



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

D2.14 Report on industry liaison

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

Due Date: 31 August 2020

Actual Submission Date: 26 August 2020

Project Dates: Project Start Date: 01 May 2016
Project End Date: 31 August 2020
Project Duration: 52 months

Deliverable Leader: EUROREC

Project funded by the European Commission within the Horizon 2020 Programme (2014-2020)		
Dissemination Level		
PU	Public	X
CO	Confidential, only for members of the consortium (including the Commission Services)	
EU-RES	Classified Information: RESTREINT UE (Commission Decision 2005/444/EC)	
EU-CON	Classified Information: CONFIDENTIEL UE (Commission Decision 2005/444/EC)	
EU-SEC	Classified Information: SECRET UE (Commission Decision 2005/444/EC)	

Document History:

Version	Date	Changes	From	Review
V0.1	12-08-2020	Initial document and most chapters, initial partner templates	EUROREC	ALL
V0.2	15-08-2020	Addition of chapter on tactics for future engagement from Charlie McCay, edited by Dipak	EUROREC	WARWICK
V0.3	22-08-2020	Executive summary and further templates added	EUROREC	WARWICK
V0.4	25-08-2020	Proofreading edits	EUROREC	
V0.5	25-08-2020	Addition of Warwick engagements	WARWICK	EUROREC
V0.6	25-08-2020	Internal Review	EUROREC	WARWICK
V1.0	2020-08-26	Final checks, proof reading and editing by the Coordinating team	WARWICK	WARWICK

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1. EXECUTIVE SUMMARY

This deliverable reports on the engagement that the project partners have had with industry, mainly in the ICT sector but also MedTech, pharma and life sciences. It has been challenging to get beyond the stage of informal interest and the seeing of potential in our solutions for the future of healthcare delivery, and therefore for the market of these ICT companies.

The Chapter 2 of this deliverable explains the key areas of feedback we have had from these engagements. This includes the design and implementation features of our solution that industry have felt to be strong and favouring sustainability and future industry adoption. However, they have also emphasised to us that the market for additional investment by healthcare providers and systems in better quality solutions for multi morbidity is not perceived to be strong. In other words, even though societal need might be there, and the digital solutions to address that need might be forthcoming through projects like ours, the healthcare provider ecosystem has not woken up sufficiently to the need to invest strategically in tackling multimorbidity and polypharmacy, and not adequately perceived the value of digital tools to do this. On the basis of industry advice, we therefore shifted in favour of more multi stakeholder events so that the players who are decision-makers and decision influencers were in the same room as the people who are solution providers.

The Chapter 3 lists some example specific industry engagement activities, often at the level of single partners speaking to a small cluster of companies, to illustrate the kinds of engagements we have undertaken. This is not comprehensive, and tends to favour things that have occurred in the last year or two.

The Chapter 4 describes our major vendor engagement activity, which was a multi stakeholder engagement activity called 'Joining the Dots'. This conference was held in November 2019, in Brussels, with 150 participants and was a joint activity with some other projects with overlapping approaches. The conference is primarily described in deliverable 2.11, the dissemination deliverable. However, we held within this event a dedicated session which is reported in this deliverable.

Chapter 5 presenting analysis of the challenges that ICT companies have discussed with us, that they face when it comes to getting innovative digital solutions adopted within the healthcare provider marketplace. It is important for us to appreciate these challenges, because we either will face the same challenges directly if we market our solutions to healthcare providers, or we will need to support ICT vendors with how they can promote a solution, in order for us to have successful B2B relationships with them.

Chapter 6 takes a wide view of tactics which we might adopt to gain visibility within the ICT community or to gain visibility with decision-makers. This includes offering a solution as a way of demonstrating, testing and illustrating the value from computerised clinical guidelines, engaging in indirect promotional activities such as hackathons and conferences. This chapter is complementary to the final business plan deliverable D2.13, because it is not directly about how a C3-Cloud business entity might function but complementary ways in which business opportunity might be finessed.

2. REFLECTIONS AND KEY MESSAGES FROM THE C3-CLOUD INDUSTRY ENGAGEMENTS

C3-Cloud has tackled a health issue, multimorbidity, which is growing in its scale (due to population ageing) and therefore is a high healthcare service burden, cost burden and a challenge for patients and their caregivers. The C3-Cloud approach to addressing this issue recognises the central role that digital health information, digital care plans and multidisciplinary team (MDT) communications have to play in supporting better co-ordinated, more evidence based and better empowered care. The project was designed from a strong understanding of some of the major care delivery challenges posed by multimorbidity and its accompanying problem of polypharmacy. It has developed a portfolio solution that:

- Integrates and summarises the health data most relevant to care planning and care tracking in long term conditions.
- Aligns multiple (independently developed) clinical guidelines so that they are well suited to be used in combination.
- Delivers care planning tools to enable multi-disciplinary teams, patients and caregivers to collaborate in developing the best-suited personalised care plan for each patient.
- Provides patients and permitted caregivers with tools to pursue their personalised care plan and to capture home monitoring and self-management progress.
- Alerts care team members of any issues with patient monitoring information, such as unexpected readings or missing readings.
- Enables patients to securely communicate with team members via their app.

From the start the project ambition has been to develop technology components that are ready for commercial adoption. The consortium has experience of spinning out companies from university software developments, and of engaging with ICT companies in research consortia that have led to product delivery based on research results. The consortium includes large ICT and SME partners. During the project we have consulted external companies and sought advice from our scientific advisory board (including industry representatives) on the success factors for downstream industry adoption that we should make sure to include.

Some of these adoption-ready features of C3-Cloud are:

- ▶ Component based and service-oriented architecture.
- ▶ Published APIs.
- ▶ Incorporation of international standards (e.g., HL7 FHIR) and/or open specifications (e.g., GDL2).
- ▶ Being able to import and export data in a standards conformant way, enabling inclusion within existing EHR system products and services.
- ▶ Robust security measures meeting health system and healthcare provider requirements.
- ▶ Offering a choice of independent user authentication or connection to existing authentication services to enable single sign on.
- ▶ Configurable to different health conditions, languages and patient groups.
- ▶ Able to connect to multiple home monitoring devices, from different vendors.
- ▶ Developed to a high TRL level (and promoted as such through the EC Innovation Radar).
- ▶ Capable of combined or component-level adoption.
- ▶ Individual components commercially available or in open source repositories before the end of the project.
- ▶ Commercial relationships and licensing of the complete C3-Cloud solution to be managed through a new legal entity (now in formation).

Our early work, on market analysis and business modelling (reported in our first three Business and Exploitation Plan deliverables, and extensively expanded, during this period, in D2.10), demonstrated the potential size of the multimorbidity market, the lack of digital solutions of our kind and the relevance of our solutions to different stakeholders and decision makers. Multidisciplinary team workflows were really only supported in disease specific contexts, e.g., in cancer. Clinical guidelines continue to be published as narrative documents (sometimes with a simple decision flowchart, but with poorly formalised and non-computable rules). There were no published multimorbidity guidelines (except for a general one expressing principles but with no disease related content). Solutions for patient self-management were largely *ad hoc* or delivered via vendor specific portals. Cross-organisational care planning support was limited. The components that we have developed during C3-Cloud were therefore not only relevant to successful multimorbidity care but were filling recognised market gaps.

Early in the project, the partners engaged in bilateral communications with ICT company contacts to explain C3-Cloud and to explore their potential future interest in incorporating it within their product offerings. We also engaged with companies via conferences, and in workshops. Sometimes, we were able to discuss C3-Cloud explicitly, and sometimes we were not invited to do that but could explore approaches being taken to address multimorbidity or the challenges faced in the health sector with adopting digital innovations. It became clear to us that, although vendor interest was there for including our innovative components, they did not strongly perceive a market for the better tackling of multimorbidity as a health issue. In other words, they did not foresee customers being willing to pay additionally for an enhanced digital capability to better manage multimorbidity.

The overwhelming advice we received from ICT company interactions was that we should not target the ICT sector exclusively in our promotion of C3-Cloud. Rather, that we need to bring the healthcare providers, decision makers and the ICT sector together so that the demand and supply sides interact and acquire a common understanding of the clinical, societal and business need to address multimorbidity proactively and strategically, and to recognise that novel digital solutions that integrate with existing products are the critical enabler. In terms of health system benefits, it was therefore important for us to communicate how C3-Cloud has been designed to be user-friendly (to multidisciplinary teams and to patients) and that it is health care provider relevant. The following are examples of purpose, design and functional features we were advised to strongly promote.

- Initial focus on four prevalent conditions that frequently co-occur.
- Innovative alignment of the guidelines for combined use, based on clinical expertise.
- Clinical engagement on the most relevant data to present to MDT members for care planning and decision making, and how that data should be presented, grouped, charted.
- Iterative feedback from clinicians to ensure that the screens and the overall application are easy to use and that they support existing workflows.
- Support for MDT collaboration in care planning and decision making.
- All care planning prompts and alerts are backed by computerised decision support following the guidelines, but not imposed on the clinician or for each patient (i.e. they are configurable, and are offered as advice but do not have to be followed).
- Medical Device Regulation conformance might be required.
- Innovative provision of care plans to patients, for transparency and good engagement.
- Design feedback from patients ensuring ease of use and relevance to their self-management.
- Simple direct collection of monitoring device data by patients, linked automatically to the C3-Cloud system.
- Separation within the system of patient provided data, not used by the decision support alerts (easing clinical acceptance, at this point in time).
- Useful patient tracking and patient interaction support via the clinician desktop, securely.
- Validation of deployment, integration, clinician and patient use in pilots performed in three EU countries.

However, we were also advised when interacting with health system decision makers (potential purchasers, budget holders or strategic players, to also emphasise the fit of C3-Cloud to their “bigger picture”:

- C3-Cloud is addressing a global health system challenge: solutions will also be relevant cross-border.
- A lack of co-ordinated care across diseases and teams may result in duplicated tests, less effective medicines choices, polypharmacy, poor clinical outcomes.
- Guidelines are increasingly harmonised across Europe (through EU clinical professional societies) and so our harmonised multimorbidity guidelines should be acceptable in most EU countries.
- Success at incorporating four disease areas, but it is possible add others without significant technical expertise or ICT cost.
- The formalisation of patient pathways is gaining acceptance within healthcare provider organisations and systems, and gradually becoming adopted.
- EHR systems increasingly used for direct clinician data entry: the data we need for clinical guideline services is likely to be present.
- Addressing a widely recognised need and opportunity for greater patient engagement and involvement in self-management.
- Adoption of C3-Cloud will position the healthcare organisation and health system to be better prepared for value-based reimbursements and KPIs.
- C3-Cloud’s solution could also be used within pharma clinical trials, and possibly also for medical device trials.

We have continued to have point to point contacts with ICT vendors, about C3-Cloud specifically and about the adoption of ICT innovations more widely (in order to better understand the adoption challenges), the most important of which are summarised in Chapter 3 of this deliverable. However, in the light of these areas of important vendor feedback, the project shifted in its original thinking of holding our main Vendor Forum event only comprising representatives from the ICT sector, in favour

of a multi-stakeholder engagement showcase event. The project therefore put significant effort in a large multi-stakeholder event, 'Joining the Dots', held as a physical event in November 2019. This included a half-day session that served as our multi-stakeholder enrichment of the original Vendor Forum concept. The overall C3-Cloud involvement in this conference is reported in Deliverable D2.11 (the final dissemination report), while the details of our Vendor Forum session, within it, is reported in this deliverable, in Chapter 3.

3. SUMMARIES OF INDUSTRY ENGAGEMENTS

This chapter summarises some of our industry engagements during the project, when we had opportunity to describe or present C3-Cloud and its intended or, later, actual technical developments to representatives from ICT companies, especially those developing electronic health record system products and services. However, some of these conversations were confidential, at times even protected by an NDA. At other times, feedback we received was confidential because it reflected a comparison between our innovations and their existing product capabilities, product development strategy, or their client interests. It has therefore not been possible to report on all of the industry interactions we have had. For some of the ones reported here, using a structured template, we have had to anonymise the information. Partners reported that they sometimes found themselves having very similar conversations with different companies or in different industry participating workshops, so to avoid repetition here these have sometimes been summarised collectively.

3.1. Industry engagement activities by the project partners

Partner SRDC
Overview
SRDC has been very active in establishing contacts with the representatives of industry from the earlier days of the project, but at the local and European level. Especially after having early prototypes of the Personalised Care Plan Management solution C3DP, SRDC has aggressively sought opportunities to demonstrate a running system. These opportunities included bilateral meetings with known and new companies / healthcare authorities, and multi-party events like industrial and scientific conferences. Further information about five most important such industry interaction is provided below.

Partner SRDC
Name for the event or conversation which included interaction with one or more industry actors
Presentation to the Deputy Undersecretary of Turkish Ministry of Health
Month and year of the interaction
December 2017
Geographic location of the interaction, or your own location if it was virtual
Ankara
The nature of your contribution to the interaction (e.g. conference presentation, workshop contribution, one-to-one discussion, emailed information)
Bilateral presentation and demonstration
An overall indication of the audience within which the interaction took place: approximate number and stakeholder profile

This meeting had high-profile participants from the Turkish Ministry of Health: Deputy Undersecretary and three Directors. They are responsible in two main domains: national health information systems and chronic disease management.

