



C3-Cloud

**“A Federated Collaborative Care Cure Cloud Architecture for
Addressing the Needs of Multi-morbidity
and Managing Poly-pharmacy”**

**PRIORITY Objective H2020-PHC-25-2015 - Advanced ICT systems and services for
integrated care**

D2.9 Dissemination Plan version c

Work Package: WP2 Dissemination, Exploitation and Innovation Related Activities”

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1. EXECUTIVE SUMMARY

Deliverable 2.9 is the third of four annual dissemination reports from C3-Cloud, covering the project year 2018-19. The trend this year has been to evolve the nature of our dissemination outputs from those describing the problem, project ambition and methodology to presentations of the emerging results. These especially focus on the architecture, design and implementation of the main C3-Cloud ICT components such as the approach to semantic interoperability, information security, care plan tools and patient empowerment platform.

The partners recognise the importance of reaching different stakeholders, since the final adoption of C3-Cloud will require a multi-stakeholder co-ordination of interests and endorsement of this approach. An over-arching strategy was presented in the second dissemination deliverable, and is summarised in Chapter 2 of this deliverable as the overall project ambition for dissemination and outreach.

The primary audiences, reached during this project year, have inevitably been the academic health informatics community, via its conferences and main journals, but the wider European stakeholders engaged with the development of integrated care and the adoption of digital solutions have also been important targets. Conferences remain the most important channel, and most of our efforts have been on submitting conference papers and winning poster and presentation opportunities. The dissemination activities of the project, in this year, are summarised in Chapter 3 of this report, with examples of some slide presentations given in the Appendix.

Much of year three of the project has been devoted to the setup of the three pilots, technically to ensure the components and integrated solution are deployment ready, and clinically to finalise and test the education and training materials, the standard operating policies and local approvals. It has therefore been more difficult to promote the pilot study as such, since we recognise that interest will only be strong once we have started to obtain evaluation results, later in 2019. However, there is a lot of candidate material to present the pilot sites, at future conferences and in academic publications, once evaluation results can be added.

The project web site is also an important channel, and this year has been spent enriching the content of the web site. The project has decided to invest in the services of a commercial web design company, which has recently produced our first version of the new site which will go live in May 2019. Some preliminary content is included in Chapter 4, as screen shots. Further content has already been developed, and will progressively be posted online during June and July.

In order to reach a much wider range of stakeholders, the project is planning to collaborate with two other projects in the second half of 2019 with complementary areas of focus, and to hold a joint two day multi-stakeholder event in November 2019. An outline of this plan is given in Chapter 5.

The dissemination activities across all partners will scale up during this final year, as pilot site evaluations emerge. These results will give vital credibility to the C3-Cloud approach and solutions, make it more likely that our conference and journal submissions will be accepted and open more doors for meetings with key stakeholders.

2. DISSEMINATION STRATEGY

2.1. Key stakeholder messages

The following table summarises the main messages we are seeking to promote to each of the stakeholder groups who eventually need to influence decisions about adopting C3-Cloud approaches and solutions to multi-morbidity and poly-pharmacy. Some stakeholder messages are the same but will be delivered in appropriate language and with an appropriate level of clinical or technical detail for each group.

Stakeholder group	Main messages	Principal outreach channels
Patients, caregivers	<p>Explanation of what multi-morbidity is, and how it leads to poly-pharmacy</p> <p>Challenges in care co-ordination faced by health systems</p> <p>Benefit of harmonising clinical guidelines across diseases</p> <p>Importance of engagement in care planning</p> <p>Value of self-management and prevention, using suitable apps</p> <p>How the C3-Cloud PEP works</p> <p>Results of the C3-Cloud pilots</p> <p>Availability of C3-Cloud solutions for adoption by health systems</p>	<p>Web site</p> <p>Multi-stakeholder integrated care events</p> <p>Direct targeting of patient organisations for diseases commonly associated with multi-morbidity</p>
Health and care professionals	<p>The growing challenge of multi-morbidity and its implications for care co-ordination</p> <p>Why single condition guidelines are unsatisfactory, and how they can be aligned to streamline care</p> <p>How aligned guidelines may alter first line treatment choices</p> <p>The importance of patient engagement in joint decision making</p> <p>The value of empowered patients taking an active role in self-management and prevention</p> <p>The knowledge components of C3-Cloud</p> <p>The end user facing technical solutions of C3-Cloud: care planning and PEP tools</p> <p>C3-Cloud pilot evaluation results</p> <p>Availability of C3-Cloud solutions for adoption by health systems</p>	<p>Web site</p> <p>Multi-stakeholder integrated care events</p> <p>Direct targeting of health professional associations</p> <p>Promotion of the C3-Cloud results to HTA agencies</p>

Health and social care provider organisations, healthcare payers, policymakers	<p>The growing challenge of multi-morbidity and its implications on healthcare efficiency, outcomes and costs</p> <p>How aligned guidelines may alter first line treatment and care planning choices</p> <p>The knowledge components of C3-Cloud</p> <p>The integrated care support provided by the C3-Cloud technical (interoperability) components</p> <p>C3-Cloud pilot evaluation results</p> <p>The demonstrated value to patients of the C3-Cloud empowerment platform</p> <p>Availability of C3-Cloud solutions for adoption by health systems</p>	<p>Web site</p> <p>Multi-stakeholder integrated care events</p> <p>Promotion of the C3-Cloud results to HTA agencies</p> <p>Dedicated meetings with decision makers, mainly at national levels</p>
Health ICT sector	<p>The growing scale of multi-morbidity across Europe and its need for more integrated care</p> <p>The potential of this as a market driver for interoperability standards adoption</p> <p>Details of the C3-Cloud technical components e.g. FHIR repository, semantic interoperability tools, care plan management tools and applications, patient empowerment platform</p> <p>Approaches for integration with existing EHR systems</p> <p>Commercial relationships</p>	<p>Web site</p> <p>Multi-stakeholder integrated care events</p> <p>C3-Cloud vendor forum</p>
Academic organisations	<p>The importance of health data and medical knowledge integration</p> <p>C3-Cloud approaches to semantic interoperability</p> <p>C3-Cloud implementations of data standards and security standards</p> <p>Details of the C3-Cloud technical components e.g. FHIR repository, semantic interoperability tools, care plan management tools and applications, patient empowerment platform</p> <p>Outstanding areas of research</p>	<p>Web site</p> <p>Multi-stakeholder integrated care events</p> <p>Academic conferences and journals</p>

The C3-Cloud web site already has elaborations of some of these messages. Others have been conveyed through conference presentations and academic publications. Stakeholder specific meetings, especially with decision makers, have taken place throughout the project, usually at national levels, and more are intended once the pilot evaluation results add credibility and evidence for our approach and solutions.

3. DISSEMINATION ACTIVITIES

The dissemination activities in this second year of the project have mainly focused on presenting the project as a whole, the problems of multi morbidity that it is addressing, its method and work packages, and its anticipated results.

3.1. Summary of dissemination activities during year 3

3.1.1. Types of dissemination activity undertaken

Our activities during year 3 of the project have focused on presentations (15 conference presentations, exhibition stands or posters, and 12 workshop presentations, were made during year 3). A video was produced, and articles published in local newsletters. In addition to the main project web site, individual partners have promoted the project on their own web sites. Social media postings have been occasional this year and will be scaled up during year 4.

There has been 1 full journal publication, associated to the project:

E. Bilici, G. Despotou, and T.N. Arvanitis, The Use of Computer-Interpretable Clinical Guidelines to Manage Care Complexities of Patients with Multimorbid Conditions: A review, Digital Health, 4: 1-21, Article ID 2055207618804927, 2018.


3.1.2. Stakeholder groups reached via our dissemination activities

It is not easy to quantify the reach of our dissemination activities across stakeholder groups. Some events have been very focused and targeted just a few key persons intensely, others have reached a hundred or more within a conference plenary session. Web site statistics do not tell us the stakeholder group of the visitors. Summing the numbers we have does not make sense. However, we do know that we have reached each of the following stakeholder groups through our activities, as indicated in the dissemination summary tables that follow.

- Health and social care payers and providers
 - care professionals
 - healthcare provider organisations
 - health insurers
 - health ministries
- Patient and community groups and associations
- Health ICT industry
- Standardisation bodies
- Research
 - clinical research
 - health informatics
- Education
 - health professional education
 - patient education
- Policymakers

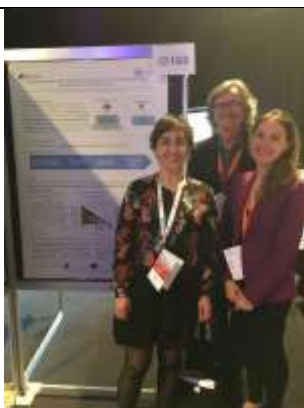
3.2. Summaries of dissemination activities undertaken during year 3

Type of activity	Participation at a Conference	
Date of activity	18 January 2018	
Title of dissemination	C3-Cloud A Federated Collaborative Care and Cure Cloud Architecture for Addressing the Needs of Multi-morbidity and Managing Poly-pharmacy	
Description of event, publishing or hosting entity	2nd Arctic Conference on OpenEHR and Archetype-based Clinical Information Systems, Tromsø, Norway, January 18, 2018	
Principal stakeholders	Scientific community	
Estimated numbers for each stakeholder category where relevant		
Scientific community (higher education, research)		65
Industry		15
Civil society [non-governmental, non-scientific organisations representing some sector of society e.g. patient organisations]		25
Key messages, viewpoint and estimated impact	The problem of multimorbidity was presented and the project objectives and consortium. Detailed description on the work to produce algorithmic support from guidelines was made. This talk came before a talk by Rong Chen, Cambio Healthcare Systems that presented the Guideline Definition Language tools and work for C3-Cloud.	
Lead partner	ORU	

Type of activity	Participation at a Conference
Date of activity	9 March 2018
Title of dissemination	Smart Cities and Digital Healthcare: Transforming Health and Wellness of Citizens and Communities – Plenary presentation by C3-Cloud's Coordinator, Professor Theodoros N. Arvanitis
Description of event, publishing or hosting entity	6 th Smart Cities Conference, Boussias Conferences, Athens, Greece
Principal stakeholders	Scientific community and Policy Makers (350 participants)
Key messages, viewpoint and estimated impact	<p>The Case for “Smart” Care Delivery</p> <p>Chronic diseases are the main reason for poor health and restricted activity, affecting over one third of Europe’s population and accounting for 70% of healthcare expenditure in Europe.</p> <p>Ageing is associated increased accumulation of multiple chronic conditions known as multi-morbidity, including a growing number of functional and cognitive impairments.</p> <p>More than half of all older people have at least three chronic conditions, and a significant proportion has five or more</p> <p>The clinical management of patients with multi-morbid chronic conditions is much more complex and time-consuming for the healthcare system.</p> <p>Further burden on social care services to enable such patients perform everyday activities, supported by informal carer or home / community care services.</p> <p>The C3-Cloud project was presented as exemplar of “smart care”.</p>
Any other material useful for the project	
Lead partner	WARWICK

Type of activity	Participation at a Conference	
Date of activity	25 April 2018	
Title of dissemination	C3-Cloud EUROPEAN PROJECTS IN THE BASQUE HEALTH SYSTEM CONFERENCE. Integrated care and research in health services	
Description of event, publishing or hosting entity	Vitoria-Gasteiz (Spain)	
Principal stakeholders	Osakidetza professionals and Policy makers	
Estimated numbers for each stakeholder category where relevant		
Scientific community (higher education, research)		95
Key messages, viewpoint and estimated impact	<ul style="list-style-type: none">• Main goal of C3-Cloud: Development of evidence based personalised care plans for complex pluripathological patients supported by ICT tools and managed by a coordinated multidisciplinary team that promotes integrated care and the involvement of the patient and/or caregiver.• Results achieved till now• Role of Basque Country• Intervention in Basque Country	
Summary description of dissemination	The aim of the conference was to make known the European projects in which the Basque Health System is immersed, in which more than 400 Osakidetza professionals are collaborating and whose aim is to improve health results, transform the health system and services, and contribute to the economic and social development of Basque society.	
Any further links, references useful for the project	http://www.osakidetza.euskadi.eus/evento/jornada-sobre-proyectos-europeos-en-el-sistema-vasco-de-salud/r85-pkcong02/es/# https://www.kronikgune.org/i-jornada-sobre-proyectos-europeos-en-el-sistema-vasco-de-salud/	
Lead partner	Kronikgune/Osakidetza	

Type of activity	Participation at a Conference	
Date of activity	23 May 2018	
Title of dissemination	Management of personalised guideline-driven care plans addressing the needs of multi-morbidity via clinical decision support services’ Presentation of C3-Cloud in International Conference on Integrated Care (ICIC) 2018	
Description of event, publishing or hosting entity	International Conference on Integrated Care (ICIC) 2018, Utrecht, Netherlands	
Principal stakeholders	Scientific community (higher education, research), Industry and Civil society organizations have attended the conference.	
Estimated numbers for each stakeholder category where relevant		
Scientific community (higher education, research)		Around 40 people attended the session, but we are not sure about the distribution of scientific community and industry.
Key messages, viewpoint and estimated impact	C3-cloud architecture is presented and well received by the attendees. Dr. Gökçe Banu Laleci Ertürkmen from SRDC has presented the paper ‘Management of personalised guideline-driven care plans addressing the needs of multi-morbidity via clinical decision support services’ introducing C3-Cloud architecture.	
Any further links, references useful for the project	Gokce B. Laleci Erturkmen, Mustafa Yuksel, Bunyamin Sarigul, Pontus Lindman, Rong Chen, Lei Zhao, Jacques Bouaud, Mikael Lilja, Nicolas Gonzalez Lopez, Dolores Verdoy, Antonio de Blas, Christopher Marguerie, Gunnar Klein, Sarah N. Lim Choi Keung, Theodoros N Arvanitis, Management of personalised guideline-driven care plans addressing the needs of multi-morbidity via clinical decision support services In 18th International Conference on Integrated Care (ICIC18), May, 2018, Utrecht, Netherlands https://integratedcarefoundation.org/events/icic18-18th-international-conference-on-integrated-care-utrecht	
Lead partner	SRDC	

Type of activity	Presentation in a Conference
Date of activity	23-25 May 2018
Title of dissemination	Organizational and care model analysis for C3-Cloud deployment preparation (C3-Cloud Project) ICIC 2018 (International Conference on Integrated Care)
Description of event, publishing or hosting entity	International Conference on Integrated Care This year's theme of the conference is "Value for People and Populations: Investing in Integrated Care". Utrecht (Netherlands) It was presented by the International Foundation of Integrated Care (IFIC) in partnership with RIVM and Vilans
Principal stakeholders	Researchers, clinicians and managers from around the world who are engaged in the design and delivery of integrated health and social care.
Key messages, viewpoint and estimated impact	Pilot sites are carrying out further work to develop the capability identified (infrastructure, skills and organizational practices) to provide the person-centred integrated care that properly addresses multi-morbidity. The final aim is the implementation of the suggested changes to adequately deploy the pilot phase of the project in the three environments.
Any other material useful for the project	
Lead partner	Kronikgune/Osakidetza

Type of activity	Participation to a Conference	
Date of activity	25-26 June 2018	
Title of dissemination	Digital Assembly Sofia, Bulgaria	
Description of event, publishing or hosting entity	<p>The event annually gathers some 1000 stakeholders and high level policy makers to debate the EU digital policy and the implications of the recent technological developments.</p> <p>Four initial thematic briefings were based on:</p> <ul style="list-style-type: none">• Digital in the upcoming Multiannual Financial Framework• Free flow of non-personal data and the April 2018 Data package• European Electronic Communications Code• Promoting fairness and transparency for business users of online intermediation services <p>The event is co-organized by EC and the Bulgarian Presidency of the council of the European Union.</p> <p>The most important activity was a working lunch that was arranged by Veli Strotman. It brought together Bulgarian health professionals, European Union representatives and the ICT industry. Moderated by the European Commission experts at Digital Health Session, topics like clinical decision support systems, integrated care and home monitoring were also discussed.</p>	
Estimated numbers for each stakeholder category where relevant		
Scientific community (higher education, research)		Unknown
Industry		Unknown
Policy makers		Unknown
Key messages, viewpoint and estimated impact	Integrated care pathways and new organizational models for complex patients were mentioned/presented. Advanced ICT tool to support care planning and integrated care for multimorbid chronically ill patients were discussed. Care planning platforms.	
Any further links, references useful for the project	https://ec.europa.eu/digital-single-market/events/cf/digital-assembly-2018/item-display.cfm?id=22712	
Lead partner	Empirica	

