

THE USE OF A SENSOR NETWORK IN THE PROMOTION OF THE HEALTH OF THE DEPENDENT ELDERLY AT HOME

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Abstract: The aging population and the increasing longevity of individuals is a challenging reality for today's healthcare, as it brings increased dependency and need for continuous care, which is often left to informal caregivers. This will be an "almost experimental" study as the investigators will attempt to control some independent variables through the implementation of a therapeutic plan's assistance and vigilance program from a sensor network, which will monitor and assist (alarm sending) in complying with medication, raisings and positionings. 28.6% of the elderly cannot move alone in bed and 100% of the elderly take medication regularly. In the control group, there are 6 elderly people with total dependence, 3 moderately dependent elderly and 5 elderly with slight dependence. So, knowing that Portugal has a high rate of informal home care, it was relevant to develop this project for the application of information and communication technologies in the development of a prototype of a system focused on the monitoring and aid of the execution of the therapeutic plan in two strands, mobilization and medication.

Keywords: Sensor network; Health; Elderly

Introduction

The aging rate has been rising dramatically. In 2017 the aging rate reached 153.2%, accompanied by an increase in longevity, but also an increase in dependency (Pordata, 2017). Older people over the age of 60 are in the highest age range and it is estimated that over the next few years the number of people over 65 years old will exceed the number of children under the age of 5 (Le Deist & Latouille, 2016).

Considering the numbers of aging and dependency, and also knowing that, according to the Health Regulatory Entity, Portugal has the highest rate of informal home care provided by a person in the same residence, therefore, the development of this project was relevant to help these caregivers in the routines, that take practically their whole day, improving their quality of life.

Some elderly people, who are in home care carried out by informal caregivers, have difficulty in locomotion and are often immobile in bed. Immobility produces musculoskeletal pathophysiological changes that cause deformities and postural alterations, promoting the appearance of pressure lesions. If there is no regular care and dedicated interventions, these changes will affect the quality of life of the elderly and predispose to the appearance of diseases (Assis, Vidal, & Dias, 2015).

The pressure ulcers is defined as localized damage to the underlying skin and / or soft tissue, striking regions of bone prominence or in regions of prolonged contact with equipment or devices that cause prolonged or intense pressure, combined or not, with friction. The pressure on bone prominence affects the blood circulation promoting the cell death and consequent appearance of these lesions in places of greater risk, such as the occipital, scapular, elbow, sacral, malleolus and calcaneal regions (Silva, Santos, Zoche, Argenta, & Ascari, 2017).

Depending on the need for care, in its complexity or duration, caregiving may require from the caregiver a restructure of his life, often having to change customs, routines, habits, not always being easy and leading to feelings of tension and distress that lead to overload. For this reason, the caregiver may, on the one hand, ignore his own needs or, on the other, neglect the care of those for whom he is responsible (Nunes, Brito, Corona, Alexandre, & Duarte, 2018).

When we talk about the needs of the elderly, we must mention the need for therapeutic compliance at the medication level. Most of the elderly have several comorbidities and are polymedicated. Sometimes these schemes are complex, which hampers correct compliance and increases the risks of misuse of medicines (Marin, Rodrigues, Druzian, & Cecilio, 2010)

This project is being developed with the objective of applying information and communication technologies in the development of a prototype of a system focused on the monitoring and assistance of the execution of the therapeutic plan in two strands: mobilization and medication.

Materials and Methods

This will be an “almost experimental” study as the investigators will attempt to control some independent variables through the implementation of a therapeutic plan’s assistance and vigilance program from a sensor network, which will monitor and assist (alarm sending) in complying with medication, raisings and positionings.

Therefore, 2 groups will be defined: the experimental group, on which the program will be applied, and a control group.

This study was authorized by the Ethics Commission of UTAD (nº 37/2019 of 20/02/2019) as well as the elderly and their caregivers who participated in the study gave their informed consent.

