Investigating the usability of off-the-shelf sensors and using patient data to diagnose frailty

KARLA MUÑOZ ESQUIVEL, DANIEL KELLY, JOAN CONDELL, STEPHEN TODD, RICHARD DAVIES, DAVID HEANEY, JOHN BARTON, SALVATORE TEDESCO, ANNA NORDSTRÖM, MARKUS ÅKERLUND LARSSON, DANIEL NILSSON, ANTI ALAMÄKI AND ELINA NEVALA

EMAIL: KC.MUNOZ-ESQUIVEL@ULSTER.AC.UK

**BACKGROUND**

- Healthcare systems overwhelmed with an increasing demand due to population aging
- Governments promoting remote/in-home rehabilitation as a potential solution to reduce costs and free up resources in critical hospitals
- Remote home rehabilitation can empower patients to have control over their own rehabilitation process
- Wearable sensor technology is transforming rehabilitation processes by providing valuable information which previously was not available, to health care staff and patients

**OBJECTIVES**

1. Investigate usability of wearable sensors within elderly rural population
2. Investigate effectiveness of “off the shelf sensors”, e.g., activity trackers, in detecting/diagnosing frailty

**MATERIALS, METHODS AND EVALUATION**

- In our SENDoc NPA project, we are evaluating the effectiveness of off-the-shelf wearables for monitoring and rehabilitating remote and rural patients
- We are conducting demonstrations in 4 partner locations, where healthy participants aged over 60 years will wear a Mi Band activity tracker (Mi Global Home, 2018), a data logger and a smartphone to attain comparable data
- The usability of this technology will be assessed from elders’ perspective
- The data attained will then be analysed in combination with medical patient data to identify frailty
- We hypothesise that off-the-shelf sensors can be used to automatically identify frailty
- Look at the correlation between patient physical activity and patient data.
- Number of steps and physical activity and exercises performed, sleep tracking and heart rate. The latter will be looked to calculate energy expenditure.
- Statistical methods and qualitative usability questionnaires will be applied to validate or reject this hypothesis.
- Artificial Intelligence and machine learning methods will be employed to classify frail and pre-frail patients from non-frail patients

**EXPECTED OUTCOMES**

Results are not available at this stage. However, we expect that on-time therapeutic and medical advice can assist patients to recover full capacity before frailty becomes irreversible.

Other expected outcomes are:
- Enhanced understanding of elders’ perception about using wearable sensors to gain awareness about their level of physical activity and overall state of health
- Attaining usability metrics of the available off-the-shelf wearable sensors
- Identifying the difficulties (if any) and advantages faced by elderly people while using “off-the-shelf” wearable sensors
- Attaining patient data that can be analysed/compared across the 4 partner locations of SENDoc
- Being able to diagnose frailty using related medical and patient data. The latter captured using off-the-shelf sensors.

Activity monitoring with off-the-shelf sensors

Patient health related and usability questionnaires

Activity monitoring with off-the-shelf sensors