Industry sectors within the audience (e.g. EHR system, clinical guideline developers, pharma, med tech)

National health authority

Company names, if practical to include and if appropriate to include

The Turkish Ministry of Health

Key messages that you exchanged, in both directions (just a few bullet points)

SRDC had the opportunity to present their past and present eHealth work, with specific focus of the Deputy Undersecretary of Turkish Ministry of Health on chronic disease management. Among the presented SRDC eHealth work, C3-Cloud was one of the presented projects. SRDC team also had the opportunity to make a demonstration of an early version of the C3DP.

What did you learn about the positive and negative possibilities of industry interest in exploiting our results?

The Turkish Ministry of Health was already looking for an extensible chronic disease management platform for a few years. The Ministry was not interested in a holistic integrated care plan management solution, but rather separate yet connected disease-specific treatment and planning modules available in a single system. SRDC convinced the representatives that they can do that as well.

What impact do you think you had on the industry audience?

The Ministry representatives were impressed with SRDC experience in chronic disease management and automation of clinical guidelines, and the C3DP demonstration. The demonstration of a working solution helped a lot in positive impression.

Was there any follow-up, or is something still intended in the future?

Several follow-up meetings took place with the Ministry representatives afterwards. The Ministry announced a tender for acquisition of the National Chronic Disease Management Platform in late summer 2018 and SRDC was among the invitees with a business partner, Innova. Innova and SRDC won the contract in September 2018. The system has been implemented from scratch in only 6 months and now running in the whole country as of August 2020. The system is being extended with support for a new disease in each 3 months.

Is there any tangible exploitation opportunity (or advice to the project) that you foresee with this industry sector in general, as a consequence of your learning from this interaction?

Regional / national healthcare authorities are among the best candidates for exploitation of C3-Cloud results

Partner SRDC

Name for the event or conversation which included interaction with one or more industry actors

Presentation and demonstration of C3DP to a large software enterprise in Turkey

Month and year of the interaction

January 2018
Geographic location of the interaction, or your own location if it was virtual
Ankara
The nature of your contribution to the interaction (e.g. conference presentation, workshop contribution, one-to-one discussion, emailed information)
Bilateral presentation and demonstration
An overall indication of the audience within which the interaction took place: approximate number and stakeholder profile
Innova is among the largest software companies in Turkey. Innova is a company of the Turkish Telecom Group and they are active not only in healthcare, but also in telecommunication, finance, manufacturing, and public services sectors. The first meeting had experts in business development and sales from the healthcare branch.
Industry sectors within the audience (e.g. EHR system, clinical guideline developers, pharma, med tech)
EHR system, System integration
Company names, if practical to include and if appropriate to include
Innova: https://www.innova.com.tr
Key messages that you exchanged, in both directions (just a few bullet points)
SRDC had the opportunity to present their past and present eHealth work, with specific focus on chronic disease management, as it became clear that it is on the agenda of the Turkish Ministry of Health. Among the presented SRDC eHealth work, C3-Cloud was one of the presented projects. SRDC also made a demonstration of an early version of the C3DP.
What did you learn about the positive and negative possibilities of industry interest in exploiting our results?
Large software companies may miss the opportunities in developing innovative solutions, but they do have the strength and operational capacity to win big contracts. Hence, collaboration of small innovative companies with large enterprises can easily end up with a win-win scenario.
What impact do you think you had on the industry audience?
Innova representatives were impressed with SRDC experience in chronic disease management and automation of clinical guidelines, and the C3DP demonstration.
Was there any follow-up, or is something still intended in the future?
Several follow-up meetings took place afterwards. Innova and SRDC agreed to be business partners for chronic disease management solutions. The Ministry announced a tender for acquisition of the National Chronic Disease Management Platform in late summer 2018. Innova and SRDC won the contract in September 2018.
Is there any tangible exploitation opportunity (or advice to the project) that you foresee with this industry sector in general, as a consequence of your learning from this interaction?

Collaboration with a large software company has made it possible for SRDC to get a contract from the Turkish Ministry of Health.

Partner SRDC
Name for the event or conversation which included interaction with one or more industry actors
International Conference on Integrated Care (ICIC) 2019
Month and year of the interaction
April 2019
Geographic location of the interaction, or your own location if it was virtual
San Sebastian
The nature of your contribution to the interaction (e.g. conference presentation, workshop contribution, one-to-one discussion, emailed information)
Bilateral discussions and demonstrations at the exhibition stand of SRDC, Presentation and demonstration at the Innovation Zone of ICIC 2019
An overall indication of the audience within which the interaction took place: approximate number and stakeholder profile
Tens of representatives from the regional / national health authorities, healthcare information system vendors, and scientific community visited the SRDC exhibition stand.
Industry sectors within the audience (e.g. EHR system, clinical guideline developers, pharma, med tech)
Regional / national health authorities, healthcare information system vendors
Company names, if practical to include and if appropriate to include
Industry representatives who were very interested and visited the stand several times for detailed discussions and demonstration were from Poland, Estonia, Israel, and Belgium.
Key messages that you exchanged, in both directions (just a few bullet points)
Several bilateral discussions took place with the participants who visited SRDC exhibition stand, especially with regional healthcare authorities as procurers. Details are provided in the following headings.
What did you learn about the positive and negative possibilities of industry interest in exploiting our results?
There is a very clear demand for personalised care plan management solutions at the regional level in several European countries. However, the responsible authorities are hesitant due to capabilities of their legacy software systems. They are having hard time to decide whether to extend the existing EHR systems via integration with newly developed care plan management solutions; or replace their setup completely with a completely new holistic pack. The latter is more easily said than done, because data and process migration challenges are usually overlooked.

What impact do you think you had on the industry audience?
The participants were impressed when provided with an actually running system and explained how the integration has been achieved in a number of European regions with diverse settings.
Was there any follow-up, or is something still intended in the future?
SRDC has sent follow-up emails to those that were extremely interested. Information exchange continued with some for some time. However, there is no concrete business development with any of them yet.
Is there any tangible exploitation opportunity (or advice to the project) that you foresee with this industry sector in general, as a consequence of your learning from this interaction?
The national / regional healthcare authorities need to be convinced that such innovative care plan management and clinical decision support systems can be integrated with their existing software and data in a non-disruptive manner.

Partner SRDC
Name for the event or conversation which included interaction with one or more industry actors
Presentation and demonstration of C3DP to the National EHR, PHR and ePrescription provider of Turkey
Month and year of the interaction
First in March 2020, followed by more meetings till June 2020
Geographic location of the interaction, or your own location if it was virtual
Ankara
The nature of your contribution to the interaction (e.g. conference presentation, workshop contribution, one-to-one discussion, emailed information)
Bilateral presentation and demonstration
An overall indication of the audience within which the interaction took place: approximate number and stakeholder profile
TIGA is the long-time provider of the national EHR, PHR and ePrescription systems of Turkey. They also have other big deployments in the EMEA region. 10 participants from TIGA included the co-founders and the top-level management of IT and business development.
Industry sectors within the audience (e.g. EHR system, clinical guideline developers, pharma, med tech)
EHR system, PHR system, ePrescription system
Company names, if practical to include and if appropriate to include
TIGA Software: https://www.tiga.com.tr/en/
Key messages that you exchanged, in both directions (just a few bullet points)
Coordinated Care and Cure Delivery Platform (C3DP) and the onFHIR.io Secure Health Data Repository were demonstrated to TIGA, the long-time provider of the national EHR, PHR and ePrescription systems of

Turkey. SRDC already had some business relationship with TIGA due to their Chronic Disease Management Platform development work at the Turkish Ministry of Health, which has already been integrated with the national EHR and PHR systems maintained by TIGA. TIGA invited SRDC to hear more about the care plan management solutions. TIGA has been impressed with the overall solution and the SRDC experience in personalized care plan management and chronic disease management.

What did you learn about the positive and negative possibilities of industry interest in exploiting our results?

There is a growing demand for care plan management solutions in the EMEA region.

What impact do you think you had on the industry audience?

TIGA representatives stated that they are very impressed with the demonstrated solutions and offered to be business partners. SRDC already having integration experience with TIGA developed national EHR and PHR systems has been a great advantage.

Was there any follow-up, or is something still intended in the future?

Several follow-up meetings have already taken place. An NDA has already been signed between TIGA and SRDC for concrete business opportunities.

Is there any tangible exploitation opportunity (or advice to the project) that you foresee with this industry sector in general, as a consequence of your learning from this interaction?

As a result of these sessions, TIGA invited SRDC to be involved in an eHealth solution bid in Qatar. Application has been completed without any result yet. TIGA and SRDC are dedicated to applying to similar opportunities in the region.

Partner SRDC

Name for the event or conversation which included interaction with one or more industry actors

Presentation and demonstration of C3DP and onFHIR Secure Repository to German industry and scientific community representatives

Month and year of the interaction

April 2020

Geographic location of the interaction, or your own location if it was virtual

Virtual (Ankara)

The nature of your contribution to the interaction (e.g. conference presentation, workshop contribution, one-to-one discussion, emailed information)

Bilateral presentation and demonstration

An overall indication of the audience within which the interaction took place: approximate number and stakeholder profile

Coordinated Care and Cure Delivery Platform (C3DP) and the onFHIR.io Secure Health Data Repository were demonstrated to industry and scientific community representatives from Saarland University, INFAI (Institut für Angewandte Informatik, Leipzig University) and DAVID eHealth & Pharma on 27 April 2020,

upon the interest of Ruslan David and his colleagues in these solutions and the overall achievements of the C3-Cloud project.

Industry sectors within the audience (e.g. EHR system, clinical guideline developers, pharma, med tech)

Medical information systems

Company names, if practical to include and if appropriate to include

Saarland University, INFAI (Institut für Angewandte Informatik, Leipzig University) and DAVID eHealth & Pharma.

Key messages that you exchanged, in both directions (just a few bullet points)

The participants were looking into a complete care plan management solution, and they already knew some about our solution thanks to our earlier public dissemination activities. They were very satisfied with capabilities of our solution at the end of the session.

What did you learn about the positive and negative possibilities of industry interest in exploiting our results?

There is a real demand for care plan management solutions in the market, which is very positive. The major concern by possible clients is the required integration effort, which is minimised by basing our solution on top of widely adapted standards and specifications such as HL7 FHIR.

What impact do you think you had on the industry audience?

The participants stated that they are very impressed with the demonstrated solutions.

Was there any follow-up, or is something still intended in the future?

Some further details have been provided via email after the demonstration session. Ruslan David and his colleagues are investigating how C3DP and the onFHIR.io FHIR Repository can be re-used in their own project. This is a regional research project titled PANOS in Sachsen / Germany.

Is there any tangible exploitation opportunity (or advice to the project) that you foresee with this industry sector in general, as a consequence of your learning from this interaction?

C3DP and onFHIR.io Repository were accepted as tangible exploitable assets by these representatives from the medical information systems industry in this event.

Partner RJH

Name for the event or conversation which included interaction with one or more industry actors

“Joint Way Forward”

Month and year of the interaction

May 15, 2019

Geographic location of the interaction, or your own location if it was virtual

e-Health Centre in Östersund, Region Jämtland Härjedalen, Sweden

The nature of your contribution to the interaction (e.g. conference presentation, workshop contribution, one-to-one discussion, emailed information)

Workshop contribution, and complementary one-to-one discussions

An overall indication of the audience within which the interaction took place: approximate number and stakeholder profile

Around 30. Civil society, Industry and Academia

Industry sectors within the audience (e.g. EHR system, clinical guideline developers, pharma, med tech)

EHR-system, Med Tech, ITC-solutions

Company names, if practical to include and if appropriate to include

Cambio, Sigma, Tieto, Telia

Key messages that you exchanged, in both directions (just a few bullet points)

- How do we implement the C3-Cloud model? a general question
- What parts of this implementation is you company able / willing / interested in, the whole solution or parts of it?
- Are healthcare organisations able / willing / interested in implementing the C3-Cloud model?

What did you learn about the positive and negative possibilities of industry interest in exploiting our results?

Not enough information available as to the intention of the project owners re the questions asked above in order to move forward

What impact do you think you had on the industry audience?

Stimulated interest and curiosity from the C3-Cloud model and other Horizon 2020 projects as to possible business opportunities

Was there any follow-up, or is something still intended in the future?

Informal talks on a continuous basis. Since the project's final business / exploitation plan is being finalised in recent months, following completion of the pilots, we will continue to follow up with the companies after the project.

Is there any tangible exploitation opportunity (or advice to the project) that you foresee with this industry sector in general, as a consequence of your learning from this interaction?

As an active partner in the C3-Cloud exploitation discussions we have provided many comments during the C3-Cloud PMB meetings dating back about two years.
Comments with the intention to provide input to the final business / exploitation plan.

Partner EuroRec

Name for the event or conversation which included interaction with one or more industry actors

This template lists events at which ICT vendors or vendor representatives made up a substantial proportion of the participants. Partner EuroRec or its sibling institute i~HD was in each case an invited speaker or round table participant, able to contribute to the content of the event.

