APPROPRIATE CARE PATHWAY

Deliverable 10

FINAL IMPACT ASSESSMENT AND SUSTAINABILITY

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Scope of the document

According to the Work Package 10, the *Deliverable 10.1 Final impact assessment and sustainability* presents the lessons from the APPCARE model implementation in the participating pilot sites (Treviso, Rotterdam and Valencia). The lessons learned include:

- The impact assessment of the deployment of the APPCARE model in the three pilot sites.
- The description of the barriers that could hinder the model deployment and recommendation to overcome them.
- The identification of other EU Member States that may be good candidate for adopting the APPCARE model.

To this aim, this document includes main insights from previous deliverables relevant for its purpose, specifically D6.1 Interoperability Solution, D7.1 Hospital Care Management, D8.1. Coordinated Care Model and D9.1. Preventive Care Model.

Furthermore, as a first step an impact evaluation of the overall project was also performed in order to measure the effects of the project. In particular, the project evaluation assesses the project performance in terms of effectiveness (measurement of results), allowing to evaluate whether the project goals are met.

Therefore, Deliverable 10.1. includes not only the APPCARE model impact evaluation but also the evaluation of the project performance, providing judgment on both of them, as well as any other outcomes they may have.

Distribution list

This document is a public and official deliverable that will be upload on the Participant Portal (for European Commission approval) and on the APPCARE project website at the following link:
http://www.app-care.org/deliverables/

History of changes

Version	Date	Main changes
APPCARE D10.1 _V.1	3TH June 2019	First draft
APPCARE D10.1 _V.2	27th June 2019	Draft to be circulated to partners
APPCARE D10.1 _V.3	28th June 2019	Feedback received from partners
APPCARE D10.1 _V.4	29th June 2019	Final version circulated to partners
APPCARE D10.1 _V.5	30th June 2019	Final version submitted

Disclaimer

Glossary

Acronym	Definition
APPCARE	Appropriate care for frail elderly patients: a comprehensive model
AUDIT C	Alcohol Use Disorders Identification Test - Consumption
BRASS	The Blaylock Risk Assessment Screening Score
BSI-18	Brief Symptoms Inventory-18
CAM	Confusion Assessment Method
CIRS	Cumulative Illness rating Scale
CDR	Clinical Dementia Rating
CGA	Comprehensive Geriatric Assessment
FES-I	Falls Self-efficacy Scale
GARS	Groningen Activity Restriction Scale
HRQoL	Health related Quality of Life
LSCAPE	Living Standards Capabilities for Elders
MMSE	Mini Mental State Examination
MRQ-10	Medication Risk Questionnaire (10 items)
PCSQ	Perceived Community Support Questionnaire
SPMSQ	Short Portable Mental Status Questionnaire
TFI	Tilburg Frailty Index

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1. Introduction

The *APPCARE - Appropriate care for frail elderly patients: a comprehensive model* project is a research project granted under the 3rd Health Programme of the European Commission. The APPCARE project is aimed at creating a new model for the management of frail elderly people (+75 years older). The objective of this new model is to demonstrate how an innovative and comprehensive management of complex and co-morbid clinical situations may maintain or improve patient's health status, and thus optimize health care systems.

According to the APPCARE proposal, the specific objectives of the APPCARE project are:

- Provide a geriatric assessment of +75 patients health conditions.
- Establish geriatric-oriented coordinated care pathways agreed by all the involved caregivers.
- Facilitate the hospital care pathways for +75 patients in order to reduce hospital stays.
- Set up of programs for frailty and co-morbidity risk factors detection.

In order to achieve these objectives, during the initial 9 months of the APPCARE project a review of best practices of integrated care and optimization of hospital care pathways for frail older adults, including preventive initiatives at primary and secondary level, was performed, together with a deep analysis of current situations in the involved pilot sites. On the basis of these best practices review, the APPCARE model was designed including three different modules: a hospital management module (including a Comprehensive Geriatric Assessment - CGA), a coordinated care module and a preventive care module, explained in detail in D7.1. Hospital Care Management, D8.1. Coordinated Care Model; D9.1. Preventive Care Model, respectively.

The APPCARE model was deployed during 24 months in three pilot sites: Treviso (Italy), Rotterdam (the Netherlands) and Valencia (Spain). In each pilot site, the APPCARE model was adapted to meet the particularities of each context (context adaptation of the model is explained in detail in D7.1., D8.1. and D9.1.). The sample size estimation was 3000 participants to be assessed through CGA in the hospital management phase for the whole project, although the final participants number was even higher (N=3725). On the basis of the CGA assessment, participants were referred to care pathways. Further assessments and follow-ups were conducted during the experimentation phase of the APPCARE model in order to conduct an impact assessment of the APPCARE model.

In the following sections the impact of the APPCARE project and the APPCARE model will be presented. Firstly, in section *2. Performance evaluation of the APPCARE project,* the performance of the APPCARE project will be assessed in terms of effectiveness (measurement of results). Then, in section *3. Impact assessment and sustainability of the APPCARE model* is described.

2. Performance evaluation of the APPCARE project

The project performance in terms of effectiveness (measurement of results and achievement of objectives) was measured according to the following indicators: process, outputs, outcome (achievement % and indicators). The indicators of achievement of the objectives (process, outputs and outcome indicators) were specified in the Grant Agreement of the project. The results of the project performance evaluation are reported in detail in the following tables 1 and 2. In general terms, the results indicated that the project was implemented as planned and reached the objectives.

Table 1. *Effectiveness evaluation of the specific objectives of the project*.

Specific Objective 1	**Provide a geriatric assessment of +75 patients health conditions**				
Process Indicator	n° of assessment performed	***Target***	3000	***Achieved***	3725
Output indicator	n° of clinical pathways set up accordingly	***Target***	50% of assessed patients	***Nearly Achieved***	45.5% (n=1696)
Outcome/Impact indicator	n° of established care pathways needing adjustments within 6 months	***Target***	< 20%	***Achieved***	No adjustments were made in any of the three pilot sites.
Specific Objective 2	**Establish geriatric-oriented coordinated care pathways agreed by all the involved caregivers**				
Process Indicator	n° of clinical pathways set up on the geriatric assessment basis	***Target***	> 75%	***Achieved***	Treviso: 6 Rotterdam: 5 Valencia: 2
	% patient's health data stored on a shared IT tool	***Target***	> 80%	***Achieved***	100%
	% of stored health data consultations	***Target***	> 80%	***Achieved***	100%
Output indicator	n° of care interventions achieved accordingly to the pathway	***Target***	> 70%	***Not fully Achieved***	45.5% (n=1696)
Outcome/Impact indicator	Hospital admission rate	***Target***	- 10% compared with current situation	***Partially Achieved***	Treviso: no data available Rotterdam: -5.1% Valencia: -67.4%
	n° of caregivers accessing and feeding the shared ICT tool	***Target***	> 80% of potentials users	***Achieved***	100% of caregivers from partner institutions involved in the project
Specific Objective 3	**Facilitate the hospital care pathways for +75 patients in order to reduce hospital stays**				
Process Indicator	n° of patients assessed	***Target***	1500	***Achieved***	2860
Output indicator	Hospital stay length rate	***Target***	< 2% compared with current situations	***Partially Achieved***	Treviso: no data available Rotterdam: +10.7% Valencia: -30.53%
Specific Objective 4	**Set up of programs for frailty and co-morbidity risk factors detection**				
Process Indicator	n° of frailty risk screening performed	***Target***	1500	***Achieved***	3725

	% of pharmacological reconciliation performed	***Target***	100%	***Achieved***	Pathway only activated in Treviso and Rotterdam
	% of training activities for patients and/or informal caregivers	***Target***	75%	***Achieved***	100%
Output indicator	n° of early frailty risk detected	***Target***	n.a.	***Achieved***	Treviso: no data available Rotterdam: 523 (51.8%) Valencia: 147 (65.9%)

In the APPCARE research proposal, the following specific objectives and actions were agreed to overcome the problems detected in the literature and best practices review. The table below shows the problems detected, the main cause(s) of each of these problems, the APPCARE objective and actions addressing each of these problems (as described in the Grant Agreement). An extra column was added to the original table in order to present the effectiveness evaluation (% achievement and the justification behind) of these actions.

Table 2. *Effectiveness evaluation framework. Analysis of the actions identified to respond to specific objectives designed to overcome existing barriers and problems. Achievement rates in APPCARE.*

Problem detected	Cause(s)	Objective	Action(s)	Achievement % and justification
Lack of geriatric competences in +75 care management	+75 patients are often complex patients and their management usually need specific competence	Provide a geriatric assessment of +75 health conditions	Application of CGA tool; its results will drive the following clinical decision path and the creation of a specific and comprehensive care pathway with a geriatric approach	100% CGA applied in all three pilot sites. Participants were referred to the different care pathways based on the CGA assessment
Fragmented care management	Lots of caregivers at different levels are involved in care activities, but not in a coordinated manner	Establish geriatric coordinated care pathways agreed by all the involved caregivers	Introduction of a care manager, in charge of the care pathways	100% In each pilot site, the care pathways were organised and conducted by specific care managers
	Lack of a shared information knowledge	Create a common health knowledge information base shared among all the caregivers	Set up an IT tool to ease health information sharing	80% The interoperability solution designed in the frame of the project granted the exchange of health data among the project partners and care professionals

				involved in the APPCARE project. However, finally due to privacy issues only project partners had access to the APPCARE general database
Many early symptoms of morbidity and frailty remain undetected	Elderly are reticent to talk about their growing impairment	Set up of programs for frailty risk factors detection	Application of CGA to screen risk factors	100% The same CGA was applied in all three pilot sites. CGA included several measures to detect symptoms of morbidity and frailty
Lack of patient's (and family informal caregivers) empowerment and awareness of their health conditions	They are not sufficiently trained on their health status and on possible self-care of their conditions	Increase the knowledge and awareness of patients and family caregivers	Training activities on the self-management of their health conditions and on risk factor to be monitored	100% In all pilot sites, participants were referred to specific care pathways to improve the health status.
Hospital stays of elderly people last longer than younger patients	+75 patients are often complex patients requiring specific geriatric competences	Facilitate the hospital care pathways for +75 patients in order to reduce hospital stays	Creation of a specific geriatric admittance area where a 48h of short-term intensive observation will be performed	75% A specific 48-hour short intensive observation period was established as part of the hospital care only in Treviso pilot site (n=2498).
Frequently hospital readmission within 30 days after discharge	Quick loss of functional hospital-related adverse outcomes incidence	Reduce hospital stay length in order to decrease the risk of adverse outcomes incidence	Creation of a specific geriatric admittance area where a 48h of short-term intensive observation will be performed	75% A specific 48-hour short intensive observation period was established as part of the hospital care in Treviso pilot site.
	Lack of or missed follow up	Guarantee the continuity of care and the correct information sharing	Set up of a specific patient's care pathway with a care manager responsible for it	100% In each pilot site, the care pathways were organised and conducted by specific care managers.

