The Usefulness of Activity Trackers in Elderly with Reduced Mobility: A Case Study

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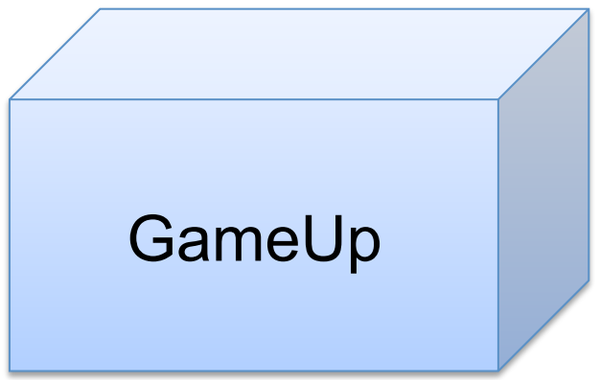
Background

- Balance
- Strength
- Flexibility
  - Indoor exercises
- Endurance/Stamina
  - Outdoor exercise
  - Walking



Background

- Encourage elderly to walk more and keep walking
  - Provide motivational feedback
  - Provide overview of progress
  - Make recommendations

  →To evaluate their current effort

- A method of accurately quantifying activity
  - Activity trackers/Pedometers
  - GPS *(not possible in GameUp)*

Goal

- Examine the accuracy of two present activity trackers:
  - Fitbit Ultra *(activity tracker)*
  - Samsung Galaxy S3 *(pedometer application)*

- Compare Elderly with normal and reduced mobility and healthy adults

Healthy Adults (HA)

Age: 25 – 45
No gait disabilities

- Global exclusion criteria
  - Cognitive impairment
  - Conditions that hinder gait or correct device placement

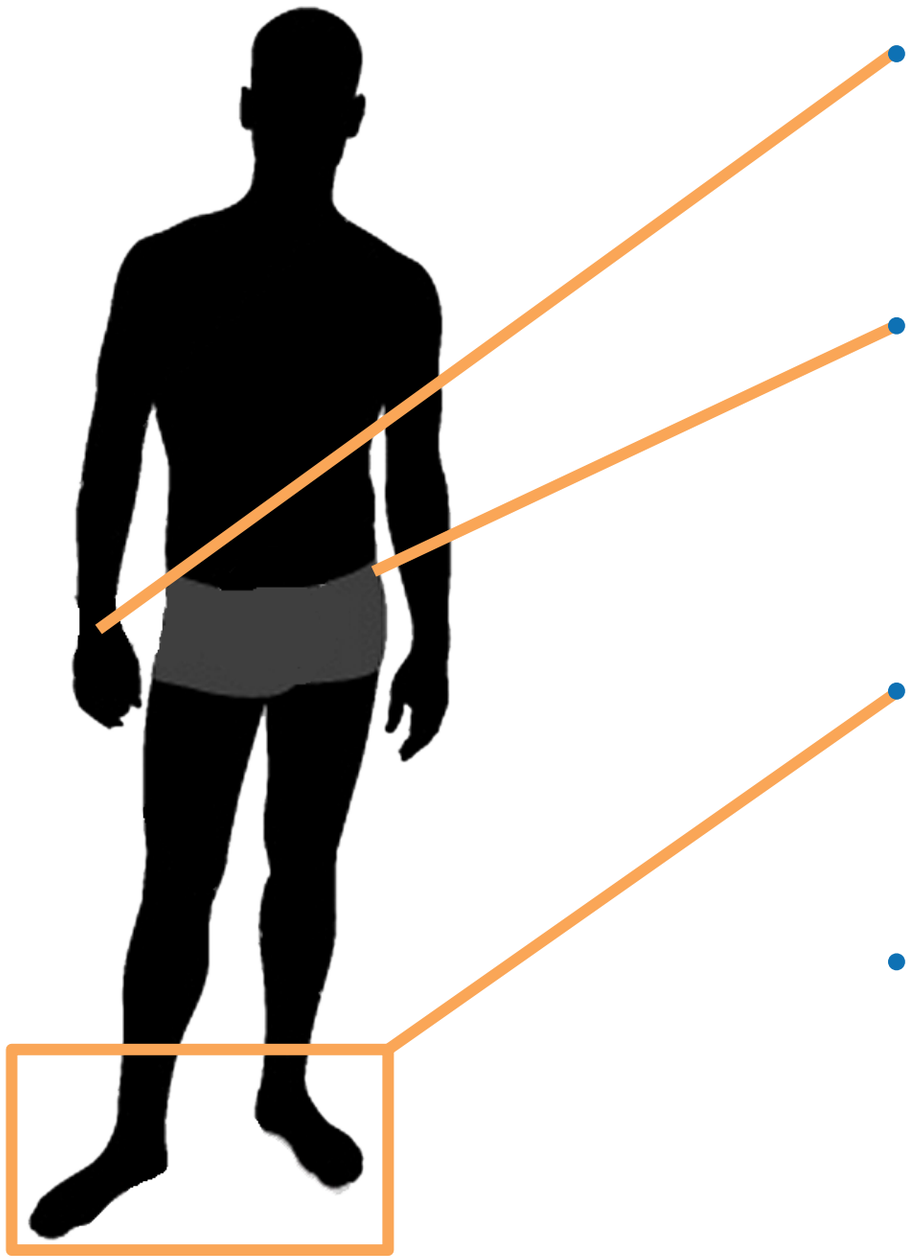
Procedure

- Participants instructed to
  - Walk a distance of 20m on a straight outlined path
  - Walk at their own pace
  - Use their own walking aid, if any *(not HA)*