- 2017-18 Ran a UK SME forum on engaging with health systems and research
- Meeting with interoperability SME thought leaders about adoption barriers
- Keynote talk, lots of discussions a big data event, February 2019
- Presentation to MedTechEurope on health data challenges, April 2019
- Panel moderator with SME presenters on health outcomes data, April 2019
- Informal discussions and session moderator at a life science conference, SMEs included, May 2019
- Presentation and panel discussion on business barriers, especially for SMEs, May 2019
- US conference on the adoption challenges of computable knowledge assets, July 2019
- Detailed 1:1 meeting with a data linking SME, August 2019
- Meeting at MedTech Europe on diagnostic information, October 2019
- Presentation, panel and discussions at UK event on computable knowledge, October 2019
- Presentation, panel and discussions at UK SME event, November 2019
- Meeting at Innovate UK, November 2019
- Informal discussions with ICT vendors at MEDICA 2019, Dusseldorf, November 2019
- EIT Health panel session, conference, discussions at SME booths, December 2019

Month and year of the interaction

The list above mainly spans 2017 to 2019. EuroRec has not yet had opportunity to engage with ICT vendors in 2020.

Geographic location of the interaction, or your own location if it was virtual

Various countries in Europe, but mostly with multi-country participation, so the geographic location was mostly incidental.

The nature of your contribution to the interaction (e.g. conference presentation, workshop contribution, one-to-one discussion, emailed information)

The invitation to contribute was on the basis of being involved in multiple digital health and research platform projects, not exclusively C3-Cloud. This enabled the contributions to carry more weight as they reflected the ambition, opportunities, barriers and approaches collated across multiple projects and consortia. As we demonstrated in *Joining the Dots*, many of the challenges faced by the ICT sector in scaling up the procurement of digital innovations are common across many areas of innovation.

An overall indication of the audience within which the interaction took place: approximate number and stakeholder profile

This was quite variable. A couple of the national workshops had 50 or 60 vendor representatives present, whereas the multi stakeholder events were more likely to have between 10 and 30 vendors.

Industry sectors within the audience (e.g. EHR system, clinical guideline developers, pharma, med tech)

The predominant industry sector was EHR system and analysis platform vendors, but included Pharma, MedTech, and SMEs developing various products such as patient risk profiling tools, health outcomes dashboards, patient apps...

Company names, if practical to include and if appropriate to include

Sorry, these cannot be included because they were either confidential or the audience was too diverse to capture all of the participant information.

Key messages that you exchanged, in both directions (just a few bullet points)

The importance of connecting healthcare data silos in order to enable clinical teams, especially when working on different sites, to be able to have a complete and safe picture of a patient's health status and treatment.

The importance of bringing patients more firmly into information about their own health situation, through transparent and patient friendly access to their own health data, and engagement in determining their ideal health trajectory, agreeing common goals and empowering them to be part of joint decision-making.

The importance of interweaving publish knowledge with the experiences of patients and optimising care pathways and organisational practices to become learning health systems.

The barriers to organisational change faced by large, complex, resource limited healthcare provider organisations, the disjoint between healthcare payers and healthcare providers when it comes to coordinating and aligning the care objectives across multiple teams and providers, especially in the care of patients with multiple mobility.

We need to educate healthcare purchasers about the importance of digital innovation, and the need to incentivise high quality care with good health outcomes as opposed to reimbursing care on the basis of healthcare activities performed.

What did you learn about the positive and negative possibilities of industry interest in exploiting our results?

There is almost universal interest as a theoretical level in adopting solutions like C3-Cloud. The major concerns voiced, which have been described in other sections of this deliverable, are to do with the highly fragmented financial models do not easily enable investment in innovative practices that leverage digital solutions.

What impact do you think you had on the industry audience?

I think it has been important and useful to be a provocative catalyst, bringing stakeholders together when we have been able to, to recognise transparently the broken nature of the current patterns of financial and reward systems, and the importance of patient empowerment supported by digital tools. Many of these meetings included other influential people, and we are therefore optimistic that the messages are being cascaded more widely across Europe than they were a few years ago.

Was there any follow-up, or is something still intended in the future?

The events themselves did not have any immediate follow-up.

Is there any tangible exploitation opportunity (or advice to the project) that you foresee with this industry sector in general, as a consequence of your learning from this interaction?

As soon as the present restrictions are lifted, we will work closely with other project partners on future events, funded through other means, at which the project and the importance of the benefits it enables, can be promoted. We have learned valuable lessons in this project about not targeting the ICT sector on its own, but for always bringing together users and solution providers with key decision-makers who could influence the market to favour innovative procurements.

Partner WARWICK**Overview**

WARWICK, as the project co-ordinating partner, have been intensively active in dissemination work and industry liaison. Through, the Institute of Digital Healthcare, WARWICK has made bilateral meetings with industry partners, including both large companies and SMEs (all under Non-Disclosure Agreements – NDAs), achieved collaboration agreements and have establish contacts with the representatives of industry in large events (conferences and exhibitions) from the earlier days of the project, both at the local and European level. Further information about the most important industry liaison work of WARWICK, over the last reporting period, is provided below.

Partner WARWICK**Name for the event or conversation which included interaction with one or more industry actors**

Continuous Input to the High Value Manufacturing Catapult (HVMC), Healthcare Strategic Team

Month and year of the interaction

Ongoing – started in 2017

Geographic location of the interaction, or your own location if it was virtual

Various locations in the UK and regular weekly teleconference with HVMC consortium members

The nature of your contribution to the interaction (e.g. conference presentation, workshop contribution, one-to-one discussion, emailed information)

C3-Cloud Concept and Project Information presented and elaborated to HVMC academic and industrial partners.

An overall indication of the audience within which the interaction took place: approximate number and stakeholder profile

Members of the High Value Manufacturing, Healthcare Strategic Team.

Industry sectors within the audience (e.g. EHR system, clinical guideline developers, pharma, med tech)

Connected Care for Diabetes – Pharmaceutical Market Segment.

Company names, if practical to include and if appropriate to include

HVMC - <https://hvm.catapult.org.uk/>

Key messages that you exchanged, in both directions (just a few bullet points)

Established by Innovate UK, the HVMC tries to bridge the gap between business and academia, helping to turn great ideas into reality by providing access to world-class research and development facilities and expertise that would otherwise be out of reach for many businesses in the UK. For the healthcare sector they growth in the UK pharmaceutical and healthcare sectors by increasing efficiency and developing new products and processes. WARWICK has promoted the C3-Cloud concept to the HVMC Healthcare Strategic Team

What did you learn about the positive and negative possibilities of industry interest in exploiting our results?
The HMVC are interested in the C3-Cloud “whole solution” and customisation of their solutions (sensors and devices, industry 4.0 platforms) for integration to the C3-Cloud solution. HMVC appreciate the modular design approach of the C3-Cloud solution and the availability for customisation of its component technologies.
What impact do you think you had on the industry audience?
HMVC strongly appreciates the research leadership of the Institute of Digital Healthcare in its association to C3-Cloud.
Was there any follow-up, or is something still intended in the future?
A collaboration is ongoing, and opportunistic industrial collaborations are sought.
Is there any tangible exploitation opportunity (or advice to the project) that you foresee with this industry sector in general, as a consequence of your learning from this interaction?
Exploitation C3-Cloud expertise for the healthcare manufacturing sector in the UK.

Partner WARWICK
Name for the event or conversation which included interaction with one or more industry actors
Presentation of the C3-Cloud Solution to a European-based Pharma Company (under NDA).
Month and year of the interaction
July 2019
Geographic location of the interaction, or your own location if it was virtual
Virtual Meeting with GoToMeeting teleconference facility (Institute of Digital Healthcare, University of Warwick, Coventry, United Kingdom).
The nature of your contribution to the interaction (e.g. conference presentation, workshop contribution, one-to-one discussion, emailed information)
C3-Cloud solution presentation
An overall indication of the audience within which the interaction took place: approximate number and stakeholder profile
This meeting was with the Chief Medical Officer of this company.
Industry sectors within the audience (e.g. EHR system, clinical guideline developers, pharma, med tech)
Connected Care for Diabetes – Pharmaceutical Market Segment
Company names, if practical to include and if appropriate to include

Company under NDA signed in July 2019 – interested in collaborating on connected and coordinated care for diabetes management

Key messages that you exchanged, in both directions (just a few bullet points)

WARWICK presented an overview of the Institute of Digital Healthcare and discussed the main outline of the C3-Cloud project. WARWICK had the opportunity to present their past and present digital healthcare research and innovations, from its Institute of Digital Healthcare. The C3-Cloud coordinator presented the project, its main innovations and expected outcome. The company discussed their interests on digital solutions for diabetes management, in conjunction to their pharmaceutical products (note that a full disclosure is not provided as discussions were under NDA [Non-Disclosure Agreement] and such detail might reveal the profile of the company).

What did you learn about the positive and negative possibilities of industry interest in exploiting our results?

The company were interested in the C3-Cloud “whole solution” and customisation of their solution for integration to the C3-Cloud solution. The company have appreciated the modular design approach of the C3-Cloud solution and the availability for customisation of its component technologies.

What impact do you think you had on the industry audience?

The company appreciated strongly the research leadership of the Institute of Digital Healthcare in diabetes management and its association to C3-Cloud. This has led to further collaboration and direct research contracting opportunities.

Was there any follow-up, or is something still intended in the future?

A collaboration is ongoing, but details cannot be disclosed.

Is there any tangible exploitation opportunity (or advice to the project) that you foresee with this industry sector in general, as a consequence of your learning from this interaction?

Exploitation C3-Cloud diabetes guideline expertise and connected coordinated care in the UK.

Partner WARWICK

Name for the event or conversation which included interaction with one or more industry actors

Presentation of the C3-Cloud Solution to a UK-based SME (under NDA).

Month and year of the interaction

November 2019

Geographic location of the interaction, or your own location if it was virtual

Virtual Meeting with GoToMeeting teleconference facility (Institute of Digital Healthcare, University of Warwick, Coventry, United Kingdom).

The nature of your contribution to the interaction (e.g. conference presentation, workshop contribution, one-to-one discussion, emailed information)

C3-Cloud solution presentation and short demonstration of C3DP

An overall indication of the audience within which the interaction took place: approximate number and stakeholder profile
This meeting included the Founders (Director, CTO and CFO) of this SME.
Industry sectors within the audience (e.g. EHR system, clinical guideline developers, pharma, med tech)
Digital Transformation for Healthcare Market Segment
Company names, if practical to include and if appropriate to include
SME under NDA signed in November 2019 – interested in collaborating on digital transformation for delivering integrated care.
Key messages that you exchanged, in both directions (just a few bullet points)
WARWICK presented an overview of the Institute of Digital Healthcare and discussed the main outline of the C3-Cloud project. WARWICK had the opportunity to present their past and present digital healthcare research and innovations, from its Institute of Digital Healthcare. The C3-Cloud coordinator presented the project, its main innovations and expected outcome. A short demo was provided on C3DP, including self-management aspects for long term condition. The SME presented their portfolio of NHS partnerships and digital transformation projects (note that a full disclosure is not provided as discussions were under NDA [Non-Disclosure Agreement] and such detail might reveal the profile of the company).
What did you learn about the positive and negative possibilities of industry interest in exploiting our results?
The SME were interested in the C3-Cloud “whole solution” and customisation of our solution for integration to their solution. The company have appreciated the modular design approach of the C3-Cloud solution and the availability for customisation of its component technologies.
What impact do you think you had on the industry audience?
The company appreciated strongly the research leadership of the Institute of Digital Healthcare in digitally enhanced integrated care. The demonstration of a working solution enhanced towards a positive impression to the SME (leading to further collaboration).
Was there any follow-up, or is something still intended in the future?
A collaboration has developed leading to include the company to our network of contacts to reach local and national NHS health and social care providers.
Is there any tangible exploitation opportunity (or advice to the project) that you foresee with this industry sector in general, as a consequence of your learning from this interaction?
Exploitation of the SME as part of the NHS network for the future C3-Cloud consortium activities in the UK.

Partner WARWICK

Name for the event or conversation which included interaction with one or more industry actors

Presentation of the C3-Cloud Solution to a UK-based SME (under NDA).