Type of activity	Participation to a Conference	
Date of activity	7 August 2018	
Title of dissemination	Plenary session “Managing Co-Morbidities through Digital Healthcare: The C3-Cloud H2020 project” by the C3-Cloud’s coordinator Professor Theodoros N. Arvanitis.	
Description of event, publishing or hosting entity	International Symposium on Biomedical Engineering (ISBE) 2018, Jakarta, Indonesia.	
Estimated numbers for each stakeholder category where relevant		
Scientific community (higher education, research)		250
Industry		20
Policy makers		15
Key messages, viewpoint and estimated impact	Overview presentation of the C3-Cloud Project and its progress in August 2018.	
Any other material useful for the project		
Any further links, references useful for the project	http://rcbe-ui.com/blog/rushmore_event/international-symposium-on-biomedical-engineering-isbe-2018/	
Lead partner	WARWICK	

Type of activity	Video/Film
Date of activity	September 2018
Title of dissemination	Infomercial movie about C3-Cloud
Description of event, publishing or hosting entity	The infomercial movie was created by Anton Sävström, communicator for the C3-Cloud project, Region Jämtland Härjedalen, in cooperation with Marie Sherman and Mikael Lilja.
Principal stakeholders	Unknown
Key messages, viewpoint and estimated impact	<p>C3-Cloud will change the care for persons with multi-morbidity.</p> <p>The patient becomes active instead of passive.</p> <p>The patient gets more transparency in their care.</p> <p>Professionals will interact more actively within its group, as well as with patients and their informal caregivers.</p> <p>Evidence-based decision support for professionals that reinforces patient safety</p>
Any other material useful for the project	https://www.youtube.com/watch?v=WzLxCpjv9Ug
Lead partner	RJH

Type of activity	Participation to a Conference
Date of activity	13-14 September 2018
Title of dissemination	C3-Cloud platform for integrated care: a tool developed with and for the patient
Description of event, publishing or hosting entity	Congreso Salud Digital: Conectando la salud 2018 (Digital Health Congress: connecting health) San Sebastian (Spain)
Principal stakeholders	The event is open to all those who are interested in the subject, but above all we want to bring together professionals from the health field, the university, technology companies and patients.
Key messages, viewpoint and estimated impact	<ul style="list-style-type: none"> • C3-Cloud can contribute to improving the patient's health. • With the use of C3-Cloud, patients: <ul style="list-style-type: none"> • They may be more involved in their treatment and have more knowledge about their condition. • They will be empowered. • They will be able to contribute and share decision-making with professionals regarding their plan of care. • Before using PEP, the patient needs to be aware of what they are trying to achieve, according to their expectations. • PEP is a complex tool. It is important to provide training to those users (patients and caregivers) on how to use this tool. <p>Digital Health is essential to cope with the continuous change in health care. In this context, health data is configured as an opportunity. The use of Artificial Intelligence, Big Data, and Blockchain will allow important advances in the knowledge of various areas related to health and health services, helping to make more appropriate, efficient, sustainable and responsive to user needs.</p> <p>But what do patients think? On the other hand, what role do social networks play? What successful experiences already exist in Connected Health? What will the future be like?</p>
Any other material useful for the project	<p>Plataforma C3-Cloud para la atención integrada: una herramienta de nueva generación desarrollada con y para el paciente. (C3-Cloud platform for integrated care: a new generation tool developed with and for the patient).</p> <p>Antonio de Blas, Nicolás González, Mikel Ogueta, Dolores Verdoy, Ane Fullaondo y Esteban de Manuel², on behalf of local team of Osakidetza and C3-Cloud consortium.</p> <p>https://www.osakidetza.euskadi.eus/evento/congreso-europeo-de-salud-digital-conectando-la-salud/r85-pkactu02/es/ (https://ehealthdonostia.com/)</p>
Lead partner	Kronikgune/Osakidetza


Type of activity	1) Website. 2) Participation in a Conference
Date of activity	1) 26 th of June 2018 and ongoing 2) October 25 th 2018
Title of dissemination	2) “Ny teknik ska hjälpa och förbättra vården för multisjuka äldre” ”New technique will help and improve the care of multimorbid elderly”
Description of event, publishing or hosting entity	2) Dagens Medicin, Stockholm
Principal stakeholders	2) Care givers, care researchers and health authorities from all of Sweden
Estimated numbers for each stakeholder category where relevant	
Scientific community (higher education, research)	1) Unknown 2) 10
Industry	1) Unknown 2) 10
Civil society	1) Unknown 2) 10
General public	1) 100 2) 10
Policy makers	1) Unknown 2) 10
Media	1) Unknown 2) 5
Investors	1) Unknown 2) 2
Customers	1) Unknown 2) 5
Key messages, viewpoint and estimated impact	<p>1) Interviews with Esteban de Manuel, Gunnar Klein and Mikael Lilja were made and information about C3-Cloud is available at www.regionjh.se and in Region Jämtland Härjedalen’s Intranet. The interviews were conducted by Sara Rönnerberg, a journalist at Region Jämtland Härjedalen, and the webpage about C3-Cloud was created by Anton Sävström, communicator for the C3-Cloud project, Region Jämtland Härjedalen.</p> <p>C3-Cloud will change the care for persons with multi-morbidity. The patient becomes active instead of passive. The patient gets more transparency in their care. Professionals will interact more actively within its group, as well as with patients and their informal caregivers. Evidence-based decision support for professionals that reinforces patient safety.</p> <p>2) Presentation of the work done in C3-Cloud, lessons learnt, organizational changes needed and potential impact. The Swedish leading medical-info newspaper “Dagens Medicin” arranged a one day symposia in Stockholm where Region Jämtland Härjedalen presented the C3-Cloud work. Mikael Lilja and Göran Larsson.</p>
Any other material useful for the project	https://regionjh.se/forskningochutveckling/utveckling/c3cloud.4.6c60c6df162bb8c91af15d.html
Lead partner	RJH


Type of activity	Exhibition
Date of activity	25-27 October 2018
Title of dissemination	Demonstration of C3Cloud prototype
Description of event, publishing or hosting entity	Exhibition stand in HIMSS Eurasia 2018, İstanbul, Turkey
Principal stakeholders	<p>Around 5000 people attended the event, including:</p> <ul style="list-style-type: none"> Health and social care payers and providers Health ICT industry Research Education Health sector, including Turkish Ministry of Health
Key messages, viewpoint and estimated impact	C3-cloud prototype is demonstrated with example scenarios.
Any other material useful for the project	
Any further links, references useful for the project	https://himsseurasia.com/en/
Lead partner	SRDC

Type of activity	Presentation to COCIR Industry members	
Date of activity	25 October 2018	
Title of dissemination	Presentation of C3-Cloud by Veli Stoetmann	
Description of event, publishing or hosting entity	COCIR Digital Health Committee Meeting	
Estimated numbers for each stakeholder category where relevant		
Scientific community (higher education, research)		Unknown
Industry		Unknown
Key messages, viewpoint and estimated impact	Integrated care pathways and new organizational models for complex patients were mentioned/presented. Advanced ICT tool to support care planning and integrated care for multimorbid chronically ill patients were discussed. Care planning platforms	
Any further links, references useful for the project	https://www.cocir.org/media-centre/events/browse/1.html	
Lead partner	Empirica	

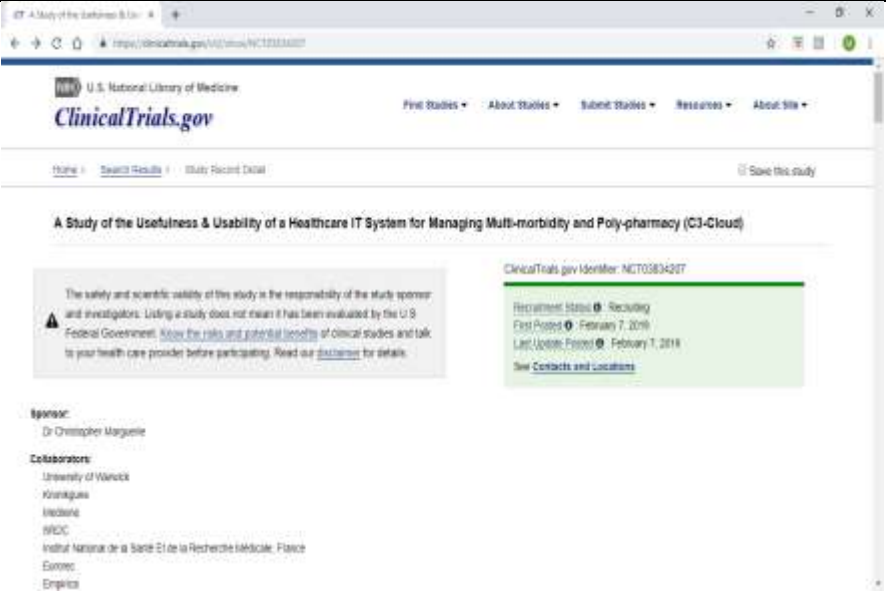
Type of activity	Participation to an event other than a Conference or a Workshop: Annual Seminar	
Date of activity	22-23 November 2018	
Title of dissemination	C3-Cloud project presentation at LIMICS Annual Seminar in Dourdan	
Description of event, publishing or hosting entity	<p>This LIMICS Annual Seminar is a two-day event hosted by the “Laboratory of Medical Informatics and Knowledge Engineering in e-Health” in Dourdan France. This event gathers physicians, pharmacists and computer scientists colleagues working in multidisciplinary research of computer science and e-Health. It aims to perform a yearly evaluation of ongoing research projects and to support building value-creating partnerships.</p> <p>C3-Cloud was presented at the LIMICS Annual Seminar in Dourdan FRANCE on 22nd Nov 2018. There were about 40 participants including physicians, pharmacists, computer scientists and PhD candidates. An overall presentation of the C3-Cloud Project was given and questions of participants answered.</p> <p>C3-Cloud Overview, INSERM main tasks and perspectives presented by a project team member Lamine Traore and the contribution of Marie-Christine Jaulent and Jacques Bouaud during the Q/A session.</p>	
Principal stakeholders	<ul style="list-style-type: none">– INSERM (The French National Institute of Health and Medical Research)– Sorbonne University– Paris 13 University– AP-HP Group hospital clinicians	
Estimated numbers for each stakeholder category where relevant		
Scientific community (higher education, research)		40
Key messages, viewpoint and estimated impact	C3-Cloud project was presented with highlights of the INSERM Team contributions in i) the Semantic Interoperability Suite (SIS), ii) Clinical Guidelines automation & reconciliation and iii) Application testing results for 3 European pilot sites (UK, Sweden and Spain). There was a good interest of participants related to health impact of the personalized & collaborative care plan management.	
Lead partner	INSERM	


Type of activity	Organization of a workshop at the EHTEL Symposium Participation in two sessions	
Date of activity	3-5 December 2018	
Title of dissemination	“Introduction to the Blueprint and the Personas” Veli Stroetmann, empirica and WP4 leader in WE4AHA project, Germany “Overview of Digital Services Addressing the Personas’ Needs” Strahil Birov, empirica and WP4 leader in WE4AHA project, Germany	
Description of event, publishing or hosting entity	The event is mainly organized in collaboration between ETHEL, the Reference Sites Coordination Network (RSCN) as well as the WE4AHA and SCIROCCO projects. In Brussels, Belgium.	
Principal stakeholders	<ul style="list-style-type: none">• Consumers and patients• Health care managers and providers• European Digital Health community• The health workforce	
Estimated numbers for each stakeholder category where relevant		
Scientific community (higher education, research)		Unknown
Industry		Unknown
Policy makers		Unknown
Key messages, viewpoint and estimated impact	<p>In a session titled “Data and Well-Being in practice: Co-Creating for Patients’ Benefits, six scenarios related to how patients will benefit from the sharing of the data in health and care fields”.</p> <p>Another session called “Interactive Session-Matchmaking around Condition for Successful Deployment” to empower partners in health through user driven digitalization was held with two phases:</p> <p>1: to invite participants to review the needs of digital health and care services of the population and gain successful cases managerial experience.</p> <p>2: roundtable conversations with these managers to discuss the context and policy elements of successful deployment of these services.</p> <p>Integrated care pathways and new organizational models for complex patients were mentioned/presented. Advanced ICT tool to support care planning and integrated care for multimorbid chronically ill patients were discussed. Care planning platforms</p>	


Any other material useful for the project	
Any further links, references useful for the project	https://www.ehtel.eu/activities/annual-ehetel-symposium/annual-symposium-2018.html
Lead partner	Empirica


Type of activity	Organisation of a Workshop
Date of activity	11 December 2018
Title of dissemination	KI Study visit at Cambio CDS
Description of event, publishing or hosting entity	<p>Each year, the “Computer Applications in Healthcare and Biomedicine” course (a part of the international master’s programme in medical informatics at KI) has one timeslot on two hours where they are invited to Cambio office in Stockholm to attend a session about Clinical Decision Support (CDS). One part of the session is focusing on the theory of medical informatics; another part of the session is focusing on business engagements that Cambio CDS is working with.</p> <p>The medical informatics programme at KI engages different student groups, some of the students has clinical experience. Cambio, together with the Karolinska Institute (KI), arranged a student visit at the Cambio office in Stockholm where Cambio CDS CEO dr Rong Chen presented the CDS team’s engagements. One major part of this presentation was regarding the C3-Cloud project. The students came from the Medical Informatics Master Programme at KI. The purpose of the visit was for the students to become more engaged in CDS in general.</p> <p>The CDS team at Cambio presented the C3-Cloud project to the students (including the responsible medical informatics professor at KI) as a part of the business engagements. After the presentation, the students asked questions in a Q&A session.</p>
Principal stakeholders	Karolinska Institute (professor and students) and Cambio CDS
Key messages, viewpoint and estimated impact	<p>The Cambio CDS team almost always pushes for ideas such as openness, cloud nativeness, and standards-based technology.</p> <p>In this way the students become more engaged in clinical decision support (and medical informatics in general).</p>
Any other material useful for the project	
Any further links, references useful for the project	<p>The student visit / workshop / lecture was a part of the “Computer Applications in Healthcare and Biomedicine” course found here: https://ki.se/en/selma/syllabus/5HI001/22833</p>
Lead partner	Cambio

Type of activity	Workshop	
Date of activity	1 February 2019	
Title of dissemination	Exchange Information Day – INSERM & EIT Health Promote C3-Cloud project by sharing related achievement examples with the scientific community and EIT Health industry network.	
Description of event, publishing or hosting entity	<p>This Exchange Information Day was co-organized by INSERM & EIT Health. It was held in INSERM Biopark – 8 rue de la croix Jarry, 75013 Paris France. This event gathered Research Directors of INSERM laboratories and the EIT Health industry network representatives.</p> <p>This event was a networking and exchange day between INSERM research teams and the EIT Health France network including industrial stakeholders. There were about 25 participants. Two members of the C3-Cloud project team (Marie-Christine Jaulent and Lamine Traore) were present to pitch and discuss the achievements of the C3-Cloud project to other participants.</p>	
Principal stakeholders	<ul style="list-style-type: none">– EIT Health– INSERM– Health sector– Industry	
Estimated numbers for each stakeholder category where relevant		
Scientific community (higher education, research)		15
Industry		10
Key messages, viewpoint and estimated impact	<p>This was more a networking program with a focus on health technology, public health, infectious disease and physiopathology. The example of C3-Cloud project was introduced during the discussion with 3 the participants below:</p> <ul style="list-style-type: none">1. ATOS Analytics Factory representative2. EIT Health France Managing Director3. INSERM Data Protection Officer <p>The discussion was oriented with highlights of health impact for elderly people and the data management process in the context of European project involving multiple pilot sites.</p>	
Lead partner	INSERM	

