Silver Economy Forum
BUILDING TOGETHER THE SILVER FUTURE

Giovedi 13 giugno 2019
1° sessione: Ageing population, le sfide del futuro

La Tecnologia al Servizio dell'Anziano

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Direttore SC Geriatria a direzione universitaria
Direttore Dipartimento Cure Geriatriche, OrtoGeriatria e Riabilitazione
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Professore Straordianrio di 1^ Fascia in Medicina Interna e Geriatria
Dipartimento Interdisciplinare di Medicina – Università degli Studi di Bari, Italy

Technology in geriatrics

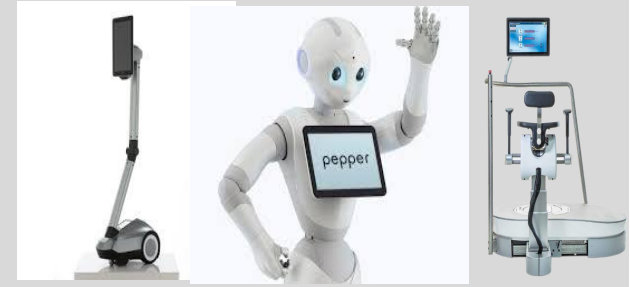
Alberto Pilotto[1], Raffaella Boi[1], Jean Petermans[2]

Which technologies?

1. Information and communication technologies (ICT)
- internet systems, telephone-based, webcams, videosys
- online services and electronic medical-health records

2. Assistive technologies (AT)
- sensors and warning systems
- smart homes tools
- telehealth or telemedicine tools
- video systems to interact with other people

3. Human–computer interaction technologies (HCIT)
- assistive robotics, service robots
- humanoid robots, companion-type robots
- exoskeletons, rehabilitation robots
- robots for cognitive activities and rehabilitation



Age Ageing 2018; 47 (6): 771-774

Technology in geriatrics

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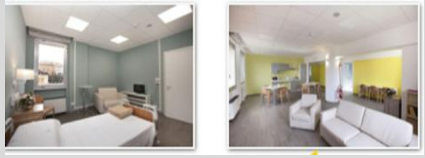
Clinical applications