Month and year of the interaction
March 2020
Geographic location of the interaction, or your own location if it was virtual
Virtual Meeting with GoToMeeting teleconference facility (Institute of Digital Healthcare, University of Warwick, Coventry, United Kingdom).
The nature of your contribution to the interaction (e.g. conference presentation, workshop contribution, one-to-one discussion, emailed information)
C3-Cloud solution presentation and short demonstration of C3DP
An overall indication of the audience within which the interaction took place: approximate number and stakeholder profile
This meeting included the Founders (Director and CTO) of this SME.
Industry sectors within the audience (e.g. EHR system, clinical guideline developers, pharma, med tech)
Health and Wellbeing Self-Management Market Segment
Company names, if practical to include and if appropriate to include
SME under NDA signed in March 2020 – interested in collaborating on digital healthy lifestyle platforms delivering disease-focused health programmes.
Key messages that you exchanged, in both directions (just a few bullet points)
WARWICK presented an overview of the Institute of Digital Healthcare and discussed the main outline of the C3-Cloud project. WARWICK had the opportunity to present their past and present digital healthcare research and innovations, from its Institute of Digital Healthcare. The C3-Cloud coordinator presented the project, its main innovations and expected outcome. A short demo was provided on C3DP, including self-management aspects for long term condition. The SME presented their current approach to self-management and coaching for health and wellbeing (note that a full disclosure is not provided as discussions were under NDA [Non-Disclosure Agreement] and such detail might reveal the profile of the company).
What did you learn about the positive and negative possibilities of industry interest in exploiting our results?
The SME were interested in the C3-Cloud “whole solution” and customisation of their solution for integration to the C3-Cloud solution. The company have appreciated the modular design approach of the C3-Cloud solution and the availability for customisation of its component technologies.
What impact do you think you had on the industry audience?
The company appreciated strongly the research leadership of the Institute of Digital Healthcare in Health Informatics and digitally enhanced integrated care. The demonstration of a working solution enhanced towards a positive impression to the SME (leading to further collaboration).
Was there any follow-up, or is something still intended in the future?
A collaboration has developed leading to the submission of one UKRI proposal for a digital solution to self-management of symptoms for COVID-19 patients in June 2020. The collaboration is looking for further UKRI proposals (NIHR and MRC) in this field.

Is there any tangible exploitation opportunity (or advice to the project) that you foresee with this industry sector in general, as a consequence of your learning from this interaction?

Exploitation of the digitally enhanced integrated care expertise - consultancy services to the specific SME and research pollination with UKRI based funding.

Partner WARWICK

Name for the event or conversation which included interaction with one or more industry actors

Presentation of the C3-Cloud Solution to a Sweden-based SME (under NDA).

Month and year of the interaction

April 2020

Geographic location of the interaction, or your own location if it was virtual

Virtual Meeting with GoToMeeting teleconference facility (Institute of Digital Healthcare, University of Warwick, Coventry, United Kingdom).

The nature of your contribution to the interaction (e.g. conference presentation, workshop contribution, one-to-one discussion, emailed information)

C3-Cloud solution presentation and short demonstration of C3DP/CDS.

An overall indication of the audience within which the interaction took place: approximate number and stakeholder profile

This meeting included the Founder and Director, CTO, CFO and Chief Developer of this SME.

Industry sectors within the audience (e.g. EHR system, clinical guideline developers, pharma, med tech)

Telehealth (Remote Patient Monitoring – Sensor Devices) Market Segment

Company names, if practical to include and if appropriate to include

SME under NDA signed in April 2020 – interested in collaborating on patient monitoring service

Key messages that you exchanged, in both directions (just a few bullet points)

WARWICK presented an overview of the Institute of Digital Healthcare and discussed the main outline of the C3-Cloud project. WARWICK had the opportunity to present their past and present digital healthcare research and innovations, from its Institute of Digital Healthcare. The C3-Cloud coordinator presented the project, its main innovations and expected outcome. A short demo was provided on C3DP and CDS, including discussion how sensor devices can be integrated to the solution. The SME presented their current patient monitoring service for specific diseases and their latest work on COVID-19 solutions through telehealth (note that a full disclosure is not provided as discussions were under NDA [Non-Disclosure Agreement] and such detail might reveal the profile of the company).

What did you learn about the positive and negative possibilities of industry interest in exploiting our results?

The SME were interested in the C3-Cloud “whole solution” and customisation of our solution for integration to the remote monitoring solution. The company have appreciated the modular design approach of the C3-Cloud solution and the availability for customisation of its component technologies.

What impact do you think you had on the industry audience?

The company appreciated strongly the research leadership of the Institute of Digital Healthcare in Health Informatics and digitally enhanced integrated care. The demonstration of a working solution enhanced towards a positive impression to the SME (leading to further collaboration).

Was there any follow-up, or is something still intended in the future?

A draft collaboration agreement has been set up and since April 2020, WARWICK and the SME have met bi-monthly (virtually), leading to the submission of one H2020 and one Eureka Eurostars proposal (WARWICK is playing an advisory role). The collaboration is looking for a further UKRI proposal for implementing remote patient monitoring solutions for COVID-19 style pandemics, where WARWICK is intending to use its C3-Cloud CDS experience and real-time health data analytics knowhow. The collaboration is also intending to seek further funding from NIHR research calls in the UK, with the company’s UK registered subsidiary.

Is there any tangible exploitation opportunity (or advice to the project) that you foresee with this industry sector in general, as a consequence of your learning from this interaction?

Exploitation of the CDS knowledge - consultancy services to the specific SME and research pollination with H2020/Eureka/UKRI based funding.

Partner WARWICK

Name for the event or conversation which included interaction with one or more industry actors

Presentation of the C3-Cloud Solution to a UK-based SME (under NDA).

Month and year of the interaction

May 2020

Geographic location of the interaction, or your own location if it was virtual

Virtual Meeting with GoToMeeting teleconference facility (Institute of Digital Healthcare, University of Warwick, Coventry, United Kingdom).

The nature of your contribution to the interaction (e.g. conference presentation, workshop contribution, one-to-one discussion, emailed information)

C3-Cloud solution presentation and short demonstration C3DP

An overall indication of the audience within which the interaction took place: approximate number and stakeholder profile

This meeting included the founder members of this university spin-off SME.

Industry sectors within the audience (e.g. EHR system, clinical guideline developers, pharma, med tech)

Telehealth (Public Screening for Diabetes Type 2) Market Segment

Company names, if practical to include and if appropriate to include
SME under NDA signed in May 2020 – interested in collaborating on innovative technologies for public screening for Diabetes Type 2
Key messages that you exchanged, in both directions (just a few bullet points)
WARWICK presented an overview of the Institute of Digital Healthcare and discussed the main outline of the C3-Cloud project. WARWICK had the opportunity to present their past and present digital healthcare research and innovations, from its Institute of Digital Healthcare. The C3-Cloud coordinator presented the project, its main innovations and expected outcome. A short demo was provided on C3DP, including discussion of management long-term conditions as diabetes. The SME presented their innovation blueprint on diabetes type 2 screening (note that a full disclosure is not provided as discussions were under NDA [Non-Disclosure Agreement] and such detail might reveal the profile of the company).
What did you learn about the positive and negative possibilities of industry interest in exploiting our results?
The SME were interested in the C3-Cloud CDS solutions and expertise, in addition to WARWICK extended expertise in health data analytics. The company have appreciated the modular design approach of the C3-Cloud solution and the availability for customisation of its component technologies.
What impact do you think you had on the industry audience?
The company appreciated strongly the research leadership of the Institute of Digital Healthcare in Health long term conditions management through digital healthcare solutions. The demonstration of a working solution enhanced towards a positive impression to the SME (leading to further collaboration).
Was there any follow-up, or is something still intended in the future?
Five follow up meetings took place during the summer and a further meeting will take place in October 2020, to explore venture capital and seed funding for this start-up.
Is there any tangible exploitation opportunity (or advice to the project) that you foresee with this industry sector in general, as a consequence of your learning from this interaction?
Research knowledge in this domain - consultancy services to the specific SME for achieving venture capital funding and research pollination with UKRI based funding.

Partner WARWICK
Name for the event or conversation which included interaction with one or more industry actors
Presentation of the C3-Cloud Solution to a UK-based SME (under NDA).
Month and year of the interaction
June 2020
Geographic location of the interaction, or your own location if it was virtual
Virtual Meeting with GoToMeeting teleconference facility (Institute of Digital Healthcare, University of Warwick, Coventry, United Kingdom).

The nature of your contribution to the interaction (e.g. conference presentation, workshop contribution, one-to-one discussion, emailed information)
C3-Cloud solution presentation and short demonstration of CDS through the example scenario of C3DP (fictional patient George Best).
An overall indication of the audience within which the interaction took place: approximate number and stakeholder profile
This meeting included the Director and CTO of this SME.
Industry sectors within the audience (e.g. EHR system, clinical guideline developers, pharma, med tech)
Telehealth (coordinated care) Market Segment
Company names, if practical to include and if appropriate to include
SME under NDA signed in June 2020 – interested in collaborating on management systems in Care Home settings
Key messages that you exchanged, in both directions (just a few bullet points)
WARWICK presented an overview of the Institute of Digital Healthcare and discussed the main outline of the C3-Cloud project. WARWICK had the opportunity to present their past and present digital healthcare research and innovations, from its Institute of Digital Healthcare. The C3-Cloud coordinator presented the project, its main innovations and expected outcome. A short demo was provided CDS, including on integrated care management in the social care setting (care homes). The SME presented their current care home management system (note that a full disclosure is not provided as discussions were under NDA [Non-Disclosure Agreement] and such detail might reveal the profile of the company).
What did you learn about the positive and negative possibilities of industry interest in exploiting our results?
The SME were interested in the C3-Cloud CDS solutions and expertise, in addition to WARWICK extended expertise in computer interpretable guidelines. The company have appreciated the modular design approach of the C3-Cloud solution and the availability for customisation of its component technologies.
What impact do you think you had on the industry audience?
The company appreciated strongly the research leadership of the Institute of Digital Healthcare in Health clinical decision support systems and care management information systems. The demonstration of a working solution enhanced towards a positive impression to the SME (leading to further collaboration).
Was there any follow-up, or is something still intended in the future?
A follow up meeting took place in early July 2020 and a further meeting will take place in October 2020, to explore funding opportunity from UKRI research calls in the UK, in order to achieve further research pollination of the clinical decision support services in C3-Cloud.
Is there any tangible exploitation opportunity (or advice to the project) that you foresee with this industry sector in general, as a consequence of your learning from this interaction?
Exploitation of the CDS technology (GDL based guidelines' formulation) and research knowledge in this domain - consultancy services to the specific SME and research pollination with UKRI based funding.

Partner WARWICK
Name for the event or conversation which included interaction with one or more industry actors
Presentation of the C3-Cloud Solution to a UK-based SME (under NDA).
Month and year of the interaction
July 2020
Geographic location of the interaction, or your own location if it was virtual
Virtual Meeting with GoToMeeting teleconference facility (Institute of Digital Healthcare, University of Warwick, Coventry, United Kingdom).
The nature of your contribution to the interaction (e.g. conference presentation, workshop contribution, one-to-one discussion, emailed information)
C3-Cloud solution presentation and short demonstration of C3DP.
An overall indication of the audience within which the interaction took place: approximate number and stakeholder profile
This meeting included the Managing Director, CTO and CFO of this SME.
Industry sectors within the audience (e.g. EHR system, clinical guideline developers, pharma, med tech)
AI and Health Analytics Market Segment (relating to Clinical Decision Support).
Company names, if practical to include and if appropriate to include
SME under NDA signed in July 2020 – interested in collaborating on AI-based clinical coaching and self-management.
Key messages that you exchanged, in both directions (just a few bullet points)
WARWICK presented an overview of the Institute of Digital Healthcare and discussed the main outline of the C3-Cloud project. WARWICK had the opportunity to present their past and present digital healthcare research and innovations, from its Institute of Digital Healthcare. The C3-Cloud coordinator presented the project, its main innovations and expected outcome. A short demo was provided on C3DP, including discussion health analytics and AI-based clinical decision support. The SME presented their interests in AI-based solutions on clinical coaching and large scale deployment trials (note that a full disclosure is not provided as discussions were under NDA [Non-Disclosure Agreement] and such detail might reveal the profile of the company).
What did you learn about the positive and negative possibilities of industry interest in exploiting our results?
The SME were interested in the C3-Cloud “whole solution” and the evaluation experience we have achieved during the C3-Cloud project. The company commented on our protocol design and, in terms of technology, they have appreciated the modular design approach of the C3-Cloud solution and the availability for customisation of its component technologies.
What impact do you think you had on the industry audience?
The SME were impressed by the C3-Cloud knowhow and were interested in further research pollination of our experience in large-scale healthcare technology trials and evaluation approaches (as conducted in C3-Cloud). The company appreciated strongly the research leadership of the Institute of Digital Healthcare in Health

Informatics, AI and Health Data Science, Behavioural Science and Human Factors. The demonstration of a working solution enhanced towards a positive impression to the SME (leading to further collaboration).

Was there any follow-up, or is something still intended in the future?

Three follow up meetings took place (virtually) during August 2020 and WARWICK is working with the SME on seed funding for an evaluative protocol of large scale technology trial of AI-based self-management/coaching technology from the company. The collaboration is intending to seek further funding from the MRC Biomedical Catalyst and relevant NIHR research calls in the UK.

Is there any tangible exploitation opportunity (or advice to the project) that you foresee with this industry sector in general, as a consequence of your learning from this interaction?

Exploitation of the evaluative knowledge - consultancy services to the specific SME and research pollination with UKRI based funding.

Partner WARWICK

Name for the event or conversation which included interaction with one or more industry actors

Presentation of the C3-Cloud Solution to a UK-based SME (under NDA).

Month and year of the interaction

July 2020

Geographic location of the interaction, or your own location if it was virtual

Virtual Meeting with GoToMeeting teleconference facility (Institute of Digital Healthcare, University of Warwick, Coventry, United Kingdom).