Type of activity	Website content
Date of activity	February 2019
Title of dissemination	A Study of the Usefulness & Usability of a Healthcare IT System for Managing Multi-morbidity and Poly-pharmacy (C3-Cloud)
Description of event, publishing or hosting entity	Clinical Trials.Gov website SWFT project team made a submission to Clinical Trials.Gov as part of its ethics approval process. Input was obtained from the majority of partners in the consortium.
Principal stakeholders	Quotation taken from the website itself:- <i>'ClinicalTrials.gov is a Web-based resource that provides patients, their family members, health care professionals, researchers, and the public with easy access to information on publicly and privately supported clinical studies on a wide range of diseases and conditions'</i>
Key messages, viewpoint and estimated impact	Study overview including methodology
Any other material useful for the project	
Any further links, references useful for the project	https://clinicaltrials.gov/ct2/show/NCT03834207
Lead partner	SWFT

Type of activity	Electronic Newsletter
Date of activity	6 March 2019
Title of dissemination	C3-Cloud research study
Description of event, publishing or hosting entity	Article in e-Pulse (SWFT's weekly newsletter)
Principal stakeholders	SWFT employees 2.000+
Key messages, viewpoint and estimated impact	Overview of the study, timescales and stakeholders
Any other material useful for the project	 <p>The screenshot shows the ePulse website interface. At the top, there's a header with the 'ePulse' logo and the tagline 'Trusted to provide safe, effective, compassionate care'. Below this, the main content area is titled 'C3-Cloud research study'. The text describes a four-year European Commission-funded research project led by Warwick University, involving SWFT and Rotham House Medical Centre. It outlines the project's purpose to evaluate the C3-Cloud IT system for improving patient care with multiple long-term chronic diseases. The system aims to facilitate closer collaboration between patients and their care teams, encourage patient self-management, and provide feedback on care plans and education. It also mentions a Clinical Decision Support function and the current testing phase, which will be completed by March 2019. The bottom of the page features social media links for Facebook and Twitter, and a section for 'Share your story to ePulse'.</p>
Any further links, references useful for the project	<p>Local Intranet:-</p> <p>https://r1.dotdigital-pages.com/p/2VZG-4Y5/c3-cloud-research-study?dm_i=2VZG,UM60,47Y3HA,366F1,1</p>
Lead partner	SWFT


Type of activity	Poster
Date of activity	March 2019
Title of dissemination	C3-Cloud Research Study
Description of event, publishing or hosting entity	Waiting room at participating GP practice
Principal stakeholders	Staff and patients at the participating GP practice
Estimated numbers for each stakeholder category where relevant	
Other (Patients)	10,000
Key messages, viewpoint and estimated impact	Information for patients at the recruiting practice As per the text in the screenshot
Any other material useful for the project	
Lead partner	SWFT

Type of activity	Organisation of a Workshop
Date of activity	5 March 2019
Title of dissemination	High Value Manufacturing Catapult Industrial Engagement Workshop
Description of event, publishing or hosting entity	Workshop with industry stakeholders, aiming to establish partnerships on future large scale project, which will impact healthcare. The workshop was organized as part of a large project funded by the Department for Business, Energy & Industrial Strategy.
Principal stakeholders	Scientific community (higher education, research) Industry Health Sector Policy Makers
Key messages, viewpoint and stimated impact	Overview of C3-Cloud motivation, objectives and technical results. Focus on CDS service implementation. Following the presentation, Warwick has organized follow-up meetings with NHS trusts and SMEs interested in the C3-Cloud approach.
Any other material useful for the project	 <p>The image shows a presentation slide titled 'Market of Medical Things (M3T)' projected onto a screen. The slide contains bullet points and a diagram. In the foreground, several people are seated at a table, looking towards the screen, indicating a workshop or meeting in progress.</p>
Any further links, references useful for the project	The workshop took place in Glasgow, UK
Lead partner	WARWICK


Type of activity	Participation in a Workshop
Date of activity	5 March 2019
Title of dissemination	Invited Presentation entitled “The big picture of future health: digital healthcare revolution” by the C3-Cloud’s Coordinator Professor Theodoros N. Arvanitis.
Description of event, publishing or hosting entity	<p>A by invitation only workshop with industry stakeholders, aiming to establish partnerships on future large scale projects in Europe which will impact healthcare. The »Health 4.0 Forum« took place in the Ambassador’s residence of the British Embassy in Vienna. Public and private sector experts and research organizations, as well as politicians, came together to discuss opportunities for international cooperation in the digital health sector.</p> <p>The event was organized by the UK Science and Innovation Network (SIN), BABLE and the UK Department of International Trade (DIT) and supported by the Fraunhofer IAIS and the Austrian Research Promotion Agency (FFG). Leigh Turner CMG, Her Majesty’s Ambassador to the Republic of Austria and UK Permanent Representative to the United Nations in Vienna, opened the event with a short introduction.</p>
Principal stakeholders	<p>Scientific community (higher education, research)</p> <p>Healthcare Industry/SMEs</p> <p>Policy Makers</p> <p>EU/Government Representatives</p>
Key messages, viewpoint and stimated impact	<p>Professor Theodoros N. Arvanitis, of the Institute of Digital Healthcare (IDH), WMG, has given a keynote presentation on the future of digital health. He also show-cased the C3-Cloud EU Project (www.c3-cloud.eu), co-ordinated by the University of Warwick, while discussed IDH’s national projects on the use of Radiomics and AI for childhood brain characterisation; the Tommy’s National Centre for Miscarriage Research; and Warwick’s involvement in the Health Data Research UK National Research Initiative (https://www.hdruk.ac.uk/).</p> <p>Theo Arvanitis, at his presentation, concluded: “The impact of digital technology and information can be transformative for healthcare. The benefits to individuals and society are multiple. People’s health journeys are better understood and appropriate lifestyle choices can be better tailored and promoted to the individual. Disease management can be more effectively supported and avoidable deaths can be prevented. This has an effect in a more cost-effective healthcare delivery, where the healthcare system provides services in a more convenient, accessible and efficient manner. Consequently, patients as citizens are put in the centre, and in control of their health and wellbeing. Digital Healthcare approaches, combined with personalised medicine principles are the centre of this transformation.”</p>


<p>Any other material useful for the project</p>	
<p>Any further links, references useful for the project</p>	<p>https://www.bable-smartcities.eu/spot/posts/post/post/health-40-forum-what-is-next.html</p> <p>https://www.bable-smartcities.eu/de/moeglichkeiten/aktuelles/post/post/health-40-forum-discussions.html</p>
<p>Lead partner</p>	<p>WARWICK</p>


Type of activity	Presentation in a Conference
Date of activity	7-8 March 2019
Title of dissemination	IMPLEMENTACIÓN DE LA INTERVENCIÓN C3-Cloud EN EL PAÍS VASCO
Description of event, publishing or hosting entity	XI Congreso Nacional de Atención Sanitaria al Paciente Crónico (XI National Conference on Chronic Patient Health Care)
Principal stakeholders	Professionals, patients and policy makers
Key messages, viewpoint and estimated impact	<p>Conference to share experiences and discuss together, professionals, patients and policy makers.</p> <p>Updating of new forms of communication, e-health, elaboration of integral and personalized care plans and therapeutic adequacy. Taking into account that the patient and his or her environment must be the centre of health care system.</p> <p>C3-Cloud helps to improve complex multimorbid patients, to empower patients, to coordinate their care.</p>
Any further links, references useful for the project	IMPLEMENTACIÓN DE LA INTERVENCIÓN C3-Cloud EN EL PAÍS VASCO (Implementation of the C3-Cloud intervention in the Basque Country) (A. de Blas de Blas, N. González López, M. Ogueta Lana, D. Verdoy Berástegui, A. Fullaondo Zabala y E. de Manuel Keenoy, on behalf of local team of Osakidetza and C3-Cloud consortium).
Lead partner	Kronikgune/Osakidetza

Type of activity	Organisation of two workshops	
Date of activity	20-21 March 2019	
Title of dissemination	DigitalHealthEurope Blueprint Workshop at the eHealth Summit in Lisbon, Portugal, 20th March 2019 Collaboration platform on "Citizens' secure access to and sharing of health data", 21th of March 2019	
Description of event, publishing or hosting entity (city if applicable)	The workshop was organised by SPMS (Shared Services Ministry of Health, Portugal). together with EuroRec, European Patients' Forum (EPF), ECHA. The overarching goal of the workshops was to facilitate expert discussion and agreement on efforts to advance the three priorities set in the European Commission's 2018 Communication on the Digital Transformation of Health and Care in the Digital Single Market. These refer to: 1) citizens' secure access to and sharing of health data across borders (2) better data to advance research, disease prevention and personalised health and care, and 3) digital tools for citizen empowerment and person-centred care.	
Principal stakeholders	Health and care professionals, public health decision makers, ICT providers and more than 30 other (key) stakeholders.	
Estimated numbers for each stakeholder category where relevant		
Scientific community (higher education, research)		Unknown
Industry		Unknown
Policy makers		Unknown
Key messages, viewpoint and estimated impact	Presentation on behalf of Esteban (Kronikgune): Persona with complex conditions who is together with the MDT supported by C3-Cloud solutions.	
Any other material useful for the project		
Any further links, references useful for the project	http://ehealthsummit.pt/ https://ec.europa.eu/eip/ageing/sites/eipaha/files/news/we4aha_blueprint_update_publishable_version_december_2018.pdf (pp13-24). https://twitter.com/guiaccar/status/1108675781541183489	
Lead partner	empirica	

Type of activity	Participation to a Conference Participation to a Workshop
Date of activity	3 April 2019
Title of dissemination	The C3 Cloud Personalised Guideline-Driven Care Plan. Presentation of C3-Cloud in Innovation Zone in International Conference on Integrated Care (ICIC) 2019
Description of event, publishing or hosting entity	Innovation Zone at International Conference on Integrated Care (ICIC) 2019, San Sebastian, Spain
Principal stakeholders	Scientific community (higher education, research), Industry and Civil society organizations have attended the conference.
Key messages, viewpoint and estimated impact	C3-cloud prototype is presented and demonstrated with example scenarios.
Any further links, references useful for the project	https://integratedcarefoundation.org/events/icic19-19th-international-conference-on-integrated-care-san-sebastian-basque-country
Lead partner	SRDC

Type of activity	Exhibition
Date of activity	1-3 April 2019
Title of dissemination	Demonstration of C3Cloud prototype at exhibition stand
Description of event, publishing or hosting entity	International Conference on Integrated Care (ICIC) 2019, San Sebastian, Spain
Principal stakeholders	Scientific community (higher education, research), Industry and Civil society organizations have attended the conference.
Key messages, viewpoint and estimated impact	C3-cloud prototype is demonstrated with example scenarios.
Provide images, presentation slides, paper (version that can be publicly shared), etc. as attachments	
Any other material useful for the project	Flier distributed during the event and the Roll-up is attached.
Any further links, references useful for the project	https://integratedcarefoundation.org/events/icic19-19th-international-conference-on-integrated-care-san-sebastian-basque-country
Lead partner	SRDC

Type of activity	Presentation in a Conference
Date of activity	2 April 2019
Title of dissemination	Conference paper entitled: “Facilitating Coordinated Care for Multi-morbidity Patients through Integrated Preventive Clinical Decision Support (C3-Cloud)”
Description of event, publishing or hosting entity	International Conference on Integrated Care (ICIC) 2019, San Sebastian, Spain. The paper was presented in the integrated care in the EC track.
Principal stakeholders	Scientific community (higher education, research), Industry and Civil society organizations have attended the conference.
Key messages, viewpoint and estimated impact	<p>Overview of C3-Cloud motivation, objectives and technical results. Focus on CDS service implementation.</p> <p>The presentation has risen awareness of the project, as well as preliminary results such as the architecture and the CDS functionality to the audience (e.g. SMEs, academics, and health system representatives).</p>
Any further links, references useful for the project	
Lead partner	WARWICK

Type of activity	Workshop (dissemination seminar)	
Date of activity	15 April 2019	
Title of dissemination	C3-Cloud: Main Tasks, Current results & Exploitation Perspectives	
Description of event, publishing or hosting entity	LIMICS Dissemination Seminar - Paris A 45 minutes presentation of the C3-Cloud project was performed during the LIMICS dissemination seminar. This was held at Campus des Cordeliers in Paris with about 20 participants including physicians, pharmacists, computer scientists, PhD candidates and Master students.	
Principal stakeholders	Scientific community (higher education, research) Health Sector	
Estimated numbers for each stakeholder category where relevant		
Scientific community (higher education, research)		20
Key messages, viewpoint and estimated impact	The C3-Cloud project was introduced, then we presented the INSERM main contributions to the C3-Cloud solution and obtained results. A demo of the C3DP was performed by a project team member Jacques Bouaud. At last we highlighted exploitation perspectives with an interest to extend the C3-cloud solution to a French pilot site.	
Any other material useful for the project	 Screenshot of the C3-Cloud seminar announcement on LIMICS website	
Any further links, references useful for the project	http://limics.fr/en/evenement/fiche-evenement/voir/140-A-Federated-Collaborative-Care-Cure-Cloud-Architecture-for-Addressing-the-Needs-of-Multi-morbidity-and-Managing-Poly-pharmacy	
Lead partner	INSERM	

3.3. Planned dissemination activities for year 4

Please note that this section only lists those activities that have already been initiated. Other activities will also be undertaken during year 4.

Type of activity	Participation to a Conference
Date of activity	22 May 2019
Title of dissemination	C3-Cloud – EU-projekt för nya former av stöd till multisjuka äldre i Region Jämtland Härjedalen C3-Cloud – EU project for new forms of support to multimorbid elderly in Region Jämtland Härjedalen
Description of event, publishing or hosting entity	Vitalis – the largest eHealth event in Scandinavia. May 21-23 2019. ORU and the Swedish clinical partner RJH will present the project for one hour The following will present: Gunnar Klein, Oru Liran Karni, Oru Göran Larsson, RJH Mikael Lilja, RJH
Principal stakeholders	>3500 This refers to the total conference. Our program of one hour have an estimated audience of 200 persons.
Estimated numbers for each stakeholder category where relevant	
Scientific community (higher education, research)	250
Industry	500
Civil society	1500
Policy makers	100
Media	50
Any other material useful for the project (that has not been already provided for sharing publicly) (e.g. published paper versions, etc.)	Description of the one hour slot: Vården av äldre som ofta har flera kroniska sjukdomar samtidigt är kanske vår största utmaning. Det är ofta en splittrad vårdapparat med primärvård, kommuner och specialistsjukvård som inte alltid fungerar väl tillsammans. Även om det finns många texter som ger riktlinjer för vård av en sjukdom så saknas i stort sett beslutsstöd som kan kombinera råd om flera sjukdomar och ge anpassade råd som tar hänsyn till den registrerade informationen i journalerna. I denna presentation kommer vi belysa olika aspekter på ett stort europeiskt samarbetsprojekt där vi utvecklat ett mångfasetterat stöd som ett komplement till dagens regionala journalsystem. I projektet C3-Cloud ingår kliniska grupper från Sverige, England och Spanien och tekniska experter jämte forskare i hälsoinformatik från många länder. Systemet innebär en integration med journalsystem där en helt ny form av vårdplaneringssystem används där automatiserade riktlinjer för Diabetes, Hjärtsvikt, Njursvikt och Depression ger snabba konkreta förslag som läkaren i samråd med patienten och annan personal kan använda för att skapa en fullständig vårdplan. En vårdplan som patienterna också har tillgång till via nätet. I vårdprogrammen ingår också ett utförligt utbildningsmaterial för patienterna med en mängd

