

WIRELESS HEALTH

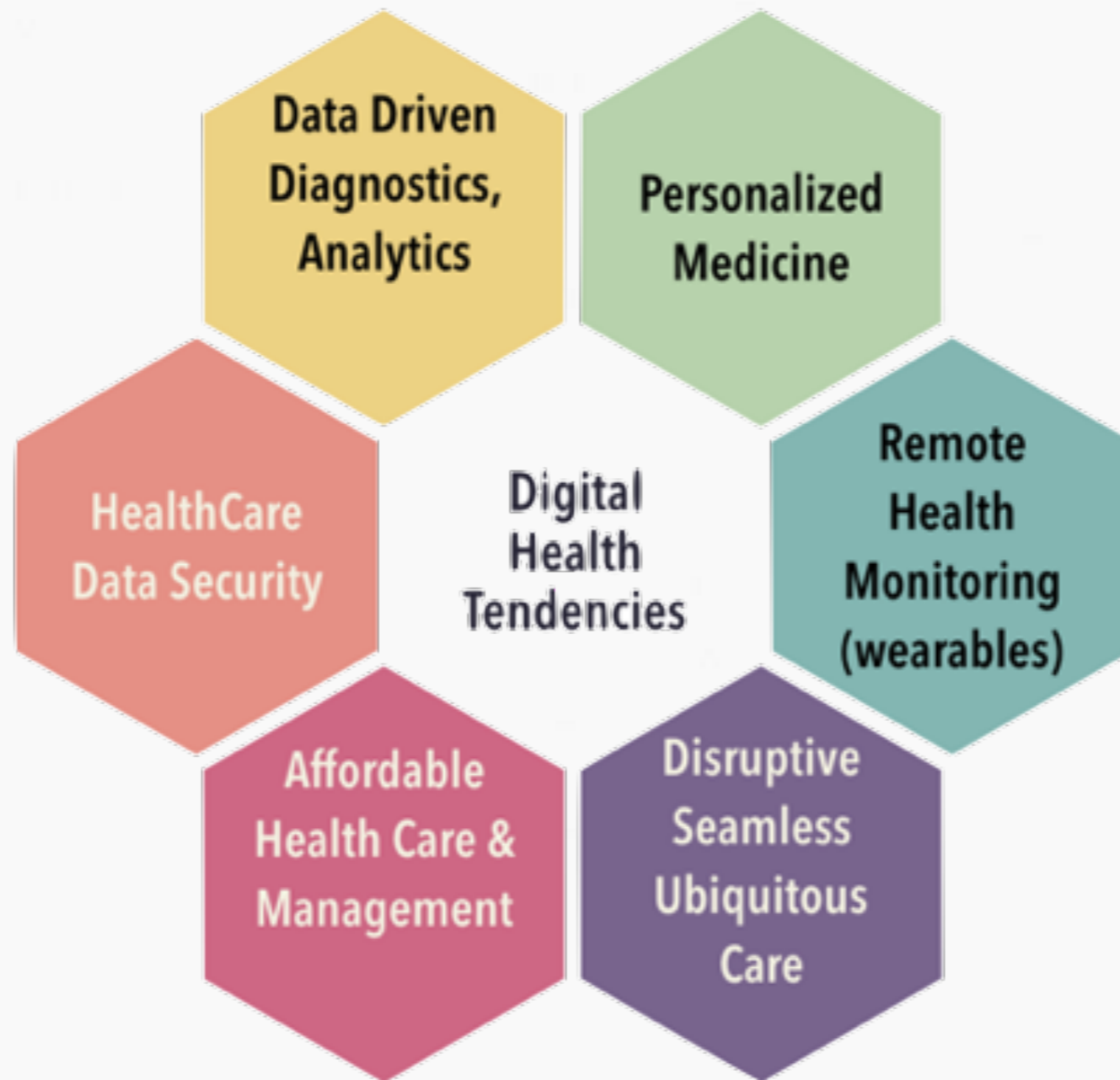
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UCLA



AT A GLANCE





Telemedicine



Healthcare devices



Health monitoring



Mobile health



TECHNOLOGIES FOR HEALTH

TeleMedicine

- Delivery of healthcare services at a distance using information and communication technologies.
- Involves secure transmission of information (medical data, eg: biological and physiological measurements, images, alerts, etc)
- Prevention, diagnosis, treatment and follow up remote monitoring, eg: TETRA 1 & 2

mHealth

- Use of mobile technology for the provision of health services
- Eg: appointment reminder through text message

TeleHealth

- Application of telecom technology to improve health
- Mostly non-clinical application
- Includes collection of health data for remote patient monitoring.
- Eg: use of FitBit to evaluate wellbeing

eHealth

- Record, collate and share information of patients electronically
- May be considered as superset of mHealth
- Electronic Health Records, eg. UCLA CareConnect



TECHNOLOGIES FOR HEALTH

TeleMedicine

- Delivery of information and services at a distance using technologies.
- Involves several types of information (medical data, documents, images, alerts, etc)
- Prevention, diagnosis, treatment, follow up remote monitoring, eg: tele-ICU, tele-ER, etc



TeleHealth

- Application of technology to improve health
- Mostly non-clinical
- Includes collection and analysis of data for remote patient monitoring.
- Eg: use of Fitbit, etc



mHealth

- Use of mobile technology for the provision of health services
- Eg: appointment reminders, health messages



eHealth

- Record, collate and share information of patients electronically
- May be combined with other technologies
- Electronic health records, etc
- Connect



WIRELESS
HEALTH



WIRELESS HEALTH

Wireless Health is the integration of wireless technology into traditional medicine, such as diagnosis, monitoring and treatment of illness, as well as other tools that can help individuals improve their personal health and wellbeing.



AT A GLANCE

- ✓ Recent years have seen the advent of wearable devices and users/developers flocking to such gadgets to enable consistent experience with the already apps in use
- ✓ Many developments are driven by the availability of low cost sensors and a whole new wave of wearable devices is anticipated
- ✓ Internet of Things: “general idea of things, especially everyday objects, that are readable, recognizable, locatable, addressable, and controllable via the Internet – whether via RFID, wireless LAN, wide-area network, or other means”



SOME OF THE OBSTACLES

- ✓ Distance: overcoming physical separation (patient/doctor)
- ✓ Social issues: dealing with people
- ✓ Data presentation: best way to represent knowledge
- ✓ Decision making, error prevention
- ✓ Evaluation: does it work? does it predict outcome? does it improve outcome? do people use it?
- ✓ Data overload: what to do with the data?



Patient Engagement



Care Management



Population Health



Integrated Data Lake



Physician Engagement

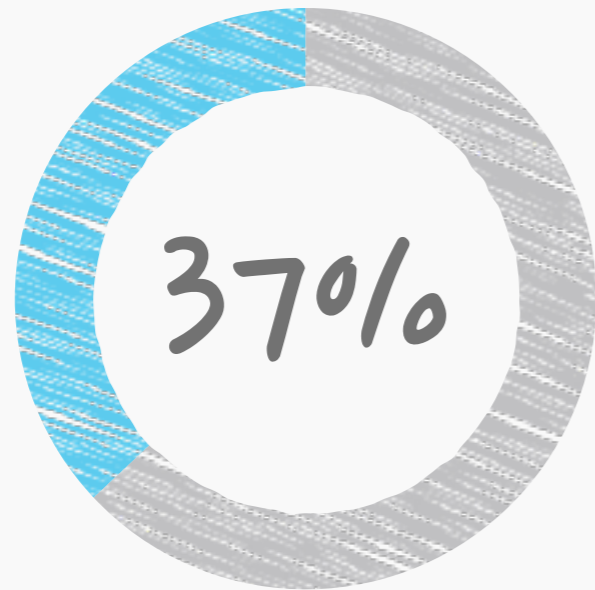


WIRELESS HEALTH

- ◆ Wireless Health Solutions worth USD 59 Billion by 2020
- ◆ Growing 33.4% during the forecast period of 2015-2020
- ◆ Growth mainly attributed to:
 - (a) penetration of smart gadgets
 - (b) increasing utilization of connected medical devices,
 - (c) apps for managing chronic diseases
 - (d) robust penetration of 3G and 4G/LTE to provide uninterrupted healthcare services

