A Multicenter Survey about Companion Robot Acceptability in Caregivers of Patients with Dementia

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Introduction

Age of Loneliness

In 2050 16% world
population over 65

Introduction

Dementia

- ▶ Another 20 people
- ▶ By 85 one person in every 3 will have dementia
- ▶ Dementia
 - ▶ worsens over time,
 - ▶ erodes your memory,
 - ▶ language,
 - ▶ communication,
 - ▶ changes your moods and personality.

Introduction

Alzheimer's disease (AD) leads to severe social consequences:

- decreased quality of life and well-being**
 - increased family burdens and health care demand**
 - longer term utilization of care facilities**
- that generate very significant impacts on health care services demand and consequently costs (*Seelye A. et al., 2012*).

To fight loneliness and the effects suffered by person with dementia, effective techniques include those that target change of a person's perception of loneliness and those that increase a person's resilience.

Resilience is an adaptive capacity that refers to one's ability to 'bounce back' and cope in the face of adversity.

Managing active and healthy aging with use of caring service robots (MARIO)

(February 2015-January 2018)

Information and Communication Technologies (ICT) solutions can be used to increase psychological skills like resilience (*Norris et al., 2008*), and to manage active and healthy aging with the use of caring service robots as will be explored with the EU funded MARIO project (<http://www.mario-project.eu/portal/>).

Partners

- National University of Ireland, Galway
- ROBOSOFT
- RU Robot
- Ortelio Ltd
- City of Stockport
- Consiglio Nazionale delle Ricerche
- R2M Solution
- Casa Sollievo della Sofferenza Hospital
- Caretta-Net
- University of Passau

MARIO objectives 1/2

- To address and make progress on the challenging problems of loneliness, isolation and dementia in older persons through multi-faceted interventions delivered by service robots.
- To conduct near project length interaction with end users and assisted living environments.
- To assist caregivers and physicians in the comprehensive geriatric assessment (CGA) through the use of service robots.
- The use of near state of the art robotic platforms that are flexible, modular friendly, low cost and close to market ready.

MARIO objectives 2/2

- To make MARIO capable to support and receive “robot applications” similar to the developer and app community for smartphones.
- Through novel advances in machine learning techniques and semantic analysis methods to make MARIO more personable, useful, and accepted by end users (e.g. gain perception of non-loneliness).
- To bring MARIO service robot concepts out of the lab and into industry.

First model of robot suggested at the begin of the MARIO project

Survey of the needs

At the first stage of the MARIO project, Focus groups were performed and a questionnaire was designed to find out perceptions of the caregivers about robot companions, especially what they would like such a robot to do for them, and how robots could be designed to build the patient resilience.

Aims

The goal of these activities were to determine the needs and preferences of formal and informal caregivers for improving the assistance of dementia patients, and guiding the technological development of MARIO though a questionnaire.

2 Focus Groups

April and May 2015

**Geriatrics Unit, Casa Sollievo della Sofferenza, IRCCS,
San Giovanni Rotondo, Italy**

- 1) 14 Participants:** 4 patients with cognitive impairment, 3 caregiver/relatives, 3 geriatrician, 1 psychologist, 1 nurse, 1 physicist and 1 engineer.
- 2) 10 Participants:** 1 geriatrician, 1 psychologist, 1 physicist, 1 office worker, 3 computer scientists and 3 engineers.

MARIO Questionnaire 1/4

**130 caregivers of patients with dementia
consecutively recruited from May to November 2015 at:**

- ☐ **N = 70** - Geriatrics Unit, Casa Sollievo della Sofferenza, IRCCS, San Giovanni Rotondo, Italy (**IRCCS**)
- ☐ **N = 39** - National University of Ireland, Galway, Ireland (**NUIG**)
- ☐ **N = 21** - Alzheimer Association Bari, Italy (**AAB**)

Inclusion criteria:

- Caregiver of patients with diagnosis of dementia according to the criteria of the National Institute on Aging-Alzheimer's Association (NIAAA)
- The ability to provide an informed consent or availability of a proxy for informed consent.