	<p>olika former av information i form av texter och video anpassat till olika problem.</p> <p>I denna programpunkt planerar vi att berätta mer om projektet från de svenska samarbetsparterna, Örebro universitet, Cambio och Region Jämtland Härjedalen (där systemet börjar användas i januari 2019).</p> <p>Vi kommer ge en översikt över hela samarbetet som pågår 2016-2020 med en rad spännande tekniska utmaningar i ett sådant multinationellt projekt. Örebro universitet har haft en viktig roll i arbetet med att överföra textbaserade riktlinjer till algoritmer som sedan realiserar med den nya logiken GDL (Guideline Definition Language) som Cambio realiserar för hela det europeiska projektet.</p> <p>Vi kommer också beskriva vårdplaneringssystemet och den typ av stöd som patienterna och deras närstående kan få.</p> <p>Slutligen kommer representanter från Region Jämtland Härjedalen beskriva de första erfarenheterna av att använda det nya systemet. Detta projekt borde vara intressant för många som ett exempel på framtidens digitala stöd till vården där vi både har verktyg som underlättar samarbete och vardagen för personalen att följa evidensbaserade riktlinjer men också inkluderar patienter på allvar i planeringen och genomförandet av sin vård också för de multisjuka äldre.</p>
Any further links, references useful for the project	https://vitalis.nu/programs/c3-cloud-eu-projekt-for-nya-former-av-stod-till-multisjuka-aldre-i-region-jamtland-harjedalen-2/
Lead partner (if applicable)	ORU

Type of activity	Exhibition
Date of activity	21 st to 23 rd of May
Title of dissemination	TBC
Description of event, publishing or hosting entity	<p>Vitalis 2019</p> <p>Vitalis is an annually hosted e-health conference and it is the biggest in Scandinavia. Cambio will attend and support the presentation that will be done by Region Jämtland Härjedalen (RJH) who also are taking part in the C3-Cloud project as a pilot site.</p> <p>The conference is hosted in Gothenburg, Sweden.</p>
Principal stakeholders	A big variety of different stakeholders
Key messages, viewpoint and estimated impact	<p>C3-Cloud will be showcased at Vitalis 2019 which is an e-health conference in Gothenburg in Sweden.</p> <p>The key message is to showcase one possible and one successful (hopefully) solution to multi-morbidity.</p> <p>The desired outcomes will be to get more eyes on what the project partners are doing in C3-Cloud and raise awareness of one successful (hopefully) possible solution to multi-morbidity.</p>
Any further links, references useful for the project	https://en.vitalis.nu/?_ga=2.256232968.284414382.1555501732-27630510.1555501732
Lead partner	Region Jämtland Härjedalen (and Cambio on the side)

Type of activity	Journal Article
Date of activity	Article has been submitted on 20 December 2018 and received a Minor Revision on 05 March 2019. A revision has been submitted in March 2019.
Title of dissemination	Journal Article submission to Computational and Structural Biotechnology Journal A Collaborative Platform for Management of Chronic Diseases via Guideline-Driven Individualized Care Plans
Description of event, publishing or hosting entity	Computational and Structural Biotechnology Journal (CSBJ) is an online gold open access journal publishing research articles and reviews after full peer review. It has an impact factor of 4.148 https://www.journals.elsevier.com/computational-and-structural-biotechnology-journal
Principal stakeholders	Scientific community (higher education, research)
Key messages, viewpoint and estimated impact	CSBJ is a high impact journal, with an impact factor of 4,18. This paper is very detailed presentation of C3-Cloud architecture, hence we expect a high impact for C3-Cloud project.
Any other material useful for the project	<p style="text-align: center;">A Collaborative Platform for Management of Chronic Diseases via Guideline-Driven Individualized Care Plans</p> <p style="text-align: center;">Gökçe B. Laleci Ertürkmen^{a,*}, Mustafa Yüksel^a, Burçin Sarıgül^a, Theodoros N. Arvanitis^b, Pontus Lindmar^c, Hong Chen^{d,e}, Lei Zhao^b, Eric Sadot^f, Jacques Bonazet^{g,h}, Lamine Tracer^g, Alper Tecman^h, Sarah N. Lim Chia Keung^g, George Despotou^h, Esteban de Munne^h, Dolores Verdey^h, Antonio de Blasⁱ, Nicolas Gonzalez^j, Mikael Löljö^k, Malte von Tetzleben^l, Marie Beuch^l, Christopher Marguerie^l, Gunnar O. Klein^m, Dipak Kalraⁿ</p> <p style="text-align: center;">^aSRDC Software Research Development and Consultancy Corp, Ankara, Turkey ^bInstitute of Digital Healthcare, WMG, University of Warwick, Coventry, UK ^cMedicon, Finland ^dCantho Healthcare Systems, Sweden ^eHealth Informatics Center, Karolinska Institutet, Sweden ^fJAP-IP, Dilection for Clinical Research and Innovation, Paris, France ^gBasora, Sorbonne Université, Univ Paris 12, Laboratoire d'Informatique Médicale et d'Ingénierie des Connaissances pour la e-Santé, LIMICS, F-75011 Paris, France ^hKronspan, Research Center in Chemistry, Spain ⁱOxakidetia, Spain ^jDepartment of Public Health and Clinical Medicine, Unit of Research, Education, and Development, Östersund Hospital, Umeå University, Umeå, Sweden ^kinspiration Gesellschaft für Kommunikations- und Technologieforschung mbH, Bonn, Germany ^lSouth Warwickshire NHS Foundation Trust, UK ^mÖrebro University School of Business, Informatics, Örebro, Sweden ⁿEuropean Institute for Innovation through Health Data, Belgium</p> <hr/> <p>Abstract</p> <p>Older age is associated with an increased accumulation of multiple chronic conditions. The clinical management of patients suffering from multiple chronic conditions is very complex, disconnected and time-consuming with the traditional care settings. Integrated care is a means to address the growing demand for improved patient experience and health outcomes of multimorbid and long-term care patients. Care planning is a prevalent approach</p> <hr/> <p style="text-align: right;">[*]Corresponding Author</p> <p style="text-align: right;"><i>Preprint submitted to Computational and Structural Biotechnology J. March 18, 2019</i></p>
Any further links, references useful for the project	https://www.journals.elsevier.com/computational-and-structural-biotechnology-journal
Lead partner	SRDC

4. C3-CLOUD PROJECT WEB SITE

As stated earlier in this report, the C3-Cloud project web site has been redesigned to be more approachable and appealing to multiple (especially non-academic) stakeholders including the public. A UK based web design company, Evolyst, has been recruited and is in the process of redeveloping the site.

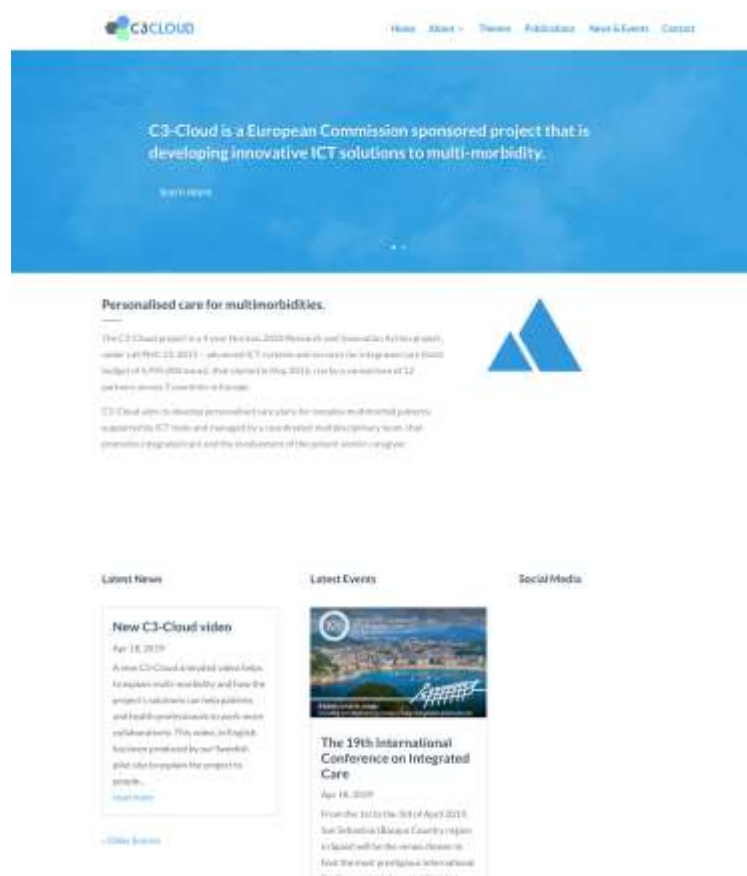
The intended structure of the site will be:

- **Home page**
- **Project menu:** Background, Overview, The Pilots, Project Structure / Work Packages, The Consortium, Dissemination activities and resources
- **Themes:** Chronic disease management, Integrated care, Polypharmacy management, Care plan management standards, Patient empowerment
- **Knowledge & Results:** Publications, Public Deliverables, Materials (Demos/software/interviews), Related Projects
- **News & Events**
- **Contact**


4.1. Sample screen shots of the draft new C3-Cloud web site

The screen shots below are of the new web site, about to go live, the content of which will be expanded in the coming months.

4.1.1. Home page



4.1.2. Project overview – top of page


[Home](#) [About](#) [Themes](#) [Publications](#) [News & Events](#) [Contact](#)

Project Overview

What is C3 Cloud?

The C3-Cloud project is a 4-year Horizon 2020 Research and Innovation Action project, under call RHC-25-2015 - advanced ICT systems and services for integrated care (total budget of 4,995,000 euros), that started in May 2016, run by a consortium of 12 partners across 7 countries in Europe.

C3-Cloud aims to develop personalised care plans for complex multi-morbid patients, supported by ICT tools and managed by a coordinated multidisciplinary team, that promotes integrated care and the involvement of the patient and/or caregiver.



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 639161.

Pilot Sites

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UK

Spain


Sweden

South Warwickshire

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4.1.3. Project overview – bottom of page



[Home](#) [About](#) [Themes](#) [Publications](#) [News & Events](#) [Contact](#)

There is an increasing need to organise the care around the patient with the involvement of all stakeholders. As a response to this requirement, the C3-Cloud project aims to achieve high quality integrated care with the support of ICT.

A Personalised Care Plan Development Platform will allow collaborative creation and execution of personalised care plans for multimorbid patients, through systematic and semi-automatic reconciliation of clinical guidelines.

This will be realised with the help of Decision Support Modules, recommendation reconciliation, poly-pharmacy management and goal setting. Fusion of multimodal patient and provider data will be achieved via C3-Cloud Interoperability Middleware for seamless integration with existing information systems.

A Terminology Service with advanced semantic functions will enable meaningful analysis of multimodal data and clinical rules. Active patient involvement and treatment adherence will be attained through a Patient Empowerment Platforms.

The Interoperability Middleware contains three components.

- 1. The Technical Interoperability Suite** enables seamless data exchange between the local care systems and the C3-Cloud components.
- 2. The Semantic Interoperability Suite** addresses the challenge of heterogeneous clinical data representation formats.
- 3. The Security and Privacy Suite** has been developed, based on open source toolkits for authentication and authorization of care team members and for ensuring encrypted and auditable data exchange across C3-Cloud software components.

To demonstrate feasibility, pilot studies will focus on diabetes, heart failure, renal failure and depression in different comorbidity combinations. Pilots will be undertaken in 3 European regions with diverse health and social care systems and ICT landscape, which will allow for strengthening the evidence base on health outcomes and efficiency gains.

C3-Cloud adaptive patient pathways and organisational models validated by a clinical reference group, change management and training guidelines will be shared with the European community.

Project Acronym:
C3-Cloud

Project Name:
A Federated Collaborative Care Cure Cloud Architecture for Addressing the Needs of Multi-morbidity and Managing Poly-pharmacy

Funding Scheme:
Horizon 2020 Research and Innovation Action

Topic:
[PHC 25-2015](#) – Advanced ICT systems and services for integrated care

Budget:
4,995,000 EUR


Duration:
May 2016 – April 2020

Contact
info@c3-cloud.eu

Consortium area

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 689181.


4.1.4. C3-Cloud WP summaries with links to detail



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Work Packages

The work plan of the C3-Cloud project is divided into a series of work packages which are responsible for different activities in the project.



All work packages

Work Package 1

Project Management Work package 1 deals with project management. It looks after making sure the whole work plan proceeds smoothly, troubleshooting any issues that arise, reporting on progress to the European Commission, financial reporting and supporting internal...

[read more](#)

Work Package 2

Dissemination, Exploitation and Innovation Related Activities. Work package 2 coordinates the information and the channels used to communicate about the project, its progress and results to organisations and communities across Europe, and internationally. It...

[read more](#)

Work Package 3

Design of C3-Cloud System Architecture Work package 3 deals with the design of the C3-Cloud solution (its system architecture). It is responsible for collecting the requirements from the C3-Cloud stakeholders, such as user requirements from patients and clinicians, as...

[read more](#)

Work Package 4

Patient Pathway and Organisational Model Development & Change Management. Work package 4...

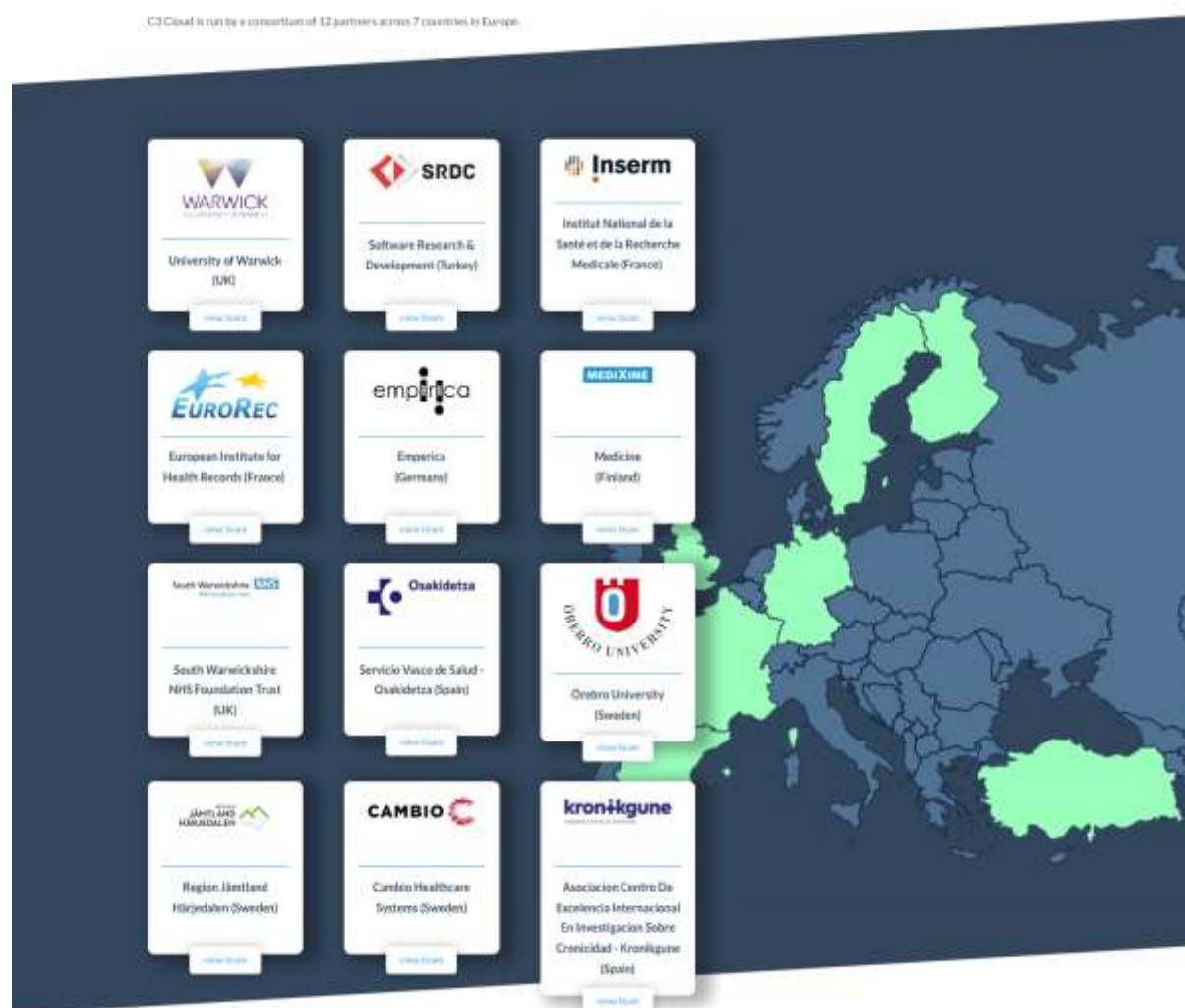
Work Package 5

Patient Empowerment Platform Work package 5 is responsible for designing and building the patient empowerment...