3. Impact assessment and sustainability of the APPCARE model

3.1. Background

The APPCARE model was designed in the frame of the APPCARE project with the objective to demonstrate how an innovative and comprehensive management of complex and co-morbid clinical situations, may maintain patient's health status in its clinical trajectory, optimizing health care systems. The deployment of the APPCARE model in the pilot sites is expected to lead to:

- Reduction of functional status loss (according to the patient's clinical trajectory)
- More appropriate and timely care interventions
- Reduction of avoidable/unnecessary hospital admission
- Reduction of hospitalization's adverse outcomes rate
- Reduction of readmission rate
- Reduction of unnecessary diagnostics and adverse outcomes related to pharmacotherapy
- Increased patient and informal caregivers' empowerment and self-management
- Early monitoring of frailty conditions, health care delivery optimization and savings

The APPCARE model presents two different phases: Hospital Care and Continuity of Care. The Hospital Care phase is composed by the **Hospital Care Management** module (explained in detail in D7.1.), which is delivered by health professionals to patients ≤ 75 years old coming from emergency department or admittance area. The Hospital Care Management was implemented in the three pilot sites (Treviso, Rotterdam and Valencia) following these general requirements:

- Standardized application of the Comprehensive Geriatric Assessment (including pre-morbid Barthel Index – health status) within 48 hours after the hospital admittance;
- Assessment of the social and environmental context of the patient (in particular, the living conditions);
- 48h intensive care (short term observation period);
- The provision of a discharge plan including diagnosis (according to International classification ICD9) + co-morbidity and indication on where the patient is addressed.

These general requirements of the Hospital Care Management were followed by all three pilot sites; however, several context-adaptations were made in order to fit the particularities of each context (namely, different instruments to measure the same variable or some extra measures were included in the CGA in some pilot sites, extra inclusion criteria were added in Valencia pilot site: NO living in residential care facilities). Table 3 shows the measures included as part of the GCA in all three pilot sites:

Table 3. *Comprehensive Geriatric Assessment measures*.

TREVISO PILOT SITE	
VARIABLE	**INSTRUMENTS**
Severity of disease	HALM'S CRITERIA (Halm et al., 1998[1])

[1] Halm, EA., Fine, MJ., Marrie, TJ., et al. (1998). Time to clinical stability in patients hospitalized with community acquired pneumonia: implications for practice guidelines. JAMA, 279, 1452-1457.

Comorbidity	CIRS (Miller et al., 1992[2])
Delirium	CAM (Ely et al., 2001[3])
Functional status	BARTHEL INDEX (Mahoney & Barthel, 1965[4])
Pressure ulcers risk	BRADEN SCALE (Bergstrom et al., 1987[5])
Dementia	SPMSQ (Pfeiffer, 1975[6]) (at patient's discharge)
Dementia	CDR (Hughes et al., 1982[7]) (at admission)
Discharge planning	BRASS INDEX (Blaylock & Cason, 1992[8])
ROTTERDAM PILOT SITE	
VARIABLE	**INSTRUMENTS**
Severity of disease	HALM's CRITERIA (Halm et al., 1998)
Comorbidity	CIRS (Miller et al., 1992)
Delirium	CAM (Ely et al., 2001)
Functional Status	BARTHEL INDEX (Mahoney & Barthel, 1965)
Risk of pressure ulcer	BRADEN SCALE (Bergstrom et al., 1987)
Dementia	MMSE (Folstein, Folstein, & Mchugh, 1975[9])
Discharge Planning	According to local protocol
Routine physiological measurements: Mean arterial pressure, Heart rate, Respiratory rate, Sodium (serum) (if available in patient file), Potassium (serum) (if available in patient file), Creatinine (if available in patient file), Hematocrit (if available in patient file), White blood cell count (if available in patient file).	
VALENCIA PILOT SITE	
VARIABLES	**INSTRUMENTS**
Comorbidity	CIRS (Miller et al., 1992)
Functional Status	BARTHEL INDEX (Mahoney & Barthel, 1965)
Risk of pressure ulcer	BRADEN SCALE (Bergstrom et al., 1987)
Dementia	SPMSQ (Pfeiffer, 1975)
Discharge Planning	BRASS INDEX (Blaylock & Cason, 1992)
Routine physiological measurements: Mean arterial pressure, Heart rate, Respiratory rate, Sodium (serum) (if available in patient file), Potassium (serum) (if available in patient file), Creatinine (if available in patient file), Hematocrit (if available in patient file), White blood cell count (if available in patient file).	

[2] Miller, MD., Paradis, CF., Houck, PR., et al. (1992). Rating chronic medical illness burden in geropsychiatric practice and research: application of the Cumulative Illness Rating Scale. Psychiatry Res, 41(3), 237-48.

[3] Ely, E.W., Margolin, R., Francis, J., May, L., Truman, B., Dittus, R., et al. (2001). Evaluation of delirium in critically ill patients: Validation of the Confusion Assessment Method for the Intensive Care Unit (CAM-ICU). Crit Care Med, 29, 1370-9.

[4] Mahoney, FI., & Barthel, DW. (1965). Functional evaluation: the Barthel Index. Md Med J, 14, 61-65.

[5] Bergstrom, N., Braden, BJ., Laguzza, A., & Holman, V. (1987). The Braden Scale for Predicting Pressure Sore Risk. Nurs Res, 36(4), 205-10

[6] Pfeiffer, E. (1975). A short portable mental status questionnaire for the assessment of organic brain defi cit in elderly patients. J Am Geriatr Soc, 23, 433- 41.

[7] Hughes, C. P., Berg, L., Danziger, W. L., Coben, L. A., & Martin, R. L. (1982). A new clinical scale for the staging of dementia. British journal of Psychiafy, 240, 56572.

[8] Blaylock A. & Cason C. (1992) Discharge planning: predicting patients' needs. Journal of Gerontological Nursing 18(7), 5 10.

[9] Folstein, MF., Folstein, S., & Mchugh, PR. (1975). Mini-Mental State: A practical method for grading the cognitive state of patients for the clinicians. J. Psych. Res, 12 (3), 189-198

In regard to the Continuity of Care phase, it comprises the **Coordinated Care Module (**explained in detail in D8.1.) **and the Preventive Care Module (**explained in detail in D9.1.)**.** These two care approaches include the care pathways to which participants assessed at the Hospital Care phase using the CGA were referred. The care pathways were adapted to the specific context of each pilot site; therefore, the differences between these two modules in which the care pathways were delivered make comparisons between pilot sites difficult, even though the continuity of care measures were similar between Rotterdam and Valencia pilot sites (Table 4). The Continuity of Care measures include functional, psychological and social variables which together with the medical variables measured in the Hospital Care phase offer a comprehensive assessment of the target group.

Table 4. *Continuity of care measures (Coordinated Care Module and the Preventive Care Module).*

ROTTERDAM PILOT SITE	
VARIABLE	**INSTRUMENT**
Physical activity and limitations	Questions from SHARE-FI study (Romero-Ortuno et al., 2010[10]) - How often do you engage in activities that require a low or moderate level of energy such as gardening, cleaning the car, or doing a walk? - In the last month, have you had too little energy to do the things you wanted to do? - Because of a health or physical problem, do you have any difficulty doing any of the following everyday activities: walking 100 metres and/or climbing one flight of stairs without resting?
Frailty	Tilburg Frailty Index (TFI; Gobbens, 2010[11])
Fear of falling	Question: Are you afraid of falling? and Falls Self-efficacy Scale (FES-I; Yardley et al., 2005[12])
Disability - Activities of Daily Living	Groningen Activity Restriction Scale (GARS; Suurmeijer & Kempen, 1990[13])
Polypharmacy	Medication Risk Questionnaire (MRQ-10; Barenholtz Levy, 2003[14])
Health-related QoL	SF-12v2 Health Survey (Ware et al., 1996[15])
Loneliness	Jong Gierveld Loneliness Scale (De Jong Gierveld & Van Tilburg, 2006[16])

[10] Romero-Ortuno, R, et al. (2010). A Frailty Instrument for primary care: findings from the Survey of Health, Ageing and Retirement in Europe (SHARE). BMC Geriatrics, 10, 57.

[11] Gobbens, R.J., van Assen M.A. Luijkx, K.G., Wijnen-Sponselee, M.T., Schols, J.M. (2010). The Tilburg Frailty Indicator: psychometric properties. Journal of the American Medical Directors Association, 11(5), 344-355.

[12] Yardley, L., Beyer, N., Hauer, K., Kempen, G., Piot-Ziegler, C., & Todd, C. (2005). Development and initial validation of the Falls Efficacy Scale-International (FES-I). Age and Ageing, 34, 614–9.

[13] Suurmeijer, T.P.B.M., & Kempen, G.I.J.M. (1990). Behavioural changes as an outcome of disease: the development of an instrument. International Journal of Health Sciences, 1, 189-194.

[14] Barenholtz Levy, H. (2003). Self-administered medication-risk questionnaire in an elderly population. The Annals of Pharmacothery, 37, 982–987.

[15] Ware, J. E., Kosinsiki, M., & Keller, S. D. (1996). A 12-item short-form health survey: Construction of scales and preliminary tests of reliability and validity. Medical Care, 34(3), 220-233.

[16] De Jong Gierveld, J., & Van Tilburg, T.G. (2006). A six-item scale for overall, emotional and social loneliness: confirmative tests on new survey data. Research on aging, 28:582–598.

Healthy lifestyles (alcohol use; smoking)	AUDIT C (Bush et al., 1998[17]) Smoking questions: - Do you smoke at the present time? - On average, how many cigarettes, cigars, cigarillos or pipes do you smoke a day?
Use of aids	Evaluate the use of: cane or walking stick, zimmer frame or walker, manual wheelchair, buggy or scooter, special eating utensils, personal emergency alarm, hearing device, glasses
Living condition	Alone, home-assisted by relatives or informal caregivers, homecare assistance with formal care givers, nursing home
Adherence to proposed coordinated pathway and user experiences	Follow-up questionnaire: - How satisfied are you with the care you received at the hospital 6 months ago? - On a scale of 0-10, how satisfied were you with the care you received at the hospital 6 months ago? - How satisfied are you with the care you received in the past 6 months? - On a scale of 0-10, how satisfied were you with the care you received in the past 6 months?
VALENCIA PILOT SITE	
VARIABLE	**INSTRUMENT**
Use of health care resources	- Nº visits to health care professionals (GP or specialist) - Nº visits to emergency room - Hospitalization (Yes/No); Nº of days
Polypharmacy	Medication Risk Questionnaire (MRQ-10)
Frailty	Tilburg Frailty Index (TFI)
Fear and falls	Falls Self-efficacy Scale (FES-I)
	Questions: - Did you fall in the past 12 months? - Are you afraid of falling?
Disability	Groningen Activity Restriction Scale (GARS)
Health-related QoL	SF-12v2 Health Survey
Loneliness	Jong Giervel Loneliness Scale
Distress	BSI-18 (Derogatis, 2001[18])
Social support	Perceived Community Support Questionnaire (PCSQ; Herrero & Gracia, 2007[19])
Living Standards	Living Standards Capabilities for Elders (LSCAPE; Breheny et al., 2013[20])

[17] Bush, K., Kivlahan, D. R., McDonell, M. S., Fihn, S. D. & Bradley, K. A. (1998). The AUDIT Alcohol Consumption Questions (AUDIT-C): An effective brief screening test for problem drinking. Archives of Internal Medicine, 158, 1789-1795

[18] Derogatis LR. (2001). Brief Symptom Inventory (BSI)-18. Administration, scoring and procedures manual. Minneapolis: NCS Pearson.

