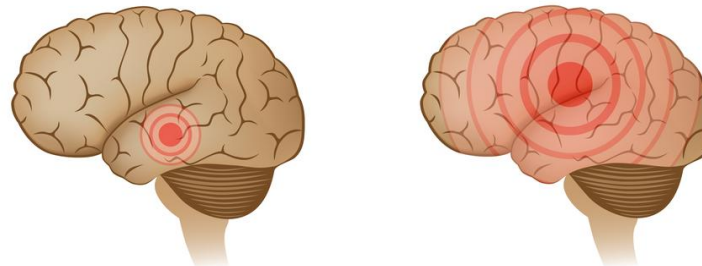
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# MoSHCA Epilepsy App

- ✓ Improve quality of care
- ✓ Reduce invasion of privacy

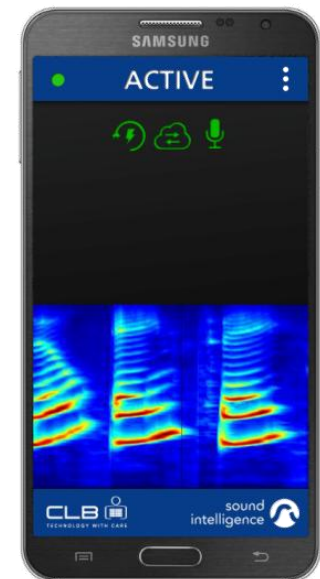
Current situation:

- **Undetected** epileptic seizures result in **unnecessary health damage**
- Epilepsy patients are **unable** to **call for help** whilst having a seizure
- **Permanent monitoring** required (also during the night)
  - **Massive invasion** of patient's **privacy** and/or mobility
  - Immense **burden** on care giver



# MoSHCA Epilepsy App

- MoSHCA Epilepsy App
  - **What:** An android app that is able to detect epilepsy via sound
  - **How:** It continuously monitors a sleeping patient via the smartphone's embedded microphone and uses algorithms to detect sounds affiliated with epileptic seizures. Upon detection, it automatically sends out an alert to care providers
  - **Why:**
    - To enable swift assistance
    - To remove the permanent burden of care providers
    - To reduce invasion of privacy
    - To eliminate restriction of mobility.



# MoSHCA Epilepsy App

- Innovative aspects
  - First (mobile) product that can **detect sounds** affiliated with **epileptic seizures**
  - Able to **alert care providers** of on-going seizures **without** using **physical sensors** attached to the patient's body
- Key benefits:
  - **Comfort:** No sensors attached to patient
  - **Use case:** Specifically for sleeping patients
  - **Monitoring time:** External power supply



MoSHCA  
Epilepsy App

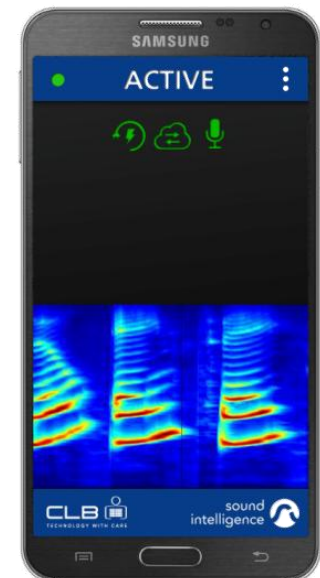
vs.



EpDetect



SENSE





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# Mobility Use Case

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- 800.000 new stroke patients per year in Europe
- Current treatment of balance problems
  - Adhering to the desired loading pattern is key factor
    - difficult to notice and correct (for both patient and physiotherapist)
  - Not supported by mobile medical devices
    - Mainly by visual and verbal feedback of physiotherapist

# MoSHCA Mobility Solution

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- The MoSHCA Mobility product will ...
  - ... give **insight in the balance**
  - ... predict the **optimal state** of the patient
  - ... predict the **period of time** in which this will be realized