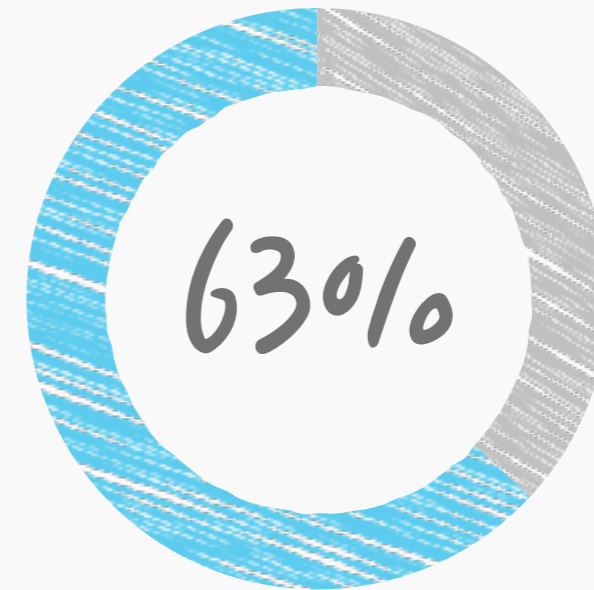


WIRELESS HEALTH



HEALTHCARE FITNESS APPS

FitBit, Misfit, Apple, NOKIA, Hundreds of messaging apps



REMOTE PATIENT MONITORING

RPM uses digital technologies to collect medical and other forms of health data from individuals in one location and electronically transmit that information securely to health care providers in a different location for assessment and recommendations



WHY WIRELESS HEALTH

1

Global health aspects
Wireless health can be of benefit worldwide rather than just to those who live in high-income countries

2

Sharing of expertise, sharing information at different times, making healthcare more accessible

3

Low-cost online care. Ex: Virtual Reality providing inexpensive interactive training environments, say, surgical training

4

In-Home patient care with the use of remote health monitoring systems

5

Seamless data collection, providing more patient data. The data can contain more crucial information compared to hospital visits

6

Better Prognostics, Analytics on Patients with the help of Data Science techniques

7

Early Interventions, better care, palliative care, hence less hospitalizations, better Quality Of Life

8

Personalized Care, deriving personalized treatment by studying each individual reactions to certain treatments





*IMPACT A RANGE OF HEALTHCARE NEEDS
SIMULTANEOUSLY BY EMPLOYING DATA-FUSION AND
PATTERN-RECOGNITION FROM A COMMON PLATFORM OF
NON-MEDICAL/ENVIRONMENTAL NETWORKED SENSORS IN
A **HOME ENVIRONMENT AND REHAB***