[19] Herrero, J. & Gracia, E. (2007). Measuring perceived community support: factorial structure, longitudinal invariance, and predictive validity of the PCSQ (Perceived Community Support Questionnaire). Journal Of Community Psychology, Vol. 35, No. 2, 197–217.

[20] Breheny, M., Stephens, C., Alpass, F., Stevenson, B., Carter, K., & Yeung, P. (2013). Development and validation of a measure of living standards for older people. Social Indicators Research, 114, 1035 – 1048.

The hospital care measures (medical variables) and the continuity of care measures (physical, psychological and social variables) were collected at baseline and at follow-up with some discrepancies between pilot sites due to differences in the duration of the care pathways. Table 5 shows the different data collection stages.

Table 5. *Data collection stages.*

TREVISO PILOT SITE	
Hospital Care variables	T0 at hospital phase (at hospital)
	T1 1 month after hospital discharge (at hospital)
Continuity of Care variables (same variables as in hospital care)	T0 at hospital phase (at hospital)
	T1 1 month after hospital discharge (at hospital)
ROTTERDAM PILOT SITE	
Hospital Care variables	T0 at hospital phase (at hospital)
	T1 between 1 and 6 months after hospital discharge (at hospital)
Continuity of Care variables	T0 at hospital phase (at hospital)
	T1 between 1 and 6 months after hospital discharge (at hospital)
VALENCIA PILOT SITE	
Hospital Care variables	T0 at hospital phase (at hospital)
	T1 up to 1 months after hospital discharge (at participant home)
	T2 up to 3 months after hospital discharge (at participant home)
Continuity of Care variables	At T1 (up to 1 months after hospital discharge at participant home)
	At T2 (up to 3 months after hospital discharge at participant home)

3.2. Impact assessment of the APPCARE model

The impact evaluation of the APPCARE model was conducted with a longitudinal, before and after study design. Data collected were analysed and interpreted for providing judgment on the effectiveness and efficiency and any other outcomes the APPCARE model may have in each of the pilot sites.

The objectives of the impact assessment are:

- To evaluate changes in health status over time in participants who were offered care according to the APPCARE model. Among them:
    - Reduction of functional status loss
    - Early monitoring of frailty conditions
    - Reduction of unnecessary diagnostics and adverse outcomes related to pharmacotherapy
- To evaluate the impact on health care resources of the implementation of the APPCARE model. Among them:
    - Reduction of avoidable/unnecessary hospital admission
    - Reduction of hospitalization's adverse outcomes rate
    - Reduction of readmission rate

In the following sections the impact assessment of the APPCARE model will be presented for each of the pilot sites.

3.2.1. Impact assessment of the APPCARE model - Treviso pilot site

Study sample

A total of 2498 participants were included in the APPCARE study in Treviso (Italy). The APPCARE model was implemented in the Treviso Regional Hospital Ca' Foncello, with patients enrolled both in the Emergency Room and in the Geriatric Department, where specific units for short observation period were active.

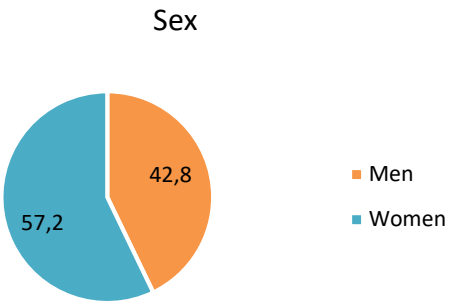
The APPCARE follow-up assessment at 1 months was offered to all recruited participants, with the exception of end-life patients addressed to hospice and palliative care (1% of the total sample) for ethical reasons. Almost the totality of the remaining patients agreed to participate and were assessed (T1). Unfortunately, a foreseen assessment at month 3 was not activated mainly due to a deep reorganization of regional health system (explained in more detail in D8.1.).

Table 6. *Flow of participants in Treviso pilot site APPCARE study.*

Participants assessed in Hospital Care		Continuity of Care		Patients included in the follow up (n=707)	
		Participants ADMITTED after Hospital Care	Participants DISCHARGED after Hospital Care	Participants ADMITTED after Hospital Care	Participants DISCHARGED after Hospital Care
2498	**N**	1437	1058	479	228
	%	57.6%	42.4%	67.7%	32.2%

Participants sociodemographic profile

A total of 2498 participants were included in the APPCARE study in Treviso (Italy). The average age of Treviso pilot site participants was 84.52 (DT=6.34). A total of 1426 (57.2%) were women and 1069 (42,8%) were men.



Participants health profile

At the Hospital Care module, all participants were assessed using a Comprehensive Geriatric Assessment that included several health variables: functional status measured using Barthel Index, risk of pressure ulcer measured using Braden Scale, dementia or cognitive impairment assessed using SPMSQ and comorbidity

measured using CIRS. In addition, the discharge planning was fed by the results of the Brass Index. Table 7 presents the results of the CGA for the total study sample.

Table 7. *Treviso participants' health profile at hospital phase (CGA; n=2498).*

	Functional Status (Barthel Index)	Risk of pressure ulcers (Braden Scale)	Dementia (SPMSQ)	Comorbidity (CIRS)	Discharge planning (Brass Index)
Mean	69.02	17.10	3.09	24.81	15.23
SD	31.59	6.69	2.94	5.94	7.34
Min.	0	6	0	12	0
Max.	100	18	10	51	30

One of the main variables to be assessed in the frame of the APPCARE project was functional status. This variable was measure at the hospital phase using the Barthel index in the total sample. The Barthel Index is an instrument that measures the capacity of the person for the execution of ten basic activities in daily life – including toileting, bathing, eating, dressing, continence, transfers, and ambulation–, obtaining a quantitative estimation of the subject´s level of dependency. Its scores range from 0 (totally dependent) to 100 (totally independent). At hospital phase, Treviso participants showed an average of 69.02 indicating that they were in general minimally dependent (interpretation of Sinoff, 1997[21]). According to this interpretation, Barthel index scores ranging from 80 to 100 indicate that the person is independent, scores from 60–79 indicate minimally dependent, scores from 40–59 partially dependent, from 20–39 very dependent and scores <20 indicate totally dependence.

Risk of pressure ulcer was assessed using the Braden Scale. This scale was developed for the early identification of patients at risk for forming pressure ulcers and it is composed of six subscales that reflect sensory perception, skin moisture, activity, mobility, friction and shear, and nutritional status. It ranges from 0 (very high risk) to 23 (not at risk). In Treviso participants an average score of 17.10 points was found indicating mild risk of pressure ulcers, as according to the authors scores ranging from 15 to 18 indicate mild risk[22]. Dementia was screened using the SPMSQ which provides a brief, objective, and quantitative measurement of cognitive functioning of elderly people. This questionnaire score counts the number of errors, so a score of 0 is ideal; and omissions are counted as errors. For the Treviso study sample an average of 3.09 mistakes was found, indicating a mild cognitive impairment[23]. Finally, comorbidity was measure using the CIRS that quantifies burden of disease in elderly patients (comorbidity scale). According to the authors[24], the maximum score is 56 and higher scores indicate higher severity. The results for the Valencia pilot site sample showed an average score of 24.81. The higher score found for one of the participants was 51. The

[21] Sinoff G, Ore L. The Barthel activities of daily living index: self-reporting versus actual performance in the old-old (> or = 75 years). J Am Geriatr Soc. 1997;45(7):832-6.

[22] Braden, B., et al. (2005). Preventing pressure ulcers with the Braden Scale: An update on this easy-to-use tool that assesses a patient's risk. American Journal of Nursing. 105(6): 70 – 72.

[23] Pfeiffer, E. (1975). A short portable mental status questionnaire for the assessment of organic brain deficits in the elderly. J Am Geriatr Soc, 23: 433-441.

[24] Miller, MD, Paradis, CF, Houck, PR, et al. (1992). Rating chronic medical illness burden in geropsychiatric practice and research: application of the Cumulative Illness Rating Scale. Psychiatry Res, 41(3):237-48.

most reported problems were, respectively, cardiovascular, respiratory, endocrine, gastrointestinal and renal diseases.

As per discharge planning, the BRASS index consists of several items organized in 10 domains: age, living situation/emotional support, functional status, cognition, behaviour pattern, mobility, sensory deficits, previous admissions/ER (emergency room) visits, number of active medical problems, and drugs. Brass Index values range between 0 (lowest risk) and 30 (highest risk) with a cut-off point of 13 or higher was used for activating the special discharge planning service. In the Treviso study sample, the average found for the Brass Index was 15.23 indicating that in general the participants required specific discharge plans. To this aim, as part of the APPCARE model in Treviso pilot site, according to their needs, participants were assigned to an intended setting at hospital discharge. Among these settings the following were activated in the Treviso pilot site:

- Integrated home care for different clinical and functional conditions compared to premorbid.
- First entry into Assisted Living Facilities (RSA) - nursing homes.
- Municipal Social Services both for home management or for access to the RSA/nursing homes with the financial support of the Municipality.
- Temporary accesses to Intermediate Structures with planning of the planned route after discharge from the Intermediate Structure (return to one's home or definitive institutionalization).

APPCARE model impact

In Treviso pilot site, as part of the Hospital Care Module a Short Observation Period was include. This observation period had a duration of 48 hours in which a CGA was conducted to all APPCARE participants. The CGA evaluated the patient's status at hospital admission including the abovementioned measures: functional status, risk of pressure ulcers, dementia comorbidity and discharge planning. From this short observation period APPCARE participants could be discharge (with a personalized discharge planning as part of the Continuity of Care) or admitted into the hospital. No data on the use of health care resources was collected in Treviso pilot. Follow-up assessment after discharge and at 1 months was offered to all recruited participants; however, only functional status and dementia variables were included as part of the follow-up assessments.

In the following section the APPCARE Model impact will be presented for the total sample and for these two groups of participants: APPCARE patients admitted after short intensive care and APPCARE patients discharged after short intensive care (table 8). The APPCARE model impact was analysed using t-test and Chi-squared test and repeated measures ANCOVA, comparing the health status at the different stages.

APPCARE model impact for the total sample

A repeated measures ANOVA were used to measure the impact of the APPCARE model in the health status of participants, which was found statistically significant. As previously described, functional status was measured using Barthel Index at Hospital Care Module (48h observation period) and after 1 months. In addition, geriatricians at hosptial phase measured and registered also the pre-morbid Barthel (conditions two weeks before the event). Therefore, the following measures are for functional status: T-premorbid refers to two weeks before observational period; T0 refers to hospital module (during observation period) and T1 refers to 1 month after the observational period.