- Participants always had someone by their side *(not for HA)*

- Setup
  - Path, Start & finish position marked out clearly
  - Test area closed for other activities/traffic
  - Participants were offered practice “runs”

Instruments



- Wrist
  - Fitbit Ultra
- Hip
  - Fitbit Ultra
  - Samsung Galaxy S3 *(Noom)*
- Feet
  - Video camera
- Time to complete
  - Stopwatch

Results

HA
n = 6
Age: 35.33 ± 6.53

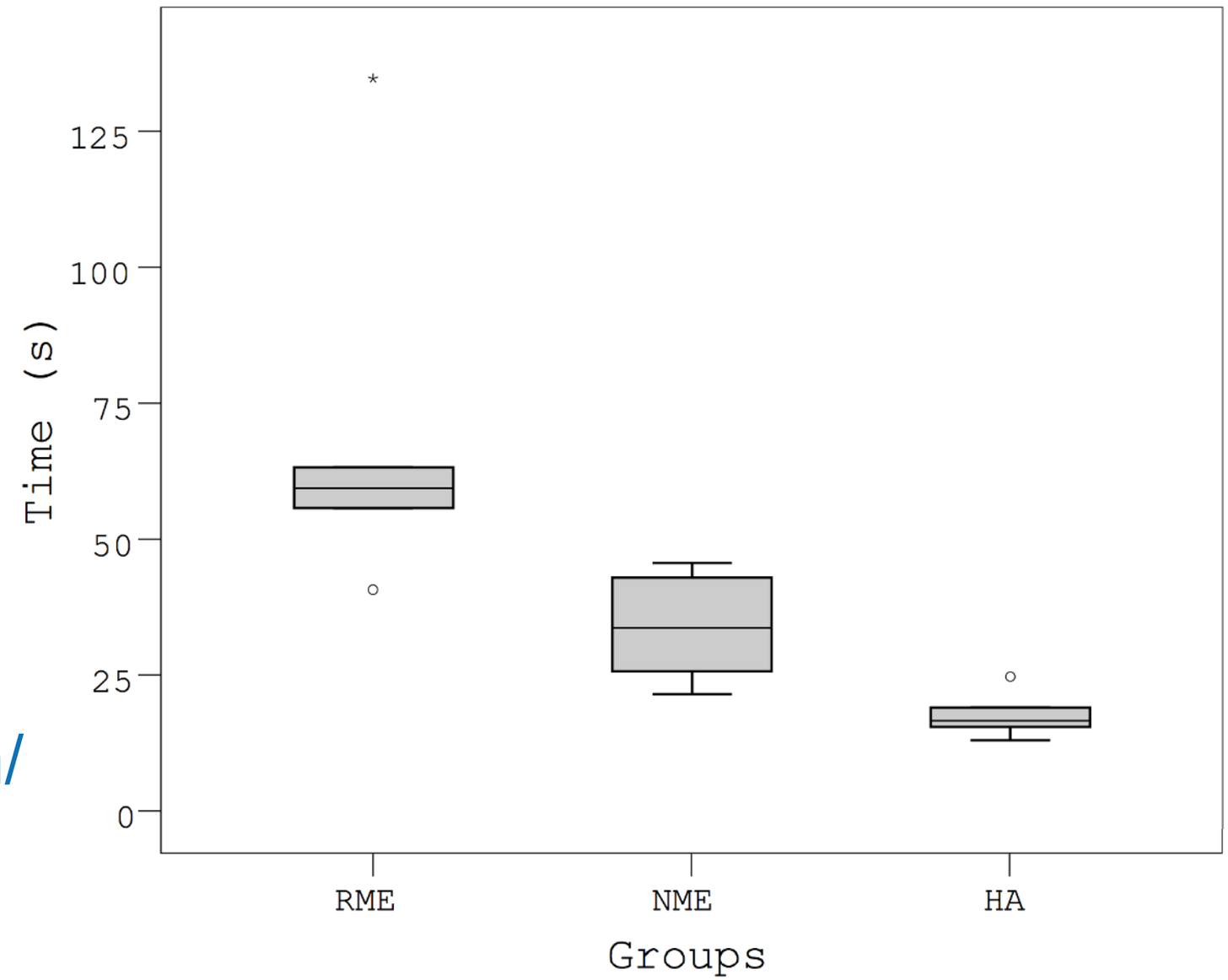
NME
n = 7
Age: 84.14 ± 3.67

RME
n = 5
Age: 87.6 ± 3.91

Results

- POMA gait score
  12 indicates max
  HA = 11.83 ± 0.41
  NME = 9.14 ± 0.9
  RME = 5 ± 1.58
  p < 0.05

