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CONFERENCE ABSTRACT

Home mobile system to early detect functional decline to prevent and manage frailty

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Introduction: In the last 50 years, life expectancy has increased an average of 20 years, and by the year 2050, it will surpass 90 years of age. Thus, elderly-associated conditions e.g. frailty and illnesses are becoming a huge challenge to the sustainability of healthcare systems. Frailty is a state of increased vulnerability to adverse outcomes due to a reduction in the ability to respond to stressors; usually characterized by a progression of functional decline. That culminates in dependency and disability. We aimed to design a home monitoring system to prevent onset and worsening of frailty.

Methods: We iteratively designed a home monitoring system to early detect changes in the functional capacity. We used a user-centred approach working together with geriatricians, geriatric nurses, psychologists, and frail people. Each version was tested with them to create an improved new version, until requirements were met. Technically, we evaluated the accuracy of sensors and algorithms towards the current standard at the hospital. For the user tests, we used usability and acceptability tests as System Usability Scale SUS.

Results: The resulted system consists of a set of ultrasound sensors, a weight scale; anda mobile application that receives, processes and sends the data to the hospital. The sensors monitored the gait speed along 2.4 meters, and the chair stand test. Clinicians monitor patients' functional status and react based on the received data.

In total, 57 elderly users participated in the evaluation, with an average age of 80 years; 54.8% were women. Out of them, 49 technically tested the sensors' accuracy. Error in the sensor measures is below the deviation when manually measured by professionals. Final version was validated with 8 elderly at their homes with very positive results: SUS of 84.06%, and acceptability results of 80%. In addition, 3 clinical professionals reported a SUS of 91.67%.

Discussions: There is an existing gap in home monitoring systems that are done with and for frail elderly. Thanks to co-creation our solution meets the real needs of this target population. Traditionally, telemedicine systems failed due to lack of adoption, which is highly correlated to low levels of usability and acceptability. Then, it is essential that usability and acceptability lead the system design.

Conclusions: We have demonstrated that the system is accurate, robust and usable. Moreover, frail people will potentially accept it. Our home system will allow elderly, at risk of frailty or already diagnosed, to stay living at their home. Early detection of functional decline permits intervention, impacting on the health and social outcome.

Lessons learned: Infra diagnosis of frail patients derives in critical outcomes. The iterative design and the involvement of clinicians and frail patients have resulted in a final system with high usability and acceptability, which ensures future adoption.

Limitations: Direct observation in usability tests may affect the users' behaviour.

Suggestions for future research: Automatic data collection to infer usability and acceptability in the long term. Clinical validation, including intervention and control group, to prove the impact on health and quality of life.

Keywords: remote monitoring; frailty; functional variables; usability; adoption