Table 8. *Impact in the CGA variables in the total sample (n=707).*

		T-premorbid (2 weeks before)	T0 (Observation period)	T1 (After 1 month)	ANOVA
Functional Status[a] (Barthel Index)	Mean (SD)	75.35 (27.65)	61.13 (31.89)	63.13 (32.48)	.000*
Dementia[b] (SPMSQ)	Mean (SD)		3.07 (2.76)	3.06 (3.19)	.001*

[a] Barthel index scores ranging from 80 to 100 indicate that the person is independent, scores from 60–79 indicate minimally dependent, scores from 40–59 partially dependent, from 20–39 very dependent and scores <20 indicate totally dependence.

[b] SPMSQ scores ranging from 0 – 2 indicate intact cognitive functioning, scores from 3 – 4 indicate mild cognitive functioning, scores from 5 – 7 indicate moderate cognitive functioning, and scores from 8 – 10 indicate severe cognitive functioning.

The results of the ANOVA for the Barthel Index showed that the level of independence at T0, two weeks prior to hospital care module, were higher than at hospital phase (during the observational period 48h); and also higher than one month after hospital care, even though that the level of independence was slightly improved at this last stage. The differences found among the levels of independence in the three measurements were found statistically significant (*p*=.000) and indicated that participants were minimally dependent in all stages. And dementia was assessed using the SPMSQ at two different stages: at hospital care (48h observation; T0) and up to 1 month after discharge (T1). The results of the analysis showed that participants present mild cognitive impartment at both stages, being slightly lower after 1 month (*p*=.001).

APPCARE model impact for the two groups of study: admitted and discharged

A total of 1437 participants were admitted to hospital and 1058 participants were discharged after the short observational period conducted as part of the Hospital Care Module in Treviso pilot site. Of those admitted, 42.7% were men and 57.3% were women; and among those discharge, 43% were men and 57% were women. No statistically significant differences were found between the sex of admitted and discharged participants (*p*=.890). Regarding the age, admitted participants had an average age of 86.26 and participants discharged had an average of 82.18, being significantly older those admitted in the hospital (*p*= .002).

Table 9. *Treviso participants admitted or discharged after Hospital Care Module (48h observation).*

	Admitted	Discharged
N Total (% total sample)	1437 (57.6%)	1058 (42.4%)
N Men (% admitted or discharged)	614 (42.7%)	455 (43%)
N Women (% admitted or discharged)	823 (57.3%)	603 (57%)

In order to know if there were significant differences in the impact of the APPCARE model between those participants discharged after the hospital phase and those participants admitted in the hospital, repeated measure ANCOVA analyses were also conducted for these two groups separately. The repeated measures ANCOVA were carried out to control for the confounding variable age, which was found statistically significant between both groups (admitted and discharged patients).

Table 10. *Impact in the CGA variables in both groups –admitted (n=479) and discharged (n=228).*

		Admitted			Discharged			
		T-premorb (2 weeks before)	**T0 (Observ. period)**	**T1 (After 1 month)**	**T-premorb (2 weeks before)**	**T0 (Observ. period)**	**T1 (After 1 month)**	**ANCOVA**
Functional Status[a] (Barthel Index)	Mean (SD)	69.15 (30.20)	50.15 (31.27)	51.90 (32.43)	88.38 (14.33)	84.19 (17.80)	86.84 (15.30)	.000*
Dementia[b] (SPMSQ)	Mean (SD)	-	3.64 (2.51)	3.90 (3.38)	-	1.92 (2.87)	1.40 (1.86)	.001*

[a] Barthel index scores ranging from 80 to 100 indicate that the person is independent, scores from 60–79 indicate minimally dependent, scores from 40–59 partially dependent, from 20–39 very dependent and scores <20 indicate totally dependence.

[b] SPMSQ scores ranging from 0 – 2 indicate intact cognitive functioning, scores from 3 – 4 indicate mild cognitive functioning, scores from 5 – 7 indicate moderate cognitive functioning, and scores from 8 – 10 indicate severe cognitive functioning.

In general, admitted participants had a worse health status in comparison with those participants discharged after the observation period part of the Hospital Care module. On the one hand, admitted participants were minimally dependent two weeks before the observation period, while during the 48h period the functional status changed to partially dependent and remained in that level of functioning one month after. On the other hand, discharged participants were assessed as independent in all three stages. Differences between both groups were found statistically significant (*p*=.000). In regard with dementia, admitted participants presented mild cognitive impairment at hospital phase and after one month, and discharged participants had intact cognitive functioning. These differences between both groups were also found statistically significant (*p*=.001).

3.2.2. Impact assessment of the APPCARE model – Rotterdam pilot site

Study sample

A total of 1002 participants aged ≤ 70 years' old were included in the APPCARE study in Rotterdam (the Netherlands). On the one hand, 137 participants were recruited from Hospital Care phase, as established in the APPCARE project. These participants were recruited from the geriatric ward of 4 hospitals: Erasmus Medical Center (Rotterdam), Havenziekenhuis (Rotterdam), Amphia hospital (Breda) and Vlietland hospital (Schiedam). In addition, some patients were recruited at the daycare center of the Erasmus Medical Center and at the outpatient clinic of the Havenziekenhuis. On the other hand, even though the original research protocol did not consider a comparative group, Rotterdam pilot site recruited a comparison group from a random sample of 865 non-institutionalized citizens ≥70 years who live in the municipality of Rotterdam to enrich the impact assessment.

After the Hospital Care module, the Continuity of Care module was offered to all participants included in the hospital care phase (n=137). As per the comparison group, measures were assessed at baseline and 6 months later. For this second group, only the Continuity Care measures (physical, psychological and social variables)

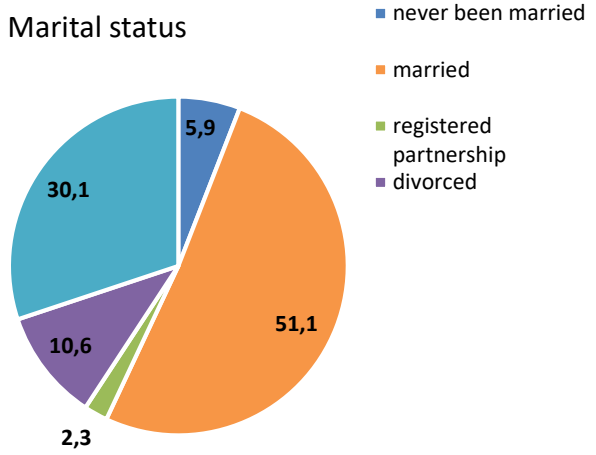
evaluated in the APPCARE model were available, while the medical variables assessed at the Hospital Care phase were not.

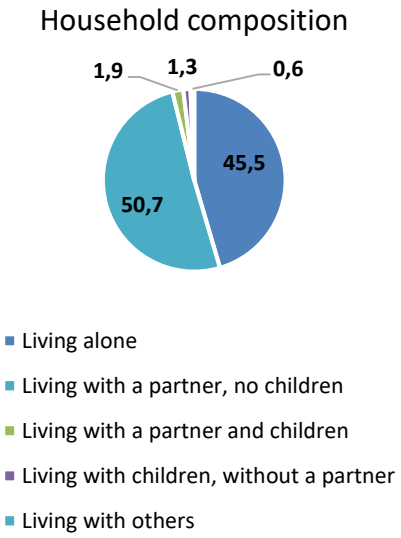
Table 11. *Flow of participants in Rotterdam pilot site APPCARE study.*

	Total Patients assessed	Patients meeting inclusion criteria	Patients included in the follow up
N total	1002	286	207
% total	100%	28.5%	72.4%
N Hospital sample	137	137	79
% Hospital sample	100%	100%	57.7%
N Community sample	865	149	128
% Community sample	100%	17.2%	85.9%

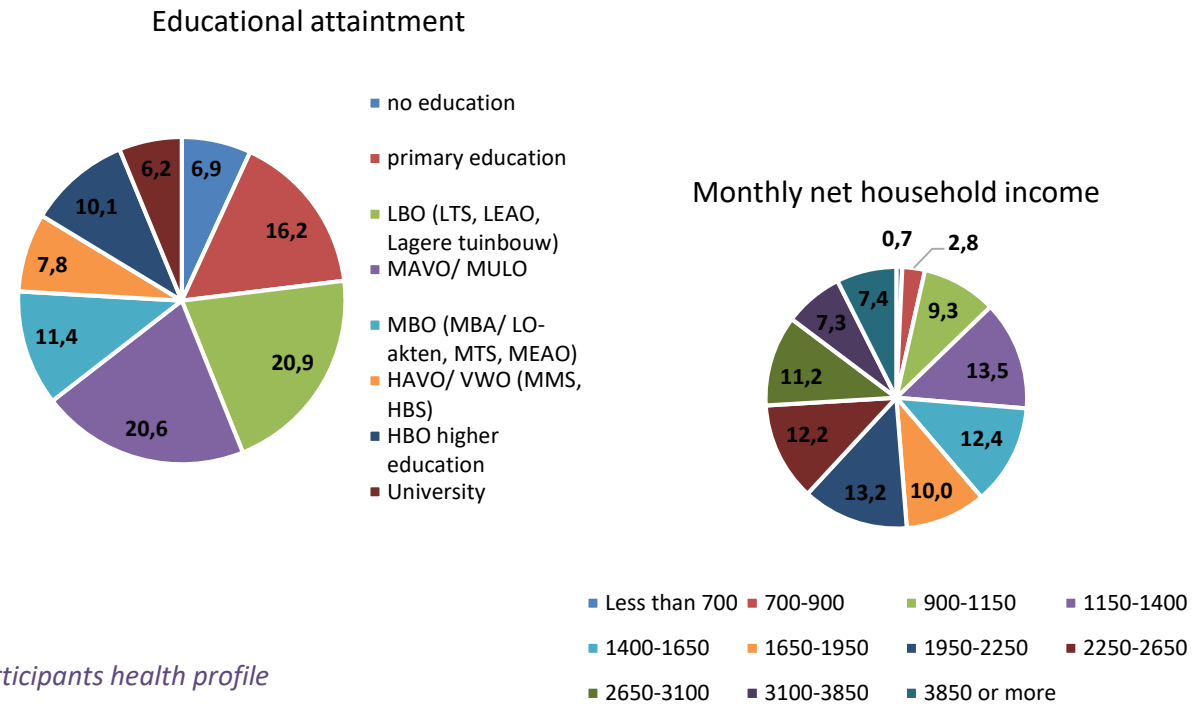
Participants sociodemographic profile

The average age of the Rotterdam pilot site participants was 78.58 years old and 489 (51.2%) were women and 466 (48.8%) were men. Regarding the marital status, most of the sample was married (51.1%; n=475) and a total of 30.1% (n=280) were widower. Only 5.9% (n=55) were single. Most of the Rotterdam pilot study participants were living with a partner with no children (50.7%; n=474) or were living alone (45.5%; n=425).