1. ICT for Multidimensional Assessment

MPI_AGE, EUROSAF, SELFY-MPI

2. AT for housing and safety

Mo.Di.Pro. Project

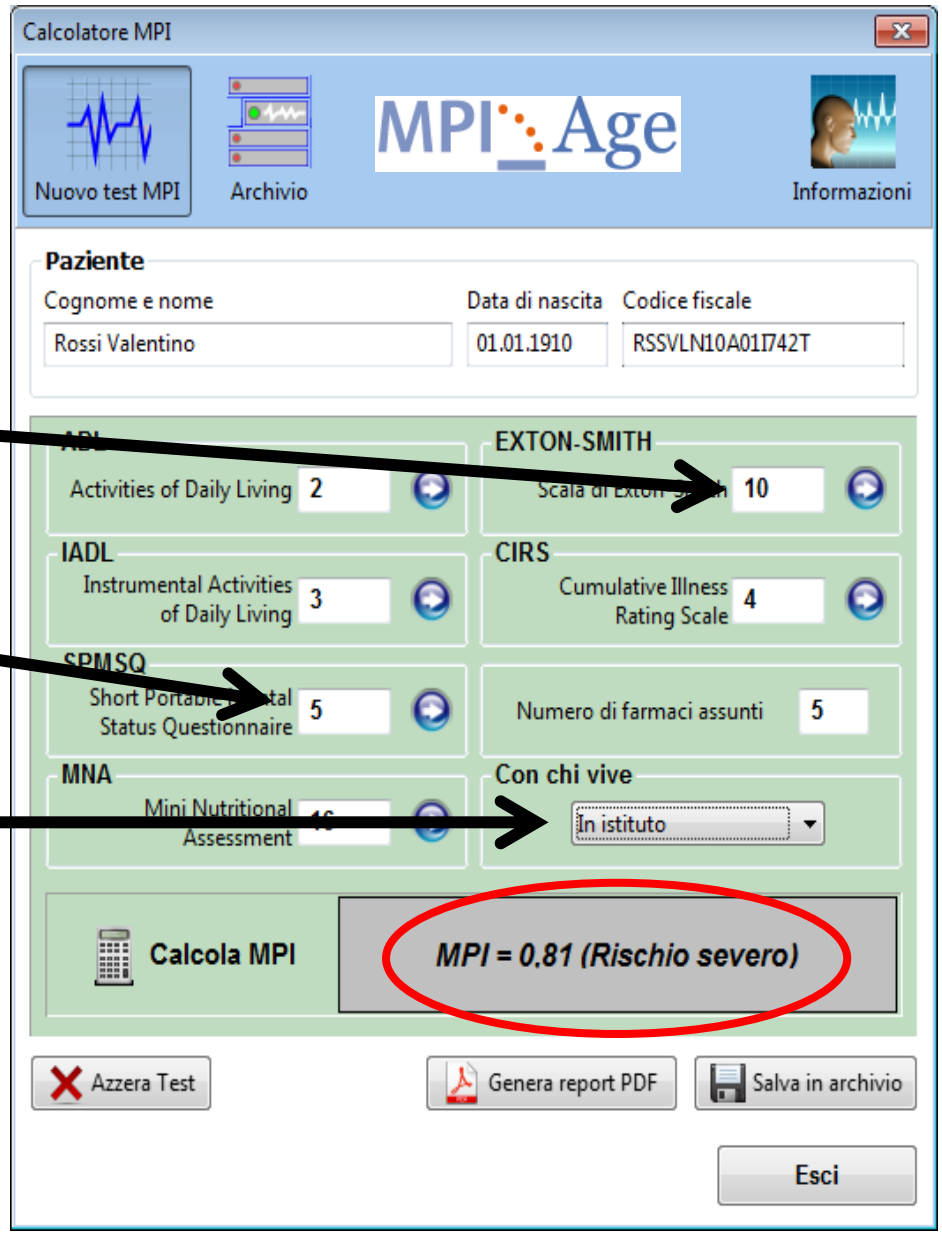


3. HCIT for mobility and rehabilitation

Hunova Project
RO.SA Project

Age Ageing 2018 Nov 1.47 (6): 771-4


Scheda S.VA.M.A.
Anagrafica
Cognome e nome
Mario Rossi
Data di nascita
17/05/1923
Età
88
Sesso
M
Necessità di assistenza sanitaria
Assistenza infermieristica (VIP):
35
compila scheda
Prevenzione - Trattamento Decubiti (VPIA):
10
compila scheda
Profilo dell'autonomia
Situazione cognitiva (VCOG):
5
compila scheda
Mobilità (VMOB):
11
compila scheda
Situazione funzionale (Attività di base - ADL):
29
compila scheda
Supporto della rete sociale (VSOC):
(famiglia, privato, vicinato e volontariato)
100
Patologie prevalenti
Patologie principali che concorrono a
determinare la situazione di non-autosufficienza
Demenza
Calcola MPI
Salva scheda
Chiudi scheda


Calcolatore MPI
Nuovo test MPI
Archivio
MPI Age
Informazioni
Paziente
Cognome e nome
Rossi Valentino
Data di nascita
01.01.1910
Codice fiscale
RSSVLN10A01I742T
ADL
Activities of Daily Living
2
EXTON-SMITH
10
IADL
Instrumental Activities
of Daily Living
3
CIRS
Cumulative Illness
Rating Scale
4
SPMSQ
Short Portable
Status Questionnaire
5
Numero di farmaci assunti
5
MNA
Mini Nutritional
Assessment
Con chi vive
In istituto
Calcola MPI
MPI = 0,81 (Rischio severo)
Azzera Test
Genera report PDF
Salva in archivio
Esci

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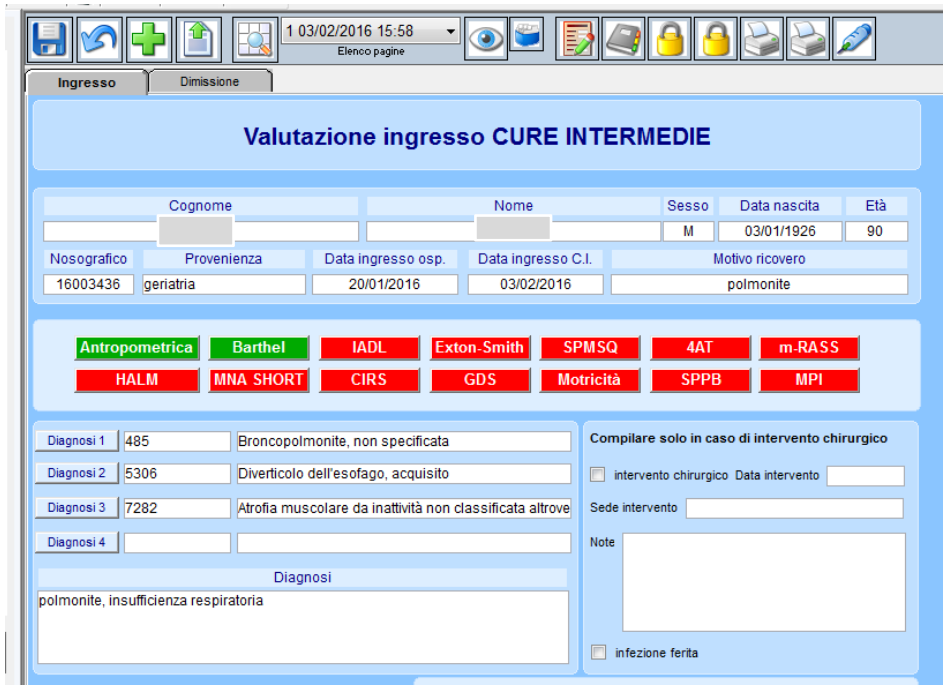
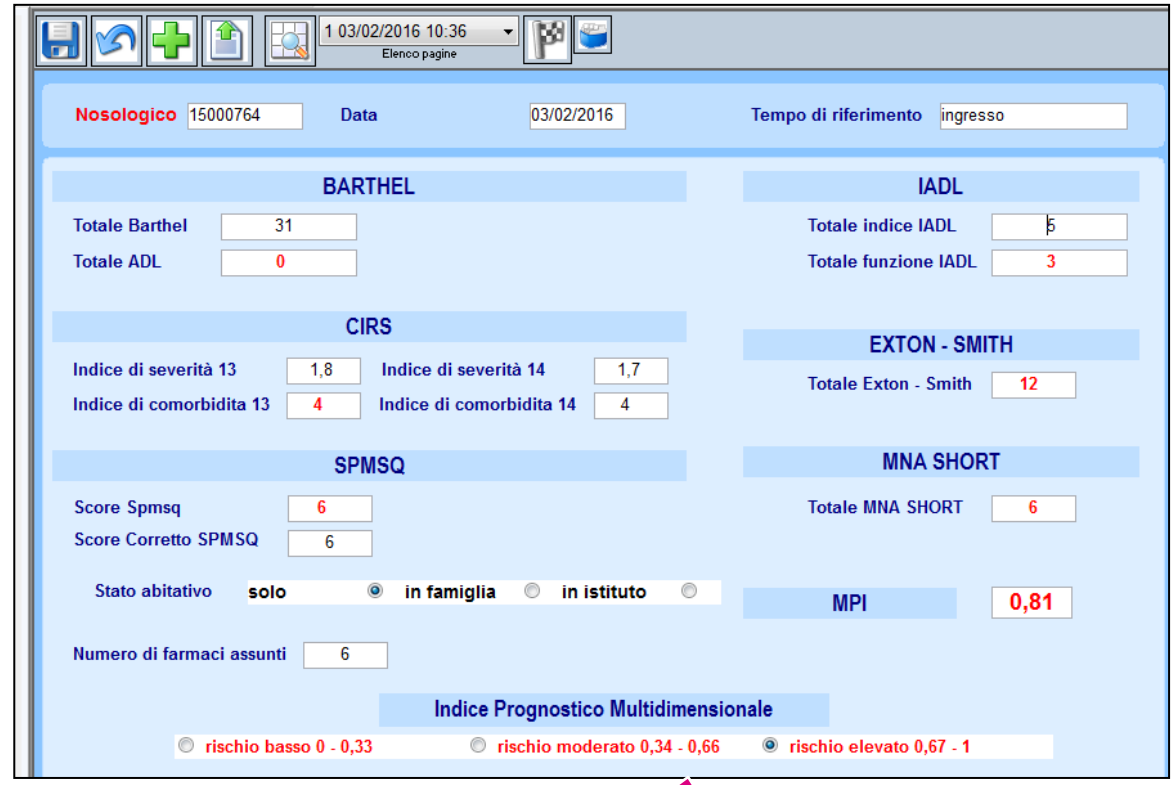
Ospedale di rilievo nazionale e di alta specializzazione