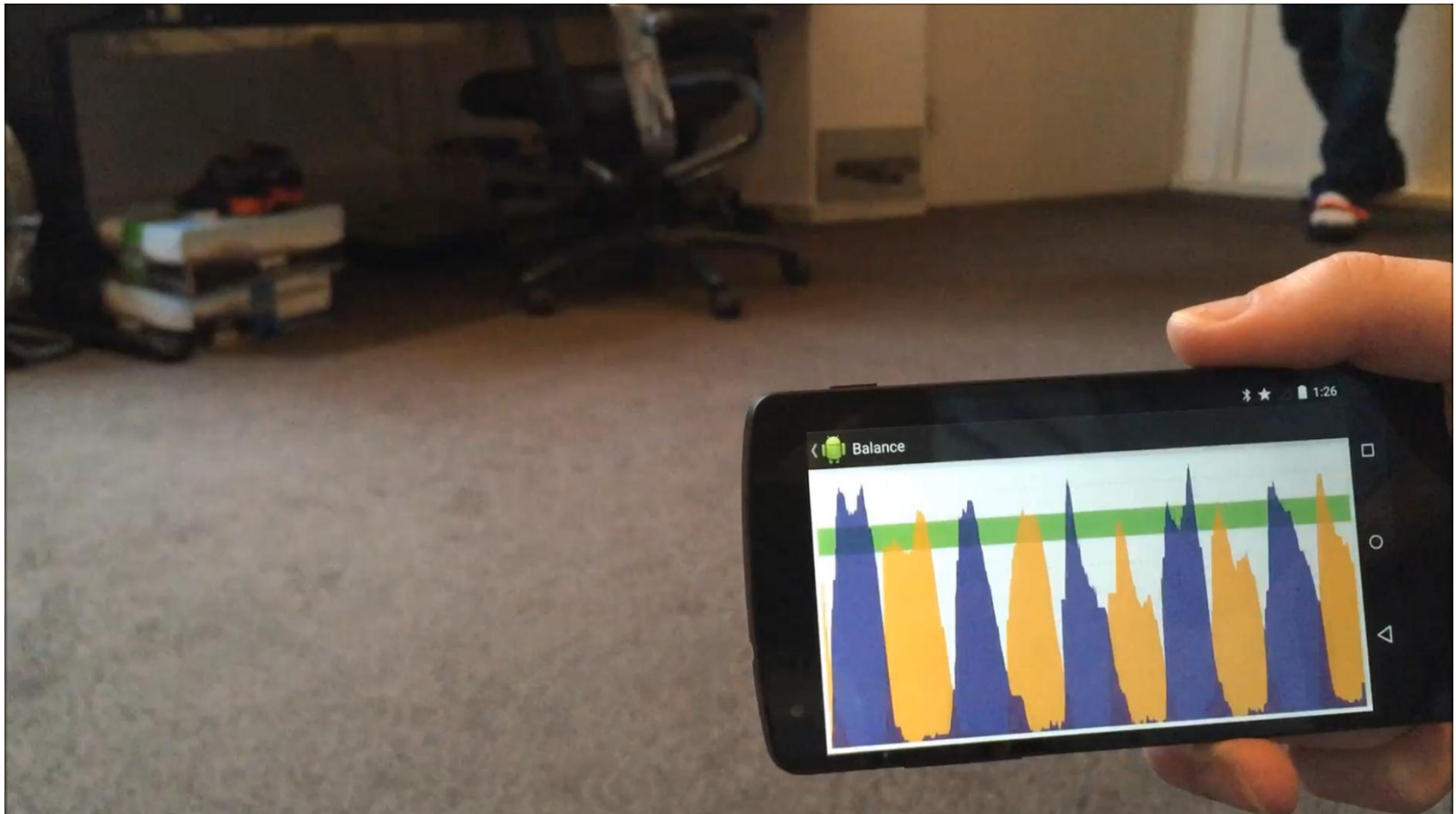
# MoSHCA Mobility Solution

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- For patients it ...
  - ... will **take away uncertainty**
  - ... can **speed up rehabilitation**
  - ... will **help regaining independency**
  
- For physiotherapists it gives insight in ...
  - ... the patients' actual **loading and balance**
  - ... the patients' **progress** over time
  - ... the expected **recovery date** based on the loading data