With regards to the educational attainment, only 6.9% (n=56) of the sample had no studies. A total of 161 participants (20.9%) attained LBO, 159 participants (20.6%) MAVO – MULO and 125 (16.2%) primary education. Forty-eight participants (6.9%) went to university. The most common monthly net household income ranged between 1150€ and 1650€ (25.9%; n=213) and between 1950€ and 2650€ (25.4%; n=208). Only 6 participants (0.7%) had an income lower than 700€.



Participants health profile

At the Hospital Care module, a Comprehensive Geriatric Assessment including the following variables was agreed to be conducted in Rotterdam pilot site: functional status, risk of pressure ulcer, dementia and comorbidity. However, most of these variables were not measured in most of the sample due to several study limitations. Concretely, these variables were planned to be retrospectively taken from the electronic patient records; however, the electronic patient records were incomplete; most likely due to that these variables were measured but not recorded.

Dementia was screened in 34 participants using the MMSE, a widely used test of cognitive function that includes tests of orientation, attention, memory, language and visual-spatial skills. MMSE scores ranges from 0 to 30, and lower scores indicate dementia or cognitive impairment. The average score found for the Rotterdam pilot site participants was 24.18, which indicates normal cognitive function in the general sample.

Risk of pressure ulcer was assessed in 18 participants using the Braden Scale. The average score found for this small sample was 20.06, indicating that participants were generally not at risk of pressure ulcers (scores ranging from 19 to 23 indicate not at risk of pressure ulcers[25]). Functional status and comorbidity were not assessed in a representative number of participants.

As per other health-related variables assessed as part of the APPCARE pilot assessment, table 12 shows the health profile of the two groups of Rotterdam study participants: APPCARE model group and comparison group. The comparison of the health-related variables between both groups was found statistically significant in all the variables expect of the social loneliness variable measured using the De Jong Gierveld Loneliness Scale, already referred. The differences among the health-related variables indicated that the comparison group participants presented a better health profile in comparison with the intervention group, those participants recruited from several hospitals and health services. Intervention group participants presented

[25] Braden, B., et al. (2005). Preventing pressure ulcers with the Braden Scale: An update on this easy-to-use tool that assesses a patient's risk. American Journal of Nursing. 105(6): 70 – 72.

a higher risk of polypharmacy, higher prevalence of falls and fear of falling, higher disability, lower HRQoL, and more loneliness feelings.

Table 12. *Rotterdam participants' health profile at hospital phase.*

			APPCARE model group	Comparison group	t-test
Polypharmacy (MRQ-10)		Mean (SD)	4.39 (1.71)	3.92 (1.59)	.002*
Frailty (TFI)	**Physical**	Mean (SD)	4.00 (1.61)	2.49 (1.62)	.000*
	Psychological	Mean (SD)	1.53 (0.85)	1.06 (0.60)	.000*
	Social	Mean (SD)	1.81 (0.81)	1.38 (1.66)	.000*
	Overall	Mean (SD)	7.27 (2.15)	4.93 (2.14)	.000*
Fear of falling (FES-I)		Mean (SD)	13.38 (5.99)	9.72 (4.35)	.000*
Falls (average of falls)		Mean (SD)	2.36 (1.20)	1. 85 (1.04)	.001*
Disability (GARS)		Mean (SD)	40.06 (15.06)	24.73 (10.04)	.000*
HRQoL (SF-12)	**Physical component**	Mean (SD)	31.74 (21.73)	63.94 (26.84)	.000*
	Mental component	Mean (SD)	54.58 (22.26)	73.28 (20.62)	.000*
Loneliness (De Jong Gierveld Loneliness scale)	**Emotional**	Mean (SD)	1.27 (1.08)	0.68 (1.05)	.000*
	Social	Mean (SD)	0.26 (0.60)	0.28 (0.76)	.778
	Overall	Mean (SD)	1.53 (1.34)	0.96 (1.43)	.000*

According to health professionals' advice based on the results of the CGA performed at hospital phase, the Continuity of Care –Coordinated Care Model and Preventive Care Model– were offered to participants from Hospital Care Module (n=137). The Continuity of Care phase includes:

- Follow-up by primary health care centres.
- A clinical pathway targeted at fall risk.
- A clinical pathway targeted at appropriate medication use.
- A pathway targeted at loneliness.
- Geriatric clinical follow up in the hospital between 1 and 6 months on indication and in accordance with the existing guidelines.

APPCARE model impact

The APPCARE model impact on Rotterdam pilot site participants was analysed using t-test in all variables measured at baseline (T0) and after six months (T1). The impact assessment includes the analyses of the health-related variables presented in the previous section and the impact assessment of the use of health care resources. Unfortunately, as the follow-up measurement of CGA variables was not conducted, the impact of APPCARE model in the CGA variables could not be analysed.

Impact in other health-related variables

As a complementary assessment to the CGA, several health-related variables were evaluated at baseline and up to 6 months from baseline. These complementary variables were assessed together in both groups to shed light on the overall progression of these variables along a six period time: the original group recruited from several hospitals in the area of Rotterdam (n=137) and the comparison group consisted of participants from the community (n=865). Both groups accounted for a total of 1002 participants, from whom 807 were assessed at baseline and after 6 months. In the following table, the results of this complementary assessment are presented.

After 6-months, participants presented significant improvement in the average of falls (p=.000) which was reduced from 2.32 falls to 1.88 falls. However, the fear of falling was significantly aggravated after this period of time (p=.013). Disability scores measured using GARS were also improved at follow-up (p=.000), as well as the physical component of the HRQoL measure (p=.000).

Table 13. *Impact in other health-related variables (n=807).*

			T0 (baseline)	T1 (Up to 6 months)	t-test
Polypharmacy (MRQ-10)		Mean (SD)	3.94 (1.59)	3.89 (1.52)	.298
Frailty (TFI)	**Physical**	Mean (SD)	2.54 (1.62)	2.56 (1.62)	.726
	Psychological	Mean (SD)	1.08 (0.61)	1.10 (0.61)	.300
	Social	Mean (SD)	1.39 (0.67)	1.43 (0.66)	.615
	Overall	Mean (SD)	4.99 (2.14)	5.05 (2.11)	.349
Fear of falling (FES-I)		Mean (SD)	9.85 (4.38)	10.25 (5.67)	.013*
Falls (average of falls)		Mean (SD)	2.32 (1.16)	1.88 (0.98)	.000*
Disability (GARS)		Mean (SD)	25.29 (10.50)	26.17 (11.18)	.000*
HRQoL (SF-12)	**Physical component**	Mean (SD)	62.86 (27.25)	61.74 (28.45)	.034*
	Mental component	Mean (SD)	72.53 (20.77)	71.58 (22.05)	.082

Loneliness (De Jong Gierveld Loneliness scale)	**Emotional**	Mean (SD)	0.69 (1.05)	0.71 (1.05)	.648
	Social	Mean (SD)	0.27 (0.76)	0.22 (0.65)	.065
	Overall	Mean (SD)	0.97 (1.41)	0.93 (1.39)	.351

Although it should be relevant to also compare these measures between the APPCARE and comparison group, the reduced number of responses for some variables for the AppCare group in the follow up made it not possible.

Impact in the use of health care resources

The use of health care resources was also measured at baseline and after 6 months for all participants for the same purpose. The results of the comparison between these two measurements showed that the number of participants reporting admission to emergency room was decreased after 6 months (from 22.8% to 17.7%) and this difference was found statistically significant (*p*=.000). A similar result was found for the participants reporting visits to physician, which was also significantly reduced (*p*=.000) after 6 months, as well as the average number of visits to physician that was decreased from 6.66 visits to 4.39 visit (*p*=.000).

Table 14. *Differences in the use of health care resources in the total sample (n=807).*

	T0 (Baseline)	**T1 (After 6 months)**	**Chi-squared test/t-test**
N (%) participants reporting emergency hospital admissions	214 (22.8%)	144 (17.7%)	.000*
Average number of hospital stay days	8.57	9.49	.319
N (%) participants reporting visits to physician	843 (88.3%)	491 (79.2%)	.000*
Average number of visits to physician	6.66	4.39	.000*

The use of health care resources at baseline was also assessed separately between both groups, in order to analyse potential initial differences in APPCARE model group and the comparison group in these specific variables. The results of t-test and Chi-square tests showed that the differences between these two groups were statistically significant in all the variables measured at baseline. The APPCARE model group reported more emergency hospital admissions and visits to physician that the comparison group at baseline, and the APPCARE group also spent a higher average of number of hospital stay days (13.04 for the APPCARE model group and 6.91 for the comparison group; *p*=.018).

Table 15. *Differences between both groups in the use of health care resources at baseline.*

	APPCARE model group	**Comparison group**	**Chi-squared test/t-test**
N (%) participants reporting emergency hospital admissions	65 (53.7%)	149 (18.2%)	.000*
Average number of hospital stay days	13.04	6.91	.018*

N (%) participants reporting visits to physician	113 (95%)	730 (87.4%)	.017*
Average number of visits to physician	8.44	6.42	.006*

The baseline differences were also found when comparing the use of health care resources at follow-up. The APPCARE model group reported a greater percentage of emergency hospital admission compared with the comparison group (70.6% and 12.9%, respectively) and this difference was found significant (*p*=.000). The average of hospital stay days was also significantly superior for the APPCARE model group (*p*=.012), as well as the average number of visits to physician (*p*=.002).

Table 16. *Differences between both groups in the use of health care resources at follow-up (6 months).*

	APPCARE model group	Comparison group	Chi-squared test/t-test
N (%) participants reporting emergency hospital admissions	48 (70.6%)	96 (12.9%)	.000*
Average number of hospital stay days	13.04	7.74	.012*
N (%) participants reporting visits to physician	52 (96.3%)	439 (89.4%)	.001*
Average number of visits to physician	6.36	4.18	.002*

3.2.3. Impact assessment of the APPCARE model – Valencia pilot site

Study sample

A total of 223 participants were included in the APPCARE study in Valencia (Spain).