- Time to complete 20m/ avg. walking speed
  p = 0.001



Results

- Wrist placed Fitbit
  - RME performs worse than NME *(p=0.003)*
  - RME performs worse than HA *(p=0.004)*

- Hip placed Fitbit
  - RME performs worse than HA *(p=0.009)*

- Hip placed Smartphone
  - RME performs worse than NME *(p=0.005)*
  - RME performs worse than HA *(p=0.017)*

- No significant difference between NME and HA

Independent Kruskal-Wallis & Mann-Whitney U tests

Results

- POMA, highly negatively correlated with
  - Age
  - Time to Complete *(avg. speed positively correlated)*
  - Number of Steps Taken
  - Error Percentage in all devices/wear locations
- Time to Complete and Number of Steps Taken correlated with Error Percentage in all devices/wear locations
- Age was not correlated with Error Percentage
- Age highly negatively correlated with avg. speed

Results

- RME data characterized by large undercounting
- RME wrist worn Fitbit failed to detect any steps in 4/5 participants
  - Detected only 1.79% of steps taken when detecting
- RME displayed overall low accuracy (Error percentage > 60%) and poor precision
- Best results obtained in hip worn Fitbit in HA *(2.86% ± 2.34%)*

Discussion

- Poor device performance in RME
  - Small steps
  - Little/no vertical foot displacement
  - Slow/abrupt walking pace
  - Static wrist position (Holding on to rollator handles)

  → Sensor not subjected to enough vertical displacement

- Activity trackers usually not targeted at RME *(and some NME)* , but people with faster pace/stride length – HA

Conclusion

- Tested devices not advisable for use in RME, even when placed in accordance to manufacturer recommendations

- Optimum device and placement is Fitbit Ultra at Hip

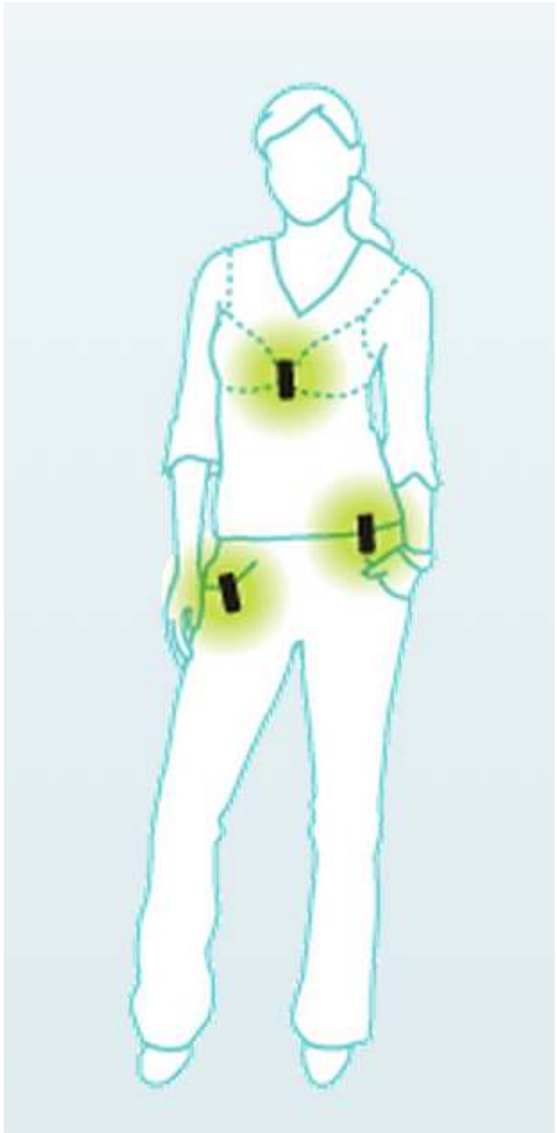
- Alternative methods required for people with reduced mobility
  - Counting rollator wheel rotations
  - Impact sensor on canes

Recent changes

- Recommended wear updated – wrist no longer recommended

- Fitbit Ultra no longer available in sale

- Fitbit Ultra replaced by Fitbit the One



GAME-BASED MOBILITY TRAINING AND MOTIVATION OF SENIOR CITIZENS

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About EDSS

Kurtzke JF. *Rating neurologic impairment in multiple sclerosis: an expanded disability status scale (EDSS)*. Neurology, 1983: Nov: 33(11):1444-52

About POMA

Tinetti ME. Performance-oriented assessment of mobility problems in elderly patients. JAGS 1986: 34: 119–26.

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