The nature of your contribution to the interaction (e.g. conference presentation, workshop contribution, one-to-one discussion, emailed information)

Bilateral presentation and short demonstration of C3DP and CDS components.

An overall indication of the audience within which the interaction took place: approximate number and stakeholder profile

This meeting included the Founder, Managing Director, CTO and Knowledge Officer of this SME.

Industry sectors within the audience (e.g. EHR system, clinical guideline developers, pharma, med tech)

Clinical Decision Support Systems Market Segment.

Company names, if practical to include and if appropriate to include

SME under NDA signed in July 2020 – interested in collaborating on digital platforms for remote monitoring and risk stratification in chronic diseases.

Key messages that you exchanged, in both directions (just a few bullet points)

WARWICK presented an overview of the Institute of Digital Healthcare and discussed the main outline of the C3-Cloud project. WARWICK had the opportunity to present their past and present digital healthcare research and innovations, from its Institute of Digital Healthcare. The C3-Cloud coordinator presented the project, its

main innovations and expected outcome. A short demo was provided on C3DP and CDS, including discussion on other risk stratification research work. The SME presented their interests in app development for remote monitoring of chronic disease patients, and provided early work results on risk stratification specific diseases (e.g., epilepsy – note that a full list is not provided as discussions were under NDA [Non-Disclosure Agreement] and such a list might reveal the profile of the company).

What did you learn about the positive and negative possibilities of industry interest in exploiting our results?

The SME was not interested in the C3-Cloud “whole solution”, but mainly at the CDS components. However, they were keen to find out about options on digitally enhanced multi-morbidity management. The modular approach of the C3-Cloud solution, and the customisation of its component technologies, have been seen as a strength of the project.

What impact do you think you had on the industry audience?

The SME were impressed by the C3DP and CDS components of the C3-Cloud solution, while appreciated strongly the research leadership of the Institute of Digital Healthcare in Health Informatics and Health Data Science. The demonstration of a working solution enhanced towards a positive impression to the SME (leading to further collaboration).

Was there any follow-up, or is something still intended in the future?

One follow up took place (virtually) in early August 2020 and a further follow up meeting is intended for mid-September. The SME is intending to collaborate with WARWICK at future UKRI-Innovate UK bids, which are industry led – for example Knowledge Transfer Projects and specific SME-led calls, in the areas discussed.

Is there any tangible exploitation opportunity (or advice to the project) that you foresee with this industry sector in general, as a consequence of your learning from this interaction?

Exploitation of the C3-Cloud results in the CDS market segment – customisation and consultancy services to the specific SME.

4. VENDOR FORUM AT ‘JOINING THE DOTS’

The ‘Joining the Dots’ conference was originally conceived as a way of bringing multiple European initiatives together which had tackled overlapping areas of health informatics challenge and would benefit from learning from each other. It was also recognized that many of the challenges are not purely technological but sociotechnical, and that a wide ranging multi-stakeholder audience was needed in order to contribute to determining the priorities that should be focused on when addressing complicated areas, understanding why new funding might be required to tackle them, and the importance of complementing informatics innovations with organisational change, culture change and the possible re-orientation of funding models within healthcare and within clinical research.

C3-Cloud was a founding project in recognizing the value of this cross-initiative collaboration, but also embracing a multi-stakeholder perspective. Our own work on vendor engagement has highlighted, as discussed earlier in this deliverable, the importance of engaging the “demand-side” for tackling multimorbidity and polypharmacy, and not only trying to promote the adoption of our solutions with the “supply-side” of ICT vendors. The partners saw the opportunity from this intended multi-stakeholder audience to enrich our original ideas for a Vendor Forum. This had initially, early in the project and even in the description of action, been conceived as a bringing together of the ICT sector, especially the EHR system vendors, to explore the potential for B2B exploitation opportunities. However, Joining the Dots offered the opportunity to bring the demand side and the supply side together and to focus collectively on the opportunities that C3-Cloud offers.

We therefore agreed with the conference organisers, i~HD, to include within the (otherwise multi-project) conference programme a dedicated session to be run with an exclusive “spotlight” on C3-Cloud. The conference as a whole is summarised in deliverable 2.11, as a dissemination activity, since C3-Cloud was strongly involved in the conference as a whole including in its opening plenary session and in the cross-cutting challenge areas that were examined within parallel breakout sessions. This deliverable reports on the C3-Cloud spotlight session which was an enhancement of our original Vendor Forum concept.

The conference as a whole was attended by over 150 participants covering multiple stakeholders, with about 20% from the health ICT sector, but also 10% from pharma and life sciences, whom we discovered also had a strong interest in our solution. Stakeholders who would be relevant to stimulating the demand side for addressing multimorbidity, including healthcare payers, policymakers (national and EC), healthcare professionals, healthcare providers and patient organisations but also strongly present, representing a little under half of the total audience.

Anticipating this ratio, but not having anticipated the high attendance, the partners constructed a programme for that spotlight session that would be suitable for a multi-stakeholder audience, emphasising explaining the problems that we are addressing, the strong engagement of pilot sites, the importance of developing our solutions to benefit clinicians and to really empower patients and their caregivers.

Since we know that the EHR vendor community tends to engage primarily in technology or market-oriented conferences, such as HIMSS, partners first collected, months in advance, national and European contact lists for ICT companies that might be potential adopters of our solution, with named contact points and personal email addresses. The promotional flyer on the next page, along with a brief resumé of C3-Cloud, was sent as a personal invitation email by the coordinator and the partner responsible for the work package on dissemination (who was also organising the main ‘Joining the Dots’ event), to encourage their participation.

A briefing pack was prepared (included as the final appendix of deliverable 2.11) with a combination of general project information, pilot site (and therefore clinician and patient friendly) material and more technical information about the solution components. This was included in the delegate pack of all conference participants (over 150), which was itself an important dissemination action.

The afternoon session comprised a software demonstration explained by some of its lead developers, followed by a presentation of the project ambition and method, with special attention to the experiences of the pilot site in starting to use the solution. There was plenty of opportunity for questions during each of the presentations and at the end of each of these two parts of the afternoon. The remainder of this chapter reports on that session.

4.1. Invitation sent to EHR system vendors



Power up your EHR products for multimorbidity

The C3-Cloud project (EU funded project, Horizon 2020) invites you to come and see the software products and services developed by the Horizon 2020 C3-Cloud project that tackles multimorbidity, with a focus on:

- Single disease guidelines integrated by experts as multi-condition care pathways
- Clinical workflow and advisory systems to enable optimal and efficient multi-condition care
- Patient empowering web application to maximise the extent of self-care and prevention
- Plug in architecture using HL7 FHIR and standard terminologies
- Deployment and integration toolkit
- Testimonies of usability and benefit from our pilot site clinicians and patients

-> **Ready to demonstrate and poised to adopt**

-> **Come and discuss how you could integrate these components into your products**

The C3-Cloud spotlight on multimorbidity-ready EHRs, targeting vendors

- starts at midday on 28th November

- 12-2pm demonstrations over lunch

- 2pm-4pm dedicated Vendor Forum

- in Brussels

We also invite you to attend the full Joining the Dots health data conference on 27th-28th November at the same venue. We are bringing together multiple European project innovations for:

- Advancing interoperability and data quality for high-value data sets
- Empowering patients for self-management and promoting data sharing
- Federated data networks, scaling up research and healthcare quality improvement
- A multi-stakeholder response to multi-morbidity

Please register for the whole two-day multi-stakeholder event, or just for the C3-Cloud Spotlight session, on the event webpage.

There is no admission charge, but registration is essential.

The conference dinner on 27th is included.

Please visit the C3-Cloud web site to learn more about our project and the ICT solutions we have developed. A special vendor briefing pack with product data sheets will be sent to you a fortnight before the event.

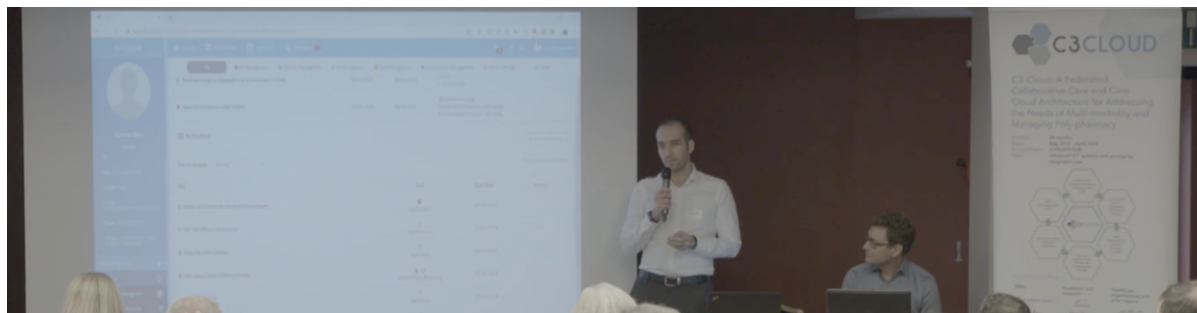
We look forward to discussing the way in which your products could incorporate the C3-Cloud solutions.

Professor Theodoros N. Arvanitis
Chair in Digital Health Innovation,
University of Warwick
C3-Cloud Project Co-ordinator

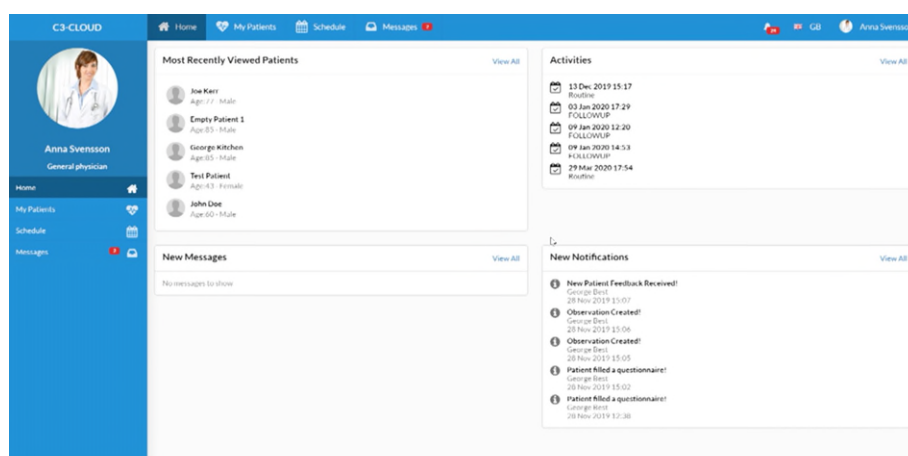
Professor Dipak Kalra
President of the European Institute for Innovation through
Health Data
Lead for C3-Cloud vendor engagement

4.2. C3-Cloud demonstration session

Mustafa and Pontus led a joint demonstration of the C3-Cloud Coordinated Care and Cure Delivery Platform (C3DP) and the Patient Empowerment Platform (PEP).

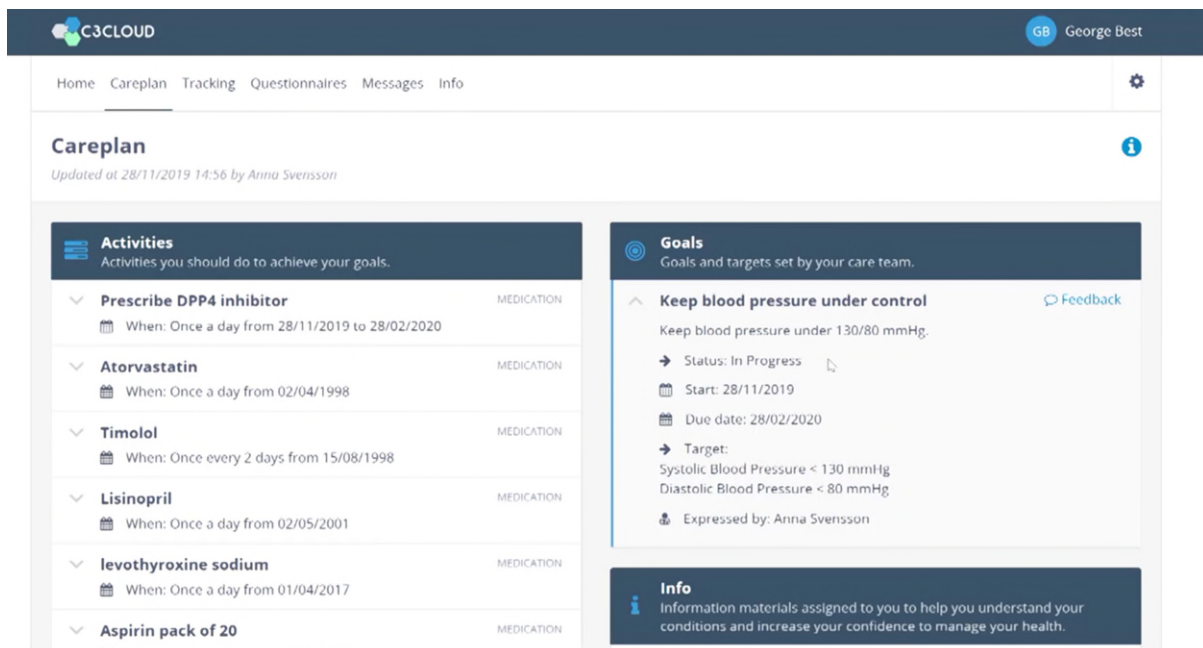


A fictitious GP, Anna Svensson was illustrated reviewing a portfolio of her patients.