SENSING AT RISK POPULATION



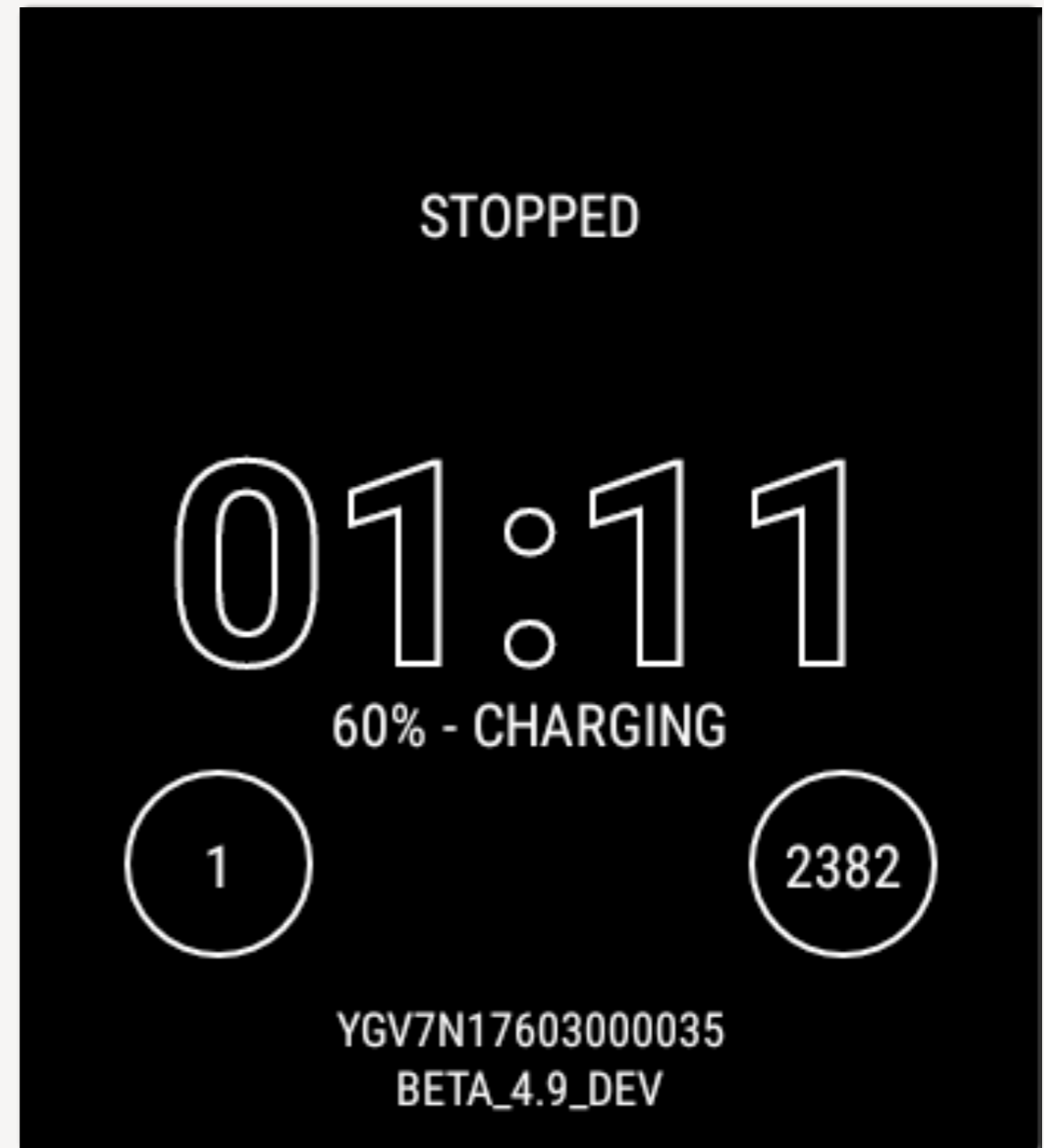
SARP

Measuring & Predicting Independence and Well-being

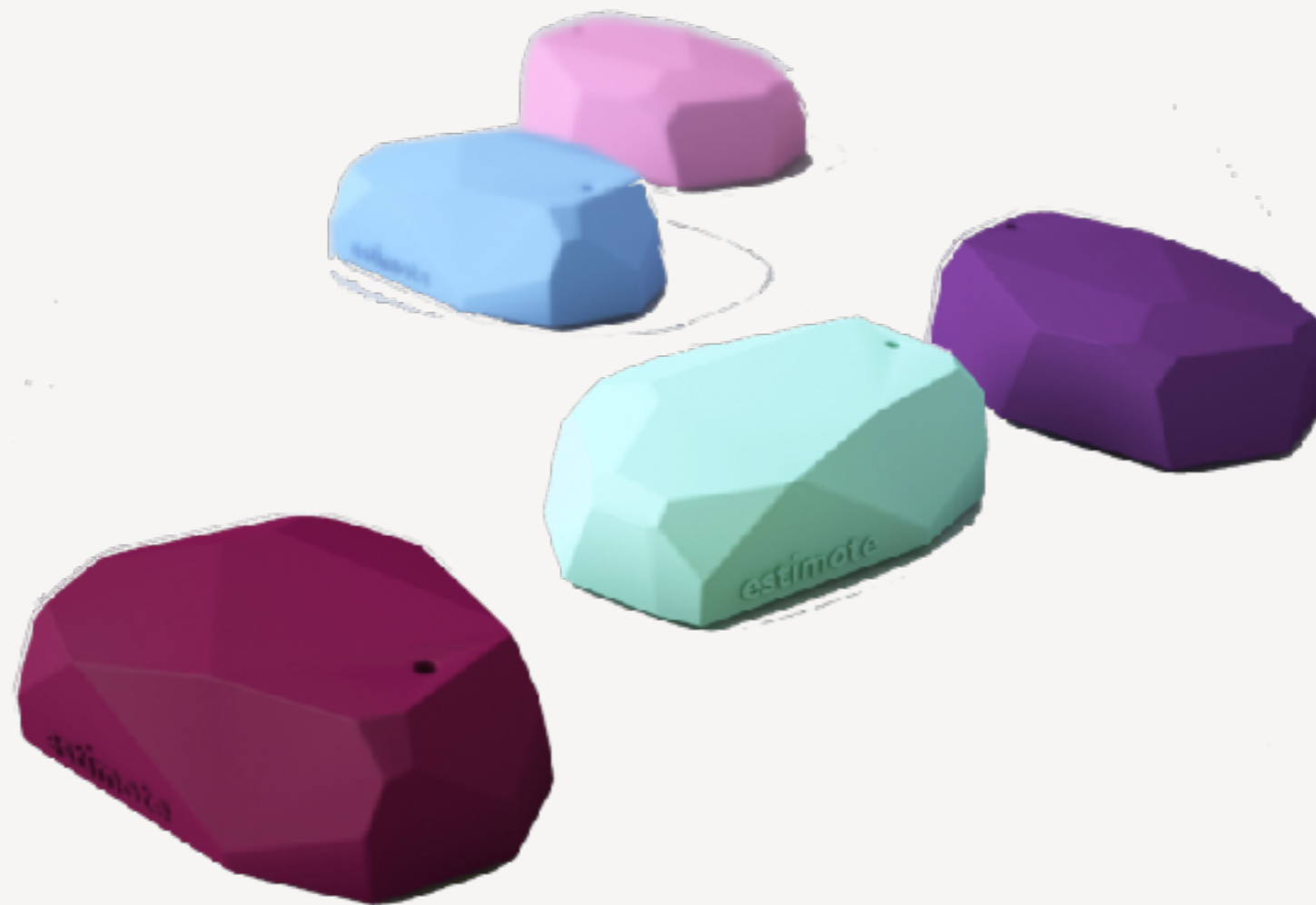


WATCH APP

- Location
- Steps
- Heart Rate
- Speed
- Survey (touch/speech)
- App cloud update
- > 24 hours of battery



INDOOR LOCALIZATION





- **LIVING ROOM**





- **BATHROOM**





- **KITCHEN**





- **STAIRS/STRIP (GAIT ANALYSIS)**



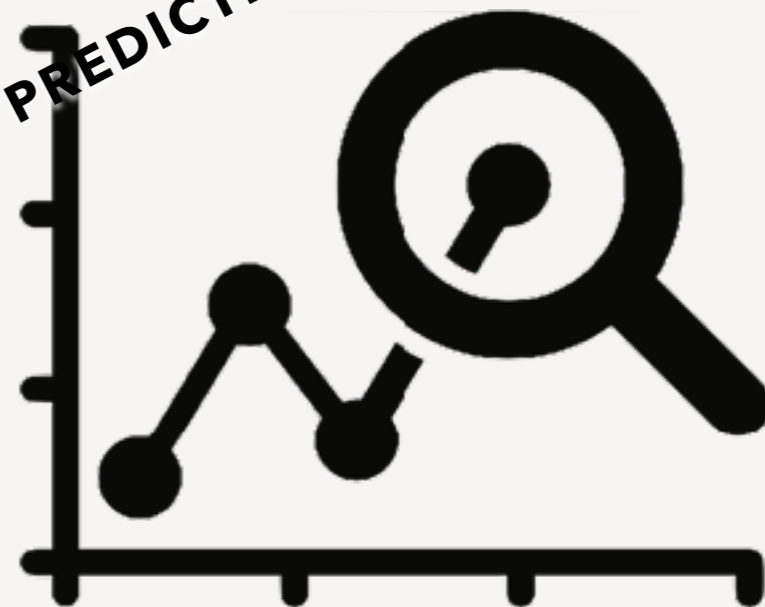
STEPS



ENERGY SPENT



PREDICTIVE ANALYSIS



DAILY SURVEY ANALYSIS



ACTIVITY



SLEEP PATTERN



HEART RATE



INDOOR LOCALIZATION



ABILITY TO HARNESS OTHER DEVICES





PERSONALIZED AND INTERACTIVE POSITIONING!

A



Breathing Rate /
Heart Rate

Sitting/standing/Lying Down

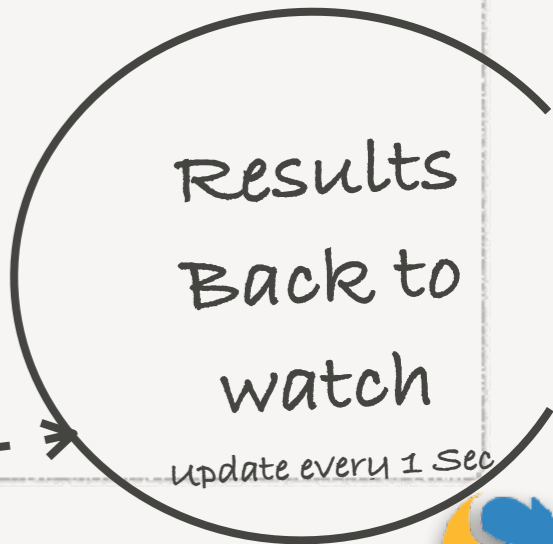


MOBILITY
Assistive Device:
Crutches
Walker
Wheelchair
Cane

B

This part was developed to enable us to assess the performance of the system real-time in real scenario