# MoSHCA Mobility Solution

Prototype  
Balance test healthy person



# MoSHCA Mobility Solution

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- Innovative aspects:
  - **Multiple innovative sensors** and **multiple sensor types** combined in one system
  - **Predicting** patient rehabilitation duration (CBR and BN)
    - Guides healthcare professionals in their treatment plan
- Key benefits (against competitors):
  - **Ambulant**
  - **Easyness of use**
  - **Re-usable sensors**

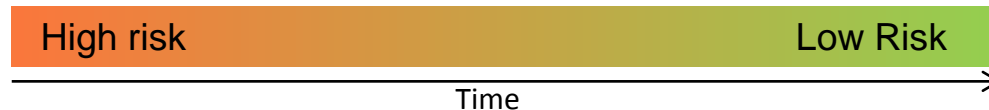


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# Premature babies

## ■ Premature babies

- 500,000 kids/year prematurely born in Europe (10% of births)
- Very long hospitalization for the baby (1-8 weeks)



## ■ Uncomfortable & Resource Consuming

- Families suffer high stress
- Hospital beds occupied for long periods

## ■ Early discharge programs (low risk stage)

- Nurse periodically visiting patients
- Limited number of patients
- Not daily information
- Bad cost-effectiveness ratio
- Distance limitation



# MoSHCA Solution

## ■ Home monitoring using **Android App & wireless sensors**

### Low Risk Stage

#### Home

- Information gathering
- Feedback for parents
- Less stress
- Caregivers interaction



#### Hospital

- Remote monitoring
- Decision support
- Parents interaction
- Less resource consumption



Monitoring

Reasoning

Acting



**MoSHCA**

# MoSHCA Procedure

- X times per day:



MoSHCA

Send Data Tracking

Temperature (°C): 36,8

Skin Color: Pink skin or mucus membranes

Respiratory Rate (bpm): 40

Weight (g): 2250

Stools: 5

☐ Abundant watery or loose stools

☐ Bloody stools

☒ None of the above

Bilirubin (mg/dl): 1.1

Oxygen Saturation (%): 88

Heart Beat (bpm): 130

Get Oxygen Saturation

Get Heart Beat

Comments:

MoSHCA

Confirm Data

"You need to take your baby to the Emergency Room."

Temperature (°C): 36.8

Skin Color: Cyanotic, bluish color to the skin or mucus membranes

Respiratory Rate (bpm): 40

Weight (g): 2250

Stools: Number: 5

Bilirubin (mg/dl): 1.1

Oxygen Saturation (%): 93

Heart Beat (bpm): 130

Comments:

Vomits per day: 1

Irritability: No

Feeling down/poor appearance: No

Feedings per day: 8

Back Send

MoSHCA

Send data

Send data

Historical data

Check Historical Data

Change Password

Change Password patient

Logout

User logout

MoSHCA

Confirm Data

"Wake up your child, ensure that the pulseoximeter sensor is well placed, in good contact with the finger and the signal is correct and remeasure."

Temperature (°C): 36.8

Skin Color: Rosy

Respiratory Rate (bpm): 40

Weight (g): 2250

Stools: Number: 5

Bilirubin (mg/dl): 1.1

Oxygen Saturation (%): 93

Heart Beat (bpm): 130

Comments:

Vomits per day: 1

Irritability: No

Feeling down/poor appearance: No

Feedings per day: 8

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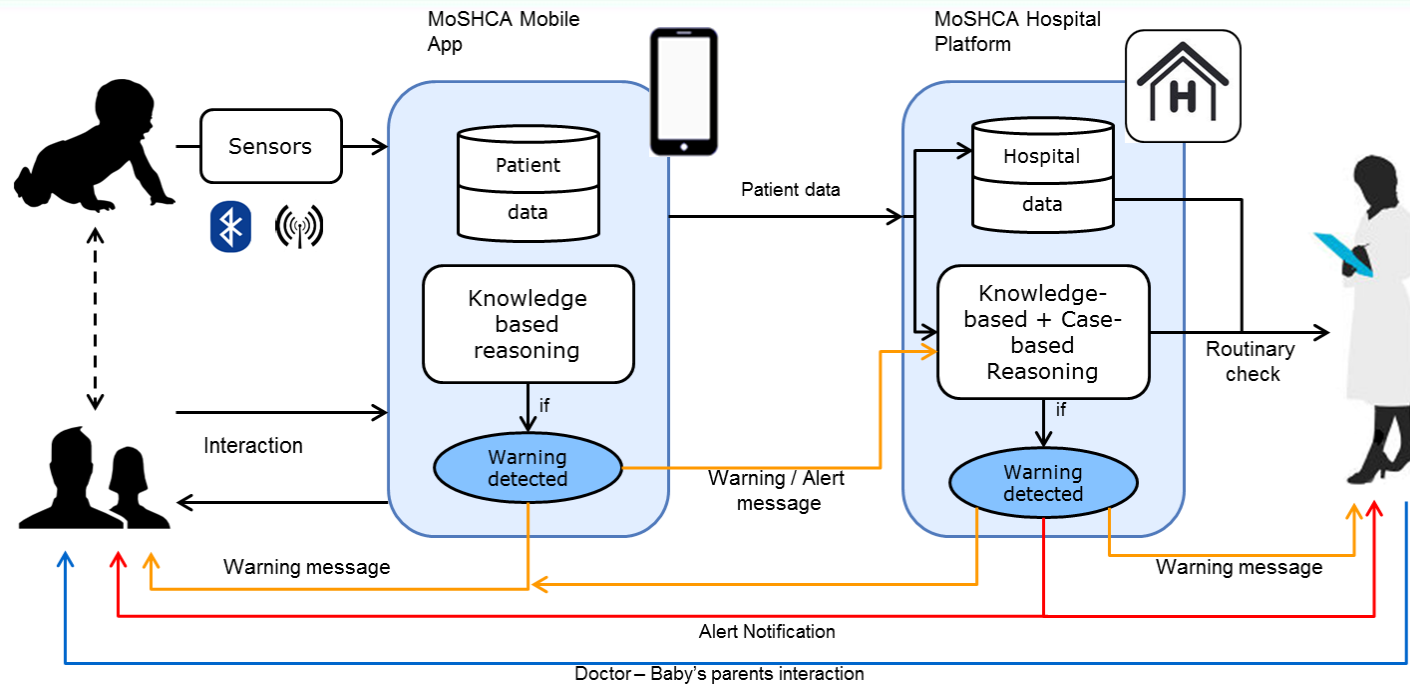


Questions to parents

- Baby's evaluation
- Feedback for parents
- Information sent to hospital
- Warnings for doctors



# MoSHCA Reasoning



- Smartphone reasoning: Knowledge-based System (KBS) → Warns Parents
  - Based on doctors knowledge
- Hospital reasoning: KBS + Case-based Reasoning → Warns & Advises Caregivers
  - Based on doctors knowledge + Hospital health records

# MoSHCA Innovations

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- Main Innovations
  - Inclusion of reasoning tools that can help parents & Care-givers
    - Warn parents about baby's status
    - Aid caregivers when assessing the baby
  - Direct interaction with medical team & Hospital facilities
    - The information is sent to the hospital where a caregiver can revise it
    - Caregivers can directly send messages to parents
  - IEEE 1073 Standard Compliance
    - Allows the use of new wireless devices supporting this standard