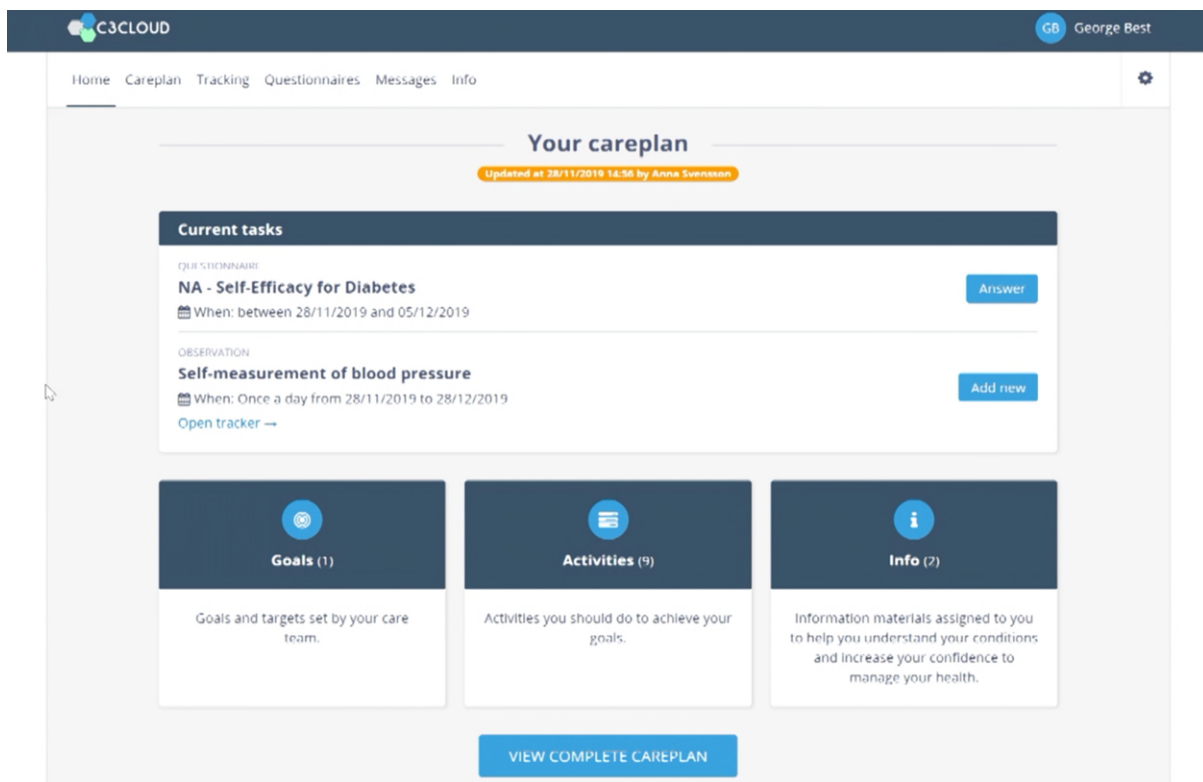


Anna was then shown creating a new care plan for fictitious patient George Best. Mustafa showed how George's patient summary is first displayed in a clinically driven layout showing conditions, allergies, recent laboratory test results, active (and past) medications and social care issues. Numeric values can be shown as timeline charts. Risk assessments (e.g., QRISK for cardiovascular risk) are calculated automatically. George has diabetes, and Mustafa showed how a care plan can be defined. Plans can be defined for each long-term condition in the patient's summary. The options proposed to the clinician are derived from published NICE¹ clinical guidelines that have been adapted to align across other condition guidelines, to handle multimorbidity. Clinical decision support services suggest suitable goals based on the patient profile including recent health data readings. Care activities can be added from a standard (guideline informed) list or added manually. These can include clinical monitoring activities and lifestyle recommendations. Each goal can be made visible to the patient, or not.

¹ The (UK) National Institute for Health and Care Excellence. <https://www.nice.org.uk>



The demonstration included adding multidisciplinary team members to his care team. Each goal can be made visible to the patient, or not. Mustafa showed the desktop display of the care plan as it can be viewed by the patient.



Pontus then demonstrated the use of the Patient Empowerment Platform (PEP). An important goal of this module, and of the whole C3-Cloud solution, is to engage patients actively. However, the PEP has been designed to emphasise the display of aspects of care that require the positive action of the patient, so as not to overload the screen or overwhelm patients. However, the full care plan is always accessible.

Digital tools allow patients to ask questions to their MDT members, via secure messaging, without the hassle of trying to contact them by telephone. The PEP connects to monitoring devices, via a Bluetooth connection linked to the PEP via a mobile phone. Pontus gave a live demonstration of measuring his blood pressure, which is simple to perform and does not require any technology actions by the patient, after it has been set up.



The blood pressure reading is seamlessly added to the patient's health record held by C3-Cloud (within each pilot site healthcare provider's intranet) and is displayed in the C3DP. Outlying values that might reflect an erroneous reading can later be excluded from use, by the clinician. Patient provided health questionnaire responses can also be displayed clearly to the clinician. The data to be provided by patients is fully configurable and can be defined by clinical teams, not requiring technical expertise. Patients can review their own progress within the care plan, which colour codes their present status for easy tracking. This includes graphical displays of their readings. The PEP can be used on a smartphone or on the patient's home computer. The PEP uses standard and open APIs so that other devices and other EHR systems can interface with it.

The system has been developed to store and display separately the data entered by clinicians and data captured by patients (manually entered or from a home monitoring device). The clinical decision support services presently only rely for calculations and guidance on clinician-entered data.

The solution incorporates robust data protection and information security measures that have met the health service requirements of all three piloting countries.

These screens were displayed in English, but the complete system can alternatively display the data and screen text in Swedish or Spanish (the C3-Cloud pilot site languages).

There were plenty of audience questions, and it was interesting to note that quite a few came from pharma industry participants as well as ICT vendor participants. Topics included how patient provided data was handled, how other devices and systems could become connected to the C3-Cloud solution, about the technical security measures adopted and how patients have been included in the pilot validation of C3-Cloud. In some pilot sites (e.g. Spain) it was permitted to form a direct connection with the electronic health record systems, so that the C3-Cloud FHIR repository could be kept up to date in close to real time. It was also permitted to integrate the C3-Cloud application (the C3DP) within the desktop and workflow of the clinicians, with seamless authentication. In the UK this was not

permitted, and a frequent extraction from GP systems was undertaken and uploaded to the C3-Cloud repository, and C3DP was accessed through a separate log in. These differences illustrate the policy challenges that have to be overcome in a project like this, in addition to organisational and technical ones. There is also tremendous variation in the digital maturity of different healthcare providers (within each country).

It was noted that the C3-cloud approach to offering alerts does not require medical device certification, since they are only offered as suggestions for the clinician to take on board in their decision-making. Clinicians can also change alert thresholds by default and per patient. This might be a future need if it was wish for the guidance to be delivered more emphatically or, for example, to orchestrate automated changes to a care plan. There could be strong SME interest in this technology, and there was discussion about how collaborations and joint further pilots might be established. The SME interest was in both directions: leveraging C3-Cloud solution components within their product offerings (e.g. the care planning tools, or the PEP), and/or providing components to C3-Cloud that could enhance its solution (e.g. medication adherence monitoring). There was also pharma interest in whether C3-Cloud could be applied to clinical trials, which Theo confirmed should be a simple configuration matter.



Theo explained that the PEP is already commercially available from Medixine, the CDS is commercially available via Cambio, and the C3DP is planned for later commercialisation as well by SRDC. The underpinning EHR repository, based on HL7 FHIR, is available as an open source component, making it easy for companies to integrate it. This is additional to the core ambition to take the C3-Cloud solution as a whole to market, via a new commercialisation entity we will create and use to

anchor licensing agreements. A service model, perhaps through nationally sponsored multimorbidity programmes, is also being considered. The knowledge representation work we have undertaken, especially guideline alignment for multi morbidity, can also be extended through consulting expertise from our pilot site clinicians. This might be sponsored by professional bodies or by future adopting healthcare sites (or by industry) to align additional clinical guidelines that they wish to incorporate. Potentially any published clinical guideline can be represented in a way that would permit to be incorporated within our clinical decision support services. There is a possibility that in future libraries of computable guidelines could be published from our work, committing their wider uptake.

4.3. C3-Cloud presentation session

This session offered a deeper dive into the project and its components, building on the demonstration and the initial discussions. The aim of this presentation though, was to engage this multi-stakeholder audience and it was therefore deliberately not a very technical presentation. Presentations from the pilot site representatives was therefore an important part of this afternoon session.

Theo opened the presentation session with an introduction to the project. Please see the slides included in Appendix 1.



He told the audience that chronic diseases are a societal burden, with people aged 55+ with multiple diseases generating significant clinical workload and consuming ~ 70% of healthcare budgets. The EC, through the EIP on Active and Healthy Ageing, has promoted the need to shift the focus of care more towards primary care instead of hospitals. Some of the challenges we have seen with addressing this are financial and organisational fragmentation within health

systems. C3-Cloud has combined an ICT infrastructure, care planning tools, team co-ordination and patient monitoring.

The C3-Cloud infrastructure combines a standards-based EHR data repository, technical and semantic interoperability components, security services and clinical decision support services. It is a sociotechnical approach to a complex problem.

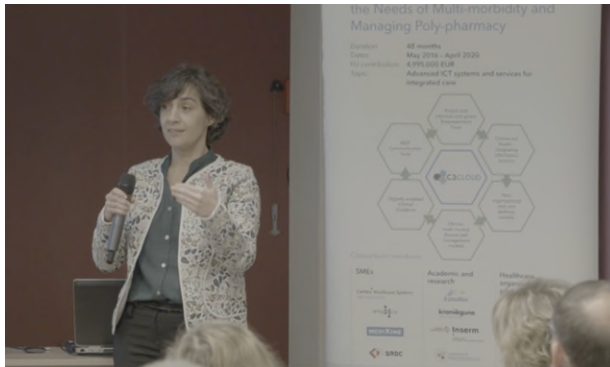
George walked through three hypothetical multimorbidity scenarios that helped to focus the development of the C3-Cloud requirements and to convey the impact of C3-Cloud to clinical and health system stakeholders.



Patient Sven lives in Sweden. He has hypertension, type II diabetes and chronic kidney disease. He lives in a remote village several hundred kilometres from his family and around 50km away from his local hospital, and the location of his multi-professional team. The project has also created scenario patients in Warwickshire, UK and in the Basque Region of Spain. Each pilot site developed their scenario to illustrate the most important features of their healthcare delivery environment. The pilot sites

have played very strong role in shaping the solution, as well as validating its acceptability and usability.

Lola introduced the Basque Country pilot site. She reported that the clinical staff had found the C3-Cloud system very easy to use and very well suited to their challenges with multimorbidity patients. They were enthusiastic to use it! However, they were aware they would now be accessing richer clinical data on their patients, and that this might increase their workload in the short term. Patients had only just started to use system at the time of this event and had so far reported that they had been able to understand how to use the system and that they had found it to be working well for them in their own homes – overcoming a concern we had about the older age group, who are the intended users. They had not yet built up much experience of its use. Clinicians had found it helpful that the PEP enables them to include caregivers (with patient consent) in the case of frail patients. The alignment of care plans across multiple diseases has been seen as a strong plus for C3-Cloud.



Mikael introduced the Region Jämtland Härjedalen in Sweden. This is geographically larger in size than England and Wales, but with a population of 130,000 and one main hospital in the centre of it. He reported that their clinicians had found the system easy to use, and patients had likewise reported ease of use (without needing a manual!). They really appreciated having computerised clinical guidelines that integrated with the clinical data, and the use of the PEP for patient empowerment. There was a positive feeling from his colleagues that the system is quite robust and ready for wide adoption.



Chris presented the South Warwickshire pilot site. He had worked extensively on formulating the formalised rules from the published guidelines, and on the alignment between them. They had experienced difficulties with getting permission to connect C3-Cloud to the widely deployed GP computer system. Patients had really liked the PEP system. The early adopters had provided

testing feedback that was rapidly taken on board in new releases. The change in culture, formalising care plans transparently with patients and caregivers, was the biggest change. Patients loved being involved in this co-design process. Phil confirmed that multidisciplinary teams had provided enthusiastic feedback during testing and then in use. Patients had found the experience of being part of care planning particularly rewarding.

There was audience interest in learning that C3-Cloud enables multi-lateral communication between MDT members and each patient when developing a care plan. It was also noted that C3-Cloud had developed its approach to avoid double entry by clinicians into multiple systems. EHR system integration was possible in two out of three sites, but technically possible at all sites. Where integration is not possible clinicians enter data in their normal system, from which the C3-Cloud system can be rapidly refreshed. It is technically possible for C3-Cloud to push data back to EHR systems, but this was not permitted at any of the sites due to the project nature of C3-Cloud.