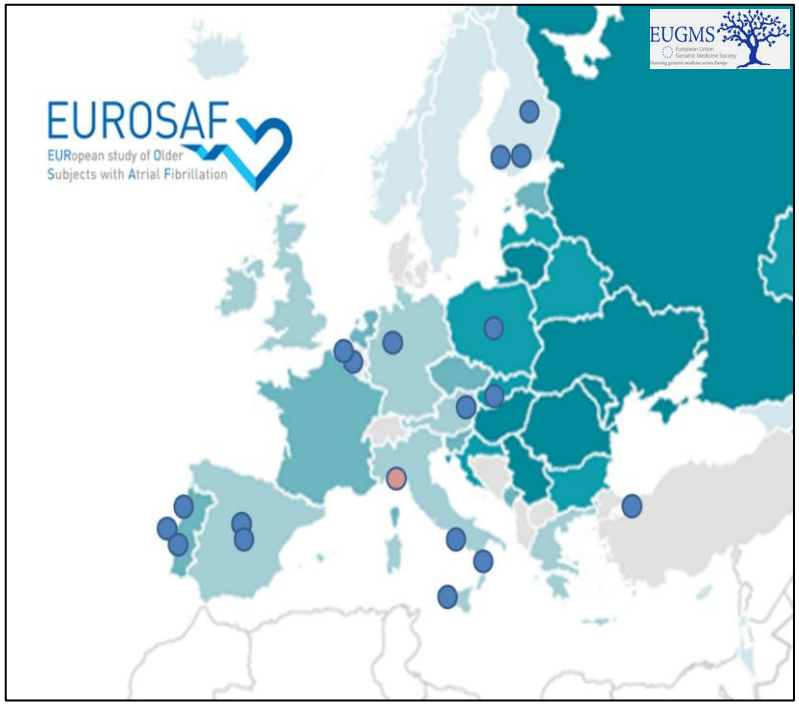
Dipartimento Cure Geriatriche, OrtoGeriatria e Riabilitazione
Livello 3 "Area delle Fragilità"
E.O. Ospedali Galliera
Ospedale di Rilievo Nazionale e Alta Specializzazione

Integrated Geriatric Clinical Record for physicians and nurses





CGA → MPI



SELFY_MPI

New application for android, iPhone and iPad

La fragilità multidimensionale dell'anziano ambulatoriale: Progetto Selfy_MPI SIGOT

Approvato CER 20.05.2019

Development of a smart post-hospitalization facility for older people by using domotics, robotics, and automated tele-monitoring

Figure 1 - The layout of the prototype apartment, where the environment sensors have been highlighted. Blue: RGBDsensors; green circles: localization tags; purple: PIR; red: video-cameras.