Exclusion criteria:

- Caregivers of patients with serious comorbidity, tumors and other diseases that could be causally related to cognitive impairment (ascertained blood infections, vitamin B12 deficiency, anaemia, disorders of the thyroid, kidneys or liver), history of alcohol or drug abuse, head trauma, psychoactive substance use and other causes of memory impairment.

MARIO Questionnaire 2/4

The following parameters were collected by a systematic interview about the caregivers:

- **Gender**
- **Age**
- **Educational level** (in years)
- **Caregiving type:**
 - ✓ Informal caregiver (unpaid)
 - ✓ Informal caregiver (paid)
 - ✓ Formal caregiver (Geriatrician)
 - ✓ Formal caregiver (Psychologist)
 - ✓ Formal caregiver (Nurse)

MARIO Questionnaire 3/4

1) A five-minute video on the first model of robot suggested at the begin of the MARIO project:

(video weblink: <https://www.youtube.com/watch?v=v1s2Hbad1l0>).

2) A 42-item questionnaire that evaluated the potential role of:

- A) Acceptability**
- B) Functionality**
- C) Support devices**
- D) Impact**

3) Responses were expressed as:

- “Extremely important/likely/useful” or “YES, very useful”
to**
- “Not at all important/ likely/useful” or “Not useful at all”.**

MARIO Questionnaire 4/4

Items of the MARIO Questionnaire

Section A: Acceptability	Section B: Functionality	Section C: Support device	Section D: Impact
How important is it that MARIO has:	How important is it that MARIO has:	Do you think that the following support devices in MARIO could be useful for your patients?	To what extent do you think MARIO could be useful in order to:
1 (Human like appearance)	1 (Face recognition)	1 (Bed rest)	1 (Quality of life)
2 (Human sounding voice)	2 (Voice recognition)	2 (Medication use)	2 (Quality of care)
3 (Familiar voice)	3 (Distinguishing individuals)	3 (Ambient environmental)	3 (Safety)
4 (Covering like to touch)	4 (Natural dialogue)	4 (Lighting, TV channels)	4 (Emergency communication)
5 (Height adjustable)	5 (Device for outside-home)	5 (CGA)	5 (Cognitive rehabilitation)
6 (Not verbally communication)	6 (Prompts for appointments)	6 (Care planning)	6 (Detecting isolation)
7 (Displays emotional expression)	7 (Person's life history)	7 (Physiological deterioration)	7 (Detecting health status changes)
8 (Daily assistance reminder)	8 (Communication by multimedia)	8 (Cognitive deterioration)	
9 (Monitor movement)	9 (Voice activation)		
10 (Entertainment)	10 (Gesture recognition)		
11 (Communication with caregivers)	11 (Help for walking)		
12 (Quiet robot)	12 (Understanding dialects)		
13 (Moving in home)	13 (GPS function)		
14 (Internet connection)			

Results 1/5

Table 1. Characteristics of dementia caregivers.

	ALL	NUIG	IRCCS	AAB	P value
	N=130	N=39	N=70	N=21	
Gender (M/F)	36/55	-	28/42	8/13	0.876
Age (years)*	48.12 ±	-	48.74±14.90	45.72±19.25	0.473
range	15.81 23– 88		23–88	24–82	
Educational level (years)*	16.09 ± 6.00	18.88 ± 1.22	14.90 ± 7.06	15.61 ± 5.30	0.006
range	0– 24	18 – 23	0 – 23	5 – 24	
Caregiving types					
<i>Informal caregiver (unpaid) N(%)</i>	33 (25.3)	0 (0)	24 (72.7)	9 (27.3)	
<i>Informal caregiver (paid) N(%)</i>	7 (5.4)	0 (0)	6 (85.7)	1 (14.3)	
<i>Formal caregiver (Geriatrician) N(%)</i>	19 (14.6)	0 (0)	18 (94.7)	1 (5.3)	<0.0001
<i>Formal caregiver (Psychologist) N(%)</i>	7 (5.4)	0 (0)	0 (0)	7 (100.0)	
<i>Formal caregiver (Nurse) N(%)</i>	57 (43.9)	32 (56.1)	22 (38.6)	3 (5.3)	
<i>Not indicated (N%)</i>	7 (5.4)	7 (100.0)	0 (0)	0 (0)	

*Values are presented as mean ± standard deviation.

