

A Personalised Integrated Care Platform

(Grant Agreement No. 689209)

D7.6 Second Care Management and Design Tools

Date: 2018-10-11

Version 1.0

Published by the PICASO Consortium

Dissemination Level: Public



Co-funded by the European Union's Horizon 2020 Framework Programme for Research and Innovation under Grant Agreement No 689209

Document control page

Document file:	D7.6 Second Care Management and Design Tools.docx
Document version:	1.0
Document owner:	Fraunhofer
Work package:	WP7 – Care Management Tools and Private & Public Cloud Integration
Task:	T7.2 Narratives Manager and Service Catalogue
Deliverable type:	[DEM]
Document status:	\boxtimes approved by the document owner for internal review \boxtimes approved for submission to the EC

Document history:

Version	Author(s)	Date	Summary of changes made
0.1	Carlos A Velasco (Fraunhofer)	2018-09-01	Initial content
0.2	Carlos A Velasco (Fraunhofer)	2018-09-11	Additional data
0.8	Carlos A Velasco, Yehya Mohamad, Rohit Ravindra Hegde, Yibin Jiang (Fraunhofer)	2018-09-25	Completion of section 4 with all diagrams and workflows
0.9	Carlos A Velasco, Yehya Mohamad, Rohit Ravindra Hegde, Yibin Jiang (Fraunhofer)	2018-10-10	Version for internal review
1.0	Carlos A Velasco, Yehya Mohamad, Rohit Ravindra Hegde, Yibin Jiang (Fraunhofer)	2018-10-11	Final version submitted to the European Commission

Internal review history:

Reviewed by	Date	Summary of comments
Marek Skokan (TUK)	2018-10-11	Minor editorial issues

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1 Executive Summary

This deliverable presents the second version of the PICASO care management tools. These tools support the objectives of the project related to the management of care plans, which are:

- care management,
- design of appropriate care management structures and workflows (such as care services, care plans and templates, etc.).

The aforementioned care management structure design has been based on existing hospitals' models, workflows and guidelines and then aligned as much as possible to existing standards (HL7 FHIR v.3.x) aiming at reaching maximum interoperability between existing and future systems. The developed models of such structures have been populated with data coming from existing models inside the hospitals and supported with formal carer friendly design tools.

This second version of the Care Plan Manager contains fundamental architectural changes in comparison to version 1 reported in the previous deliverable. This version has been deployed in both pilots. The feedback of the clinicians during this phase will be incorporated in the final version of the prototype.

2 Introduction

Care Management is used by health professional to design the medical and clinical rationale of the different services to be available in the PICASO platform. Our services arrange their execution in a pre-described sequence to support the execution of the care plan across the different care domains. The outcome of the design is on one hand a catalogue of standard services, and on the other hand, the connecting of services into a set of clinical logistic operations defining personalised, dynamic care plans for the patients.

The subset also maintains API interfaces to workflow and skills models, legacy patient records, and standardised guidelines and knowledge databases. Finally, it introduces high-level abstraction mechanisms that make the formal carer independent of high level programming skills when defining the services and narratives.

This deliverable presents the second version of the PICASO Care Plan Manager and its associated tools.

2.1 Purpose, context and scope of this deliverable

Related objective: New care management programmes for multi-morbidity

- Create a decision support methodology for analysing conflicts, constraints and limitations from singlemorbidity care plans and patient/physician/therapist preferences applied to patients with co-morbidities and multi-morbidity conditions by using the concept of constraint satisfaction problem, to allow the cares to define new care programmes for the management co-morbidities in community and home care settings.
- Develop new training programmes for the care workforce, new organisational models and new ways of exchanging medical information to improve the coordination of care management across silos.
- Specific technological innovations: Create a Care Management system based on dynamic design of complex care plans guided by narratives using goal-driven heuristic search and with secure authentication of patients and carers involved.

Related tasks:

• T7.2 Narratives Manager and Service Catalogue [Task leader: Fraunhofer, partners: CNET] [M3-M41]

Modelling of narratives will be performed using knowledge representation methods, such as ontologies, frames, scripts or rules. The first goal is the design of formal description of narratives in a form of predefined workflows enabling adaptation to the needs of specific patients and concrete patient environment. This requires design of person profiles and model of the environment. Patient profiles should enable to take into account specific personal needs. Environmental model should enable to take into account specific personal needs. Environmental model should enable to take into account specific personal needs. Environmental model should enable to take into account specific context of the deployment area (different devices, services, situational context). The adaptability of the narrative formal description will enable reusability. The result of the modelling process will be design of formal structures representing narratives and services. Narratives are developed and stored in exchangeable knowledge representation that describes the services, the virtual objects involved and its dynamic properties (event handling, risk assessment, personalisation). Fraunhofer will perform the work assisted by CNET and with domain knowledge from WP3.

2.2 Intellectual Property (IP)

The different components of the Care Plan Manager, the Reference Data Server and the Communication Center are subject to open source and commercial licences, which are subject to the licences reflected in the IP repository being created for the project.