Table 17. *Flow of participants in Valencia pilot site APPCARE study.*

	Participants included in the APPCARE Hospital Care Module	Participants receiving the holistic assessment (Hospital Care + Continuity of Care)	Participants meeting the inclusion criteria for Continuity of care (care pathways)	Participants included
N	223	152	93	61
%		68%	61%	66%

LOSS TO FOLLOW-UP (continuity of care): N=71

n= 32 Exitus
n= 28 Withdrew from the research
n= 11 Unreachable

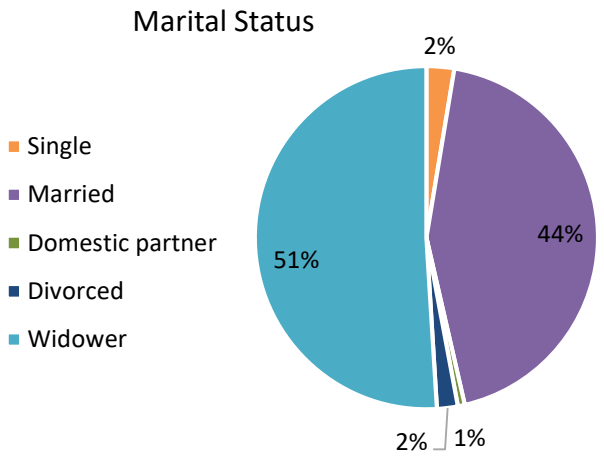
LOSS TO FOLLOW-UP (3 months): N=32

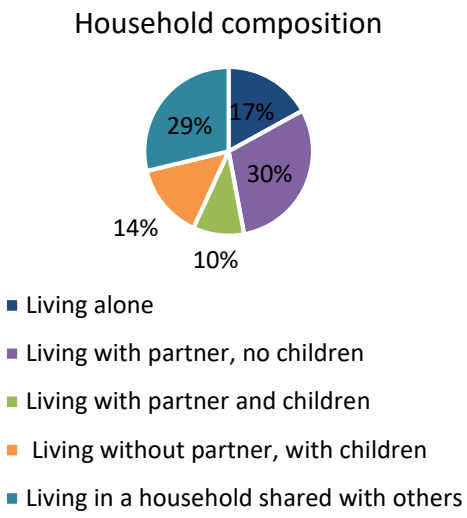
n= 14 Exitus
n= 16 Withdrew from the research
n= 2 Unreachable

Participants sociodemographic profile

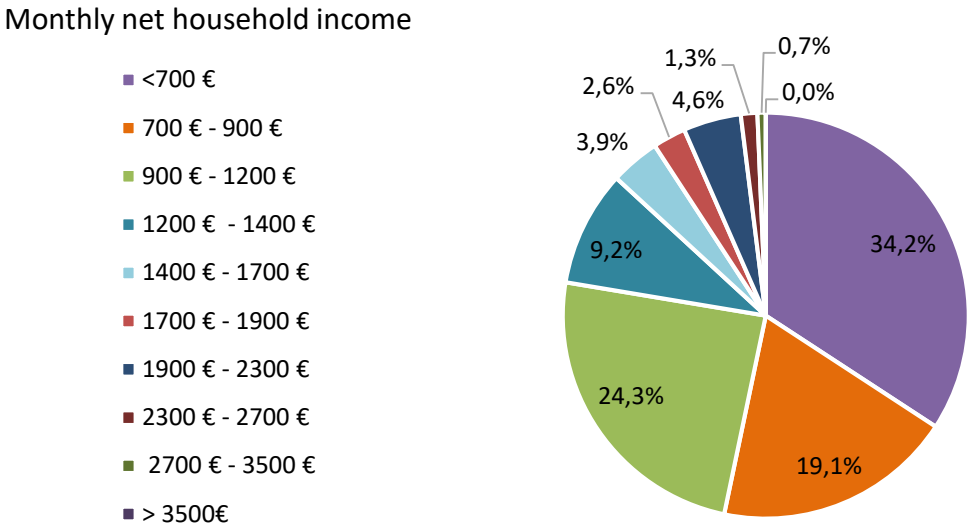
The study population consisted of people aged ≤ 75 years' old who were admitted in the home hospitalisation unit from La Fe hospital in Valencia (Spain). The average age of the Valencia pilot site participants was 84.63 years old and 128 (57.4%) were women and 95 (42.6%) were men.

Regarding the marital status, most of the sample was widower (51%; n=78) or married (44%; n=67). And most of them were living with a partner with no children (30%; n=46) or living in a house shared with others (e.g. at a child home with grandchildren) (29%; n=44); and 17% (n=26) were living alone.

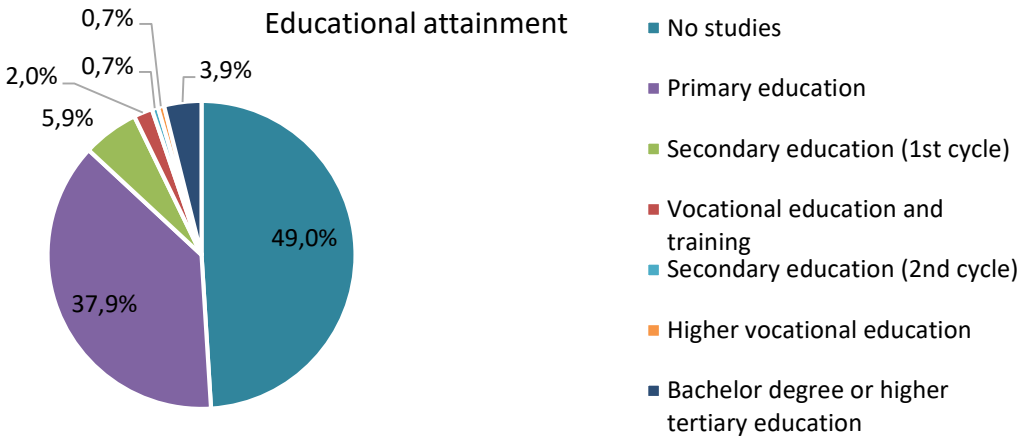




The most common monthly net household income ranged between >700 and 1200 €. A 34,2% of the study sample (n=52) had a net household income lower than 700€ per month, 19.1% (n=29) had a monthly income between 700 and 900€ and 24.3% (n=37) between 900 and 1200€. Only 3 participants (2%) had a monthly income higher than 2300€ and no one had it higher than 3500€.



With regards to the educational attainment, almost half of the study sample (49%; n=75) had no studies. A total of 58 participants (37.9%) attainted primary education and only 3.9% (n=6) got a bachelor's degree or higher tertiary education.



Participants health profile

At the Hospital Care module, all participants were assessed using a Comprehensive Geriatric Assessment that included several health variables: functional status, risk of pressure ulcer, dementia and comorbidity. Table 18 presents the results of the CGA for the total study sample.

Functional status was measure at the hospital phase using the Barthel index in the total sample, which showed an average of 56.89 indicating that the Valencia pilot site participants were in general partially dependent (interpretation of Sinoff, 1997[26]). Risk of pressure ulcer was assessed using the Braden Scale, the results found that participants had mild risk or lower risk of pressure ulcers (average of 17.42 and scores ranging from 15 to 18 indicate mild risk of pressure ulcers[27]). Dementia was screened using the SPMSQ which showed an average of 3 mistakes for the total sample. According to the guidelines[28], this result indicates mild cognitive impairment. Finally, comorbidity was measure using the CIRS with a maximum score of 56 and higher scores indicate higher severity[29]. The results for the Valencia pilot site sample showed an average score of 12.81. The higher score found for one of the participants was 21. The most reported problems were, respectively, cardiovascular, respiratory endocrine, and renal diseases.

[26] Sinoff G, Ore L. The Barthel activities of daily living index: self-reporting versus actual performance in the old-old (> or = 75 years). J Am Geriatr Soc. 1997;45(7):832-6.

[27] Braden, B., et al. (2005). Preventing pressure ulcers with the Braden Scale: An update on this easy-to-use tool that assesses a patient's risk. American Journal of Nursing. 105(6): 70 – 72.

[28] Pfeiffer, E. (1975). A short portable mental status questionnaire for the assessment of organic brain deficits in the elderly. J Am Geriatr Soc, 23: 433-441.

[29] Miller, MD, Paradis, CF, Houck, PR, et al. (1992). Rating chronic medical illness burden in geropsychiatric practice and research: application of the Cumulative Illness Rating Scale. Psychiatry Res, 41(3):237-48.

Table 18. *Valencia participants' health profile at hospital phase (CGA; n=223).*

	Functional Status (Barthel Index)	Risk of pressure ulcers (Braden Scale)	Dementia (SPMSQ)	Comorbidity (CIRS)
Mean	56.89	17.42	3	12.81
SD	29.92	3.72	3.37	3.77
Min.	0	6	0	0
Max.	100	18	10	56

A follow-up assessment of these variables measured through the GCA at the hospital phase was conducted at each participant's home up to one month after this baseline assessment. As part of this follow-up assessment, other health-related variables were included. These complementary variables were frailty, medication risk, falls, activity restrictions, health-related quality of life, loneliness, psychological distress, social support, and living standards, as well as the use of health care resources. The impact of the APPCARE project on all these variables (CGA + complementary variables) will be analyse in the following section.

According to the results of the CGA, participants were referred to the Coordinated Care Model when score high in: loneliness (De Jong Gierveld loneliness scale ≥ 2) and/or moderate cognitive impairment (SPMSQ 5-7 errors). The Coordinated Care Model was intended to coordinate the usual medical care provided to each participant in order to address their chronic conditions and other medical needs with other care pathways based on psychological and social aspects of care. The care pathways that composed the Coordinated Care Model in the Valencia pilot were the social support pathway and the cognitive stimulation pathway. Both care pathways were designed by experts in the frame of the APPCARE project. Both Coordinated Care Model pathways had a duration of 3 months; after which participants were follow-up using the same comprehensive assessment as after hospital discharge.

APPCARE model impact

In order to assess the patient's health care status a CGA was implemented in the Unit of Home Hospitalisation at La Fe Hospital in the city of Valencia (Spain). This CGA included several medical and health measures which were complemented with other health-related measures in order to get a comprehensive assessment of each participants including not only medical aspects but also psychological and social aspects. In the following subsections the impact of the APPCARE model on these variables is presented, as well as the impact on the use of health care resources.

Impact in the CGA variables

The variables included in the CGA in the Valencia pilot site were: functional status, risk of pressure ulcers, dementia and comorbidity. However, comorbidity was only measure at the hospital phase (baseline), as it is presented in the previous section.

The APPCARE model impact on the CGA variables was analysed using repeated measures ANOVA, as each variable was assessed in three moments: at hospital phase (T0), up to one month after hospital discharge (T1) and up to three months after hospital discharge (T2). The results of these analyses showed that the functional status of participants was not improved after being included in the APPCARE model; indeed, the functional status of participants was slightly aggravated after three months from the hospital phase, however

this worsening was not found statistically significant. As per risk of pressure ulcers, this was found significantly increased after three months (*p*=.002); however, participants after three months were still not presenting high risk or very high risk of pressure ulcers. Finally, cognitive status was also significantly aggravated after three months (*p*=.000). After 3 months, participants increased their scores in SPMSQ by 1.39 points, although the final assessment still indicated mild cognitive functioning for the total study sample.

Table 19. *Impact in the CGA variables (n=223).*

		T0 (At hospital phase)	T1 (Up to 1 month)	T2 (Up to 3 months)	ANOVA
Functional Status[a] (Barthel Index)	Mean (SD)	56.89 (29.92)	60.49 (28.27)	66.27 (28.56)	.094
Risk of pressure ulcers[b] (Braden Scale)	Mean (SD)	17.42 (3.72)	16.42 (7.45)	14.31 (9.45)	.002*
Dementia[c] (SPMSQ)	Mean (SD)	3 (3.37)	2.86 (2.79)	4.39 (4.15)	.000*

[a] Barthel index scores ranging from 80 to 100 indicate that the person is independent, scores from 60–79 indicate minimally dependent, scores from 40–59 partially dependent, from 20–39 very dependent and scores <20 indicate totally dependence.