## Other use cases



General Health



Hypertension



Pregnancy



Chronic Obstructive  
Pulmonary Disease

**Thank you for your attention**  
**We value your opinion and questions**  
**Interested in other use cases?**

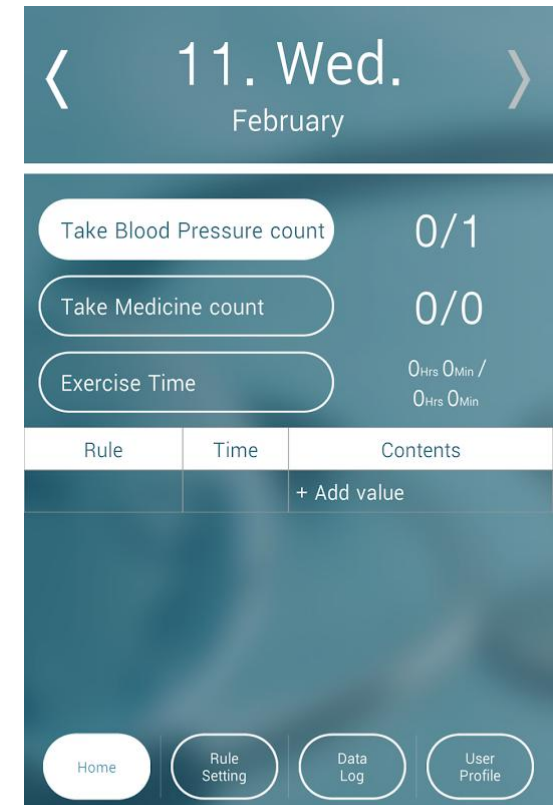
# Hypertension use-case

- Hypertension issues
  - Major risk factor for stroke, heart failure and chronic kidney disease.
  - Half of patients with hypertension are not properly controlling their blood pressure.
  - Controlling hypertension for senior is a big challenge
- Positive antecedents
  - Telephone-based & telemedicine systems have improved patients health.
  - Sensors & mobile apps reduce patient intervention
- Develop a solution to facilitate hypertension management.



# Hypertension: MoSHCA App

- MoSHCA Smartphone app:
  - Intelligent decision making for hypertension
  - Decision making: rule-based system
  - Flexible rules set by doctors
  
- Easy to use:
  - Wireless sensors
  - Reminders
  - Management



The screenshot shows the MoSHCA app interface. At the top, it displays the date '11. Wed. February'. Below this, there are three progress indicators: 'Take Blood Pressure count' at 0/1, 'Take Medicine count' at 0/0, and 'Exercise Time' at 0 Hrs 0 Min / 0 Hrs 0 Min. A table with columns 'Rule', 'Time', and 'Contents' is visible, with a '+ Add value' button. At the bottom, there are four navigation buttons: 'Home', 'Rule Setting', 'Data Log', and 'User Profile'.

Rule	Time	Contents
+ Add value		



## COPD use case

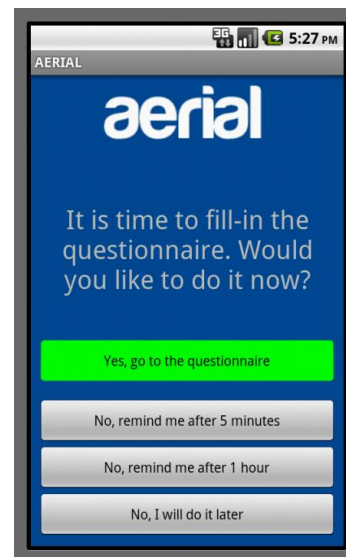
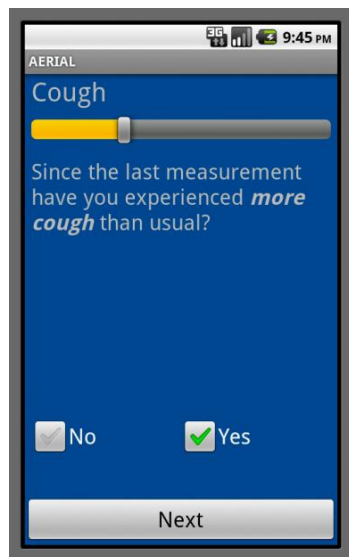
- COPD: Chronic obstructive pulmonary disease
- High impact
  - Patient quality of life
  - Disease progression
  - Healthcare costs
- The COPD Aerial App aims to predict the worsening of symptoms at an early stage.
  - Prevent worsening of COPD
  - Prevent **hospitalization**
  - Improve **quality of life**





## COPD: Aerial App

- Early prediction of exacerbations:
  - New methods for learning from historic data
  - Adapts to patient along time
- Data from sensors & patient's impressions
  - Spirometer for measuring lung function
  - Pulse-oximeter (measuring blood oxygen)