Work Package 6

Interoperability Middleware Work package 6 is responsible for developing...

4.1.5. Overview of the C3-Cloud consortium



4.1.6. C3-Cloud dissemination summaries, with links to detailed content



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Publications

Oral & Poster Presentations

Experiences in Integration from people and for people
Apr 18, 2018
Abstract accepted for a presentation Event: III Workshop of good practices in the integrated care in the Basque Country, Experiences in Integration from people and for people Date: November 2017 Location: San Sebastian, Spain Description: The abstract summarized the...
[read more](#)

Medical Informatics Congress 2017
Apr 18, 2018
Abstract accepted for a oral presentation Event: Medical Informatics Congress 2017 ("Tip Bilgimi Kongresi"), <http://www.miaconferences.org/> Date: 13-14 October 2017 Location: Antalya, Turkey Title: C3-Cloud: A Federated and Collaborative Care and Cure Cloud...
[read more](#)

17th International Conference on Integrated Care (ICIC)
Apr 18, 2018
Abstract accepted for a short oral communication (ID-632) Event: 17th International Conference on Integrated Care (ICIC) Date: 8-10 May 2017 Location: Dublin, Ireland Title: A FEDERATED COLLABORATIVE CARE CURE CLOUD ARCHITECTURE FOR ADDRESSING THE NEEDS OF...
[read more](#)

VII Meeting of the Forum on Health Interoperability
Apr 18, 2018
Speaker in Round Table Event: VII Meeting of the Forum on Health Interoperability Date: April 27th 2017 Location: Salamanca, Spain, Authors: Nico González Relevant
URLs: <http://www.seis.es/interoperabilidad2017/> <http://www.seis.es/imagenes/REVISTAS/125.pdf>
[read more](#)

Recent Posts

The 19th International Conference on Integrated Care

MIE2018 Conference

C3-Cloud's presence at the Informatics for Health Congress 2017

New EUR 5 million project that will transform care for multimorbid patients launched

New C3-Cloud video

Archives

April 2019

March 2019

Other Dissemination

Medical Informatics Europe
Apr 18, 2018
Paper accepted for conference presentation Event: Medical Informatics Europe (MIE2018), <https://mie2018.org/> Date: 24 - 26 April 2018 Location: Gothenburg, Sweden Title: Personalised Care Plan Management Utilizing Guideline-Driven Clinical Decision Support Systems...
[read more](#)

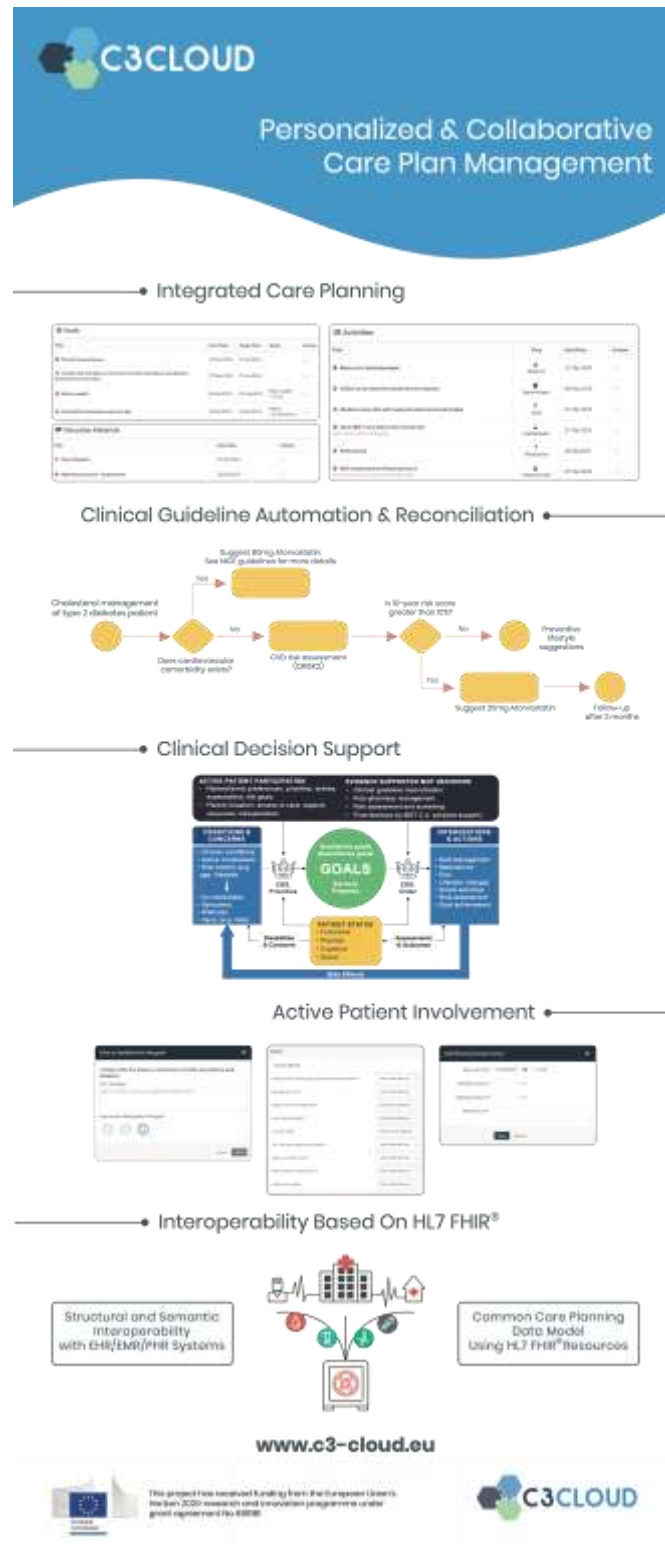
4.2. Next steps for the web site

Additional content that will be added over the summer includes:

- updated information and more diagrams describing the project objectives and its work packages
- additional detail about the pilot sites and the areas of evaluation evidence that we are seeking to obtain
- online summaries of project research publications and conference proceedings, with some slide presentations
- copies of EC approved deliverables
- information for different stakeholders about multi-morbidity and poly-pharmacy, their importance and challenges
- news about forthcoming events and activities across Europe in the field of multi-morbidity and eHealth, links to related project web sites
- information about what C3-Cloud results are expected to be sustainable, and why ICT companies and healthcare providers should be interested in our work

5. APPENDIX: EXAMPLE SLIDE PRESENTATIONS AND PAPERS

5.1. C3-Cloud roll up poster

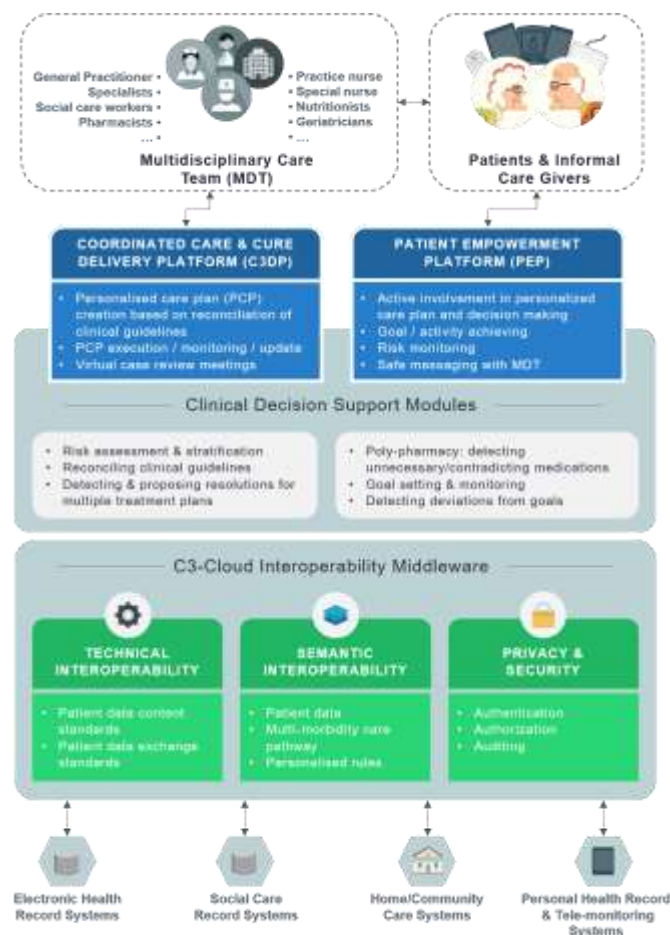


5.2. ICIC 2019 Flyer and presentation



A Federated Collaborative Care & Cure Cloud Architecture for Addressing the Needs of Multi-morbidity and Managing Poly-pharmacy

C3-Cloud is a Horizon2020 project for facilitating implementation of integrated care plans. C3-Cloud has established an ICT infrastructure to enable continuous coordination of patient-centred care activities by a multidisciplinary care team (MDT) and patients/informal care givers. The Collaborative Care Plan Management Software allows collaborative creation and execution of personalised care plans for multi-morbid patients. The system is integrated with tens of Clinical Decision Support (CDS) services for risk prediction and stratification, recommendation reconciliation, poly-pharmacy management and personalised goal and activity suggestions. These CDS services have been implemented based on evidence-based clinical guidelines for four major chronic diseases: diabetes, chronic kidney disease, heart failure and depression. Integration with local healthcare systems is achieved via C3-Cloud Interoperability Middleware. Active patient involvement and treatment adherence is realized through a Patient Empowerment Platform, ensuring patient needs are respected in decision making.



Goals					Activities				
Title	Start Date	Repeat Info	Subject	Actions	Title	Type	Start Date	Actions	
Monitoring red blood cells	27 Nov 2019	27 Jan 2020		...	Referenced in Cytidiphosphoglycogen	Referral	27 Mar 2020	...	
Complete with the doctor's evaluation of mild-moderate osteoarthritis. Evaluate other therapies.	27 Nov 2019	27 Jan 2020		...	Following up on the results of the treatment	Assessment	08 Mar 2018	...	
Reduce weight	28 Feb 2019	28 Aug 2019	Self weight 175 lb	...	Medication does not with reduced weight (with blood)	Doc	27 Mar 2019	...	
Keep a log of food intake and weight	25 Sep 2019	14 Sep 2019	14 Sep - 100 continued	...	Have H2C level before the next visit (H1 Hemoglobin C level)	Lab Report	27 Mar 2019	...	
Education Materials									
Title	Start Date	Subject							
Fast 2 (1000000)	27 Sep 2019		...		Subscriptions	Subscription	24 Feb 2017	...	
High blood pressure - paper version	12 Feb 2017		...		Self-management of blood pressure (Self-management of blood pressure)	Patient Guide	27 Mar 2019	...	

```
graph LR; Start(( )) --> Q1{Does cardiovascular comorbidity exist?}; Q1 -- Yes --> A1[Suggest 80mg Atorvastatin  
See NICE guidelines for more details.]; Q1 -- No --> A2[CVD risk assessment (QRisk2)]; A2 --> Q2{Is 10-year risk score greater than 10%?}; Q2 -- No --> A3((Preventive lifestyle suggestions)); Q2 -- Yes --> A4[Suggest 20mg Atorvastatin]; A4 --> A5((Follow-up after 3 months));
```

Cholesterol management of type 2 diabetes patient

Does cardiovascular comorbidity exist?

Yes: Suggest 80mg Atorvastatin. See NICE guidelines for more details.

No: CVD risk assessment (QRisk2)

Is 10-year risk score greater than 10%?

No: Preventive lifestyle suggestions

Yes: Suggest 20mg Atorvastatin

Follow-up after 3 months

The screenshot shows a patient portal interface. At the top, there's a header with a close button (X). Below the header, there's a section titled 'Add Blood pressure entry'. The form contains the following fields:


- Date and time:** A date picker set to 12/12/2017 and a time picker set to 12:00.
- Systolic pressure:** A text input field with a value of 120.
- Diastolic pressure:** A text input field with a value of 80.
- Blood pressure status:** A dropdown menu with options: 'Normal', 'Elevated', 'Hypertension stage 1', 'Hypertension stage 2', and 'Hypertension stage 3'.
- Additional info:** A text area for additional notes.
- Buttons:** 'Save' and 'Cancel' buttons at the bottom right.

On the left side of the portal, there's a sidebar with a close button (X) and a section titled 'Add Blood pressure entry'. It contains a list of recent entries with columns for 'Date and time', 'Systolic pressure', 'Diastolic pressure', and 'Blood pressure status'. The first entry is '12/12/2017 12:00', '120', '80', and 'Normal'.

The diagram illustrates a central concept: "Common Care Planning Data Model Using HL7 FHIR® Resources". This central model is connected to two main components:


- Structural and Semantic Interoperability with EHR/EMR/PHR Systems:** This component is represented by a box on the left. It is connected to the central model via a line that branches into four colored circles (red, green, blue, and yellow), each containing a different icon (a heart, a person, a building, and a car). These icons represent various types of data or systems that feed into the central model.
- Common Care Planning Data Model Using HL7 FHIR® Resources:** This component is represented by a box on the right. It is connected to the central model via a line that branches into four colored circles (red, green, blue, and yellow), each containing a different icon (a heart, a person, a building, and a car). These icons represent various types of data or systems that feed into the central model.

The central model itself is depicted as a computer monitor displaying a red cross icon, symbolizing healthcare or medical data.




C3CLOUD
A FEDERATED COLLABORATIVE CARE AND CURE CLOUD
ARCHITECTURE FOR ADDRESSING THE NEEDS OF MULTI-MORBIDITY AND MANAGING POLY-PHARMACY

Management of personalised guideline-driven care plans addressing the needs of multi-morbidity via clinical decision support services
Dr. Gokce Banu Laleci Erturkmen



This project has received funding from the European Union Horizon 2020 research and innovation programme under grant agreement No 689181




PROJECT INFORMATION

A Federated Collaborative Care and Cure Cloud Architecture for Addressing the Needs of Multi-morbidity and Managing Poly-pharmacy

- H2020 RIA project
- Dates: May 2016 – April 2020
- Total budget: €4.9 million
- Coordinator: University of Warwick, UK
- 12 partners from 7 European countries

Pilot sites:

- Region Jamtland Härjedalen, Sweden
- South Warwickshire NHS Foundation Trust, UK
- Servicio Vasco de Salud - Osakidetza, Spain











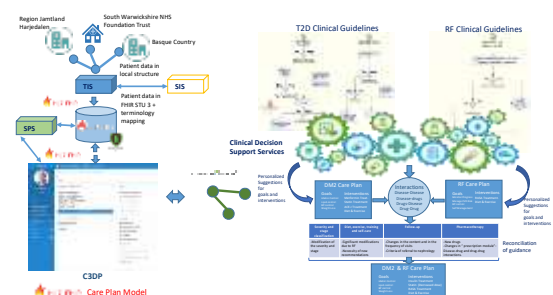

THE CHALLENGE

- Ageing is associated with increased accumulation of multiple chronic conditions known as **multi-morbidity**
 - More than 50% of all older people have **at least 3 chronic conditions**, and a significant proportion **has 5 or more**.
- Clinical management of patients suffering from multiple chronic conditions is very **complex, disconnected and time-consuming** in traditional care settings
- **Integrated care** is seen as a means to transform health services to meet these challenges
- Yet, the health professionals are lacking the means to effectively and collaboratively manage care of multi-morbid patients with ICT support

THE OBJECTIVE

- The main objective of C3-Cloud project is to develop an online collaborative platform;
 - for **personalised and integrated care plan management** of multi-morbid elderly patients,
 - by a **multi-disciplinary team** of health and social care providers,
 - supported with **Clinical Decision Support (CDS)** services implementing personalised goal and activity recommendations from **evidence based clinical guidelines**, and drug-drug / drug-disease contraindications,
 - seamlessly accessing and assessing the **electronic health records** of the patients,
 - by also making the **patients and their informal care givers** part of the overall process.