[b] Braden Scale scores >18 indicate not at risk, scores from 15 – 18 indicate lower/mild risk, scores from 13 – 14 indicate moderate risk, scores from 10 – 12 indicate high risk, and 9 or less scores indicate very high risk.

[c] SPMSQ scores ranging from 0 – 2 indicate intact cognitive functioning, scores from 3 – 4 indicate mild cognitive functioning, scores from 5 – 7 indicate moderate cognitive functioning, and scores from 8 – 10 indicate severe cognitive functioning.

Impact in other health-related variables

Apart from the variables included as part of the CGA, other health-related variables were included in the follow-up measurements conducted at each participant home after hospital discharge. Concretely, these follow-up measurements were performed up to one month after hospital phase (T1) and up to 3 months after hospital discharge (T2); therefore, these health-related variables were only measured at T1 and T2. The follow-ups assessment included the following variables: polypharmacy, frailty, fear of falling, falls, disability, health-related quality of life (HRQoL), loneliness, distress, social support and living standards.

The results of the t-test showed no statistically significant differences in the evolution of the health-related variables. Most of the variables remained stable for the three months' period between assessments; except for the variables falls, which was slightly reduced (from an average of falls of 2.59 at T1 to an average of 1.98 at T2), and the living standards variable that was also improved (from 76.75 to 80.79 score in LSCAPE, being the total score 125 and the higher the score, the higher the standards of living). However, these improvements were not found statistically significant.

Table 20. *Impact in other health-related variables (n=102).*

			T1 (Up to 1 month)	T2 (Up to 3 months)	t-test
Polypharmacy (MRQ-10)		Mean (SD)	4.97 (1.42)	4.86 (1.49)	.572
Frailty (TFI)	**Physical**	Mean (SD)	4.86 (1.52)	4.64 (1.84)	.236
	Psychological	Mean (SD)	1.93 (0.82)	1.82 (1.05)	.370
	Social	Mean (SD)	1.37 (0.68)	1.43 (0.78)	.556
	Overall	Mean (SD)	8.15 (1.96)	7.88 (2.72)	.309
Fear of falling (FES-I)		Mean (SD)	16.93 (7.46)	16.26 (7.22)	.448
Falls (average of falls)		Mean (SD)	2.59 (2.05)	1.98 (2.19)	.684
Disability (GARS)		Mean (SD)	49.32 (17.62)	48.42 (18.29)	.458
HRQoL (SF-12)	**Physical component**	Mean (SD)	30.54 (25.54)	31.24 (26.61)	.693
	Mental component	Mean (SD)	49.22 (25.41)	47.60 (24.42)	.723
Loneliness (De Jong Gierveld Loneliness scale)	**Emotional**	Mean (SD)	0.81 (1.07)	1.04 (0.98)	.064
	Social	Mean (SD)	0.38 (0.61)	0.39 (0.65)	.899
	Overall	Mean (SD)	1.19 (1.39)	1.43 (1.27)	.139
Distress (BSI-18)		Mean (SD)	1.02 (0.68)	1.12 (0.79)	.155
Social support (PCSQ)	**Community integration**	Mean (SD)	14.44 (4.32)	14.62 (4.24)	.735
	Community participation	Mean (SD)	10.86 (4.99)	10.65 (5.02)	.712
	Community organizations	Mean (SD)	15.02 (6.79)	15.37 (7.37)	.756
Living standards (LSCAPE)		Mean (SD)	76.75 (21.30)	80.79 (23.52)	.076

Impact of the APPCARE care pathways

As part of the Continuity of Care, several care pathways were designed and tested in the Valencia pilot site. One of these care pathways was the Cognitive Rehabilitation Pathway which was explained in detail in the Deliverable 8.1 Coordinated Care Model and Deliverable 9.1: Preventive Care Model, in which the Continuity of Care phase was presented. A total of 29 participants (13% of the total sample) were included in the cognitive rehabilitation pathway. Of them 22 were referred only to this pathway and 7 were referred also to the social support pathway. As presented in table 21, the results of the t-test showed that those participants

included only in the cognitive rehabilitation pathway have significantly aggravated their cognitive function after 3 months, going from mild cognitive impairment (an average of 4.26 mistakes in SPMSQ) to moderate cognitive impairment (an average of 6.47 mistakes in SPMSQ). However, those participants included in both care pathways –cognitive rehabilitation and social support– at 3 months' follow-up showed a lower average in the mistakes made in SPMSQ, but this difference was not found statistically significant.

Table 21*. Impact on dementia (SPMSQ) of the Cognitive Rehabilitation Pathway.*

		T0	T1	t-test
Participants only in the cognitive rehabilitation pathway (n=22)	Mean (SD)	4.26 (1.41)	6.47 (4.15)	.024*
Participants in both care pathways (n=7)	Mean (SD)	4.85 (1.95)	3.86 (2.54)	.134

On the other hand, a social support pathway was designed and it is also explained in detail in in the Deliverable 8.1 Coordinated Care Model and Deliverable 9.1: Preventive Care Model. A total of 27 participants (12.1% of the total sample) were included in the social support pathway. Of them, 20 participants were referred only to this pathway and 7 were referred also to the cognitive pathway. Table 22 shows the impact of the social support care pathway on the related variables: loneliness, community support and living standards. No statistically significant differences were found for any of the variables; however, small changes occur between the baseline assessment and the follow-up at 3 months; for instance, the living standards of the participants attending only the social support pathway were improved at follow-up, while among participants attending both care pathways suffered a worsening in the perception of their living standards after 3 months. The perception of the community support was also slightly improved among participants attending only the social support pathway and worsened among those attending both care pathways. It is worthy to mention that the small sample size of this specific pathway groups could also hidden differences since statistical power decreases.

Table 22*. Impact on social support variables of the Social Support Pathway.*

Participants only in the social support pathway (n=20)					
			T0	**T1**	**t-test**
Loneliness (De Jong Gierveld Loneliness scale)	**Emotional**	Mean (SD)	1.25 (1.16)	1.05 (0.89)	.428
	Social	Mean (SD)	0.55 (0.82)	0.45 (0.60)	.649
	Overall	Mean (SD)	1.80 (1.73)	1.50 (0.94)	.368
Social support (PCSQ)	**Community integration**	Mean (SD)	13.68 (4.84)	15.05 (3.58)	.239
	Community participation	Mean (SD)	10.00 (4.35)	10.84 (4.79)	.607
	Community organizations	Mean (SD)	15.20 (6.38)	15.90 (7.33)	.677
Living standards		Mean	71.21	73.89	.547

(LSCAPE)		(SD)	(20.04)	(24.81)	
Participants in both care pathways (n=7)					
Loneliness (De Jong Gierveld Loneliness scale)	**Emotional**	Mean (SD)	1.86 (1.34)	1.87 (1.21)	1.000
	Social	Mean (SD)	0.71 (0.48)	1.14 (1.07)	.289
	Overall	Mean (SD)	2.57 (1.61)	3.00 (1.82)	.675
Social support (PCSQ)	**Community integration**	Mean (SD)	14.50 (5.05)	10.83 (6.76)	.216
	Community participation	Mean (SD)	9.50 (3.27)	8.67 (5.08)	.790
	Community organizations	Mean (SD)	12.28 (6.75)	11.57 (7.69)	.829
Living standards (LSCAPE)		Mean (SD)	76.50 (25.59)	71.18 (21.83)	.652

Impact in the use of health care resources

Regarding the use of health care resources, these were collected in the continuity of care phase which was conducted at each participant's home up to one month after the hospital care phase. Therefore, between these two measurements a loss of the study sample was experienced due to different reasons which are explained in the table 23.

At continuity of care phase baseline, a total of 148 participants were assessed. Of those, 135 participants (91.2%) reported visits to hospital's emergency services in the 12 months prior to the study (responding at baseline to the following question: Did you go to the hospital's Emergency services (A&E department) in the last 12 months?). Moreover, those participants reported an average of 4.14 visits to the emergency department for that period. Of the total 135 participants reporting visit to emergency department, 47 (34.8%) were participants attending the care pathways designed as part of the continuity of care intervention, and 88 (65.2%) were participants to whom only hospital care module was delivered. As regards to hospital admission, a total of 139 (93.9%) reported having been admitted for an emergency hospital admission in the last 12 months prior to the study. Of those, 47 (33.8%) were participants in the Continuity of care pathways and 92 (66.2%) received only the Hospital care module. As per the number of visits to physician/s (general practitioner or specialist), a total of 136 (61%) participants reported visits to their physician. Concretely, an average of 9.61 visits.

After 3 months, 103 out of 148 participants were assessed using the same questionnaire. A total of 40 participants (38.8%) from them reported visits to hospital's emergency services in the 3-month period between the baseline and the follow-up assessment. The average of visits to the emergency department in this period was 2.05 visits. Of those participants reporting visits to the emergency department, 25 (62.5%) were participants attending the continuity of care pathways and 15 (37.5%) only received the Hospital care. With regards to the admittance to the hospital, a total of 27 participants (26.5%) reported having experienced an emergency hospital admission in that period. Of them, 16 (59.3%) were intervention pathways participants and 11 (40.7%) were older adults included only in the Hospital care module. As per the number of visits to physician/s at follow-up, a total of 77 (34.5%) reported visits, with an average of 3.71 visits.

In order to know the impact of the APPCARE study in the use of health care resources, the evolution of the use of the health care resources among participants was measured in two different moments: baseline and 3 months later (table 24). Chi-squared test was used for testing relationships on the categorical variables and t-test was used on continuous (scale) variables. Regarding the visits to emergency department, participants have experienced a reduction in the visits to emergency department of 52.4% (*p*=.000). The reduction in the number of visits to the emergency department and the reduction in the number of visits to the physician among study participants were also found statistically significant (*p*=.005 and *p*=.000, respectively). The differences between the other variables related to the use of health care resources were not found statistically significant.

Table 24. *Impact in the use of health care resources (n=102).*

	T0 (Baseline)	T1 (After 3 months)	Chi-squared test/t-test
N (%) participants reporting visits to hospital's emergency services	135 (91.2%)	40 (38.8%)	.000*
Average number of visits to hospital's emergency services	4.14	2.05	.005*
N (%) participants reporting emergency hospital admissions	139 (93.9%)	27 (26.5%)	.174
Average number of hospital stay days	27.91	19.39	.624
N (%) participants reporting visits to physician	136 (61%)	77 (34.5%)	.065
Average number of visits to physician	9.61	3.71	.000*

3.3. Discussion on the impact assessment of the APPCARE model

The objectives of the impact assessment were: 1) to evaluate the changes in health status over time in participants who were offered care according to the APPCARE model; 2) to evaluate the impact on health care resources of the implementation of the APPCARE model.

Regards the **health status**, the overall results of the different pilot sites studies have showed the current health status of +70 years old persons in three European countries: Treviso (Italy), Rotterdam (the Netherlands) and Valencia (Spain), as well as their evolution over the time. As part of the health status assessment, several health-related variables were evaluated in the participants included in the APPCARE study. Even though the assessments performed in each pilot site are not identical, there are still common variables.