Personalized



MOST WEARABLES: STEPS & HEART RATE



PERSONALIZED MODELS: ASSISTIVE DEVICES



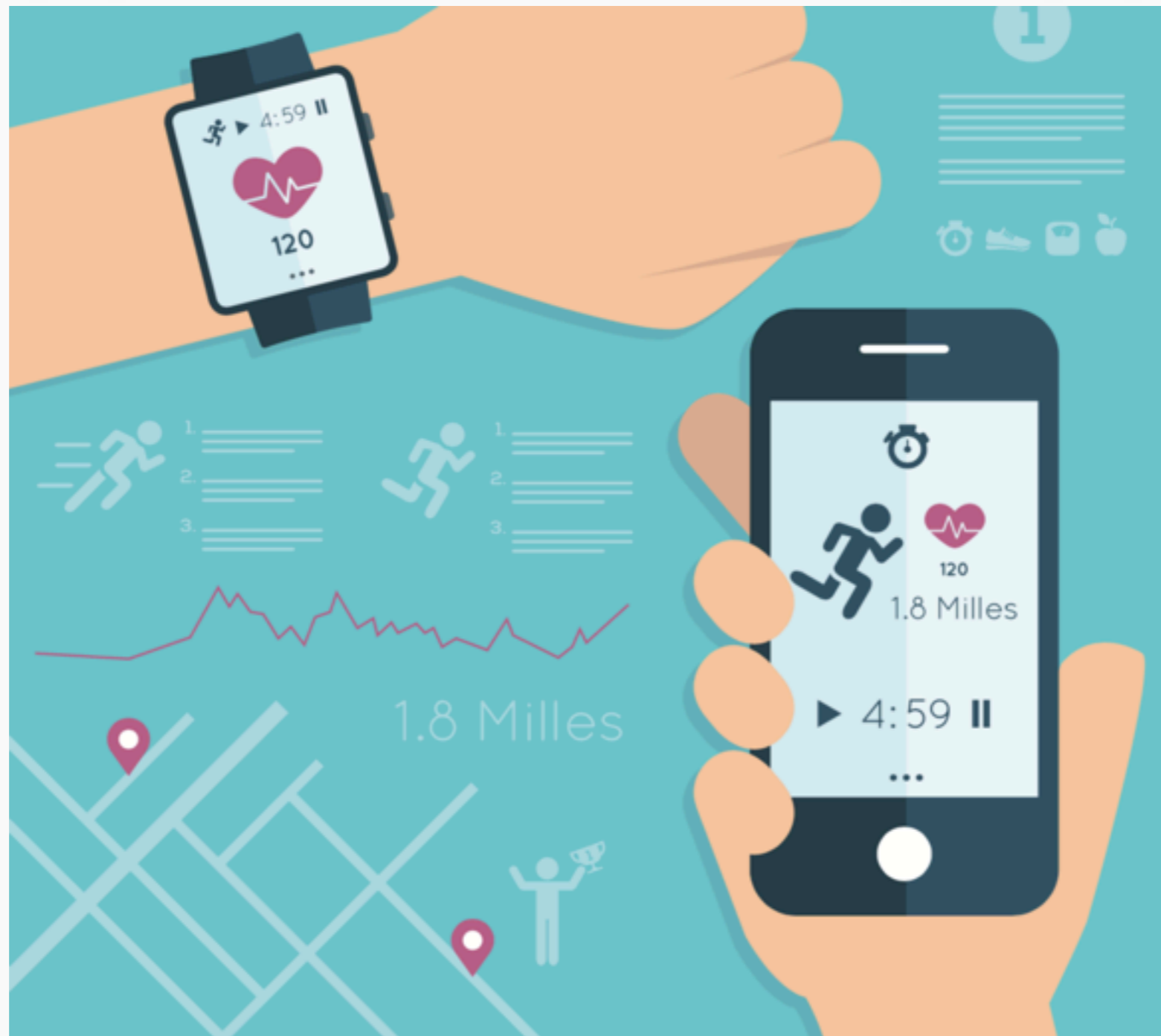


OUR MODELS

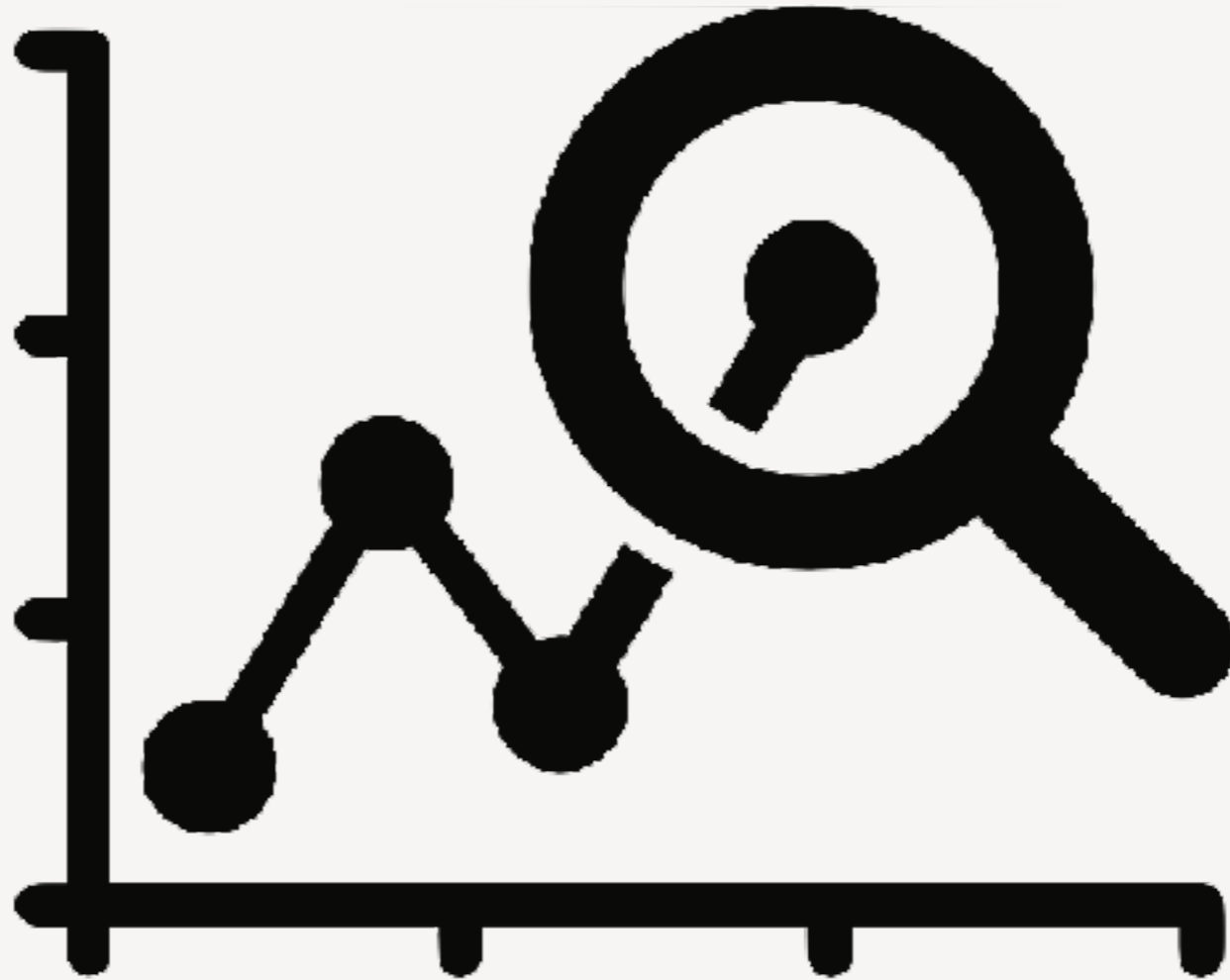
> **2 YEARS** OF STUDYING PATIENTS' BEHAVIOR IN REHAB CENTERS AND GETTING **FEEDBACK** FROM **PATIENTS & CARE GIVERS** FOR **DATA VISUALIZATION**



NEEDLESS OF SMART PHONE



ANALYTICS



Score: 0 B13D1	Score: 0 B13D2	Score: 0 B14D1
Score: 0 S6	Score: 0 O3D2	Score: 0 B18D2
Score: 0 B25D1	Score: 0 B25D2	Score: 0 B27D1
Score: 207.37 ramlnr2	Score: 0 WatchTest1	Score: 0 WatchTest2
Score: 0 B24D1	Score: 0 B26D1	Score: 315.43 Naeim