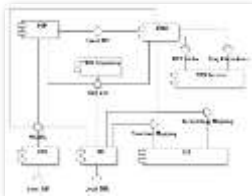
C3-CLOUD CARE PLAN MANAGEMENT PROCESS



C3-CLOUD INTEGRATED SYSTEM ARCHITECTURE

Major building blocks:

1. Technical Interoperability Suite (TIS)
2. Semantic Interoperability Suite (SIS)
3. Security and Privacy Suite (SPS)
4. C3-Cloud Secure FHIR Repository
5. Clinical Decision Support (CDS) Services
6. Coordinated Care and Cure Delivery Platform (C3DP)
7. Patient Empowerment Platform (PEP)



C3-CLOUD

INTEROPERABILITY LAYER

Technical Interoperability Suite (TIS)

- Enables data exchange between the local EHR systems of the pilot sites and the C3-Cloud components:
 - HL7 CDA interface in Basque Country
 - HL7 v3 interface in Jundland Hargeladen
 - Excel dumps in South Warwickshire
- Manages data synchronization
- Implemented as an ETL SDK

Semantic Interoperability Suite (SIS)

- Structural transformation from local EHR formats to HL7 FHIR
- Semantic transcoding between locally used code systems and common terminologies preferred by the CDS services
 - Benefits from existing code mappings in HICOT when possible
 - Further code mappings are done by C3-Cloud medical experts

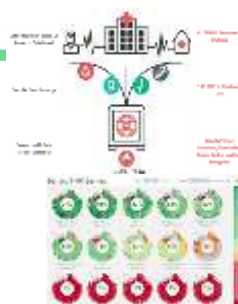
Security and Privacy Suite (SPS)

- Care Team Member authentication and authorization
- Implements OAuth 2.0, OpenID Connect 1.0 and Smart App Authorization specifications
- Integration with pilot site IdP systems (e.g. MS ADFS)
- Audit Record Repository

C3-CLOUD

ONFHIR - HL7 FHIR® BASED SECURE DATA REPOSITORY

- Common, standardized, HL7 FHIR® compliant way for health data access and storage
 - Highest scores in FHIR testing tools Crucible and Touchstone
- Dynamically configurable
 - Everything is configured from the original FHIR specifications (i.e. definitions)
 - Can support a new version of FHIR within an hour
 - Support for new custom FHIR operations via a library
- Security & Privacy
 - OAuth 2.0 and Smart App Authorization compliant via onAuth
 - Structural and functional role based access control
 - Automatic audit trail creation
- High performance and scalability
 - Outperforms the publicly available FHIR repositories in both reads and writes
 - Direct join manipulation with MongoDB
- For more information: onfhir.io



9

HL7 FHIR AS THE COMMON DATA MODEL

Used FHIR STU3 Resources:

- CarePlan
- CareTeam
- Goal
- Appointment
- ReferralRequest
- MedicationRequest
- ProcedureRequest
- DeviceRequest
- Device
- CommunicationRequest
- Communication
- Questionnaire
- QuestionnaireResponse
- Types of others for medical data, e.g. Condition, Observation, MedicationStatement, AllergyIntolerance, FamilyMemberHistory, Patient, Practitioner
- Foundation resources, e.g. AuditEvent, ValueSet



10

CDS SERVICE DEVELOPMENT PROCESS

1. Identification of the major diseases:
 - a. Type 2 Diabetes, Renal Failure, Heart Failure and Depression
2. Identification of the corresponding evidence-based clinical guidelines
 - a. All NICE guidelines with minor local deviations in our case
3. Detailed analysis of the paper-based guidelines and preparation of flowcharts by the clinical experts
4. Further analysis of the flowcharts to specify implementable technical CDS specifications by technical experts (with clinical support)
 - a. Defining the inputs (FHIR resources) and outputs (CDS Hooks cards + FHIR resources)
 - b. Specifying the decision tree
 - c. Terminology system binding for the clinical concepts
5. Software implementation as a RESTful service compliant with the CDS Hooks specification
 - a. Profiling of the generic CDS Hooks specification for this purpose
6. Integration of CDS services with the C3-Cloud Coordinated Care and Cure Delivery Platform (C3DP)

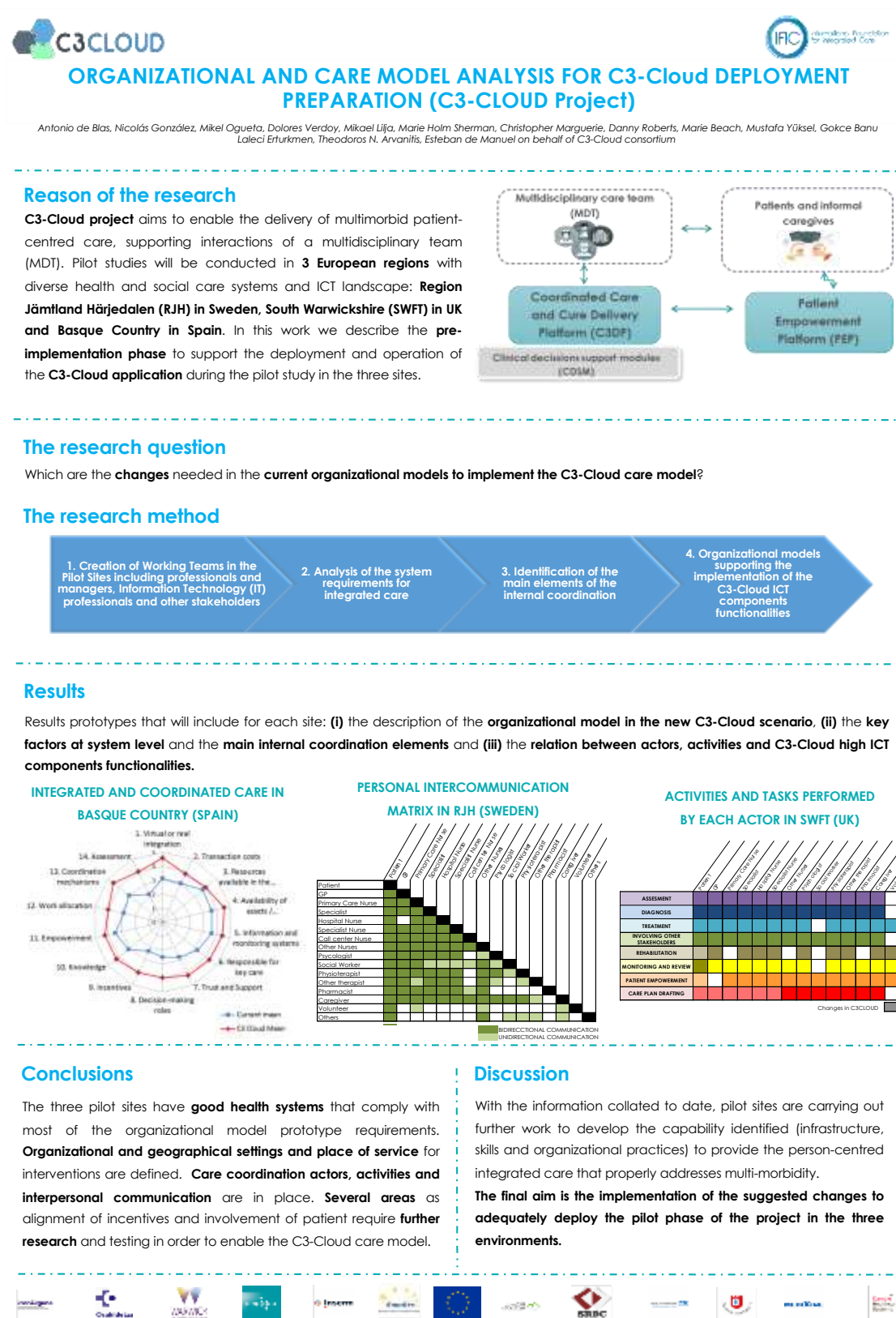
C3-CLOUD

EXAMPLE CDS SERVICE SPECIFICATION: BP MANAGEMENT



CARD 1	
Summary	ACE inhibitor recommendation
Detailed description	Add Angiotensin Converting Enzyme Inhibitor, Blood pressure check(2-2 months interval) and Follow-up appointment
Source	NICE guideline Hypertension in adults: diagnosis and management https://www.nice.org.uk/guidance/ng137
Suggestion 1	
Medication Request	Title: Prescribe ACE inhibitor Description: Prescribe ACE inhibitor Medication Code: C03AA, Angiotensin Converting Enzyme Inhibitor, ATC Dosage: Text Status: proposed start: (Date + 2 weeks) speciality: -
Activity (Appointment)	Title: Treatment Follow-up Appointment Description: Follow up to check the results of the treatment Status: proposed start: (Date + 2 weeks) speciality: -
Activity (Observation Request)	Title: Blood Pressure Observation Description: Have Blood Pressure systolic and diastolic levels before the control visit Category: Observation Code: BLOOD, Blood Pressure, LOINC performer: PATIENT

5.3. ICIC 2019 Poster



5.4. Poster for XI National Conference on Chronic Patient Health Care



IMPLEMENTACIÓN DE LA INTERVENCIÓN C3-CLOUD EN EL PAÍS VASCO

A. de Blas de Blas¹, N. González López¹, M. Ogueta Lana¹, D. Verdoy Berástegui², A. Fullaondo Zabala² y E. de Manuel Keenoy², en representación del equipo local de Osakidetza y del consorcio C3-Cloud.

(1) Organización Central de Osakidetza, Vitoria-Gasteiz, País Vasco. (2) Instituto de Investigación en Servicios de Salud-Kronikgune, Barakaldo, País Vasco.

C3-Cloud, www.c3-cloud.eu (H2020, PHC-25-2015, 689181), es un sistema TIC interoperable para mejorar la atención a las personas mayores con múltiples enfermedades crónicas, que facilita la atención integrada, colaborativa y centrada en el paciente mediante **planes personalizados basados en la evidencia**. Su **aplicabilidad** se va a probar en tres regiones europeas, siendo una de ellas **País Vasco a través de Osakidetza**.



PLANES DE ATENCIÓN PERSONALIZADOS

Están basados en la evidencia (guías clínicas NICE)

Se estructuran en cuatro elementos principales:

- Problemas de salud
- Objetivos: personalizados, temporizados, cuantificados
- Actividades: relacionados con objetivos, clasificados en tipologías
- Materiales educativos/formativos: personalizados, accesibles

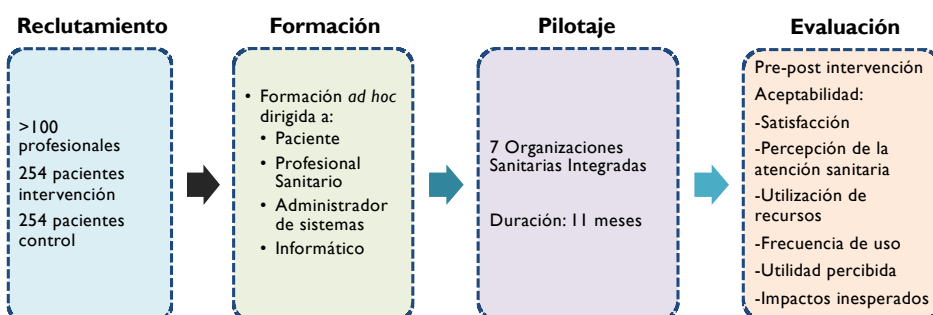
Se definen mediante acuerdos entre el paciente y el equipo multidisciplinar



MODELO C3-Cloud EN EL PAÍS VASCO

La implementación se ha realizado a través de solución TIC integrada en la Historia Clínica Electrónica Osabide Global:

- El diseño se ha basado en los requerimientos de los profesionales
- Se ha resuelto la interoperabilidad técnica, estructural y semántica
- Se ha asegurado la privacidad y seguridad
- La implementación requiere y refuerza el modelo de atención integrada



Este proyecto ha recibido financiación de la Unión Europea, Programa de Investigación e Innovación "Horizon 2020", número de contrato 689181.

5.5. Presentation on integrated care and research in health services to the Basque region



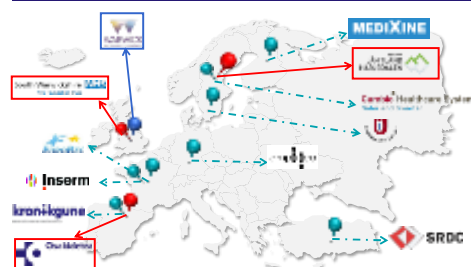
Índice

- Presentación proyecto
- Rol del País Vasco en el proyecto
- Resultados
- Intervención
- Próximos pasos

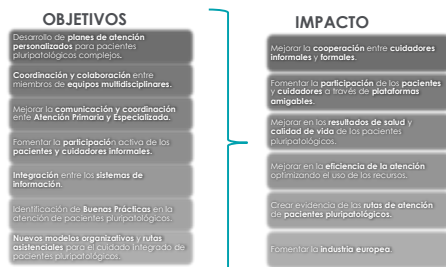
Proyecto C3-Cloud

- **Título:** Desarrollo de una **arquitectura en la nube para el cuidado y atención en colaboración con el enfermo pluripatológico, mediante planes personalizados, y la gestión de la polifarmacia**. (A Federated Collaborative Care Cloud Architecture for Addressing the Needs of Multi-morbidity and Managing Poly-pharmacy)
- **Consortio:** 12 socios
- **Coordinador:** UNIVERSIDAD DE WARWICK, Reino Unido.
- **Comienzo proyecto:** mayo 2016
- **Duración:** 48 meses
- **Convocatoria:** PHC-25-2015, H2020, EU

Consortio – C3-Cloud

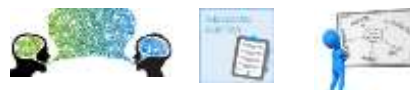


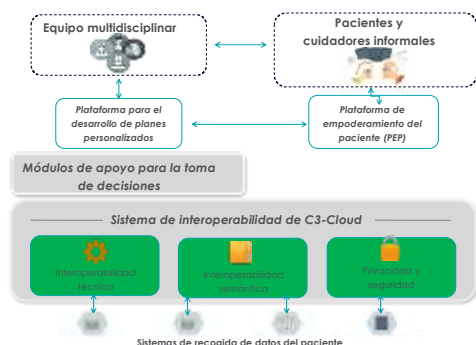
Retos del proyecto



Objetivo

- Desarrollo de **planes de atención personalizados** para pacientes **pluripatológicos complejos**, basados en la **evidencia** y apoyados en **herramientas TIC** y gestionados por un **equipo multidisciplinar coordinado** que fomenten la **atención integrada** y la implicación del **paciente y/o cuidador**.





Paciente pluripatológico C3-Cloud

Enfermedades crónicas:



Paciente Pluripatológico:

Al menos 2 de las 4 enfermedades

Fases del proyecto



Índice

- Presentación proyecto
- Rol del País Vasco en el proyecto
- Resultados
- Intervención
- Próximos pasos

Rol del País Vasco en el proyecto

- Definición de las necesidades asistenciales de los pilotos
- Identificación de los requerimientos técnicos de la arquitectura C3-Cloud
- Contenido de Módulos de apoyo a la toma de decisión clínica
- Nuevos modelos organizativos y rutas asistenciales
- Diseño e implementación del piloto
- Evaluación de resultados
- Formación usuarios



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- Presentación proyecto
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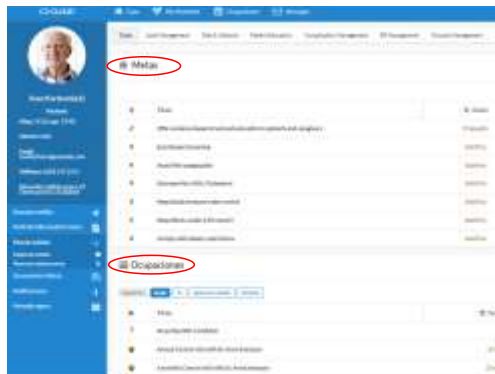
Resultados

- ✓ Necesidades asistenciales de los pilotos
- ✓ Requerimientos y arquitectura de C3-Cloud
- ✓ Nuevos Modelos organizativos
- ✓ Materiales de auto gestión para el paciente
- ✓ Plataforma de creación de planes personalizados
- ✓ Plataforma de empoderamiento del paciente
- ✓ Interoperabilidad
- ✓ Módulos de apoyo a la toma de decisión clínica
- ✓ Plan de Protección de datos
- ✓ Criterios de evaluación
- ✓ Aprobación del Comité Ético



Elementos del Plan de Atención Personalizado

- Problemas de salud
- Objetivos
- Actividades
- Materiales educativos/formativos



Plataforma de Empoderamiento del Paciente (PEP)

- La **Plataforma de Empoderamiento del Paciente (PEP)** garantiza la implicación activa de los **pacientes y sus cuidadores** informales a través de:



PLAN DE ATENCIÓN PERSONALIZADO

Presenta objetivos y actividades al paciente.