4.4. Health system and industry success factors

Following the event, reflecting on the feedback remarks and comments made by the audience of our dedicated session and more informal interactions partners had during the conference break times, we were able to synthesise the following success factors of C3-Cloud that will make it favourable to health systems and to industry.

- Market:
 - Tackling a healthcare lead and, importantly, healthcare cost that is increasingly recognised to be a challenge for every European health system.
- Health system success factors:
 - Clinical engagement to ensure screens and application are easy to use and fit within workflow.
 - Configurable alerts.
 - Patient engagement to enable an intuitive interface and functions patients find useful.
 - Clear demarcation and labelling of patient generated data, not automatically taken into account by the CDS.
 - Capability add other languages.
 - Capability add other guidelines and expertise to help with that.
- ICT industry:
 - Open APIs, able to connect other monitoring devices.
 - FHIR Standards based repository enabling easier connectivity to EHR systems, bidirectional capability (avoiding double data entry).
 - MDR certification not required (but possibly a future ambition).
 - Commercial exploitation of C3-Cloud components via some partners already, or in the near future.
 - Possibility for B2B relationships with SMEs, via a new C3-Cloud commercial entity to be created.
 - Robust security measures meeting (some) health system and healthcare provider requirements.
 - Single sign on capability.
- Pharma:
 - Possible reuse of C3-Cloud for clinical research studies.

These success factors should not be seen as a picture of our key features or unique selling points, but rather the noteworthy features that were picked up on by the audience as things they might not have expected from a research project development but were pleased to find. They have been included within the overall reflections on industry liaison inputs, reported in Chapter 2 of this deliverable.

5. ANALYSIS OF THE CHALLENGES FACED BY THE HEALTH ICT SECTOR IN MARKETING INNOVATIONS

This chapter analyses our overall learning from companies about the challenges they face with commercialising innovations and selling them into the health sector. This is important learning for us directly, as we market our solution, but also indirectly because we will have to advise potential future business to business partnering companies on how they can successfully market our components within their products, to their customers.

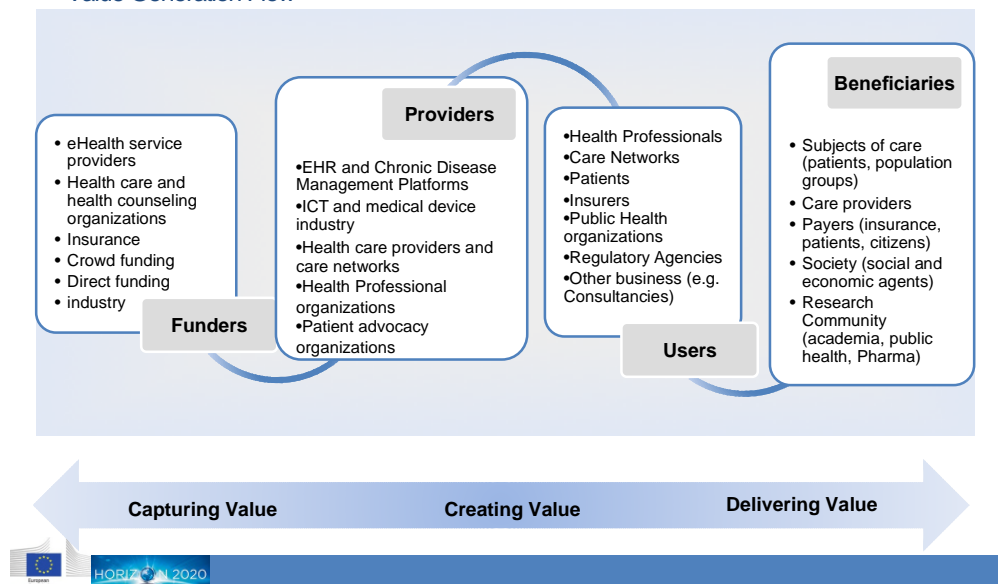
Probably the greatest challenge faced in the health sector is that the purchase of ICT innovations does not follow a classical market paradigm. In a classical market, the purchaser (the customer) is also a beneficiary of the purchased product or service, even if others in an ecosystem also benefit. The purchase of a conventional hospital information system, for example, largely follows that paradigm because the cost of the information system is fully or mostly carried by the purchasing hospital, and the hospital primarily receive the benefit of improved business efficiency, data capture and processing, connectivity across its many administrative and service providing departments, and the ability to track and manage its costs and KPIs.

An electronic health record system is a little different, because the added business value to the hospital from having electronic clinical data has not, until recently, been matched by a corresponding cost saving or increase in revenue. In other words, investments in EHR systems is largely an operational cost rather than a source of value. Any cost savings realised from an EHR system are to do with the reduction or complete avoidance of paper systems, the timeliness of data access, potentially the avoidance of duplicated or redundant healthcare activity costs, possible reduction in the drug budget due to more efficient prescribing, and potentially, but not often demonstrated, avoiding excess bed days through the reduction in complications attributed to better quality and safety of care.

A notable “Cinderella” challenge has been promoting the connectivity between healthcare organisations through integrated electronic health record systems. To date, almost no hospital reimbursement models favour investments in better clinical data connectivity with local general practitioners or social care services. A smoother discharge and better care coordinator is undoubtedly of huge benefit to patients and their families, and eases the burden for community care providers because they are better informed when they take over care rather than having to figure out what might have taken place in hospital. However, none of those benefits translate into an increase in revenue for hospital, which therefore incurs the cost without a ROI. This has been one of the recognised barriers to the scaling up of the adoption of interoperability standards.

The situation is far from easy in healthcare, because it is recognised to be a multisided market: this means that there are complex value chains between those parties who fund healthcare services or improvements in care services, those who purchase the solutions needed to deliver better quality, especially better integrated, care, those who develop and sell the systems and the end beneficiaries, especially the patient who is not a funder, not a decision maker, not a purchaser and mostly not an end user of the systems. The figure below is a chronic disease value chain constructed during the previous EC project, VALUeHEALTH, which some of the C3-Cloud partners were involved.

Optimizing Multi-Stakeholder Value Chains
Enabled chronic disease management services (EHR, care management (ERN) platforms,...)
Value Generation Flow



This value chain is only an example but was proved a useful illustration in this project to help convey the complexity that C3-Cloud itself would face when seeking to establish business to business relationships with the ICT sector. The problem with the complicated value chain is that each of the categories of actor has a different perspective and priority in their relationships. Healthcare providers, when interacting with funders, strive to maximise reimbursement. The ICT sector strives to demonstrate how its solutions can offer improved business efficiency to purchasing healthcare provider organisations. It is only in recent years, when the cost and value of clinical care, including the importance of health outcomes, that the contribution of ICT solutions to quality and safety of care has additionally arisen as a driver in that purchasing relationship. Clinicians are busy, and one of their greatest anxieties is the introduction of change that increases their workload, either in terms of elapsed time (something that is time-consuming to perform) or cognitive load (something that requires additional concentration but will probably also then slow them down). This resistance to change, not intrinsically because changes are not welcome (many clinicians don't find their working practices to be efficient as they stand) but the fear of increased workload. (There is a secondary anxiety about innovation, to do with the possible impact on their personal remuneration, but this only affects those healthcare professionals who are directly paid for their activities, as opposed to being on a fixed salary.).

The biggest driver for changing this multisided complex value chain impulse is to increase the recognition given to good quality long-term care. This recognition might be in the form of key performance indicators to organisations or Chief Executives of organisations, or in the form of increased reimbursement or supplementary payments. The "bundled payment" model is an example of this, more prevalent in the US than in Europe at the moment. There is a growing interest in the implementation of value-based care models that will reimburse only on the basis of measured and demonstrated improvements in health outcomes or offer a supplementary payment for achieving high quality outcomes. These models transform the game when it comes to leveraging investments in ICT that are delivering added functionality to clinicians. They also change the game in relation to patient empowerment and self-management, because these are likely to help improve health outcomes.

When interacting with ICT companies, especially SMEs who themselves are innovative and often struggle with selling their products and services into health systems, we identified a number of "features" within the C3-Cloud that are deliberate design functions that enable its maximum value to

clinicians and patients tackling multimorbidity, but at the same time are the very challenges that make it difficult for a single healthcare organisation to justify from a purely business perspective in investing in C3-Cloud – whether by directly licensing our solution or by paying extra to an EHR system vendor for having included our product in its offering.

We facilitate the collaboration and co-ordination of multidisciplinary team members across organisational boundaries, which means that no single organisation is the exclusive user of our services and therefore no single organisation is automatically and naturally the purchaser. Almost no health systems have built-in acceptable policies and methodologies for joint procurement. This means that it is very difficult organisationally, contractually and financially for multiple care organisations to collaborate on a purchase that might benefit them mutually.

There is a reluctance amongst purchasers in general to pay for features or products that do not address organisational needs that they recognise. Since addressing multimorbidity through a proactive strategy is itself something new, there is no clear basis whereby a procurement officer could determine what functions if any they should purchase to solve this problem (which might not be well recognised in the organisation), how to judge a product offering and how much to pay for it. If budgets are limited, core business functions will always be prioritised, and innovations are the easiest to cut out of a procurement specification because no loss of existing function will be incurred.

Even if there are KPIs or financial rewards for better integrated care and for better management of polypharmacy, there is inevitably a time delay between deploying better clinical care coordination solutions and the impact on healthcare burden and cost, such as the avoidance of redundant healthcare activities or the avoidance of complications from one or more of the multi morbidity conditions. This time delay could easily be more than one year (the annual budget and planning cycle length). Just as it is difficult to demonstrate a measurable health impact within the period of a normal pilot study duration, it would be difficult for the vendor adopting the C3-Cloud solution to demonstrate the business value within a deploying healthcare organisation within a year, or even two. However, most of the benefits from better quality care in the context of multi morbidity will arise through “invisible savings” such as deteriorations and concurrent illnesses avoided, absence from work avoided, burden on caregivers reduced etc. The direct financial benefits from these physical savings are only realised at the level of governments (not even health ministries) which regrettably means that they are below the usual radar of any politician’s interest.

An additional challenge with adopting innovations is the Catch-22 of scale. Patients with a long-term condition could have any number of other long-term conditions as their multi morbidity problem, and might be seen in a wide ranging number of hospital departments and community-based care services. Any adoption of C3-Cloud has to start somewhere, and pick a small number of often co-occurring diseases, as we have done in the project. However, in order to deliver value to a large organisation, such as a hospital, a substantial proportion of its multimorbidity patients need to be included within the solution. Otherwise, clinical staff will have to operate with a mixed model where for some of their patients they should use the C3-Cloud desktop and tools, and prepare to discuss patient empowerment and self-management with the patient. For other patients in the same clinic, who have different concurrent diseases, they should continue with existing practice. This problem is, of course, by no means unique to our project, and was voiced frequently by innovative SMEs, but can only be mitigated by organisational commitment to accept incremental penetration of the solution within the organisation over a period of a few years, and be willing to give backing to the temporary challenge of multiple ICT approaches within their organisation.

Although this may appear to be a long list of compelling reasons why C3-Cloud should abandon any attempts to reach the market, these challenges are sufficiently universal across all of digital innovation that there is recognition that health systems and healthcare organisations need to be prepared to take a different approach. However, this section highlights how a novel approach can only become adopted and scale up within a multisided market that has a complex value chain if multiple stakeholders are collectively engaged in understanding the problem and valuing the solution.

This understanding has driven our approach in the last year of the project, and has stimulated us towards follow-on projects that could enrich the evidence base, including the economic evidence base, in favour of our solutions.

6. TACTICS FOR FUTURE ENGAGEMENT WITH ICT VENDORS

6.1. Introduction

The previous chapter has explained why the ICT sector, and especially EHR system vendors, has told us why they would find it challenging to convince their customers to pay extra for enhanced multi morbidity and patient empowerment services. This then becomes their obstacle to investing in the licensing or other B2B relationships with a future C3-Cloud commercial entity. Therefore, as a compliment to the core business plan of C3-Cloud, as documented in D2 10, we consider in this chapter some tactics we could consider for connecting with the vendor community and working with them in less direct ways to gain visibility, become more attractive to them and help convince them of the business value we would bring to their products, services and ultimately to their customers. We have developed these ideas working with an external business consultant who has run a successful tech SME for many years in the health sector, has worked with healthcare providers, regional and national health systems and played important roles in the international standards landscape.

6.2. Context

The suite of C3-Cloud offerings are not commodities that can be sold from a catalogue. They will require solution selling techniques to identify and develop opportunities.

The suite of C3 Cloud offerings will be used in environments where there are already information systems that are supporting the healthcare organisation's workflow, and the suppliers of these systems may believe that they can already provide the functionality that C3-Cloud is offering to a sufficient level for their customers' needs and willingness to pay.

- It therefore needs to be clear how C3-Cloud adds value to the existing ICT infrastructure and that its solution works with it, so that where possible it can be marketed as an add-on to these systems, rather than getting into destructive competition with them.
- Part of the C3-Cloud value proposition is that it can fill some of the gaps in existing information infrastructures – for example supporting care pathway execution and providing a user interface to care pathways, where there is not a suitable clinical system currently serving that purpose.