Results 2/5

Figure 1. Rate of “Extremely important/likely/useful” or “YES, very useful” answer by caregivers of dementia patients to the MARIO Questionnaire.

Results 3/5

Figure 2. “Extremely important/likely/useful” or “YES, very useful” answer by caregivers of dementia patients to the MARIO Questionnaire: effect of sex of caregivers

Results 4/5

Figure 3. “Extremely important/likely/useful” or “YES, very useful” answer by caregivers of dementia patients to the MARIO Questionnaire: effect of age of caregivers

Results 5/5

Figure 4. “Extremely important/likely/useful” or “YES, very useful” answer by caregivers of dementia patients to the MARIO Questionnaire: effect of educational level of caregivers

Customization of the CGA

The principal objective is to translate the CGA from a personal subjective based administration to a robotic objective system that can autonomously and continuously monitor a subject during an predefined time interval and can expand the possibility, accuracy and intervention efficacy

Reviewing process about ICT used for CGA domains were performed:

1. Cognitive stimulation and Information-Communication Technologies (ICT) in Alzheimer's disease: a systematic review
2. Insomnia and Assistive Technologies in elderly people: a systematic review
3. Intelligent Technologies (IT) for the Activities of Daily Living in elderly patients with dementia: a systematic review
4. Literature review on Technologies used to monitoring vital signs
5. Literature review on Assessment of Nutritional status
6. Literature review on Compliance to drug Treatment
7. State of the art in speech-based robot socialization
8. State of the art in robotic and sensor technologies for human mobility, and gait evaluation

Implementation stage

For MARIO implementation the following sensors and apps are developing:

- **Beddit Sleep Monitor**
- **FITBIT**
- **ZephyrLIFE™**
- **CGA app**
- **Music and Flash game apps**
- **News app**
- **Hobby app**
- **Dementia Friendly Communities (DFC) app**

MARIO arrived in Casa Sollievo della Sofferenza on August 24, 2016

The experimentation stage begins...

MARIO

Experimentation stage (September 2016): Preliminary results (1/3)

We are administering a 13-item questionnaire that evaluates:

A) Acceptability

B) Functionality

**19 patients with mild cognitive impairment (M=6, F=13)
with a mean of educational level of 9.63 ± 5.64**

Experimentation stage: Preliminary results (2/3)

Acceptability

Experimentation stage: Preliminary results (3/3)

Functionality

First Trial

(November-December 2016):

Material and Methods 1/2

Inclusion criteria:

- 1) age $\geq$ 65 years;**
- 2) patients with diagnosis of mild dementia according to the criteria of the National Institute on Aging-Alzheimer's Association (NIAAA);**
- 3) the ability to provide an informed consent or availability of a proxy for informed consent.**

The patients were invited to use the following apps: My Music and My Games.

The patients interacted with MARIO 60 min/die in mean (respectively, a mean of 41 min/die for My Music app, and a mean of 19 min/die for My Games app) for a mean of 7.6 ± 4.3 hospitalization days (range = 3-12 days).

First Trial:

Material and Methods 2/2

At admission and at discharge, the following parameters were collected:

- **Demographic data**
- **Clinical and medication history**

Cognitive and affective assessment

1. Mini Mental State Examination (MMSE)
2. Clinical Dementia Rating (CDR)
3. Clock Drawing Test (CDT)
4. Frontal Assessment Battery (FAB)
5. Hachinski Ischemic Scale (HIS)
6. Neuropsychiatric Inventory (NPI)
7. Geriatric Depression Scale (GDS-15)
8. Hamilton Rating Scale for Depression (HDRS-21)

Evaluation of social aspects and resilience

1. Multidimensional Scale of Perceived Social Support (MSPSS)
2. Social Dysfunction Rating Scale (SDRS)
3. Brief Resilience Scale (BRS)

