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Title:

User Evaluation of Multifaceted Activity Monitoring System for Fall Prevention

Abstract: In the present work, we discuss the results of a study we conducted in vivo with Fallarm, an innovative system for preventing falls in hospital, care facilities and home settings.

INTRODUCTION: In the last decade, both methodological strategies and technological interventions were defined to prevent falls [1]. Unfortunately, all the measures were found to be too restrictive (from a patient's mobility point of view), and limited in terms of efficacy [2]. All the current systems are targeted either on the service provider side (i.e. assessment tools, incident reporting) or on the client side (i.e. technological aids for individuals). Conversely, Fallarm realizes a multifaceted strategy (as discussed by [3]) based on closed-loop information exchange between proactive and reactive methods: comprehensive assessment protocols determine the individuals' risk of falling; an innovative device continuously monitors subjects' activities and it provides patients with constant feedback about their actual risk to increase their awareness; simultaneously, it aims at preventing adverse events, and it reports any incident. Thus, Fallarm is a comprehensive solution for the remote management of a person's risk of falling 24 hours a day. For the purpose of this study, we evaluated the usability of our solution in two contexts: hospital (the European Institute of Oncology - IEO) and home settings. We compared the wrist and the waist as the preferred position for the fall detector.

METHODS: We developed eight prototypes of the device. 20 subjects (6 males and 14 females, aged from 25 to 88) were recruited to perform the test. All of them had normal sensitivity, and they were physically able to walk. Subjects were equipped with two devices: one on the right hip, and the other on the left wrist. They were required to autonomously put the equipment on, and to wear it for 10 hours while carrying out their daily activities. During the experiment the prototypes raised an alarm at random, simulating an increase of the level of risk. Both the devices monitored the inertial parameters of the subjects for the duration of the whole tests. At the end of the experiment, subjects filled an evaluation questionnaire to indicate their preference.

RESULTS: Our solution was accepted by the majority of subjects (95%). They would straightforwardly use the device on the wrist; otherwise, they would not utilize it at all (or they would accept it only if they are ought to). All subjects were able to easily put on themselves both the devices, and they were able to perform all the activities they ordinarily carry out. In terms of psychological impact, the difference between the two locations is noteworthy ($p = 0.02$).

CONCLUSIONS: Results confirmed the applicability of the fall detector mounted on the wrist, which is the most comfortable position for the subjects, and the best placement for an activity monitoring device. Moreover the introduction of an interactive device encouraged subjects' mobility because the Risk Awareness Provider helps them to feel safer. Furthermore, the integration between proactive and reactive methods supports the documentation of adverse events (which is still a methodological pitfall in hospitals) and the reuse of previously acquired knowledge.

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