Results and Discussion

At the moment, in the experimental group (where the sensors will be placed), there are already 9 elderly people with total dependency, 1 elderly with severe dependence, 3 elderly with moderate dependence and 8 elderly with slight dependence, 10 elderly people in this group have a high risk of developing pressure ulcers, see (Table 1).

Table 1: Dependency – Experimental Group

	N	%
Total Dependency	9	42,8
Severe Dependency	1	4,8
Moderate Dependency	3	14,3
Slight Dependency	8	38,1
Total	21	100,0
High Risk of Developing Pressure Ulcers	10	47,6

In the control group, there are 6 elderly people with total dependence, 3 moderately dependent elderly and 5 elderly with slight dependence. In this group, 6 elderly people are at high risk of developing pressure ulcers, see (Table 2)

Table 2: Dependency – Control Group

	N	%
Total Dependency	6	42,9
Severe Dependency	0	0
Moderate Dependency	3	21,4
Slight Dependency	5	35,7
Total	14	100,0
High Risk of Developing Pressure Ulcers	6	42,9

In the experimental group there are more women than men, 57,1% are female and 42,9% are male. 28.6% of the elderly cannot move alone in bed, were 33,3 % never get out of bed and 23,8% don't even get seated during daytime. 100% of the elderly take medication regularly, see (Table 3)

Table 3: Gender, mobility and medication – Experimental Group

Variables		N	%
Gender	Male	12	57,1
	Female	9	42,9
Move alone in bed	Yes	15	71,4
	No	6	28,6
	Doesn't get seated during the day	5	23,8
	Bedridden	7	33,3
Does medication	Yes	21	100
	No	0	0
	Needs help	21	100
	Knows time and name of medication	0	0

AGE MEAN – 75,9 years old

In the control group there are the same number of men and women, 28.6% of the elderly cannot move alone in bed, were 28,6 % never get out of bed and the same 28,6% stay bedridden. 100% of the elderly take medication regularly, see (Table 4)

Table 4: Gender, mobility and medication – Control Group

Variables		N	%
Gender	Male	7	50
	Female	7	50
Move alone in bed	Yes	10	71,4
	No	4	28,6
	Doesn't get seated during the day	4	28,6
	Bedridden	4	28,6
Does medication	Yes	14	100
	No	0	0
	Needs help	14	100
	Knows time and name of medication	0	0
AGE MEAN – 81,2 years old			

The selection of dependent elderly people at home has already been made (experimental group and control group). There have also been applied scales that determinate functional independence in the domains of personal care and mobility and scales that gives us the type of risk of development of pressure ulcers. We will also assess the difficulties and overload of the informal caregiver, and will apply sensors to test respiration, heart rate, humidity, temperature, change of position and detection of falls to implement programs of assistance and surveillance of therapeutic plans.

Regarding the sensors we will test:

- Bed sensors (placed in the bed of the elderly, allows the evaluation of breathing, heart rate, estimate the cardiac output and detects the occupation of the bed);
- RFID's (radio frequency identification for humidity and temperature detection);
- Accelerometer (this sensor will allow detection of falls);
- Fixtures (consisting of an LED rule that will be associated with an elderly person and that will serve as a way to quickly see some of the warnings regarding the elderly in question: detection of falls, heart rate and respiratory cycles, medication and change of position of the elderly);
- Two buttons (one will be to check if the medication is given by the informal caregiver, and another that would serve as an alarm, which is used by the elderly);
- Gateway FE - Central computing unit (which will have all the sensors connected to it, wireless, and will process all the data).

Conclusion

Technology application in healthcare has been arousing engineering's attention for a long time in support to health recovery and maintenance therapy practices.

In this regard, creating support systems to watch the fulfilling of the therapeutic plan, assisting healthcare professionals and informal caregivers on dependent elders' care may be an added value.

The advantages of the installation of a sensor network are endless, since the possibility of scheduling alarms to warn of positioning at predetermined times, alarm in case of forgetfulness or delay in positioning and warning of medication time. These written alarms will be available to the informal caregiver, as well as to health professionals, since there will be a web interface where health professionals and / or the family will be able to visualize the values of the sensors, the state of the elderly and warnings.

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