2.3 Content and structure of this deliverable

This deliverable starts with a short description of existing tools and models at the trials' sites. Then, we focus on the description of the Care Plan Manager, its architecture and its components. This document is an extension of the deliverables D7.1 and D7.2.

3 Existing tools and models

3.1 UDUS

UDUS runs the local clinical register at the Policlinic of Rheumatology and Hiller Research Unit Rheumatology with currently approximately 20,500 patients with rheumatic diseases, whose clinical characteristics are routinely documented in a web-based documentation application called DocuMed.rh. This system was developed at UDUS and is also able to export data to the national database run at the German Rheumatism Research Centre in Berlin. Currently care plans for all our out-patients including RA patients are already generated automatically via DocuMed.rh and stored in the system.

In addition, UDUS owns a hospital information system (called Medico, manufacturer Cerner) that interacts with the web-based documentation system DocuMed.rh and e.g. delivers laboratory data to it. The HIS is used for doing prescriptions for medication, physiotherapy and occupational therapy for our outpatients and for administrative duties (e.g. invoices). Furthermore, it is used to refer patients to other departments of the hospital for consultations electronically. The consultation results come back via the HIS to the Policlinic of Rheumatology. For inpatients the HIS is used to generate discharge letters.

From the more clinical perspective guidelines and care plans already used in the management process of patients with rheumatoid arthritis have been described in the deliverable D3.1 "Integrated Care Plan Integrated Care Plans Across Care Sectors – Analysis and Recommendations". For example according to "treat-to-target" guidelines patients' follow-up review/consultation with the RA Specialist are performed on a regular basis. In addition, the evidence-based recommendations for the assessment and management of cardiovascular risk in RA patients that have been published from the EULAR are supposed to be followed.

3.2 UTV / Santa Lucia

"Santa Lucia" Foundation is a landmark institution in the field of highly specialized neuro rehabilitation. Strong related health cares and research build its core activities. Rehabilitation programs affects patient with both, motor and cognitive deficits.

In the wide spectrum of illness and conditions treated, rehabilitation therapies are especially focused on patients affected by stroke and coma, spinal cord injuries, amputations, and people suffering from degenerative diseases such as Parkinson's disease.

Alongside its in-patient and day hospital, a dedicated structure exists for outpatients, of all ages, in need of extensive rehabilitation. Often patients are clinically observed for extended periods, even years. This allows the Hospital to offer a complete range of services, even to those not admitted to the Hospital.

The services for outpatients with Parkinson's disease are:

- 1) Neurological Assessment with pharmacological and physio-therapy;
- 2) Neuropsychological Assessment with cognitive training programs;
- 3) Evaluation of psychopathological disorders;
- 4) Magnetic Resonance Imaging.

In Santa Lucia and UTV there is still a strong dependence on paper-based documentation for the care plans.

4 Care Plan Manager

4.1 **PICASO** Care management entities

PICASO defines the following entities:

- Service: A service aims to model a care plan reusable element that can be configured by a carer based on a patient's situation and executed as part of a care plan. A service can be either an automated service (e.g. scheduled reminder), a manual one (e.g. make an appointment) or a mixed (semi-automatic) one.
- Service Instance: A service, after being defined can be instantiated one or more times inside a care plan. A service instance also can be cloned, deleted or saved as service template by the clinician. The service instance consists of the service configuration and the service subject data, which is populated automatically by the design tools.
- Service template: A service template is a service in a default configuration. It is similar to an instance of a service but the template has no patient and carer information, and it is available to carers for reuse. When a template is assigned to specific care plan, the missing data are inserted automatically.
- **Care plan**: A care plan is a combination of services that targets to a specific goal for a specific patient. Apart from the services a care plan has some extra properties in order to define global attributes of the care plan like the goal, the time period, etc.
- **Care plan instance**: Similarly to service instance, a care plan instance is a care plan configured with patient's situation specific services and data.
- **Care plan template:** Similarly to service template, a care plan can be saved (removing patient/clinician data) as a template. Using this artefact the clinicians have the flexibility to store their "guidelines" and standardised "workflows" in a very easy way.
- Service Process Model: A Service Process Model is a service/care plan instance model enriched with runtime data.
- **Narrative**: A narrative contains a summary of the service, and may be used to represent the content of the service in a human readable format. A care plan narrative is composed as the sum of the assigned services. This is an automatically generated text based on pre-configured text templates.
- **ValueSet:** A ValueSet is a FHIR resource that is intendent to model the terminology inside a silo like a hospital. We extend this use and we use this as a mechanism to model all medical reference data and share between all PICASO "subscribers".
- **Concept:** A concept is an element of a ValueSet.

4.2 Data Modelling based on FHIR 3.0

PICASO models all entities necessary for the care management based on FHIR 3.0 introducing when necessary new PICASO FHIR extensions. This specification consists the PICASO FHIR profile.