Reforzar la adherencia.

GUÍAS/MATERIALES

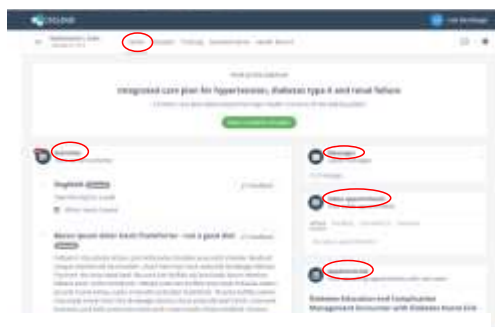
Permite capacitar el auto-cuidado y manejo de sus condiciones.

Acceso a materiales de educación en diferentes formatos.

REGISTRO DE DATOS

Registro de sus actividades y los problemas.

Seguimiento de posibles factores de riesgo.



Índice

- Presentación proyecto
- Rol del País Vasco en el proyecto
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Intervención

- Pregunta principal: ¿Es el uso de una **herramienta TIC personalizada**, que permite la planificación de la atención coordinada, la optimización del tratamiento y la autogestión del paciente, **aceptable** para **pacientes pluripatológicos** crónicos y para **el equipo de profesionales** que lo atiende? "



Variable principal: **aceptabilidad** de la **tecnología C3-Cloud**

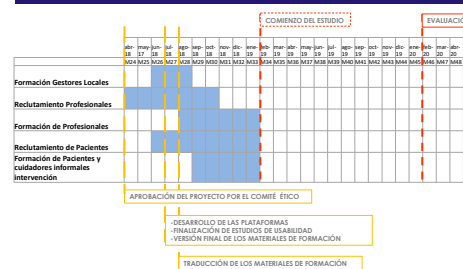
País Vasco

- **Estudio:**
 - **300 pacientes intervención / 300 pacientes control**
 - **16 profesionales** (nº mínimo)
 - **12 meses (1 febrero 2019-31 enero 2020)**
- **5 OSIs** en 3 territorios
 - OSI Alto Deba
 - OSI Araba
 - OSI Bilbao-Basurto
 - OSI Ezkerrialea Enkarterri Cruces
 - OSI Donostialdea

Índice

- Presentación proyecto
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- **Próximos pasos**

Próximos pasos




Eskerrik Asko


www.c3-cloud.eu




5.6. Dissemination Seminar, LIMICS, Paris


 A FEDERATED COLLABORATIVE CARE AND CURE CLOUD
 ARCHITECTURE FOR ADDRESSING THE NEEDS OF MULTI-
 MORBIDITY AND MANAGING POLYPHARMACY

C3-Cloud: Main Tasks, Current results & Exploitation Perspectives
 April 15, 2019
 Dissemination Seminar
 LIMICS, Paris

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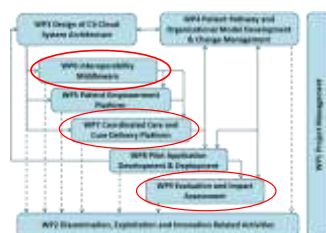


CHALLENGES, OBJECTIVES AND TOPICS



Basic concepts of the C3-Cloud system

LIMICS MAIN RESPONSIBILITIES AND OBTAINED RESULTS

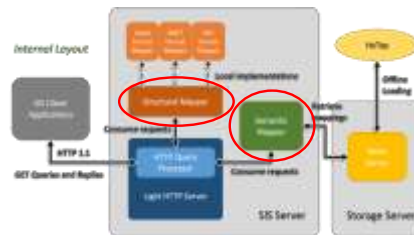


PART I: SEMANTIC INTEROPERABILITY SUITE (SIS)

STRUCTURAL & SEMANTIC MAPPER

The SIS handles both :

- **Structural** mappings among different **information models**
- **Semantic** mismatches due to the use of different **terminology systems** and different **compositional aggregations**, used to represent the same clinical concept.



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STRUCTURAL & SEMANTIC MAPPER TASKS

SIS Sub-components	Summary of fulfilled Tasks
Structural Mapper	<ul style="list-style-type: none"> ✓ A fully deployable exchange suite running on docker. <ul style="list-style-type: none"> ○ Based on HTTP communication standards (JSON content) ○ Developed using Java 8 & Maven ✓ Supports FHIR inputs and outputs ✓ Supports pilot site inputs (transformation rules)
Semantic Mapper	<ul style="list-style-type: none"> ✓ Concepts mapping table to cover use cases ✓ Semantic mapping service ✓ Translate a code from (and to) local terminology to CDSM terminology ✓ Retrieve the code of a concept in a terminology ✓ Record new mappings

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SIS STRUCTURAL MAPPER I/O

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SUMMARY OF PATIENT DATA APIs FOR EACH LOCAL EHR SYSTEM

API Name	API Description	API Data Type
GET /patients	A GET service to return data for a patient	JSON
POST /patients	A POST service to return all data for a patient	JSON
GET /patients/{id}	A GET service to return all data for a patient	JSON
POST /patients/{id}	A POST service to return all data for a patient	JSON
GET /patients/{id}/diagnoses	A GET service to return all diagnoses for a patient	JSON
POST /patients/{id}/diagnoses	A POST service to return all diagnoses for a patient	JSON
GET /patients/{id}/medications	A GET service to return all medications for a patient	JSON
POST /patients/{id}/medications	A POST service to return all medications for a patient	JSON
GET /patients/{id}/tests	A GET service to return all tests for a patient	JSON
POST /patients/{id}/tests	A POST service to return all tests for a patient	JSON
GET /patients/{id}/vitals	A GET service to return all vitals for a patient	JSON
POST /patients/{id}/vitals	A POST service to return all vitals for a patient	JSON

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EXTRACTS FROM C3-CLOUD DATA DICTIONARY

Entity	Attribute	Primitive	Cardinality	Data Type (Int / String / Boolean / Enum / Date / Time / Binary / Other)
Prescription / Medication / Observation	id	YES	1..1	String
	code	YES	1..1	String
	description	YES	1..1	String
	status	YES	1..1	String
	effective	YES	1..1	String
	effective	YES	1..1	String
	effective	YES	1..1	String
	effective	YES	1..1	String
	effective	YES	1..1	String
	effective	YES	1..1	String
Prescription / Medication / Observation	id	YES	1..1	String
	code	YES	1..1	String
	description	YES	1..1	String
	status	YES	1..1	String
	effective	YES	1..1	String
	effective	YES	1..1	String
	effective	YES	1..1	String
	effective	YES	1..1	String
	effective	YES	1..1	String
	effective	YES	1..1	String

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XML/CDA MEDICATION ENTRY [OSAKI TEST DATA]

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JSON/RJH DIAGNOSIS ENTRY [RJH TEST DATA]

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CSV CONDITION ENTRIES [SWFT TEST DATA]

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C3.CLOUD

JSON/FHIR OUTPUT

Original data coming from SWFT CSV file
Observation[social history category] about alcohol use of the patient

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SIS SEMANTIC MAPPER I/O

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SIS SEMANTIC MAPPER (1/3)



> Reference Terminologies for CDSM:

- SNOMED-CT
- LOINC
- ATC

> In total, 218 common clinical concepts including:

- Conditions
- Medications - active ingredients -
- Procedures
- Lab results
- Vital signs
- Immunizations
- Family history

have been identified and bound to above reference terminology systems


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C3.CLOUD

SIS SEMANTIC MAPPER (2/3)

➤ These concepts have been mapped to **516** different codes from locally used terminology systems of **3** pilot sites.

➤ **Local codes:** **Spanish** and **Swedish** versions of **ICD-10**, completely local terminologies for laboratory tests and READ codes for **UK**.

- SemMapper spreadsheet 
- [Coding Systems](#)

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SIS SEMANTIC MAPPER (3/3)

The semantic mapping is triggered via a **HTTPS GET request** with **4** parameters:

1. **code** --> local code to transcode.
2. **codeSystem** --> local code system
3. **fromSite** --> origin of the code to transcode.
4. **toSite** --> destination requested.

Query Example:

https://rubis.limics.upmc.fr/c3-cloud/translate/?code=49601007&code_system=http://snomed.info/sct&fromSite=CD&toSite=RJH

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SIS SEMANTIC MAPPER RESPONSE



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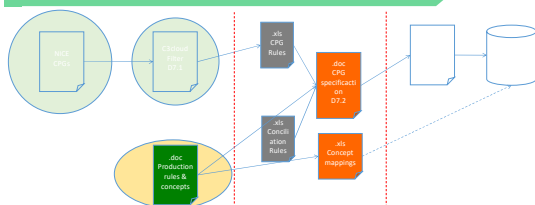


PART 2: KNOWLEDGE SPECIFICATIONS OF **RENAL FAILURE** RULES USING THE GUIDELINE DEFINITION LANGUAGE (GDL) FOR THE CDSMS

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RF GUIDELINE FORMALISATION



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METHODOLOGY FOR RECONCILIATION OF GUIDELINE RECOMMENDATIONS

1. Primary source of information: the individual conditions flowcharts/algorithms from D7.1 "Evidence Based Clinical Guideline Definitions and Flowcharts for Individual Chronic Conditions" along with other sources of information
2. Select the critical issues where interactions can occur and that they want to address and reconcile
3. Check for possible conflicts between CPGs recommendations (choice among several alternative options)
 - Examples of conflicts: Overlaps, Wrong sequence of activities, Medication interactions, Location inconsistencies
4. Reconcile trying to mitigate the conflict or inconsistency by modifying the CPGs recommendation according to available knowledge (select, removal, merge, substitution, modify with extra input and output)
 - Examples of solutions: Reverse the sequence (to be decided / confirmed by clinician)
5. Define the reconciled rule
6. Clinicians peer review and local issues
7. Final reconciled rules

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A SAMPLE FLOWCHART FOR LIPID MANAGMENT CDS



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A SCREENSHOT OF THE DIABETIC FOOT PROBLEM GUIDELINE IN GDL2 EDITOR



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PART 3: EARLY APPLICATION TESTING OF THE C3-CLOUD SYSTEM INVOLVING 48 END-USERS FROM 3 PILOT SITES

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HOW THE STUDY EVALUATION OBJECTIVE WILL BE ACHIEVED

Pre-study phase	Layer 1: user-centred design (T9.2)	Testing the design of the C3-Cloud components (e.g. functionality, content provided, language used, level of detail, user-friendliness) and their application chain (evaluating if all components are well integrated).
	Layer 2: Usability and usefulness (T9.2)	This layer will provide feedback to T7.4 to inform the technical partners on the usability of the C3-Cloud software components to reconfigure and update the C3-Cloud components.
Study phase	Layer 3: Exploratory trial (T9.3)	With the involvement of 150 patients and 52 MDT members during the 15-month piloting trial, layer 3 evaluates the user experience, satisfaction and acceptability of the C3-Cloud application and patient training material.
Post-study phase	Layer 4: monitoring for impact modelling (T9.5)	Layer 4 prepares the modelling of the large-scale impact of C3-Cloud implementation after the 15-month exploratory trial, which will be carried out in T9.5

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C3-CLOUD

EARLY APPLICATION TESTING OF THE ENTIRE SYSTEM

- 48 test participants issued from different groups of end-users
 - 22 MDTs
 - 26 Patients
- From the 3 pilot sites
 - Basque Health Service - Osakidetza [OSAKI], Spain
 - Region Jamtland Harjedalen [RJH], Sweden
 - South Warwickshire NHS Foundation Trust [SWFT], UK
- For the "product reaction cards" and Delphi methods

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"PRODUCT REACTION CARDS" PRC METHOD

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PRC - SUMMARY OF PARTICIPANTS RESPONSES



- For the 22 participants of the MDT profile:
 - 30% describe the system as "Collaborative"
 - 16% find it "Comprehensive"
 - 17% find it both "Empowering" and "Innovative" and 20% as "Time Consuming"
- For the 26 participants of the patient profile:
 - 25% describe the system as "Useful"
 - 21% find it both "Accessible" and "Convenient"
 - 17% find it "Appealing"
 - 16% find Advanced"

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QUESTIONNAIRE PLATFORM



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5.7. Medinfo 2019 paper

User-Centered Design of the C3-Cloud Platform for Elderly with Multiple Diseases – Functional Requirements and Application Testing

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Abstract

The number of patients with multimorbidity has been steadily increasing in the modern aging societies. The European C3-Cloud project provides a multidisciplinary and patient-centered “Collaborative Care and Cure-system” for the management of elderly with multimorbidity, enabling continuous coordination of care activities between multidisciplinary care teams (MDTs), patients and informal caregivers (ICG). In this study various components of the infrastructure were tested to fulfill the functional requirements and the entire system was subjected to an early application testing involving different groups of end-users. MDTs from participating European regions were involved in requirement elicitation and test formulation, resulting in 57 questions, distributed via an internet platform, to 48 test participants (22 MDTs, 26 patients) from three pilot sites. The results indicate a high level of satisfaction for all components. Early testing also provided feedback for technical improvement of the entire system, and the paper points out useful evaluation methods.

Keywords:

Multimorbidity; Evaluation Studies; User-computer Interface.

1 Introduction

The World Health Organization estimates that 63% of all annual deaths (~36 million people) is attributable to non-communicable, chronic diseases [1] and the number of people with multiple comorbidities has considerably increased for some years, mainly due to the ageing of the population [2]. Elderly patients with multimorbidity (i.e., having at least two chronic diseases) [3] are at higher risk of safety incidents [2]. These could include incidents such as delayed diagnosis, no recommended treatment, drug side effects, drug interactions, over/under dose of drugs, complications, infections, etc [2,4]. Increased risks in patient safety, in this context, may be

explained by many reasons. Firstly, patients with multimorbidity are often polymedicated, with a potential decrease in treatment adherence and a possible increase of drug side effects. Secondly, patients may receive contradictory advice or treatments, due to the application of different guidelines that are designed to manage only single disease pathways. Thirdly, patients with multimorbidity are often cared by several Health and Social Care professionals, who are not always coordinating and communicating through the patients' journey. For example, there is often a lack of communication between general practitioners (GPs) and secondary care specialist centres. Finally, these patients are often more vulnerable than others, due to their multiple diseases and their advanced age, which makes the care process even more complex.

C3-Cloud¹ is a European Commission supported Horizon 2020 research and innovation project, which aims at improving the provision of integrated care to patients with multimorbidity via enhanced ICT solutions. The research aims at resolving guidelines' conflicts (by reconciliation of varying recommendations from individual disease guidelines), supporting clinical decision making through clinical decision support services, and facilitating communication among multidisciplinary care team (MDT) members through an interoperable platform, which integrates patients' health records from existing Electronic Health Record (EHR) systems [5]. The project mainly focuses on elderly patients (65+) with diabetes, heart failure, renal failure and depression in different comorbidity combinations. Three European pilot sites are involved in the study: Osakidetza (Basque Country, Spain), RJH (Region Jämtland Härjedalen, Sweden) and SWFT (South Warwickshire NHS Foundation Trust, UK).