***DOCTORS/PATIENTS DASHBOARD
GETTING WORSE HIGHLIGHTED IN RED, BETTER IN GREEN***



Score
B3D

Score
B8D

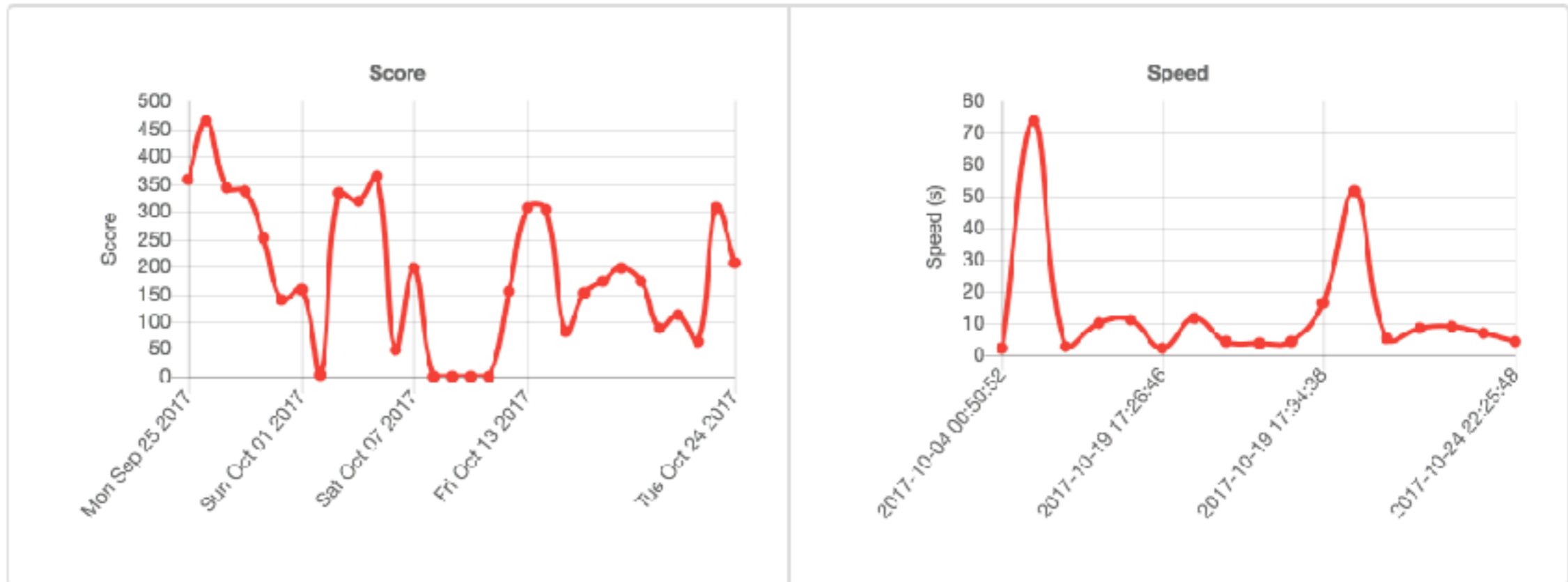
Score
B12D

Score: 0
B15D1

Score: 0
B27D2

Score: 0
S6

Score: 0
O3D2



DAILY SCORE AND MOVEMENT FLUCTUATIONS



Oct 24, 2017 09:00

Oct 25, 2017 09:00

... SUBMIT

Home: 18.25h

Out: 4.76h

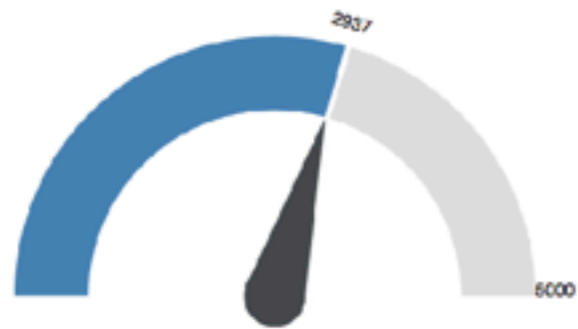
Active:
2.53h

Nonactive: 20.48h