4.2.1 CarePlan Resource

Based on https://www.hl7.org/fhir/careplan.html

Field	Туре	Comments	UI
id	string	timeuuiid generated by NM	Care plan ID
meta.versionid	int	incremental integer generated by NM	Version
text.div	string	Narrative template (dynamic text)	Generated Narrative

Field	Туре	Comments	UI
status	code	https://www.hl7.org/fhir/value set-care-plan-status.html	Status
description	string		Description
subject.reference	string	patient UPID	
period.start	dateTime	Time of start	From
period.end	dateTime	Time of end	То
author.reference	string	carer UPID	
activity[i].reference	string	References to activates – PICASO services	
contained	Resource[]	Referenced resources	

4.2.2 CarePlan Services

4.2.2.1 Base PICASO Service

This is the based structure of a PICASO CarePlan Service. This is based on Domain resource (selection). All Services inherit the following properties:

Field	Туре	Comments	Default	UI
id	string	timeuuiid generated by NM	NULL	
meta.versionId	int	incremental integer generated by NM	0	
text.div	string	Narrative template (dynamic text)		
status	code	https://www.hl7.org/fhir/valueset- request-status.html	draft	Service Status
subject.reference	string	UPID (Unique Picaso ID) of the patient		
extension[0].extension[0]. valueString	string	Value of extension with name ServiceName	Service name	Service:
extension[0].extension[1].valueString	string	Value of extension with name Service ID	Service ID	
extension[0].extension[2]. valuePeriod	Period	Suspend Period of service	undefine d	Suspend period
extension[0].extension[3]. valueString	string	Message to Patient when suspended	undefine d	Suspend message to Patient

4.2.2.2 Health Questionnaire Service (id = HealthQuestionnaire)

Based on https://www.hl7.org/fhir/communicationrequest.html

Field	Туре	Comments	Default	UI
topic.reference	string	id of selected questionnaire	NULL	Questionnaire
authoredOn[0]	dateTime			

Field	Туре	Comments	Default	UI
occurrencePeriod[0]	Period		NULL	From:, To:
note[0].text	string		NULL	
note[0].time	dateTime		NOW	
note[0].author.reference	string	UPID	UPID	

4.2.2.3 Appointment Service (ID: Appointment)

https://www.hl7.org/fhir/appointment.html

Field	Туре	Comments	Default	U
speciality.coding[0]	Coding	http://hl7.org/fhir/ValueSet/c80- practice-codes		Practice Setting Code
requestedPeriod[0]	Period		NULL	Requested Period
minutesDuration	PositiveInt		15	Duration (minutes)
created	dateTime		NOW	
description[0]	string		NULL	Description
participants[0].actor.reference	string	Patient UPID	UPID	
participants[1].actor.reference	string	Clinician UPID	UPID	

4.2.2.4 Blood Pressure Measurement Service (ID: BloodPressureMeasure)

https://www.hl7.org/fhir/devicerequest.html

Field	Туре	Comments	Default	UI
intent	code		active	
device.reference	string		#	Device
authoredOn	dateTime			
occurrenceTiming[0]	Timing			Measurement Timing

4.2.2.5 Weight measurement Service (WeightMeasure)

https://www.hl7.org/fhir/devicerequest.html

Field	Туре	Comments	Default
intent	code		active
device.reference	string		#
authoredOn	dateTime		
occurrenceTiming[0]	Timing		

4.2.2.6 Walk Steps Service (WalkStepsMeasure)

https://www.hl7.org/fhir/devicerequest.html

Field	Туре	Comments	Default
-------	------	----------	---------

intent	code	active
device.reference	string	#
subject.reference	string	#
authoredOn	dateTime	
occurrenceTiming[0]	Timing	

4.2.2.7 Heart rate measurement Service (HeartRateMeasureService)

https://www.hl7.org/fhir/devicerequest.html

Field	Туре	Comments	Default
device.reference	string		#
subject.reference	string		#
authoredOn	dateTime		
occurrenceTiming[0]	Timing		

4.2.2.8 Medication Request Service (MedicationRequest)

https://www.hl7	ora/fhir/medicationrequest html
11003.// 00000.111/	

Field	Туре	Comments	Default
intent		http://hl7.org/fhir/ValueSet/m edication-request-intent	
recorder.reference	string	Clinician UPID	
authoredOn	dateTime		
validityPeriod	Period	Start/end of medication	
dosageInstruction[0].additionalInstr uction.coding[0]	Coding	Supplemental instruction - e.g. "with meals" <u>http://hl7.org/fhir/ValueSet/ad</u> <u>ditional-instruction-codes</u>	
dosageInstruction[0].text	String	Additional (Patient Instruction text field - only if additionalInstruction.coding[0]=000 (other)	
dosageInstruction[0].route.coding[0]	Coding	Administration route (oral, subcutaneous, intramuscular, intraarticular, intravenous, Apply externally on skin) <u>http://hl7.org/fhir/ValueSet/ro</u> <u>ute-codes</u>	
dosageInstruction[0].doseQuantity	Quantity		
dosageInstruction[0].timing	Timing		
medicationCodeableConcept.codin g[0]	Code	See Medication below	{MedicationRequestID}Me dication