- RGBD sensors
- Cameras
- Passive Infra-Red
- Central Server

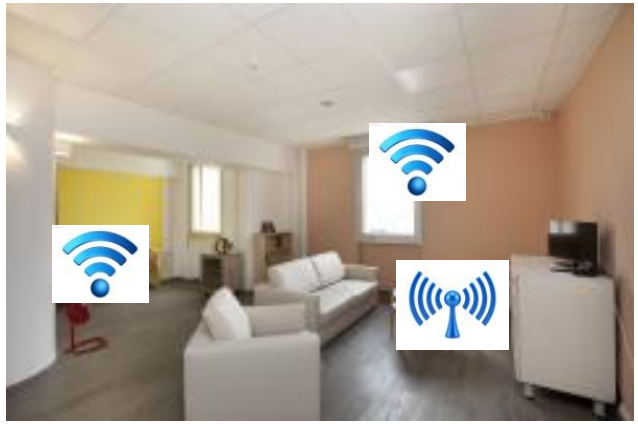
AIMS

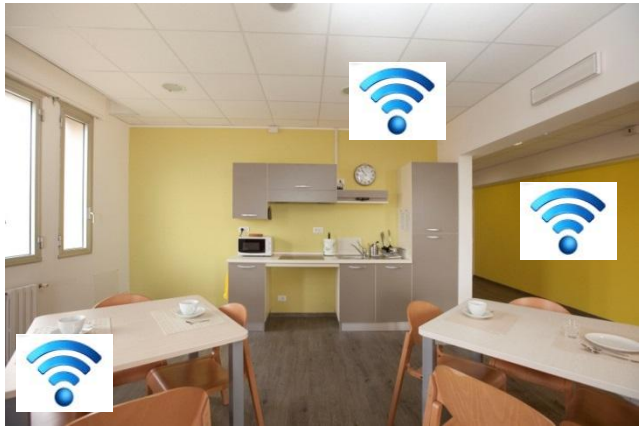
1. To develop a prototype of a smart technology-based facility for older patients who need a transitional care period after discharge from the hospital
2. To evaluate the usefulness of technologies for an automatic monitoring of motility, functional and clinical conditions in older subjects

Patrone et al. Geriatric Care 2019; 5:8122

DAD
DIBRIS

The Mo.Di.Pro. Technology





Equipment

1. An indoor **localization system** (Eliko KIO RTLS6) for continuous and un-ambiguous tracking of persons
2. **Passive Infra-Red (PIR) Sensors** detecting whether there is movement in the sensed area
3. Cabinet **doors' sensors** (SparkFun7 Luminosity Sensor) for the detection of cooking and eating activities
4. **Chair occupancy sensors** (SparkFun Force Sensitive Resistor) positioned on chairs and the sofa
5. Sensors distributed in the environment with measurements obtained by **wearable accelerometers** (LG G Watch R5 equipped with a triaxial accelerometer)
6. A set of **vital parameters** (blood pressure, heart rate, oxygen saturation, glucose) are collected daily through wearable and non-invasive devices

Patrone et al. Geriatric Care 2019; 5:8122

DAD DIBRIS

The Mo.Di.Pro. Technology

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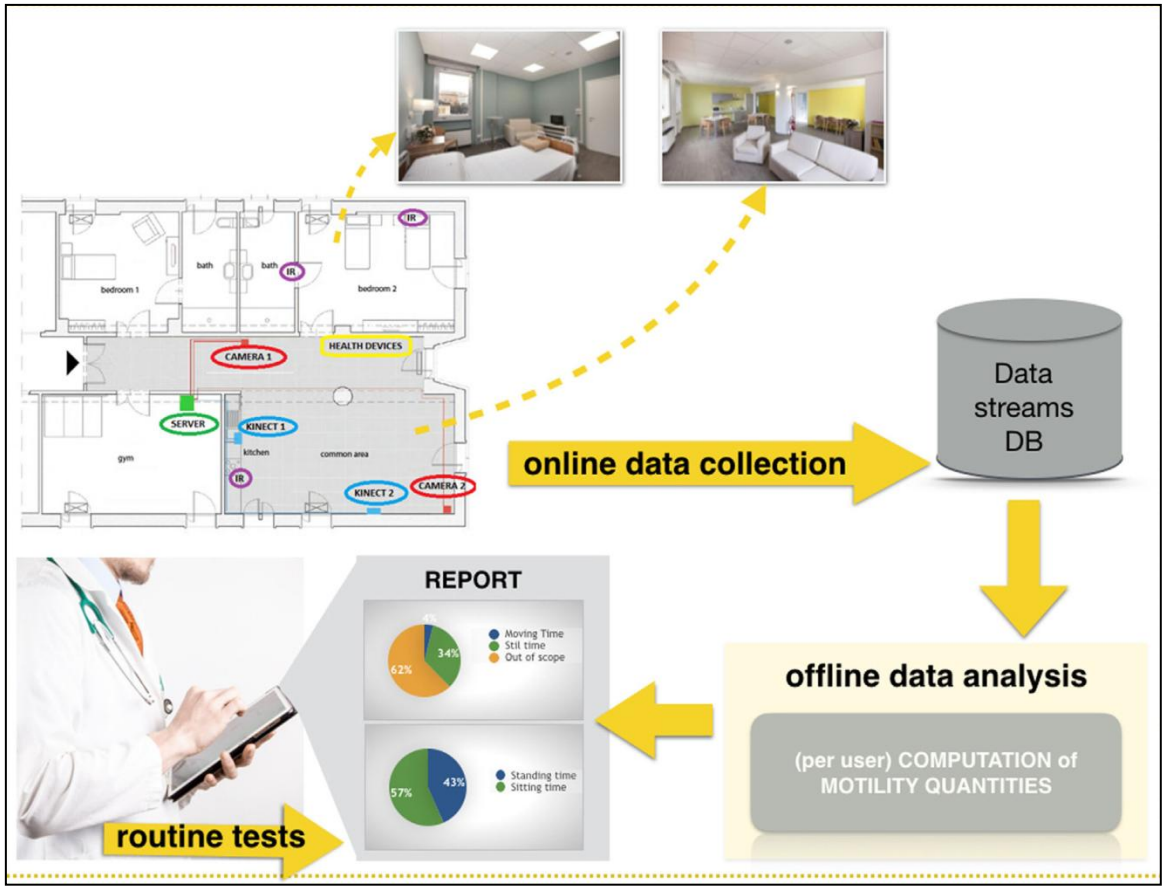
MoDiPro facility and the generated data flow