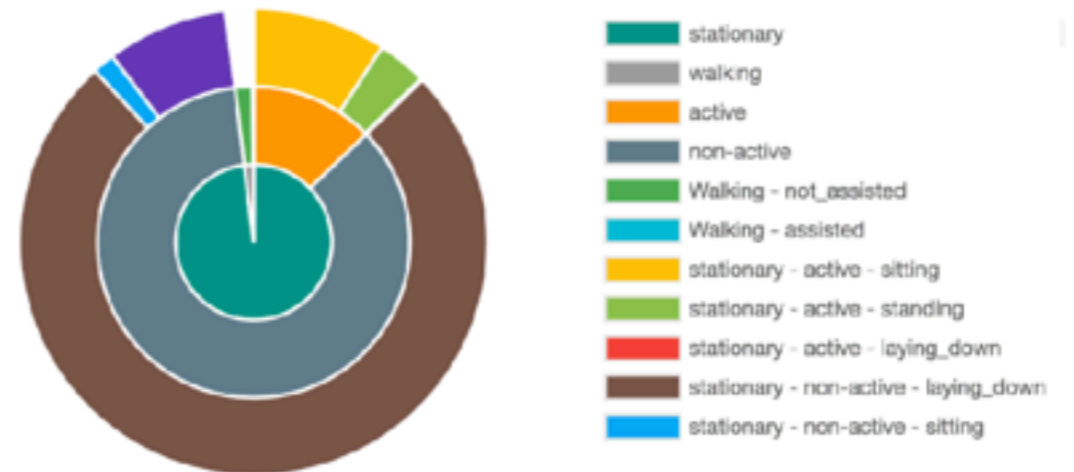
up: 95.9%

off: 4.1%

Steps



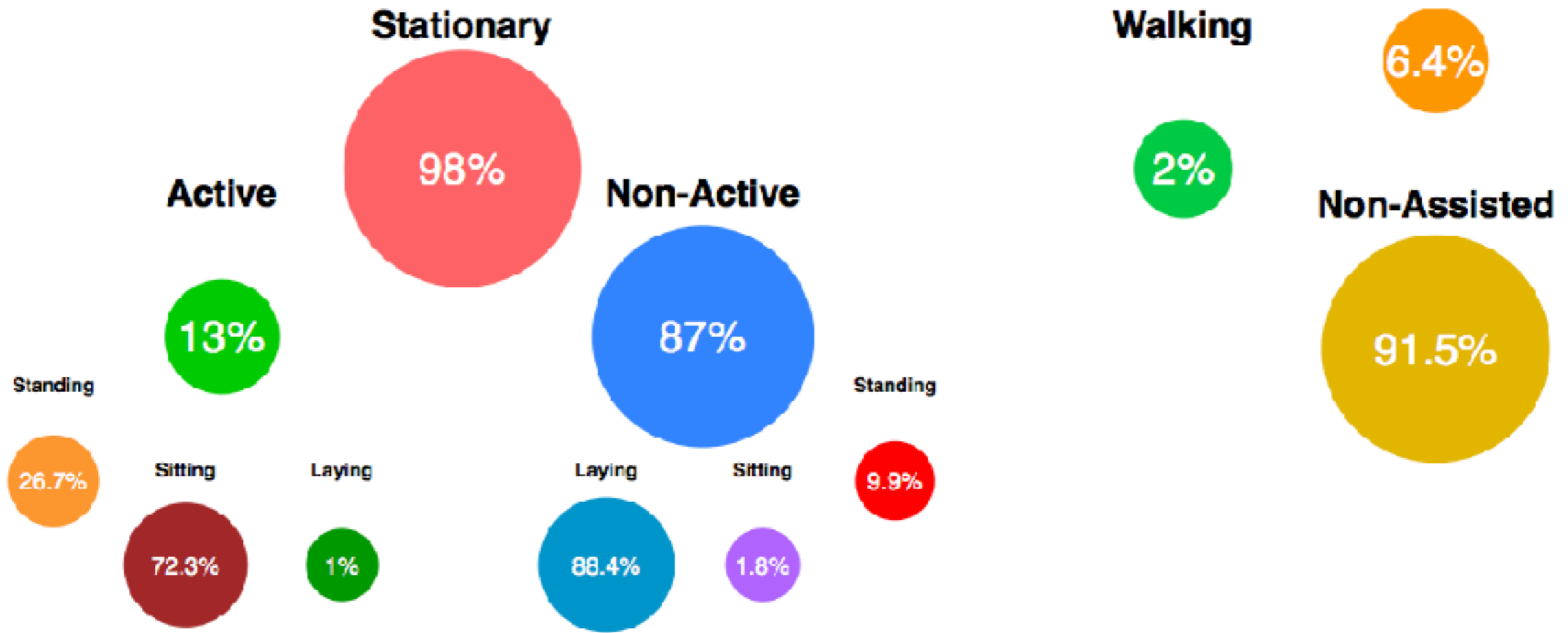
Overall Activities



SUMMARY OF DAILY STORYLINE



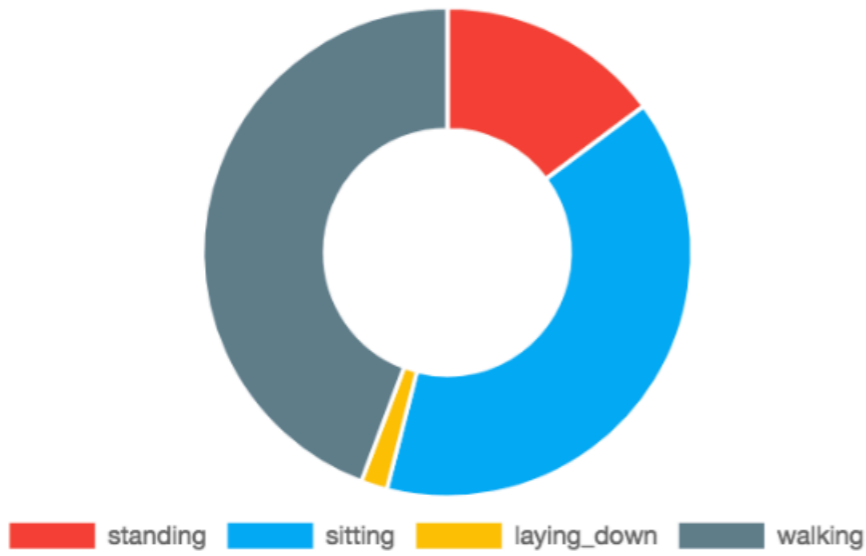
Overall Activities



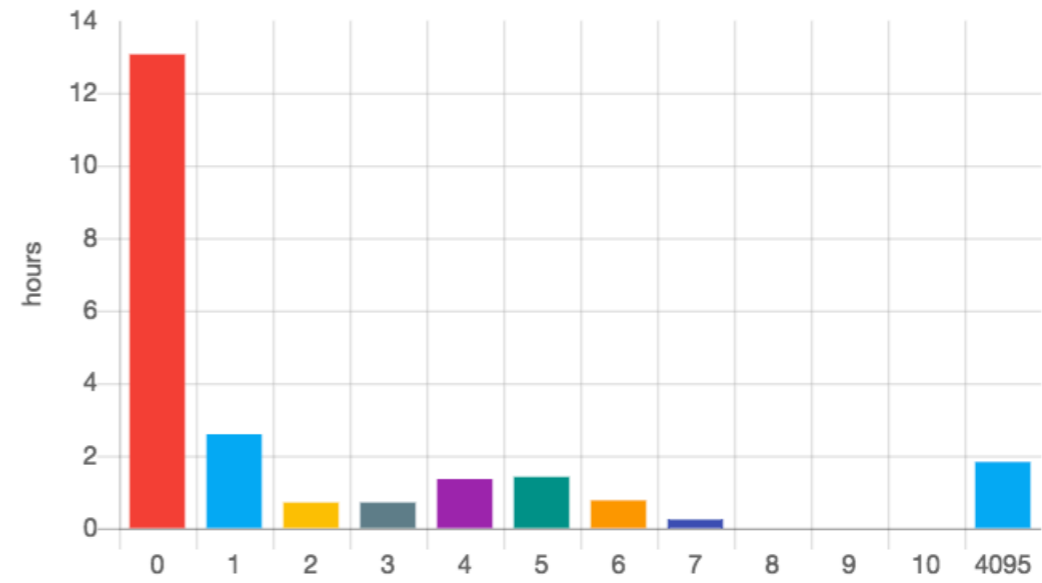
SUMMARY OF ACTIVITIES



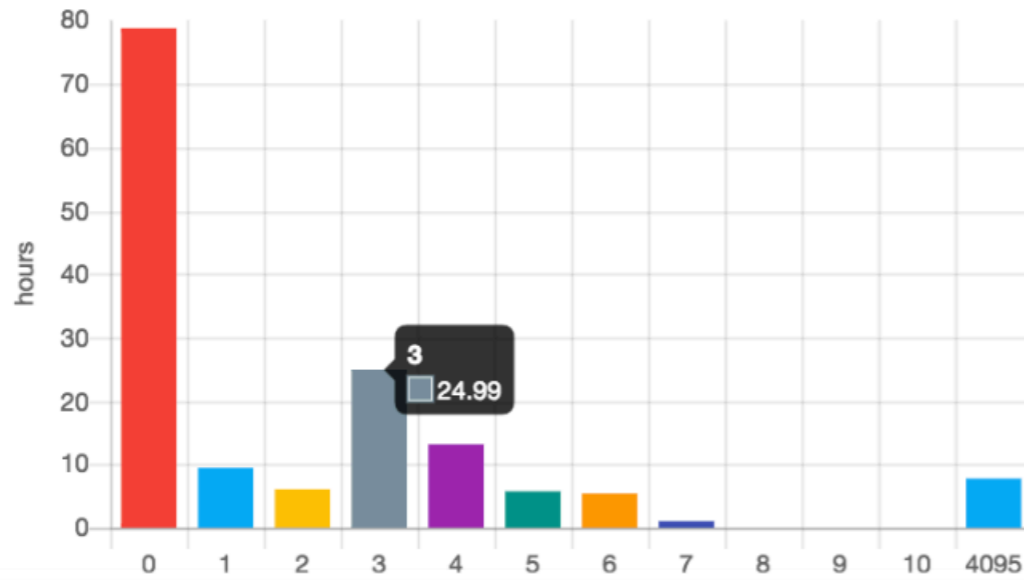
Time in Activities



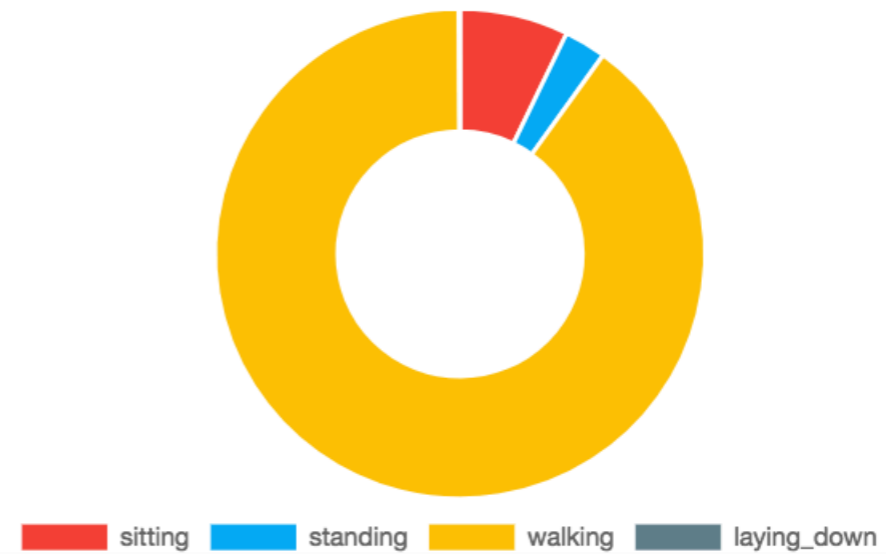
Time for each Locations in Activity: standing