4.2.3 Other Types

4.2.3.1 Medication Resource - referenced from MedicationResource

https://www.hl7.org/fhir/medication.html used by Medication Request

Field	Туре	Comments	Default
id			
code.coding[0]	Code	Name of medication: (selectable from drop-down list as provided by clinicians) Pending input from UDUS/UTV/SantaLucia	
form		Type of medication (selectable): Tablet, Chewable tablet, Injection, Drops, Oral solution, Ointment, patch, <u>http://hl7.org/fhir/ValueSet/medication-form-codes</u>	

4.2.3.2 Medication Statement

https://www.hl7.org/fhir/medicationstatement.html

Field	Туре	Comments	Default
id			
basedOn[0]	MedicationRequest		
subject.reference	String	UPID	
reasonNotTaken[0]	Coding	http://hl7.org/fhir/ValueSet/reason-medication-not- taken-codes	NULL

4.2.3.3 Timing Datatype

https://www.hl7.org/fhir/datatypes.html#timing

Field	Туре	Comments	
boundsPeriod.start	Period		now
period	positive int		1
periodUnit		https://www.hl7.org/fhir/valueset-units-of-time.html	wk
dayOfWeek	code[]	https://www.hl7.org/fhir/valueset-days-of-week.html	Day now
frequency	positive int		1
timeOfDay	string[]	For every next occurrence (start from earlier to later) the time of the day. Should calculate repeated occurrences and use same array index for getting the time.	[12:00]
when	code[]	https://www.hl7.org/fhir/valueset-event-timing.html similar to timeOfDay if when[i]=undefined means no event for this occurrence TODO: add more in ref system	0

4.2.3.4 Communication Resource (HealthCare Communication component)

https://www.hl7.org/fhir/communication.html

Field Type	Comments	Default
------------	----------	---------

id	string	timeuuid generated by NM	NULL
subject.reference		UPID	
category.coding[0].code	code	https://www.hl7.org/fhir/valueset-communication- category.html	instruction
recipient.reference	string	List of IDs of clinicians / roles	
sent	dateTime		
sender.reference	string	UPID	
payload[0].contentString	string	Message	

4.2.4 FHIR PICASO Extensions

4.2.4.1.1 Notification Extension

Used	bv	the	services	for	configuring	reminders
0300	IJУ	uic	301 11003	101	connigannig	remnuers.

Field	Туре	Comments	Default	Values
NotificationType: [1 .1]	string			
NotificationConditio n: [01]	Exten sion	systolicRange: [01] Range diastolicRange: [01] Range noMeasurementDays: [01] Int eger highlight: [01] Boolean heartBeat [01] Range	undefine d	
NotificationMessage : [11]	string	when not done		
NotificationTime	postiti ve int[]	Number of minutes after every occurence of service's timing or 0 (not notification)	[10]	
NotificationMeans: [11]	string		reminder	http://hl7.org/fhir/ValueSet/c ommunication-category
NotificationEmail: [0. .1]	string	mail address to send	undefine d	

4.2.5 Other Data requirements

- List of clinicians (UPID, display name) from ODS
- List of patients (UPID, display name) from ODS

4.3 Care Plan Manager

The aim of this tool is to allow the creation, integration and effective sharing of a Patient pathway between all involved professional carers. Every organisation/physician uses a number of standard care plans for various diseases management actions. These care plans are expressed in a narrative form and are stored as Narrative templates in the Process Model repository through the Careplan Orchestrator component. A narrative template uses in a specific arrangement standard services stored in the service catalogue with open data fields for specific service parameters. In order to develop a Patient Pathway, a physician or an assistant instantiates one of the existing templates and fills the missing services' data with specific patient data. The resulting patient's pathway is then stored for in the Process Model Repository for optimisation and service orchestration.

Current major features:

- FHIR v3.0 compatible
- Reusable FHIR compatible Angular 4 components
- Create a new care plan from scratch or based on an existing template
- Load existing care plan per patient
- Save care plan in JSON FHIR v3.0 format
- Save care plan as template
- Add services (see list of existing services in 4.2.2 and 4.2.3)) based on existing templates or not
- Clone services
- Delete service
- Save services as template
- Active medication Plan for quick glance of medication timings



Figure 1: Care plan manager components diagram

Figure 1 displays the Care Plan Manager, which contains the care plan, and which have services like medication, blood pressure measurement, weight measurement, step measurement, heart rate measurement, health rate measurement, health questionnaires and appointment request. When there is no care plan in the Care Plan Manager, a new care plan can be created with or without a template, if a template exists in the Care Plan Manager. Besides, the Care Plan Manager can delete and save changes when there is a care plan. Therefore, the Care Plan Manager can manipulate the care plan. In the care plan, the service can be added with or without a template if a template exists and the service can be grouped according to the service type. As to each service, it can be modified, cloned, deleted and saved as a template for future use.

4.4 Care Plan Manager User Interface

The User Interface provides a visual aid for clinicians to create a care plan. Figure 2 depicts a care plan where a clinician can provide basic information of a care plan like description, status and timing. This helps other care providers to differentiate care plans for a patient.