Quality of life and Caregiver burden level assessment

1. Quality of Life in Alzheimer's Disease (QOL-AD)
2. Caregiver Burden Inventory (CBI)

Clinical Assessment

1. Tinetti Balance Assessment (TBA)
2. Comprehensive Geriatric Assessment (CGA):
 - **Activities of Daily Living (ADL)**
 - **Instrumental -ADL (IADL)**
 - **Short Portable Mental Status Questionnaire (SPMSQ)**
 - **Mini Nutritional Assessment (MNA)**
 - **Scala di Exton –Smith (ESS)**
 - **CIRS-comorbidity (CIRS-CI)**
 - **Number of medications**
 - **Co-habitational status**

Acceptability Assessment

1. Almere Model Questionnaire (AMQ)

First Trial: Results 1/2

5 patients (M = 3, F = 2)
with an average age of 74.20 ± 10.06
range = 66 - 86 years

At admission	
- MMSE mean score = 19.66 ± 1.67	- MMSE mean score = 19.66 ± 1.67
- CDT mean score = 2.20 ± 0.84	- CDT mean score = 2.20 ± 0.84
- FAB mean score = 13.00 ± 1.27	- FAB mean score = 13.00 ± 1.27
- NPI mean score = 24.40 ± 1.27	- NPI mean score = 24.40 ± 1.27
- GDS-15 mean score = 1.20 ± 0.46	- GDS-15 mean score = 1.20 ± 0.46
- HRSD-21 mean score = 16.80 ± 1.79	- HRSD-21 mean score = 16.80 ± 1.79
- MSPSS mean score = 32.80 ± 5.72	- MSPSS mean score = 32.80 ± 5.72
- SF-36 mean score = 18.20 ± 4.60	- SF-36 mean score = 18.20 ± 4.60
- QoL mean score = 16.80 ± 1.79	- QoL mean score = 16.80 ± 1.79
- CBI mean score = 18.00 ± 6.93	- CBI mean score = 18.00 ± 6.93
- CIRS mean score = 2.20 ± 1.30	- CIRS mean score = 2.20 ± 1.30
- MNA mean score = 23.00 ± 6.04	- MNA mean score = 23.00 ± 6.04
- ESS mean score = 23.00 ± 6.04	- ESS mean score = 23.00 ± 6.04
- N of medications (mean) = 5.60 ± 2.51	- N of medications (mean) = 5.60 ± 2.51
- SPMSQ mean score = 4.20 ± 2.49	- SPMSQ mean score = 4.20 ± 2.49
- FAB mean score = 4.80 ± 3.56	- FAB mean score = 4.80 ± 3.56
- NPI mean score = 2.60 ± 2.67	- NPI mean score = 2.60 ± 2.67

At discharge
No significantly improvement was shown!

First Trial:

Results 2/2

Almere Model Questionnaire (1)

Code	Construct	Definition	%
ANX	Anxiety	Evoking anxious or emotional reactions when using the system	0
ATT	Attitude	Positive or negative feelings about the appliance of the technology	80
FC	Facilitating condition	Objective factors in the environment that facilitate using the system	100
ITU	Intention to use	The outspoken Intention to Use the system over a longer period in time	60
PAD	Perceived adaptivity	The perceived ability of the system to be adaptive to the changing needs of the user	60
PENJ	Perceived enjoyment	Feelings of joy or pleasure associated by the user with the use of the system	100
PEOU	Perceived Ease of use	The degree to which the user believes that using the system would be free of effort	40

First Trial:

Results 2/2

Almere Model Questionnaire (2)

Code	Construct	Definition	%
PS	Perceived sociability	The perceived ability of the system to perform sociable behavior	80
PU	Perceived usefulness	The degree to which a person believes that using the system would enhance his or her daily activities	80
SI	Social influence	The user's perception of how people who are important to him think about him using the system	60
SP	Social presence	The experience of sensing a social entity when interacting with the system	40
TRUST	Trust	The belief that the system performs with personal integrity and reliability	60
USE	Use/Usage	The actual use of the system over a longer period in time	60

Conclusion

Thank you!

- Acknowledgements

The research leading to these results has received funding from the European Union Horizons 2020 – the Framework Programme for Research and Innovation (2014-2020) under grant agreement 643808 Project MARIO “Managing active and healthy aging with use of caring service robots”

- Contact

<http://www.mario-project.eu/>