Time in Locations

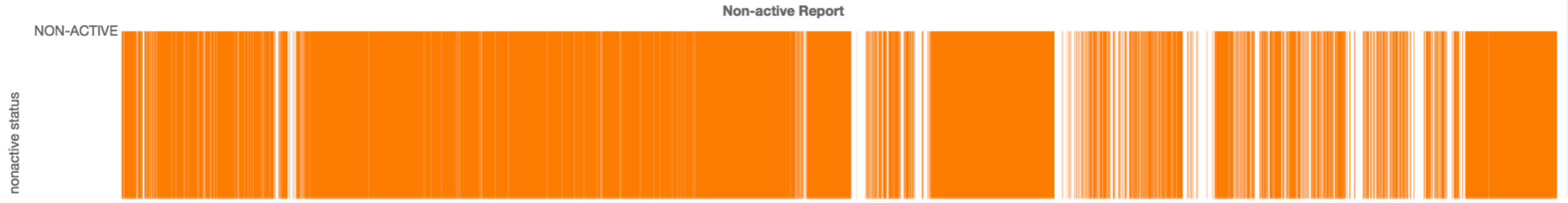
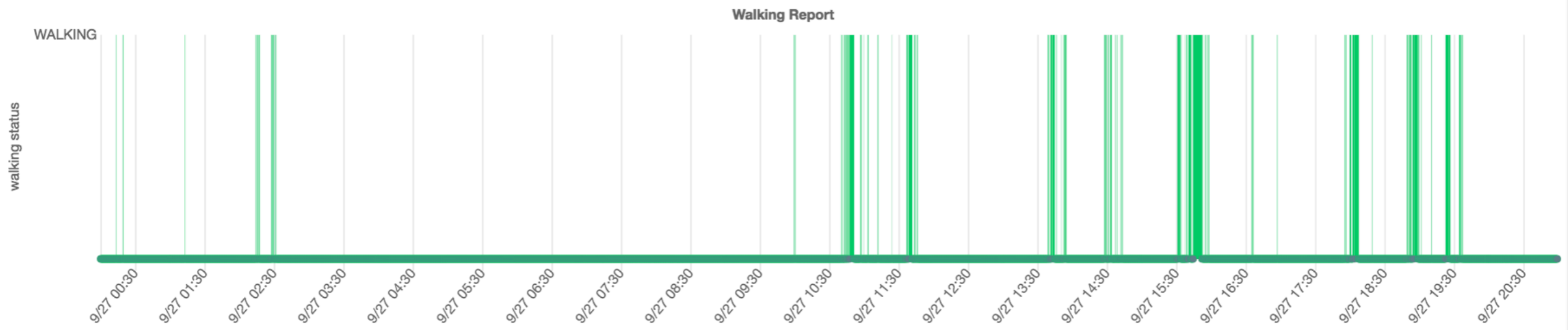
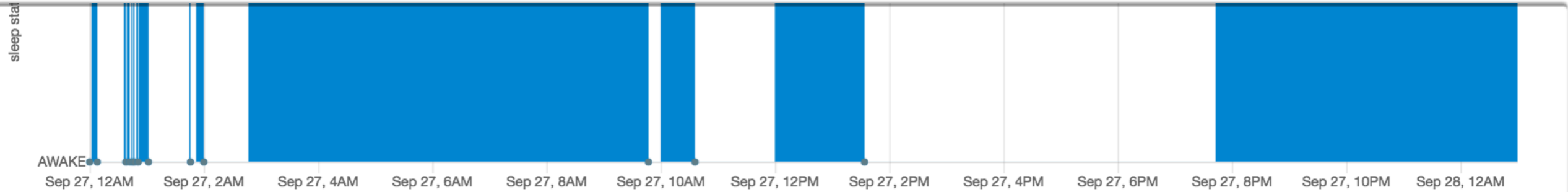