Home / Care Plan Manager		
Care plan manager		
Care plan information		
CarePlan ID: cd4eedb4-d336-8d3e-3e1a-07d101da3ccc	Patient ID: e0776d22290b11e8a2bb525477465977 (Patient TestUTV)	Author ID: 016f7960e0ad11e7986d0050569d39ae (016f7960e0ad11e7986d0050569d39ae)
Description		
Il paziente inizia terapia con pantorc 40 mg 1 cp/die per 2 settimane per MRGE		A
Status		
Active		٠
From:		
03/22/2018		
To:		
04/05/2019		

Figure 2. Care plan information

Figure 3 lists all the services defined for a patient in grouped view. Each kind of services are grouped together for better readability. Each service can be expanded by clicking on the 'plus' icon to modify the service. There are two more buttons, which are used to save a care plan after modifying it. You can also delete a care plan by clicking on the delete button



Figure 3. List of services defined in the care plan

Figure 4 provides a list of available services that can be added to the care plan. Each of these services can be added either from a pre-saved template or create a new service from the blank template.

Delete care plan⊖	Save changes in care plan
\dd care plan service 👻	
edication	
Blood pressure measure	ment
Weight measurement	: Status 'Active',
Step measurement	ig), z.B. generic Ac antity: Acimetacin (
Health questionnaires	il 2019-10-07, week
Appointment request	

Figure 4. Selecting type of service to add to a care plan

Figure 5 lists all available Medication templates to create a medication service.



Figure 5. Selecting a template to add as a service

Figure 6 depicts a medication service where a clinician can select: Status, Medication, Form of medication, Quantity of medication, Route through which medication should be taken, any further instruction that need to be indicated to the patient and the timing of the medication.

re plan service 👻			
rouned (18 services)			
The Medication intake: Status 'Active',			
ation: Metformina (400mg) / Glibenclamide (5m t per intake: 1, Total quantity: Metformina (1200	g), p.e. Glibomet, ng) / Glibenclamide (15mg), p.e. Glibomet,		
r's role: Dermatologist	e(s) per day (07:00, 13:00, 20:00). Reminder bero	ore: 11 mins, Reminder after: 10 mins	
ve			
me of medication			
Metformina (400mg) / Glibenclamide (Smg), p.e. Glibor	aet		
m of medication			
Capsules			
tedication count per intake (in case of prescription	As needed' note here the max. dose per intake)		
ute			
Drat			
ient instruction (in case of prescription 'As needed'	choose here 'other' and provide a text message to in	(form the patient about the max. dose per day)	
before the meal			
sk timing			
From 2018-10-09 until 2019-01-26, daily, 3	:ime(s) per day (07:00, 13:00, 20:00).		
Starte: 10/09/201	8		
Ends: Same Da	y 🔍 Never 🖲 On 01/26/2019		
Define the time frame of repeats			
Repeats: Daily	×		
Schedule per day			
Frequency per day : 3			
Start date (Tuesday) 10/09/2018	When	at	
	Specify *	07:00 AM	
Start date (Tuesday) 10/09/2018	When	at	
	Specify *	01:00 PM	
Start date (Tuesday) 10/09/2018	When	at	
	Specify *	08:00 PM	
Reminder settings			
Time settings			
 No reminders: Do not fill in anything in this section Reminders same as 'Task timing': Insert .0' in field 	an. J 'Reminder before'.		
Unspecific task timings like 'Morning' follow a pr	defined time schedule for firing of reminders. [More]		
 Reminders before/after ,Task timing: Insert require When defining a reminder for unspecific task tim 	sted amount of minutes in field(s) ,Reminder before/afte ings like 'Morning', consider the predefined time schedul	ar'. Je for firing of reminders. [More]	
Reminder before: 11 mins			
Reminder before message (mandatory, if a remind	er is defined):		
Reminder after: 10 mins			
* Reminder after message (mandatory, if a reminde	is defined):		
Remind patient by:			

Figure 6. Medication service example

Creating a template out of a service can be achieved by clicking on the 'save service as a template' button on the service. Then, the clinicians can give a suitable name for the template which is shown on Figure 7.

BICASO - CLINICIAN				
T DASHBOARD	=	Save comites as template		Automatical Sector S
Q Patient Selection	Home / Care Plan Manager	Save service as template		
Data Resource Browser	Care plan manager	Give a short and descriptive name for this template		
Patient Data Viewer	Care plan information	Save Service template ⊕		
🔲 Care Plan Manager	CarePlan ID: 826a91c2-a887-7491-4d88-5b5	6eb26fbc3 Patient ID: b	ctedb4e0ad11e7986d0050569d39ae (YibinPatient YibinPatient)	Autrior /ID: 01617960e0ad11e7986d0050569d39ae
Communication Center	Description			(016f7960e0ad11e7986d0050569d39ae)
us rusk manager				
	Status			
	Active			•
	From:			
	09/21/2018			
	To:			
	09/21/2019			
		10.000		The Addition share
	Delete care plan 🖯 🔛 save changles in d	are pan		HE MEDICATION DUIT
	Add care plan service 👻			
	Show grouped (5 services)			
	Medication Blood pressure measurement	Health guestionnaires		
	🖬 🏛 🖓 🗈 Fill in questionnaire: Statu	s 'Active',		
	Guestionnaire: RADAI, Fill in: From 2018-09-05 onwards, w	eekly, Saturday (Any time). No reminders		
	Authors role: Dermatologist			
	Action			
	Select Questionnaire			
	RADA			
	Task timing			
	E From 2018-09-05 onwards, we	ekly, Saturday (Any time).		
	Define time period by start and en	i date		
	Starts:	09/05/2018		
	Ends:	○ Same Day [®] Never ○ On mm/dd/yyyy		
	Define the time frame of repeats	Weekly		
	Repeats:			
	Repeat on: (Please select at least one day)			
	Schedule per day			
	Frequency per day :	1		
	Start date (Saturday) 09/08/2018	When		
		Any time *		