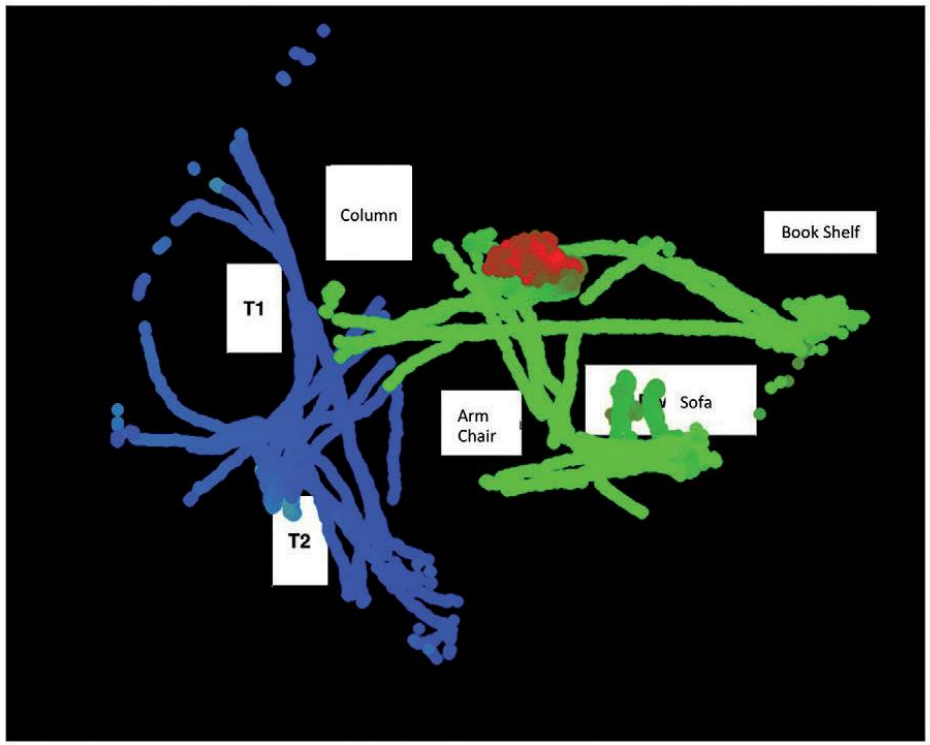


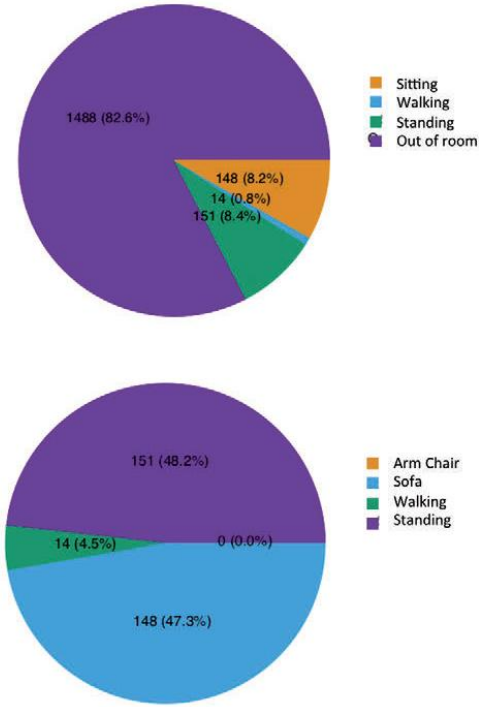
A **continuous monitoring of patients' location and activities** was given by analysing the measurements obtained from ambient and wearable sensors by means of appropriately designed **signal processing and machine learning algorithms**.