The C3-Cloud system consists of a variety of components:

- Coordinated Care and Cure Delivery Platform (C3DP),
- Patient Empowerment Platform (PEP),

¹ <http://C3-Cloud.eu>, A Federated Collaborative Care Cure Cloud Architecture for Addressing the Needs of Multi-morbidity and Managing Poly-pharmacy.

- Clinical Decision Support Modules (CDSM),
- Interoperability Middleware, which includes modules of

technical and semantic interoperability, as well as privacy and security. All these components constitute the solution that will be used for the technological trial of the C3-Cloud application. Following a user-centered development (UCD) approach [6], the solution has to be evaluated iteratively during its life cycle; during development and implementation with a restricted number of participants, during deployment with larger number of users as well as during the routine phase for prospective cost-benefit analysis and real impacts.

The objective of this study is three-fold: the report of the user-centered functionality testing, the conclusions to further improve the C3-Cloud system and, for the community, to present useful methods among the UCD evaluation methods often used in health informatics.

2 Methods and Materials

This evaluation consisted of a number of questionnaires to collect user feedback regarding system functionality. The questionnaires were created based on a Delphi approach [7]. In the context of the project, a total of 51 pilot application requirements (PARs) and 72 use cases have been defined covering the scope of all high level C3-Cloud components to depict expected functionality. Three different types of users interact with the system: multidisciplinary team members (MDTs) also known as health and social care professionals; patients; and informal care givers (ICGs), and are accordingly studied. This is in line with previous informatics research, e.g. OLD@HOME[8–10] and more recent research regarding patient access of health information [11–13]

This qualitative inductive study directly separated the demands or requirements with the use cases needed. For example, “as a patient, I need to access drug interaction information” is a PAR for the pilot sites and “Enabling patients to access self-management material” is a use case of the PEP component. A full list of user scenario descriptions and PARs is presented in deliverable D8.1 [14].

2.1 Evaluation Procedure

Following the Delphi approach [7], the evaluation framework was developed:

2.1.1 Brainstorming: Formulation and Evaluation of an Initial List of Relevant Questions.

Based on an analysis of 51 PARs and 72 use cases, the first step was to formulate a list of questions, starting by a simple mapping (1 PAR to 1 use case) to identify possible links between the PARs. Secondly, the questions were grouped by profiles identified during the PARs’ analysis process, in order to define one questionnaire per user profile. The workflow was based on a C3-Cloud key scenario linked to a use case and defined by application testing criteria.

2.1.2 Refining and Prioritization: Internal Review Based on a Cognitive Walkthrough by Experts

The initial questions were reviewed by the three pilot sites as well as by the technical partners of the C3-Cloud project. The results of the cognitive walkthrough [11] by five IT and clinical reviewers, allowed us to validate, modify, delete or add questions based on the updated PAR list and covered system functionality. Based on the review from the aforementioned experts, although addressing different professionals and individuals, the questionnaires could be appropriated to, two

user profiles: 1) MDTs and 2) Patients & ICGs, as grouped respondents of the questions.

2.1.3 Think Aloud

During the test sessions, the think aloud method [11] was encouraged and the pilot site managers, who moderated the sessions, noted all comments of the participants. Feedback from the different pilot sites could be complementary. If feedback was raised more than once, it was reported only once. Examples, issued from the feedback, and how they were handled by technical partners to improve the C3-Cloud components, are reported in the Result section.

2.2 Evaluation Set-Up

We implemented an online application that allowed participants to answer questionnaires. The application site is available at <https://c3cloud.irsan.eu>. In the questionnaire, participants responded with [Yes], [No] and [NA] (for functionality, which was Not Available). When the response was [No], both MDTs and Patients/ICGs had the opportunity to specify and explain the problem faced by writing free text comments.

2.2.1 Participants

Overall, 26 elderly patients (> 65 years) and 22 MDTs from the three pilot sites: Osakidetza, RJH, and SWFT; participated in the testing. At the time of testing, only English-language demonstrator and materials were available, and local sites considered this when recruiting test participants.

2.2.2 Test Sessions

The participants received login credentials for the online demonstrators of the C3DP (for MDTs) and the PEP (for Patients/ICGs) as well as training materials including a walkthrough that guided them through certain activities on the demonstrators. In Osakidetza and RJH pilot sites, a language facilitator moderated each session, available for translation of the material and any other question raised by the participants. Think aloud notes taken during the test sessions generated a summary report.

3 Results

Overall 57 questions were formulated; 33 for MDTs and 24 for Patients & ICGs. Below, detailed results of the application testing for MDT and Patients/ICGs, respectively, are reported, as well as examples of the questions in the questionnaires.

3.1 Evaluation by MDTs

Questions were categorized by the following main topics: Care Plan; Decision Support Module; Patient Data; Communication; and Notifications. The MDT responses [Yes], [No] or [NA] are reported, in percentages, in Table 1.

Table 1– Summary of MDTs average response rates to C3-Cloud application testing

C3DP Categories	MDTs’ Response rates		
	[Yes]	[No]	[NA] (Not Available)
Care plan	94 %	4%	2%
Decision Support Module	72%	0%	28%
Patient Data	75%	6%	19%
Communication	79%	3%	18%
Notification	89%	5%	6%

Questions related to **Care Plan** received the highest amount of [Yes] responses, 94%. The following questions received positive responses by all (N=22) participants:

- “Are you able to create a new specialized care plan for the patient?”
- “Are you able to define new or update planned intervention?”
- “Are you able to define new or update self-care activities (like exercise recommendation)?”

The question “Are you able to update an existing care plan?” scored: [Yes] 82%, [No] 9% and [NA] 9%. The [No] responses were complemented with MDT comments, revealing that some update functionalities were missing. For example:

- *“I can update some elements of the plan as goals and activities and training material, but I cannot update the health conditions of the patient.”*

From the free text feedback, further details about “health conditions,” in a new care plan creation, were considered, together with improvement proposals from MDTs and responses from the technical partners. For example:

- MDT proposal: *“When creating a new care plan ‘Addressed Conditions’ may need rephrasing. It is also unclear how it is decided what conditions the list here suggests. The list can be very long if many conditions apply or are possible.”*
- Technical partner improvement feedback: *“Addressed conditions will be removed, the SNOMED-CT codes of the 4 main diseases will be added.”* Regarding the **Decision Support Module**, an average of 72% of the participants provided [Yes] answers to questions such as:
- “Does the Clinical Decision Support Module give you advice about treatment options such as i) new safety, treatment or lifestyle? ii) starting/stopping of medication, based on the most recent context of the patient including changes in recent remote monitoring results?”

There were zero [No] answers and [NA] responses were rated at 28% on average, meaning that all accessible functionalities were approved by the participants.

For **Patient Data**, average responses were [Yes] 75%, [No] 6% and 19% for [NA]. There were highly rated [Yes] responses >90% for questions such as:

- “Are you able to access patient data after the Care Plan Manager approved your membership to the Multidisciplinary Care Team?”
- “Are you able to review the patient’s Health Records?”

A lower percentage of [Yes] responses were received for example regarding questions like:

- “Are you able to access the readings, which have been uploaded by patients manually or via remote monitoring systems such as wireless medical sensor devices?” with [Yes] 55% respective [NA] 36%.
- “Are you able to follow-up patients’ activities, such as complications, side effects via questionnaires?” 68% responded [Yes] and 18% [No] which were completed with MDT comments like “Not recorded” and “Did not find them...”
- “Are you able to access information completed by the patient such as files uploaded via the PEP?”

64% responded [Yes] and 32% responded [NA].

Communication questions were related to message exchange between the MDT members or invitations to another specialist to join the care team. On average, 79% responded [Yes], 3% [No] and 18% responded [NA]. Questions regarded, e.g.:

- “Messaging - Are you able to send messages to other members of the MDT via asynchronous messaging?”

- “Invitation - Are you able to invite another specialist to join the patient’s Care Team?”

Finally, responses related to **Notification** functionalities received an average of 89% [Yes], with questions such as

- “Are you able to notify the existence of the updated care plan to Care Team Members and to the patient?”

All participants (100%) answered positively on

- “Can you see the upcoming activities in your calendar and in the Activities section of your dashboard?”

3.2 Evaluation by Patients and ICGs

For the Patient Empowerment Platform (PEP), Patient and ICG responses were categorized in the following main topics: Care Plan; Patient Empowerment; Patient Data; Notifications and Communication. The responses [Yes], [No] or [NA] are reported, in percentages, in Table 2.

Table 2 – Summary of Patients & ICGs average response rates to C3-Cloud application testing

PEP Categories	Patients and ICGs Response rates			
	[Yes]	[No]	[NA]	(Not Available)
Care plan	87%	4%	10%	
Patient Empowerment	68%	8%	24%	
Patient Data	48%	4%	48%	
Communication and Notification	32%	5%	63%	

Questions related to **Care Plan** received average responses of 87% [Yes], 4% [No] and 10% [NA]. Examples of questions:

- “As a Patient or Informal Care Giver, are you able to access the care plan?” 96% of participants responded positively, and 4% responded [NA]
- “Do you receive enough advice and support about how to follow the care plan?”

[No] responses were provided, with comments such as:

- *Not clear how to work through the system.*
- *Not obvious what needs to be done, when and how. Some guidance notes would be helpful.*
- *More time is needed.*
- *Needs to be more simple with clear single click pathways through each of the components for the patient. A lot of the technical material in each patient activity is not needed by the patient and therefore confusing.*

Patient Empowerment average responses were 68% of [Yes], 8% of [No] and 24% of [NA]. Example of questions:

- “Do you think that the information given could help you to improve your health and wellbeing?” 85% responded [Yes], 15% responded [NA].
- “Are you able to learn about treatment options through the PEP?” 61% [Yes], 8% [No], 31 % [NA].
- “Are you able to learn about drug benefits through the PEP?” 58% [Yes], 11% [No], 31 % [NA].

[No] responses were completed, with patients’ comments as:

- *Not recorded.*
- *Depends on which materials are presented.*
- *I have not stopped/answered.*

Patient Data gathered average response rates of 48% for [Yes], 4% for [No] and 48% responded [NA]. Some examples

- “Are you able to access the readings uploaded to the system from remote monitoring systems (e.g., wireless medical sensor devices) from the PEP?”

42% responded [Yes], 8% responded [No], 42% lacked the functionality with [NA] responses.

- “Are you able to upload documents, such as a picture, to your PEP?” 54% responded [Yes] and 46% [NA].

[No] responses were completed, with patients’ comments such as: “Not available”, “I have not tried it”.

Communication and Notification average responses were 32% [Yes], 5% [No] and 63% [NA]. Example of questions:

- “Messaging - Are you able to contact MDT members via messaging from the C3-Cloud Platform?” 58% [Yes], 0% [No], 42% [NA]
- “Video calls - Are you able to join a video conferencing session with MDT members?” 8% [Yes], 92% [NA]
- “Notifications - Are you able to schedule an appointment with your Primary Care Provider?” 16% [Yes], 15% “No and 69% [NA]

3.3 Proposed Actions Based on the Evaluation

Based on technical partners’ feedbacks regarding the overall responses from participants, below is a summary of issues to be handled to improve the first version of the C3-Cloud system. These issues are currently being followed up in the project in relevant work tasks.

- ☐ Bugs – errors related to the expected functionality should be fixed.
- ☐ Training needs to be improved – related to the uncertainty of users regarding the functionality of the system, next steps, scope.
- ☐ Local configuration – local customizations need to be implemented during deployment.
- ☐ Evaluation questionnaires – More time to complete the tests and a way to report issues repeatedly should be.
- ☐ Language – issues related to native language usage on the platform, both for local configuration and content.
- ☐ Feature improvement – issues related to aspects such as unclear labels, layout, etc. Some comments for features could be out of scope but noted for future recommendations.
 - Incomplete/unclear specification – insufficient information to implement the improvement, for example: Care plan content, and concept issues – specific issues relating to care plan clarifications are required.
 - New feature – a new feature requested.
 - Visual guideline – information missing regarding visual guidelines or available accessibility settings
 - Test data unrealistic – value ranges incorrectly: can be improved with realistic test samples as provided by pilot sites.
 - Scope clarification – the scope of the project needs to be clarified [to whom?/technicians/developers/?] in order to implement improvements.

4 Discussion

Our findings indicate that with the help of a user-centered design methodology [6] it was possible to define the functional ICT requirements for the C3-Cloud project and further refine them through an early application testing by end-users. A combination of different techniques that complement one another should preferably be used as their collective application will be more powerful than applied in isolation [11]. Therefore we used different evaluation methods.

The first approach used, inspired from the Delphi method, permitted “to obtain the most reliable opinion consensus from the group of experts by subjecting them to a series of questionnaires in-depth interspersed with controlled opinion feedback”[7]. The development of the questionnaires for application testing was therefore preceded by and based upon the creation of pilot application requirements which were matched with the use case scenarios, and later reviewed by both IT and clinical experts. However, we are aware that a 2nd review round by the experts may have improved the formulation of the questions.

During the test session, we observed some limitations regarding the contextual coupling and synchrony between the test environment that was based on PARs and case scenarios and the perceived relevance of some items of the questionnaires. This was highlighted by some of the responses from the participants such as: “not finding the option”; “not knowing”; “not been informed about it”; “not clear how to work through the system”; “not obvious what needs to be done”; “more time needed”.

Although we encouraged the think aloud method during the application testing, in some cases feedback was too vague to be interpreted. For example, such feedback included statements such as “Depends on which materials are presented” and “I have not stopped/answered”. In such cases, participants need to be more specific about the problem they face, and the observers need to make sure they fully understand what the user means at that specific moment.

The analysis of feedbacks also highlighted that it would have been advantageous to apply a shorter questionnaire that addressed some site-specific smaller discrepancies of the C3-Cloud platform and the language-related barriers. Most notably, the prerequisite of a good command of English caused both limitations regarding the recruitment of participants and an accurate understanding of nuances in the non-English speaking countries. Additionally, some participants felt that the questionnaire was not sufficiently detailed to allow them to express all their concerns with the C3-Cloud platform. Specifically, some suggested that it would have been more efficient to answer questions directly in the evaluation walkthrough document, which in turn would have enhanced their understanding of the entire test module in advance. Further, two participants did not feel that they wanted to use the patient empowerment platform in its current format at all. Notably, as the majority of the participants were elderly, early testing in the development is crucial, as one could expect that such users would experience difficulties with the comprehension and adaptation of the novel C3-Cloud platform, but it could be hard to know in advance where in the system the unintended effects arise. This finding is in line with current research on evaluation methods in health IT, used for early detection an addressing of the unintended consequences of IT usage [12]

However, the overall response of the participants was that the system has great potential to simplify and enhance their engagement in and understanding of the care process. This was reflected by the high overall rate of positive [Yes] responses.

This study also demonstrated that with a multi-faceted user-centered design methodology it was possible to perform an early evaluation of a complex ICT infrastructure, involving different groups of end-users from three different pilot sites (in Spain, Sweden, and the United Kingdom), which in turn further consolidated the European-wide collaboration within the C3-Cloud project.

This constructive evaluation was performed at an early stage of the development to achieve a fast improvement of the C3-cloud

system. The results summarized in Section 3.3 were communicated as user feedback to the technical partners, who have reconfigured and updated the C3-Cloud components accordingly. Incorporating the end-user's requests for change and modification has been completed before the pilot application deployment. The C3-Cloud platform which has been developed by the results of this evaluation will be subjected to further and more vigorous testing based on real life experience, with actual MDT members and patients/ICGs in the three pilot sites during the planned pilot study starting in April 2019.

5 Conclusion

This study demonstrates how an integrated application can be tested against the requirements, as elicited through an extensive European collaboration to improve care for the elderly with multiple diseases. Mainly, application testing was performed without any adverse incident. The online platform worked well, throughout the application testing sessions.

The aim of this evaluation was not only to appraise the system's functionality but also to investigate how to improve the C3-Cloud application and its implementation further. The results obtained reflect insights from MDTs, patients and informal care givers for both user-facing components: C3DP and PEP.

Overall, this application testing is an early evaluation exercise, in order to adapt the system, where needed, and to get the first users' feedback for further development. Integrating the questions into the evaluation walkthrough document, so that participants can answer the questions as they are testing the relevant sections, would make it simpler for the participants.

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