Figure 7. Creating a Health questionnaire template

There can be more than 6 medications per care plan, which makes it difficult for medical professionals to go through the summary of each medication service and see the timing and medication the patient is taking. To provide a quick glance of all the medications in the care plan, the 'Active medication plan' option is depicted in Figure 8 as a table with just medication and timing.

	No. No.	Active Medication Plan		X dus Auser: 01517960e0ad11e798600	1050569d39ae + O Contiguration +
Q Patient Selection	Home / Care Plan Manager				
Data Resource Browser	Care plan manager	Medications	Timings		
🗐 Patient Data Viewer	Care plan information	Prednisolon (5mg), z.B. Decortin H®	From 2018-05-16 onwards, daily, 1 time(s) per day (Before breakfast).		
E Care Plan Manager	CarePlan ID: f1a65d27-2178-2407-389c-e5b	Diclofenac (50mg), z.B. generic Diclofenac	From 2018-05-16 onwards, as needed.	016f7960e0ad11e7986d0050569d39ae	
 Communication Center Risk Manager 	Description	Methotrexat parenteral (15mg), z.B. generic Methotrexat parenteral	at parenteral (15mg), z.B. generic Methotrexat From 2018-05-16 onwards, weekly, Thursday (12:00).		
	Krankheitsaktivität rheumatoide Arthritis	Ramipril (2.5mg), z.B. generic Ramipril	From 2018-09-06 onwards, daily, 1 time(s) per day (Morning).		
	Status			_	
	Active				
	From:				
	05/07/2018				
	To:				
	05/07/2020				
	Delete care plan 🛞 🖹 Save changes in c	are plan			Medication plan
	Add care plan service 👻				
	Show grouped (16 services)				

Figure 8. Active medication plan

4.5 Care Plan Manager User Interface workflow

In the following, we summarise some of the workflows that the clinician can select to control the care plan of a given patient.

Use case 1: If the user wants to add a new empty service from a new empty care plan, the workflow is shown in Figure 9. First, the user should login in the Clinician Dashboard and then select a patient from the patient list. After that, the user goes to the Care Plan Manager. If in Care Plan Manager there is no existing care plan, the user can create a new empty care plan without the template. Next, the user can add a service such as a medication from the service list. If the care plan exists, the user can directly add the service from the service list.



Figure 9. Workflow to create a service for an empty care plan

Use case 2: Clinicians do not want to create the same medication service for different patients. If you allow them to create a template, they can add a medication service to the patient care plan easily while prescribing medication. If you want to add an available service template which is saved by you. You can just go to care plan manager in the existing care plan, then click on 'Add care plan service' then select a template which was saved by you or your colleague, and then click on add service.



Figure 10. Select a template to create a care plan for the patient

4.6 Communication Center

The Communication Center provides clinicians a way to quickly exchange information between them in regard to the care plan of a given patient. It also provides a way to review previous recommendations or messages

exchanged. Figure 11 depicts all the communications related to a fictitious patient exchanged by different clinicians. Clinicians can also scroll down to see all the history of communications.

Communication on patient name: Patient TestUTV





A clinician can create a new message to a colleague by giving a speciality and the name of the clinician. This message can be securely sent over email as well. This process is shown in Figure 12.

DASHBOARD	=	• Defent Dennet Tentifity - • • • • • • • • • • • • • • • • • •
Q Patient Selection	Home / Communication Ce	Message to clinician
Data Resource Browser	Communicatic	
🗐 Patient Data Viewer	List of Commu	Refers to patient-ID: e0776d22290b11e8a2bb525477465977
Care Plan Manager	List of commu	Select addressee
Communication Center	Author: Schmidt Gaby, Addressee: Clelia Pellic	Speciality
🖩 Risk Manager	Rivalutazione cogniti	Choose an option
		Clinician
	Author: Schmidt Gaby, Addressee: Dr. Agostin	Choose an option
	Valutazione della lun	Show only selected clinician
		Send message by e-mail to: email
	Create message to cliniciar	send message ()

Figure 12. Creating a message to a clinician

A typical workflow is presented in Figure 13. Let us say that a patient has come to see a radiologist. The radiologist does not have to depend on what scans need to be done based on the patient's explanations. The radiologist can see which doctor has requested the scan by logging in to the dashboard, select the patient and read the complete message sent to him in the communication centre. If there is a need to clarify the message, the radiologist can create a message to the original author by clicking on 'Create message to clinician'.