Martini et al, Frontiers Dig Human 2018; doi: 10.3389/fdigh.2018.00006

Development of a smart post-hospitalization facility for older people by using domotics, robotics, and automated tele-monitoring

Patrone C, Cella A, Martini C, Pericu S, Femia R, Barla A, Porfirione C, Puntoni M, Veronese N, Odone F, Casiddu N, Rollandi, GA, Verri A, Pilotto A





Maps and pie charts summarizing 120 minutes of activities: patient No 3

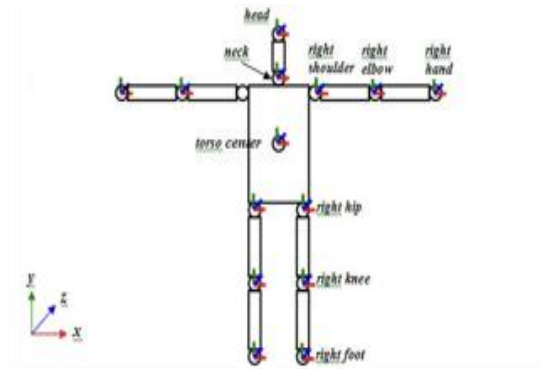
Data collected by two environment sensors (trajectories coded in blue and green). Red area indicated the person when sitting. Pie charts summarize the statistics of the amount of time spent on different conditions

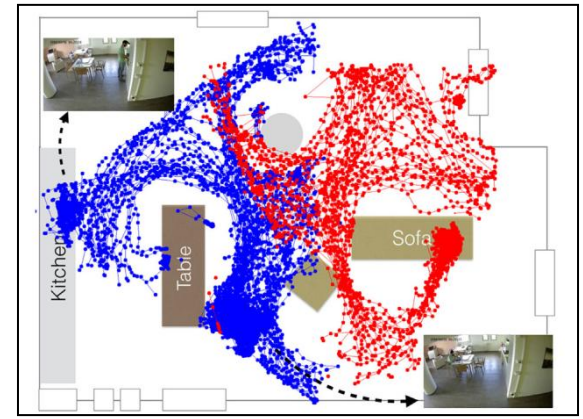
Patrone et al. Geriatric Care 2019; 5:8122

Data-Driven Continuous Assessment Of Frailty in Older People

Chiara Martini, Annalisa Barla*, Francesca Odone*, Alessandro Verri*, Alberto Cella^, Gian Andrea Rollandi^ and Alberto Pilotto^*

ASUS Xtion Pro RGBD camera





?

$$\mathrm{MI} = (1-\alpha)\left(\frac{T_{\mathrm{sit}} + TS}{TT}\right) + \alpha\left[C\left(1 - \frac{TR_{2\mathrm{sit}} + TR_{2\mathrm{st}} + W + S}{TT}\right)\right]$$

- Time spent sitting
- Time spent standing
- Total Time
- Nº Postural changes: Stand to Sit
- Nº Postural changes: Sit to Stand
- Nº Instance of Walk
- Total Time
- Stop events

Motility Index (MI)

Value from 0 to 1

Martini et al, Frontiers Dig Human 2018; doi: 10.3389/fdigh.2018.00006

Data-Driven Continuous Assessment Of Frailty in Older People

Estimated Motility Index (MI)
on 10 active and healthy volunteers
yellow bars = 5 young , green bars = 5 older subjects

Clinical and Functional Assessment

Short Physical Performance Battery (SPPB)
3 tests: *balance, gait speed, sit-to-stand 5x*

Hand Grip: strength of the upper arm

Multidimensional Prognostic Index (MPI)
8 domains : ADL, IADL, SPMSQ, EES, MNA, CIRS, Drugs, co-habitation

Conclusions

In clinical practice functions and activities are usually estimated through medical tests and questionnaires performed sporadically.
Continuous automatic assessment may help physicians in evaluating functions and health status by complementing their assessments with **quantitative** and **non sporadic** measurements.

Martini et al, Frontiers Dig Human 2018; doi: 10.3389/fdigh.2018.00006

ISTITUTO ITALIANO DI TECNOLOGIA

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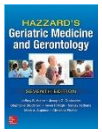
Hunova robot and fall prevention in older people

movendo technology

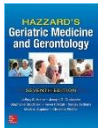
enabling people



Risk Factors for Falls in Older Adults 1

Domain	Risk Factor	Association
Psychosocial and demografic	Advanced age	+++
	Female gender	++
	Living alone	++
	History of falls	+++
	ADL limitations	+++
Medical	Stroke	+++
	Parkinson disease	+++
	Incontinence	++
	Acute illness	++
	Arthritis	++
	Dizziness	++
Medications	Psychoactive medication	+++
	Antihypertensive	+
	Polypharmacy (> 4 medications)	+++

Lord SR. Chapter 48. Falls. H*azzard's Geriatric Medicine and Gerontology, 7th Edition, 2017: 723-731*