Time for each Activities in Location: 3



ACTIVITIES/INDOOR LOCALIZATION



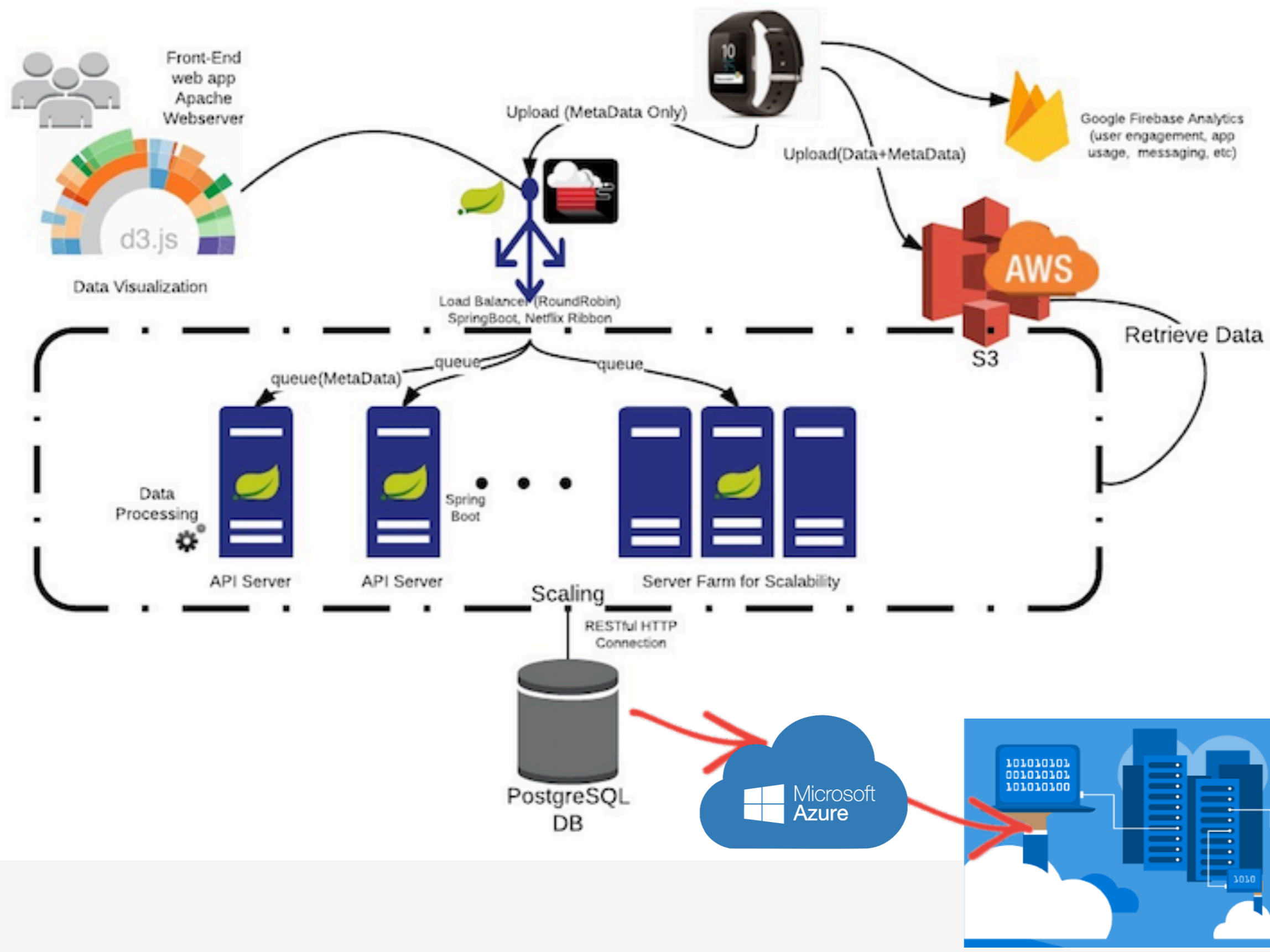


SLEEP/ACTIVE/NONACTIVE PATTERNS



- ☑ Preliminary Pilot in 50 Oncology and 200 Rehab Elderly Patients
- ☑ Watch Days worth of Data > 2000
- ☑ 5 papers on system design
- ☑ 8 abstract papers
- ☑ our system is EVOLVING - PREDICTIVE POWER expands as DATA progresses







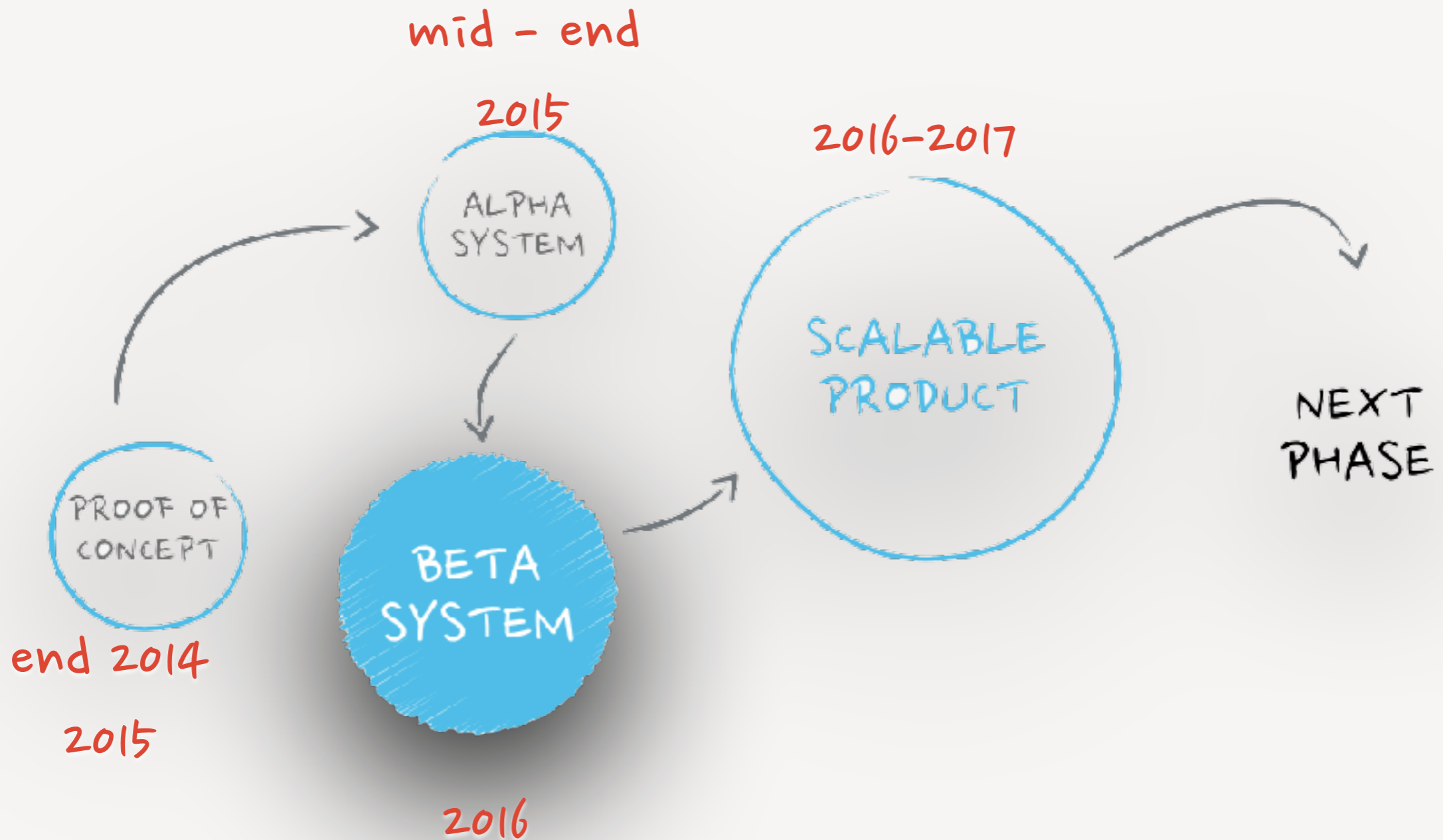
- **DATA PRIVACY**

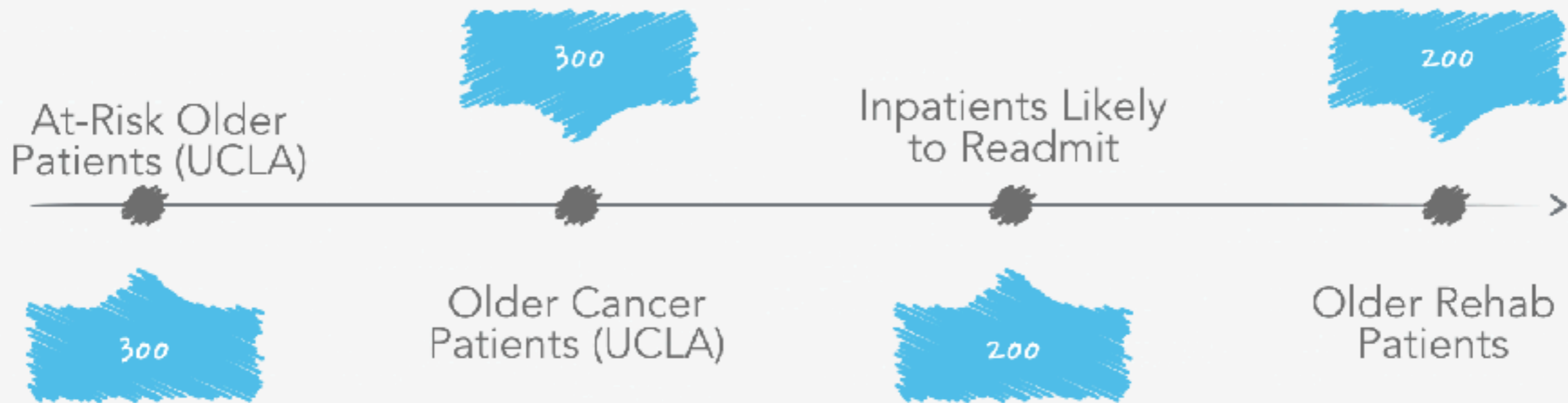


**HIPAA
COMPLIANT**



SARP: EVOLUTION





NEXT STEP: CLINICAL VALIDATION, 1000 MORE PATIENTS
2018 Q2



14 Students (PhD, Post-Doc, MSc and Undergrad) over 3 years