Figure 13. Workflow example in the Communication Center

4.7 Reference Data Server

This component allows the management of PICASO reference data including both clinical reference data and more PICASO trial generated data. It has been developed based on the definition of the FHIR Terminologies and has been further extended in order to support all required PICASO reference data. Some parts of the API as shown in Figure 14.

PICASO Reference Data Server (RDS) API®
Schemes HTTPS
email 🗠
POST /email
codesystem \sim
GET /CodeSystem
GET /CodeSystem/{id}
medication \checkmark
GET /Medication
GET /Medication/{id}
valueset \checkmark
CET /ValueSet
GET /ValueSet/{id}

Figure 14: Overview of Reference Data Server API

Figure 15 shows the UI of Reference Data Server.

$\leftarrow \rightarrow \mathbf{C}$ B Secure https://picaso.fit.fraunhofer.de/cd/#/	codings			T 🖈 🖽 🥶 🔍 i
CAAD DAGAN DASHEOARD			🚑 Patient:	≜User: Clinician:1 → 🛛 & Configuration →
Home / FHIR Codes Manager				
Terminology management				
Selected System: http://hl7.org/fhir/care-plan-stat	us			
Search for system:				
http://hl7.org/fhir/care-plan-status				
List of concepts (3 concepts)				
Add concept				
Table View JSON View				
Code	Display	Value	Action	
active	Active	null	⊖ Remove	
completed	Completed	null	⊖Remove	
suspended	Suspended	null	⊖Remove	

Figure 15: Reference Data Server UI – list of concepts in selected system

(•) FIT Chat ×	🔹 PICASO Clini	cian dashbo ×		ysis — 🗆 🗾	×
← → C ● Secure https	s://picaso.fit.frau	inhofer.de/cd/#/codings	우 ☆ 💷	os 🥥 😮	:
DASHBOARD			âs Patient: âUser: Clinician1 → 🌣	Configuration 👻	^
Q Select Patient	http://ww	w.picaso-project.eu/refs/drugs			
Data Resource Browser	List of Add conce	f concepts (329 concepts)			
 Clinician Manager 	Table View	W JSON View			
🖻 Care plan manager	Code	Display	Value	Action	
p Communication	DE40	Abatacept (125 mg), e.g. Orencia®	{ "substrance": "Abatacept ", "dosage": "125 mg ", "trade": "Orencia®", "lang": "DE" }	⊖ Remove	
	DE196	Aceclofenac (100 mg), e.g. Beofenac®	{ "substrance": "Aceclofenac ", "dosage": "100 mg", "trade": "Beofenace", "lang": "DE" }	⊖ Remove	
	DE197	Aceclofenac (100 mg), e.g. Biofenac-kohlpharma	{ "substrance": "Aceclofenac ", "dosage": "100 mg", "trade": "Biofenac-kohlpharma", "lang": "DE" }	⊖ Remove	
	DE198	Acemetacin (30 mg), e.g. Azetat	{ "substrance": "Acemetacin ", "dosage": "30 mg", "trade": "Azetat", "lang": "DE" }	⊖ Remove	
	DE199	Acemetacin (60 mg), e.g. Rantudil®	{ "substrance": "Acemetacin ", "dosage": "60 mg", "trade": "Rantudil*", "lang": "DE" }	⊖ Remove	
	DE119	Acetylsalicylsäure (100 mg), e.g. Aspirin®	{ "substrance": "Acetylsalicylsaure ", "dosage": "100 mg", "trade": "Aspirin*", "lang": "DE" }	⊖ Remove	
	DE120	Acetylsalicylsäure (300 mg), e.g. Aspirin®	{ "substrance": "Acetylsalicylsaure ", "dosage": "300 mg", "trade": "Aspirin*", "lang": "DE" }	⊖ Remove	
	DE118	Acetylsalicylsäure (50 mg), e.g. Aspirin®	{ "substrance": "Acetylsalicylsaure ", "dosage": "50 mg", "trade": "Aspirin®", "lang": "DE" }	⊖ Remove	
	DE121	Acetylsalicylsäure (500 mg), e.g. Aspirin®	{ "substrance": "Acetylsalicylsaure ", "dosage": "S00 mg", "trade": "Aspirin*", "lang": "DE" }	⊖ Remove	
				0	-