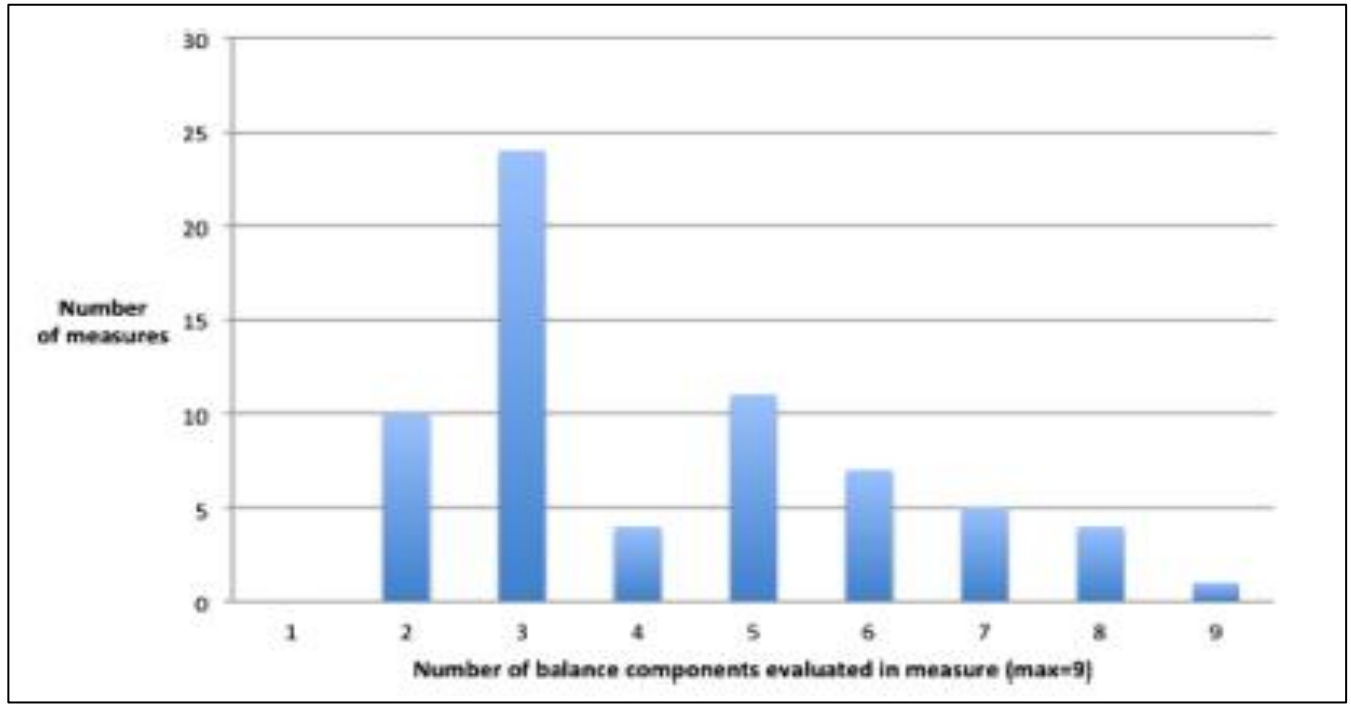
Risk Factors for Falls in Older Adults 2

Domain	Risk Factor	Association	
Balance and mobility	Impaired stability when standing	++	1
	Impaired stability when leaning	+++	2
	Inadequate response to ext. perturbation	+	3
	Impaired gait and mobility	++	4
	Impaired ability in standing up	++	5
	Impaired ability with transfers	++	6
Sensory and neuromuscolar	Visual acuity, visual field loss	++	
	Visual contrast sensitivity	+++	
	Reduced periphereal sensation	+++	7
	Muscle weakness	+++	
	Poor reaction time	+++	8
Neuropsychological	Impaired cognition, depression	+++	9
Enviromental	Poor footwear, ambient barriers	+	

Lord SR. Chapter 48. Falls. H*azzard's Geriatric Medicine and Gerontology, 7th Edition, 2017: 723-731*

Using the Systems Framework for Postural Control to Analyze the Components of Balance Evaluated in Standardized Balance Measures: A Scoping Review

Number of Balance Components Assessed in 66 studies included in the study

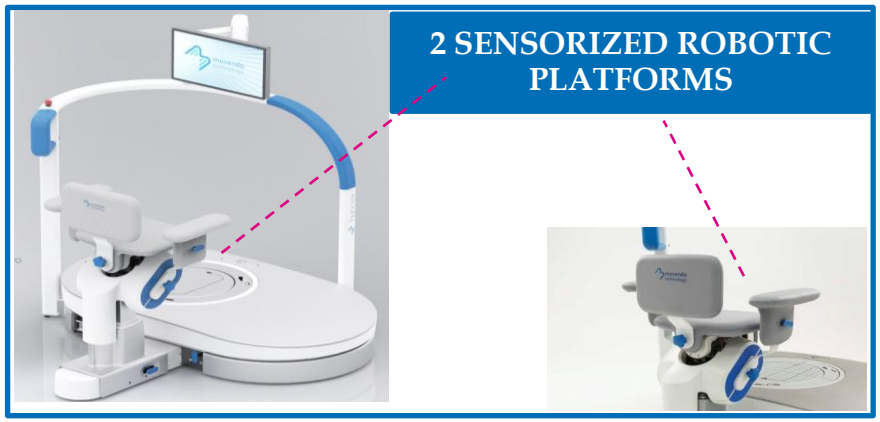


Conclusions: Standardized balance measures provide only partial information on postural control and omits important components of balance related to avoiding falls.