## Pregnancy use case

- Pre-eclampsia: serious complication during pregnancy:
  - high blood pressure
  - large amounts of proteins in urine
- Is one of the most common causes of death during pregnancy.
- It can be treated effectively at an early stage
- eMomCare: self-monitoring by pregnant women for ***early detection of pre-eclampsia***



# Pregnancy: eMomCare App

- Early prediction of pre-eclampsia
  - Probabilistic inference methods
  - Integration of reasoning techniques in smartphones
- Data from sensors
  - Blood pressure monitoring
  - Measurement of proteins in the urine using the smartphone's camera



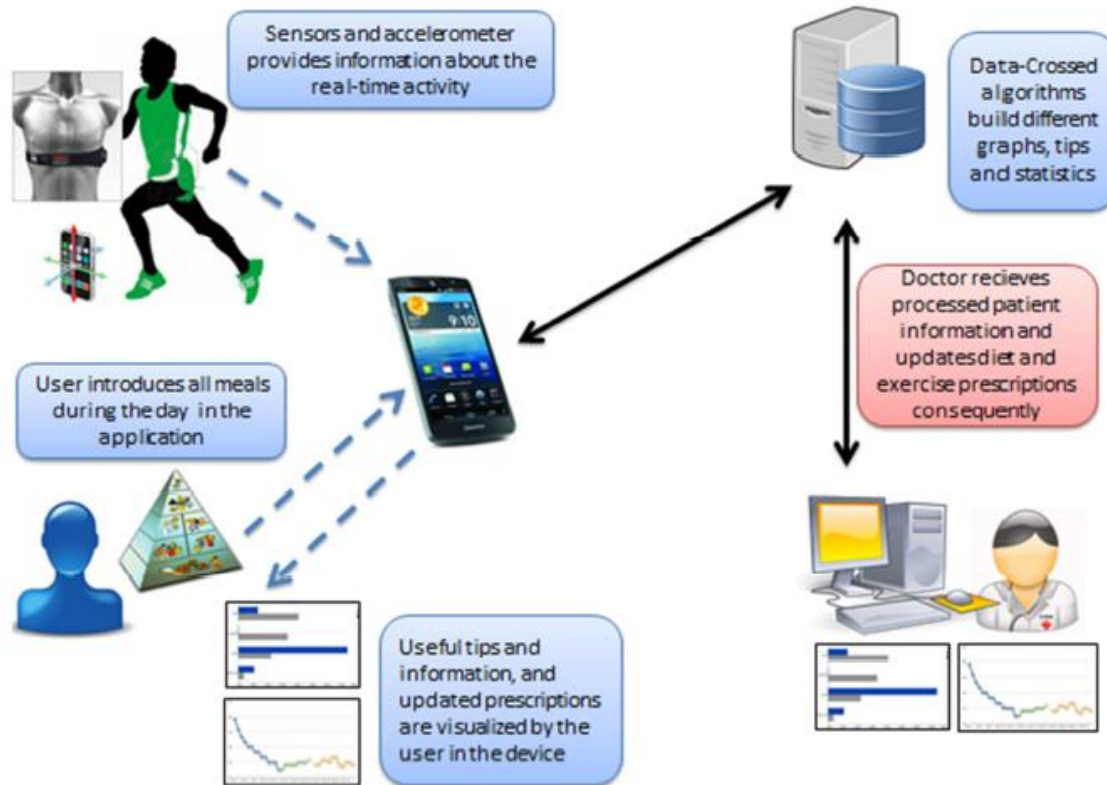
## General health use case

- Increasing number of people suffering from overweight & obesity
- Chronic patients are treated by:
  - Workout & Exercise Planning.
  - Diet Self-Monitoring.
- Develop a smart monitoring app for general health



# General health: MoSHCA App

- Complete monitoring application
  - Diet & Workout
  - Calorie counting
  - Personalized tips
  - Plans & tips from caregivers





**Thank you for your attention**  
**We value your opinion and questions**