Figure 16: Reference Data Server UI – list of concepts - PICASO valueset

(•) FIT Chat ×	PICASO Clinician dashbo ×		
← → C Secure https://	/picaso.fit.fraunhofer.de/cd/#/codings	우 ☆ 🕮 🚥 🤤	a 🖌 E
DASHBOARD		🛃 Patient: 🛛 🛔 User: Clinician.1 👻 🌼 Configur	ration 👻
Q Select Patient	Table View JSON View		
Data Resource Browser	{ "resourceType": "ValueSet", "url": "http://www.picaso-project.eu/refs/drugs",		
 Clinician Manager 	"publisher": "", "status": "", "wersion": "1.6".		
🖻 Care plan manager	"description": "", "meta": "",		
Communication	<pre>"concept:: [{ ""system": "http://www.picaso-project.eu/refs/drugs", "dosage": "125 mg ", "trade": "Orencias", "dosage": "125 mg ", "trade": "Orencias", "trade": "Orencias", "lang": "DE") }, { "system": "http://www.picaso-project.eu/refs/drugs", "code": "DE196", "dosage": "100 mg", "trade": "Aceclofenac (100 mg), e.g. Beofenac*", "trade": "Defenac*", "lang": "DE") }, { "system": "http://www.picaso-project.eu/refs/drugs", "code": "DE196", "dosage": "100 mg", "trade": "Beofenac*", "lang": "De") }, { "system": "http://www.picaso-project.eu/refs/drugs", "code": "DE196", "lang": "Secondenac ", "dosage": "100 mg", "trade": "Beofenac", "lang": "De") }, { "system": "http://www.picaso-project.eu/refs/drugs", "code": "DE197", "display": "Aceclofenac (100 mg), e.g. Biofenac-kohlpharma", "value": "Aceclofenac ", "substrance": "Aceclofenac ", "substrance": "Aceclofenac (100 mg), e.g. Biofenac-kohlpharma", "value": "Aceclofenac ", "substrance": "Aceclofenac ", "substrance": "Aceclofenac ", "substrance": "Aceclofenac ", "substrance": "Aceclofenac (100 mg), e.g. Biofenac-kohlpharma", "value": "Aceclofenac ", "substrance": "Aceclofenac ", "substrance": "Aceclofenac ", "substrance": "Aceclofenac ", "substrance": "Aceclofenac (100 mg), e.g. Biofenac-kohlpharma", "value": "Aceclofenac ", "substrance": "Acecl</pre>		

Figure 17: Reference Data Server UI – list of concepts – JSON view

← → C	raunhofer.de/cd/#/codings				우 ☆ 집		• :
DASHBOARD	_			A+ Patient:	User: Clinician 1 💌	Configurat	tion 💌
Q Select Patient Home / F	Concept form			×			
Data Resource Browser Term	Short Code						
 Clinician Manager	Select a code Display text						
🗄 Care plan manager Search fo	Select a descriptive name						
Communication Inttp://r List c Add cor Table>	Value (text) Set a value						
Code	Submit						
active	2	Active		⊖ Remove			
comp	pleted	Completed	null				
suspe	ended	Suspended	null	⊖ Remove			

Figure 18: Reference Data Server UI – form for adding concept in a ValueSet

4.7.1 Current systems used by PICASO components

These are the ValueSet systems that are currently exposed through the Reference Data Server API.

Table 1: List of systems used in PICASO

System
http://hl7.org/fhir/encounter-type
http://hl7.org/fhir/observation-category
http://hl7.org/fhir/practitioner-specialty
http://hl7.org/fhir/sid/icd-10
http://hl7.org/fhir/ValueSet/additional-instruction-codes
http://hl7.org/fhir/ValueSet/care-plan-status
http://hl7.org/fhir/ValueSet/communication-category
http://hl7.org/fhir/ValueSet/days-of-week
http://hl7.org/fhir/ValueSet/event-timing
http://hl7.org/fhir/ValueSet/manifestation-or-symptom
http://hl7.org/fhir/ValueSet/medication-codes
http://hl7.org/fhir/ValueSet/medication-form-codes
http://hl7.org/fhir/ValueSet/medication-request-intent
http://hl7.org/fhir/ValueSet/observation-codes
http://hl7.org/fhir/ValueSet/reason-medication-not-taken-codes
http://hl7.org/fhir/ValueSet/request-status
http://hl7.org/fhir/ValueSet/route-codes
http://hl7.org/fhir/ValueSet/units-of-time
http://hl7.org/fhir/ValueSet/v2-0276
http://www.picaso-project.eu/refs/devicerefs
http://www.picaso-project.eu/refs/disease-type
http://www.picaso-project.eu/refs/questionnaires
http://www.picaso-project.eu/refs/medication-units
http://www.picaso-project.eu/refs/drugs
http://www.picaso-project.eu/refs/fhir/event-timing

5 Implementation

The tools presented before have been developed with the following technologies:

- NodeJS: <u>https://nodejs.org/</u>
- Express: http://expressjs.com/
- Angular 4: https://angular.io/
- CoreUI: <u>https://coreui.io/</u>
- Cassandra DB: <u>https://cassandra.apache.org/</u>

6 Conclusions

We have presented in this document the complete set of care plan management tools that has been deployed in the pilots, based upon the designs presented in the 1st phase of the project, together with the feedback provided by the clinicians afterwards, and by incorporating the different requirements.

This second version of the Care Plan Manager contains fundamental architectural changes in comparison to version 1 reported in the previous deliverable. The feedback of the clinicians during this pilot phase will be incorporated in the final version of the prototype.

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7.2 Tables

Table 1: List of systems used in PICASO 24
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