Sibley KM et al., Arch Phys Med & Rehabil 2015; 96: 122-32

Robotic assessment 1

Hunova combines 2 sensorized mechatronic platforms, under the seat and the platform, and a wearable sensor for full body mobilization



By using the robotic platforms, hunova evaluates patients' functions in **seated** and **standing** positions as well as in **static**, **dynamic** and **perturbating** conditions providing biofeedback in real time **in order to develop a tailored sensori-motor rehabilitation program**

CLINICAL-ROBOTIC EVALUATION OF FALL RISK IN OLDER PEOPLE

Study Popolation

150 subjects aged ≥65 years consecutively admitted to the Frailty Center of the CUROGE Department, Galliera H, Genoa, IT

Study Protocol

- ✓ **CGA-based MPI:** ADL, IADL, SPMSQ, MNA, EES, CIRS, Drugs, Co-hab.
- ✓ **Physical performance tests:** Gait Speed, Hand Grip, SPPB, TUG, PASE
- ✓ **Laboratory tests**
- ✓ **Body-comp (DEXA)**
- ✓ **Robotic balance evaluation**

12-month follow-up

Primary outcome: Falls

Secondary outcomes: hospital admission, NH admission, death

…. NEXT (ONGOING) STEPS….

To validate an “integrated” intervention program “tailored” on the basis of the clinical, functional and robotic parameters





RO.SA Project: Physical activity by using «humanoid» robot in subjects with Sarcopenia

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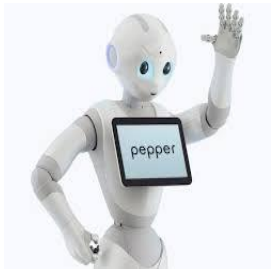
Scuola di Robotica®



Inclusion Criteria

Subjects aged ≥ 75 years with sarcopenia or pre-sarcopenia

Basal Assessment

BIA, HandGrip, SPPB, CGA-based MPI

Group 1: 20 subjects
2 sessions /week for 8 weeks
Protocol of Group Exercises
TUTOR: Physioterapist

Group 2: 20 subjects
2 sessions/week for 8 weeks
Protocol of Group Exercises
TUTOR: «PEPPER ROBOT»

Stretching degli arti inferiori (tricipite surale). Sostenere la schiena appoggiando le mani sulla sedia, estendere un ginocchio sino a che la punta della scarpa tocchi il pavimento; fletterepoi la caviglia portando verso di voi la punta del piede e contare sino a 5. Ripetere 10 volte per arto.

gli arti superiori. Tenere i pesetti in mano con i gomiti flessi; 'erticalmente entrambe le braccia portando I pesetti verso l'alto, ta.
volte.

Assessment After Intervention

BIA, HandGrip, SPPB, CGA-based MPI, QOL, Human-Computer Interaction Questionnaire

Technology in geriatrics

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Key points

- ICTs, ATs and HCITs provide innovative solutions to improve housing, communication, personal safety, mobility and rehabilitation of older subjects
- Psychosocial and ethical issues, acceptance by end-users, costs and the time of intervention may impair a broad use of these technologies in older age
- **A great effort in interdisciplinary collaboration is necessary to integrate technology into existing health and social service systems**

Age Ageing 2018; 47 (6): 771-774

Ministero della Salute
DIREZIONE GENERALE DELLA RICERCA E DELL'INNOVAZIONE IN SANITA'
UFFICIO 4
Viale Giorgio Ribotta, 5 - 00144 Roma

MULTIPLAT-AGE

REGIONE LIGURIA

	Codice WF		**NET-2016-02361805**	
	Titolo		**Development and implementation of common strategy for the management of community-dwelling older subjects with multimorbidity and polypharmacy: integration with a multicomponent intervention platform by using domotic, robotic and telecare systems (MULTIPLAT_AGE)**	
	Centro Coordinatore italiano della Rete		**E.O. Ospedali Galliera, Dipartimento CUROGE – Genova**	
	Principal Investigator		**Alberto Pilotto**	
n.	**Regione**	**Ente/Ospedale**	**WP**	**Titolo del progetto**
1	Liguria	**E.O. Ospedali Galliera, Dipartimento CUROGE Genova**	**1**	**Development and validation of a care transition model in a home-oriented protected area by using high technology systems for the management of multimorbid and polytreated older people (PRO-HOME)**
2	Campania	AOU Salerno & Università Federico II, Napoli	2	The ICT based integrated care of chronic multimorbid patients at their home: the EASYDOM trial.
3	Piemonte	AOU Novara e Università del Piemonte Orientale, Novara	3	Evaluation of appropriateness of drug prescriptions in the elderly and development of programs to improve it in Piedmont.
4	Liguria	IRCCS AOU San Martino e UniGE, DINOGMI, Genova	4	Combined training with action observation and exergames (eAction-training) to improve balance and gait stability in elderly subjects at risk for falls.
5	Calabria	AO Mater Domini, UO Neurologia e Università di Catanzaro	5	Clinical efficacy and neurophysiological correlates of cognitive stimulation in aged subjects with mild and moderate cognitive impairment.

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Ospedale di rilievo nazionale e di alta specializzazione

Department of Geriatric Care, OrthoGeriatrics and Rehabilitation
" Frailty Area"
E.O. Galliera Hospital – Genoa, Italy
National Relevance & High Specialization Hospital

MPI Age

http://www.mpiage.eu

Mpi_Age

effichronic

https://www.galliera.it/20/58/strutture-sanitarie/178/progetto-effichronic

Effichronic

EUROSAF
EUROpean study of Older Subjects with Atrial Fibrillation

http://eurosaf.eu/home.html

Grazie per l' attenzione