One of the main objectives of APPCARE project was to reduce the functional status loss among those older adults included in the study. In the frame of the project, functional status has been assessed using Barthel Index in Treviso and Valencia pilot sites but not in Rotterdam pilot site. However, Rotterdam evaluated disability using GARS, as well as Valencia. The concepts functioning and disability serve as umbrella terms for positive and negative aspects of health: body functions and structures/impairments, activity/activity limitations and participation/participation restrictions, respectively. Therefore, certain comparisons between the three pilot studies may be established in regard to these variables.

With regard to functional status, Treviso pilot site participants (n=2498) presented at baseline an average score of 69.02 in Barthel index, indicating minimal dependence, while Valencia pilot site participants (n=223) presented at baseline an average of 56.89, indicating that they were partially dependent; and therefore, Valencia participants presented a worse functional status in comparison with Treviso. As per the impact of the APPCARE model in functional status, Treviso participants showed a significant evolution of this variable over the time. In Treviso pilot, functional status was measured two weeks before hospital care (pre-morbid), at hospital care during the observation period and one month later. Among the total sample of Treviso participants, the evolution of functional status went from 75.36 (pre-morbid status) to 61.13 during 48h observation and then to 63.13 after one month (*p*=.000). Moreover, this variable was also compared among the two study groups from Treviso pilot site –admitted and discharged participants–. Those participants admitted in the hospital after 48h observation period presented a worse functional status than those discharged (50.15 vs. 84.19) and the evolution for each of these groups was similar to the evolution for the total sample. Similar results were found for the Valencia pilot site participants who went from an average score of 56.89 in Barthel Index at hospital phase to 60.49 up to one month and then to 66.27 after 3 months, going from partially dependent to minimally dependent as Treviso pilot site participants.

As to disability measured using GARS, at baseline Valencia pilot site participants showed an average score of 49.32 and the average for Rotterdam pilot site participants was 25.29, indicating that Rotterdam participants presented a lower level of disability in comparison to the participants from Valencia. Regarding the impact of the APPCARE model in the disability variable, this was reduced from 49.32 to 48.42 among Valencia pilot site participants but this reduction was not found statistically significant; while among Rotterdam participants the disability level was significantly improved after 6 months (from 25.29 to 26.17; *p*=.000).

The risk of pressure ulcers was also assessed in all participants in the three pilots as it remains a common problem in all health care setting. Risk of ulcers was measured using Braden scale and the results showed that at baseline (during hospital phase) participants from Treviso and Valencia presented mild risk of suffering from pressure ulcers (17.10 and 17.42, respectively); while Rotterdam participants were not at risk (20.06). Follow-up measurements of this variable was only performed in Valencia, showing that the evolution of the risk of pressure ulcers increased over the time, going from mild risk to moderate risk at 3 months.

Dementia was another variable measured as part of the CGA conducted in the three pilot sites. On the one hand, in Treviso and Valencia cognitive impairment was assessed using SPMSQ and in Rotterdam the MMSE was used for the same purpose. As in the risk of pressure ulcers, Treviso and Valencia participants in general presented mild cognitive impairment at baseline; while Rotterdam participants showed normal cognitive function. The impact of the APPCARE model on cognitive functioning was moderated but still significant in the case of Treviso (from 3.09 to 3.06; *p*=.000) and among Valencia participants it worsened (from 3 to 4.39; *p*=.000); even though among those participants included in the cognitive rehabilitation care pathway (from 4.26 to 6.47; *p*=.024). No follow-up assessment was conducted in Rotterdam.

As previously described, apart from the variables included as part of the CGA, other health-related variables were measured in Rotterdam and Valencia pilot sites. Among these variables were: polypharmacy, frailty, falls, HRQoL and loneliness. In Rotterdam the impact of the APPCARE model was measured at baseline and after 6 months in a total sample of 807 participants; while in Valencia these variables were assessed at baseline and up to 3 months in a sample of 102 participants.

In regard to polypharmacy and its risk, it was measured using MRQ-10. At baseline, Valencia participants presented higher scores (4.97) than Rotterdam participants (3.94), indicating that participants were at risk of medication-related problems (threshold score of 3 or more to discriminate between lower- and higher-risk groups). After being included in the APPCARE study, participants presented slightly lower scores on this variable (3.89 and 4.86, respectively) but the reduction of the risk of medication problems was not statistically significant for any of the samples. Frailty was assessed by TFI in which scores higher than 5 indicate frailty. At baseline Rotterdam participants presented an average 4.99 and the average for Valencia participants was 8.15, showing that at baseline the older adults included in the Valencia study were frailer than those from Rotterdam. After 6 months the frailty variable among Rotterdam participants was slightly worsened (4.99 to 5.05) and among Valencia participants was slightly improved (8.15 to 7.88), still showing that the Valencia sample was frailer. The average of falls between both pilot sites was similar at baseline and at follow-up, participants from Rotterdam presented an average of falls of 2.32 at baseline and 1.88 after 6 months; and the Valencia sample felt an average of 2.59 at baseline and 1.98 after 3 months.

From a more psychological perspective, HRQoL and loneliness were measured. HRQoL was assessed using SF-12 survey which results in two components: physical component and mental component. As per the physical component, on the one hand Rotterdam participants showed a significant change over the 6 months' period (from 62.86 to 61.74; p=.034), indicating a good quality of life related to physical aspects. On the other hand, Valencia participants showed much lower scores on this component of QoL (from 30.54 at baseline to 31.24 at 3 months' follow-up; p= .693). Similar results were found for the mental component of QoL, Rotterdam presented higher scores indicating a better QoL related to mental health (from 62.86 to 61.74) than Valencia results (from 49.22 to 47.60) and any of these changes were found statistically significant. Finally, loneliness was measured as it is of great importance for health status. As in the other variables, Valencia pilot site participants presented higher scores on the Jong Gierveld Loneliness Scale, indicating higher level of loneliness in comparison with Rotterdam participants. Concretely, participants from Valencia pilot showed an average of 1.19 at baseline and an average of 1.43 at follow-up, which led us to conclude that those participants suffered a worsening of their loneliness feelings. On the contrary, Rotterdam participants went from an average of 0.97 to 0.93, indicating lower levels of loneliness. However, in general participants did not suffer from loneliness as the loneliness threshold is established in ≥ 2.

The second objective of the impact assessment was to evaluate the **impact on health care resources** of the implementation of the APPCARE model. The use of health care resources was measured by the following self-reported variables: number of emergency hospital admissions, average number of hospital stay days, number of visits to physician and average number of visits to physician. These variables were only assessed in Rotterdam and Valencia pilot sites. The number of emergency hospital admission was higher among Valencia participants at both baseline and follow-up. A 39.9% of the Valencia participants were admitted in hospitals prior to be included in the APPCARE study and 3 months after this number was reduced to 26.5%; however, this reduction was not found statistically significant. In Rotterdam, the number of participants reporting emergency hospital admissions at baseline was 22.8%; while at follow-up 17.7% reported admissions. For Rotterdam participants this change over the time was found significant (p=.000). The average number of hospital stay days was also different between both pilot sites. In Valencia the average number at baseline was 27.91 and after 3 months this average was reduced to 19.39. Conversely, in Rotterdam the average number of hospital stay days increased from 8.57 at baseline to an average of 9.49 days at follow-up. The visits to physician was also reported by participants from both pilot sites. In this case, the number of participants having visited the physician was higher in Rotterdam where at baseline the 88.3% of the sample

reported visits to the physician while in Valencia was the 61% of the participants who reported visits. At follow-up these numbers were reduced in both pilot; in Rotterdam 79.2% of participants reported visits to physician while in Valencia the reduction was more drastic, from 61% to 34.5%. As to the average number of visits to physician, Valencia pilot site presented a higher average at baseline (9.61) in comparison with the average number of visits reported by Rotterdam participants (6.66). Even though that in both pilots sites this number was significantly (*p*=.000) reduced, this reduction was greater among Valencia pilot site participants who went from 9.61 visits at baseline to 3.71 visits at follow-up; while in Rotterdam they went from 6.66 to 4.39.

These results led us to the following conclusions regarding the impact of the APPCARE model:

- APPCARE model may had an effect on participants' health status. In particular, on the functional status, medication risks, falls and the physical component of QoL, which were improved in all pilot sites. However, the APPCARE model no had the same impact on dementia, frailty, loneliness and the mental component of QoL, which were slightly improved in some pilot sites and worsened in others. This may be due to the psychosocial nature of these variables who were not directly addressed as part of the APPCARE model, expect for the Valencia pilot site.

- APPCARE model may had an effect on the use of health care resources. In particular, on emergency hospital admissions and the average number of hospital stay days, and on visits to the physician and the average number of visits to the physician, which were reduced–except for the average number of hospital stay days that was slightly increased in Rotterdam– among all participants after being included in the APPCARE model.

4. Scalability recommendations

According to the results, we can elaborate on specific recommendations to increase the scalability of APPCARE model. Several characteristics of the APPCARE model have been found to be essential or highly relevant to be taken into account for the success of their transferability to different European contexts:

1. ***Model design and delivery***: The APPCARE model was designed as a flexible model to be adaptated to different contexts and the needs of the populations being targeted. The characteristics of the APPCARE model are strongly dependent on the participant/patient health needs and the context in which these are addressed. So, the process of the model design, implementation and follow-up can be resolved in many different formats that depend on aspects, such as the settings where care is provided, the tools available, the number and kind of actual interventions, etc. Moreover, the APPCARE model can be understood not only as a healh care model but in a wider sense to include aspects such as promotion of well-being, social care, rehabilitation, socialisation, etc; resulting in even further complexity. Therefore, the model adaptability and usability are essential factors for its scalability. Both adaptability and usability of the model will then depend on: a) a deep understanding of the context of use; b) the identification of participants requirement and needs; c) the optimal design and context-adaptation to meet the identified requirements and needs and; d) the capacity to be evaluated in terms of the requirements and needs.

2. ***Mix of professional skills***: The APPCARE model implementation relies on a number of different professionals working together with a variety of competencies and skills. One of the most significant aspects is the need to better understand what characterises effective coordination of work practices across such a variety of professionals and across different care settings (such as hospital care and continutiy of care implemented at community level). Therefore, an essential aspect to be considered is that the human factor is a highly relevant aspect for transferability within the organisations. In particular, it is recommended to address, specifically, human-related factors that might undermine the self-efficacy from a subjective and individual perspective.

3. ***Involvement of patients and carers***: Patients (and their families) are becoming health consumers who want to be active participants in the management of their own health. This implies the right of choice and decision-making and this influences the characteristics of the services to be provided and must be properly understood. Continuity of care, and the relationship between patient and professional, is intrinsic to supporting patient-centred integrated care. Therefore, it may also be relevant to involve in the process, not only the professionals working in health care, but also health consumers (patients and carers) who, if adequately engaged, will have a positive influence on their peers and colleagues to motivate them and generate an adequate environment for the transferability process.