6.3. Multi-faceted market

The C3-Cloud solutions deliver value by enabling effective collaboration between stakeholders with very different perspectives. By enabling this collaboration C3-Cloud enhances the value of what these separate stakeholders are already creating or receiving.

When a C3-Cloud solution is considered for deployment it will be important to identify *a priori* where value is going to be added, as any stakeholder who is benefiting from C3-Cloud is a potential customer who may be willing to pay for C3-Cloud services. Those who are aware that they will receive, and then are receiving, benefits without paying will become advocates for the product/service.

The following list of stakeholders (through not comprehensive) illustrates the range of potential beneficiaries:

- Clinical Knowledge Organisations (HTA such as NICE, knowledge curators such as BMJ and Elsevier, etc.)
 - Authors.
 - Publishers.

- Clinical Information Systems and workflow engines
 - Users (healthcare workers, patients, etc.).
 - Vendors/Suppliers.
 - Purchasers.
- Health Policy and Strategy
 - Operation Analysis (UK examples: NHS Improvement, Health Foundation).
 - Medical professional societies.
 - Clinical Policy (National and regional health ministries, public health agencies).
- Healthcare Delivery
 - Hospitals, Primary Care, and other health and care organisations.
 - People working in those organisations in many different roles
- Digital Health Projects
 - Regional and national innovation catalysts (UK example: LHCRs²)
 - Healthcare provider level digital transformation projects.
 - Project within or led by other stakeholders in this list.
- Patients and Communities (e.g., via a project or sponsorship model)
 - Public Health initiatives.
 - Health Literacy Digital Health Literacy programmes.
 - Health in All Policies³.
 - The lived experience of being a patient – or “subject of care”.
- Health Innovation Suppliers
 - Pharma, MedTech and biotech offering new diagnostics, treatments and monitoring devices.
 - Innovations in transport, buildings, process, etc.

For any specific implementation it is simplest to identify one or two customers who will be paying for the product/service and to identify enough benefit for them to justify the cost.

Digital Health Projects are considered separately, as they are often collaborations, and it may be better to characterise, identify and target specific sorts of Digital Health Projects that C3-Cloud can help with in a tactical way, as well as identifying organisations who may have an ongoing strategic interest in using C3-Cloud products and services.

6.4. Different Perspectives on Value

For C3-Cloud to be successful it needs to be adopted in organisations that will already have significant health informatics in place but now want to manage processes. This provides two routes to adoption: C3-Cloud may be used by the suppliers of digital health products to add value to their offering, or it may be brought directly by a health delivery organisation and integrated with their other digital health products as needed.

² Local Health and Care Records (LHCRs),
<https://www.england.nhs.uk/digitaltechnology/connecteddigitalsystems/health-and-care-data/joining-up-health-and-care-data/>

³ <https://www.health.org.uk/publications/reports/implementing-health-in-all-policies>

This leads to focusing on two key personas who need to see the value being offered:

- Product Manager - why will a product owner support the framework in their product (will be different for knowledge and software products).
- Process Manager - why would a care delivery organisation adopt/require the C3 Cloud products to be used?

6.5. Standards and the Messy Reality

There is a strong push towards standardised health data in many European countries in order to grow connectivity, enable clinical decision support and to operate digital care pathways.

As the effort is put into aligning data collected and used with the standards (whether SNOMED, HL7 FHIR, or others) it is important that benefits are identified and realised. The capabilities that C3-Cloud has developed could be part of that process, because it has adopted a standards-based approach to clinical data representation and to computerise guideline representation.

Where organisations are investing substantial effort in creating interoperable health information, there is an opportunity for C3-Cloud to work alongside the standardisation efforts, helping those adopting communities to quickly realise the benefits of decision support and digital care pathway implementation. C3-Cloud can therefore offer a means of achieving a quick win from organisational or regional health data standardisation. To adopt this approach, it will be important to understand what standardised data is going to be available, how quickly, and how C3-Cloud can help use that data to deliver demonstrable clinical benefit. Because many of the data items utilised in the C3DP and by the guideline rules are either clinical data that aligns very well with the European and international patient summary data content, or our data items that are often already well computerised such as laboratory results. C3-Cloud can therefore also be a way of enabling a regional health system, for example, to provide local benefit from adopting something that is otherwise moment mainly being promoted as of cross-border value.

Thus, C3-Cloud becomes part of the benefits realisation offering for data standardisation projects, providing tools and services that make it easier for the wide range of stakeholders to collaboratively use the newly standardised data.

Even if a customer for the deployment of C3-Cloud solutions is not motivated by the move towards standardised health data, this is a benefit that can be made visible as part of the C3-Cloud contribution to the project, and may be helpful in getting other stakeholders to engage with the project and make it a success.

6.6. Strategic or Tactical Sell

C3 Cloud offerings could be used in either a tactical project, as part of a longer-term strategy by any of the stakeholder groups identified above.

Where there is a short-term project need then the speed and ease of deployment will be a priority, for which C3-Cloud has an advantage through its configuration, installation and organisational change experience at the pilot sites. There are parts of the C3-Cloud suite of offerings that can be packaged for use in a rapid, tactical way. This may open opportunities to demonstrate more strategic solutions as well.

It is clear that some of the C3 Cloud functionality can be delivered by other stakeholders and partners, and so may not be required for any one specific project. From a project risk management perspective, it may be that the (unused) wider suite of C3-Cloud components could be offered as fall-backs if existing plans do not work out, adding to the value of working with the C3-Cloud entity.

6.7. Hackathons, Workshops, and Conferences

Many countries have events, at which the health ICT community engages across companies (e.g. hackathons) and/or with other stakeholders via workshops and conferences (including the exhibition halls). There is scope for both top down and bottom up selling of C3-Cloud offerings.

For Top down selling the business case for adopting C3 Cloud product needs to be made, and a clear driver for change needs to be identified. This may be by declaring how C3-Cloud supports policy alignment. For example, there is a statement in the NHS “Phase 3” letter requirement to “Develop digitally enabled care pathways in ways which increase inclusion, including reviewing who is using new primary, outpatient and mental health digitally enabled care pathways by 31 March 2021”⁴.

Bottom up selling could include attending hackathons and co-design events, where C3-Cloud could be offered up as part of the infrastructure to be used in the event. This would allow C3-Cloud partners to show the value of their offering, build relationships and also to develop collaborative demonstrations with others who attend the events.

6.8. Examples of opportunities in the UK

6.8.1. Health Data Research UK process modelling and representation

The British Computer Society (BCS)⁵ and the faculty of Clinical Informatics (FCI)⁶ are collaborating under the banner of Mobilising Computable Biomedical Knowledge (MCBK)⁷, which is in fact an international movement spearheaded from the University of Michigan (and in which two C3-Cloud partners are involved). They are working with Health Data Research UK⁸, reviewing the knowledge management strategy that is in place for sharing knowledge between projects that they sponsor, and with the NHS and others who can make use of the research findings.

They are planning a hackathon in early 2021, which may be a good opportunity for C3-Cloud to target, to demonstrate how the C3-Cloud architecture and product suite could help contribute to the Learning Health System and the wider knowledge sharing agenda promoted by the MCBK agenda. Since MCBK is an international movement, this could also be a route of entry to other countries.

6.8.2. NHSX⁹ / NHSD¹⁰ Pathways and Event Sourcing Architecture

SMEs have been working with NHSX on pathway driven simulation that can be used to support hackathon activities (amongst many other things). They have been specifically looking at how event sourcing can be used in a healthcare context, building up a demonstration suite of docker components to show how various architectural options work with a simulation population. There is scope for collaboration, and for including C3-Cloud products in this suite of demonstration / reference implementations.

⁴ <https://www.england.nhs.uk/coronavirus/wp-content/uploads/sites/52/2020/07/Phase-3-letter-July-31-2020.pdf>

⁵ <https://www.bcs.org/membership/member-communities/bcs-health-and-care/>

⁶ <https://facultyofclinicalinformatics.org.uk/>

⁷ <https://facultyofclinicalinformatics.org.uk/uk-mcbk>

⁸ <https://www.hdr.uk/> - The C3-Cloud Coordinator, Professor Theodoros N. Arvanitis, is one of the Associate Directors of the Midlands Site of HDR UK.

⁹ NHSX is a UK Government unit with responsibility for setting national policy and developing best practice for National Health Service technology, digital and data - <https://www.nhsx.nhs.uk/>

¹⁰ NHSD is a UK Government unit providing information and technology support to the NHS in using digital technology to transform the NHS and social care - <https://digital.nhs.uk/>

6.8.3. NHS Clinical Standards

There is scope for working with the UK Professional Records Standards Board (PRSB), National Institute for Health and Care Excellence (NICE), and other clinical leadership organisations on the development of clinically assured pathways. These organisations have standards and specifications that should underpin digital pathways (Professional Information Standards from the PRSB, and Guidelines from NICE). The C3-Cloud products and services could help get those products more widely adopted and drive demand for standardised data that supports effective application of the NICE guidelines.

6.9. Wider international opportunities

6.9.1. BPM-Plus Process Modelling Standards

BPM-plus¹¹ is a strong community of organisations hosted by the Object Management Group, looking the adoption of Business Process Modelling Notation (BPMN) in healthcare. This community is a natural place for C3-Cloud to find others interested in the adoption and use of pathways, and potentially to take a leadership role in this area of standardisation.


6.9.2. ISO Safe, Secure and Effective Software Standards

There is potential for looking at a wider value proposition, combining the use of pathways across institutions with how these are shown to be safe, secure and effective - taking inspiration from work on interoperable devices within ISO and HL7¹². Working with these international standards groups may be a route to find and engage with others who are looking at a standards-based digital health projects where C3-Cloud may add value.

¹¹ <https://www.bpm-plus.org/>


¹² <https://confluence.hl7.org/pages/viewpage.action?pageId=82906657>

7. APPENDIX 1 - SLIDES PRESENTED DURING THE VENDOR FORUM




C3-Cloud spotlight on multimorbidity EHRs

Joining The Dots
C3-Cloud Session (28 Nov 2019)



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



PROJECT INFORMATION


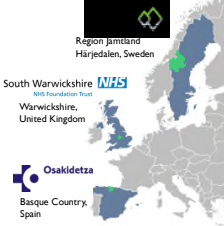


- Project name: C3-Cloud: A Federated Collaborative Care and Cure Cloud Architecture for Addressing the Needs of Multi-morbidity and Managing Poly-pharmacy
- Duration: 48 months
- Dates: May 2016 – April 2020
- EU contribution: 4,995,000 EUR
- Topic: Advanced ICT systems and services for integrated care

2

C3-CLOUD

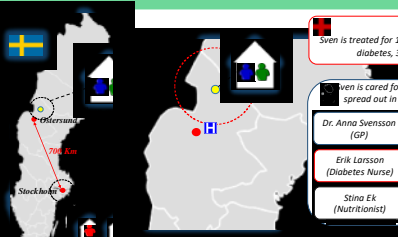
SMEs Academic and Research Healthcare organisations and pilot regions

3

C3-CLOUD

THE HEALTH AND CARE STORY OF SVEN

Sven is treated for 1) hypertension, 2) type II diabetes, 3) kidney failure

Sven is cared for by a team of clinicians spread out in different locations

Dr. Anna Svensson (GP)	Martina LC (Community Nurse)
Erik Larsson (Diabetes Nurse)	Anders Blom (Nephrologist)
Sitina Ek (Nutritionist)	Helene MM (Nurse specialist nephrology)

C3-CLOUD

THE HEALTH AND CARE STORY OF SVEN




...is also the story of Mary and Brenda

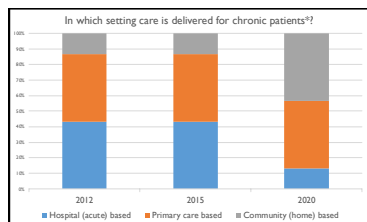
C3-CLOUD

CONTEXT

- Chronic diseases are the main reason for **poor health and restricted activity**.
 - Affect 30% of Europe's population.
 - Account for 70% of healthcare expenditure in Europe.
- Ageing is associated with **multi-morbidity**
 - Includes a growing number of functional and cognitive impairments.
 - More than 50% of all older people have at least 3 chronic conditions, and a significant proportion has 5 or more.

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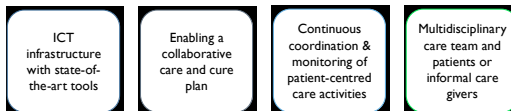
C3-CLOUD



*European Innovation Partnership on Active and Healthy Aging Action Plan on 'Replicating and tutoring integrated care for chronic diseases, including remote monitoring at regional level'.
http://ec.europa.eu/research/innovation-union/pdf/active-healthy-aging/h3_action_plan.pdf

The Challenge: Transformation of care delivery

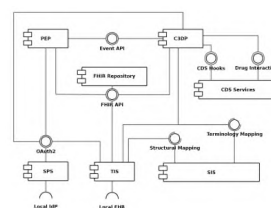
WHAT IS C3-CLOUD?



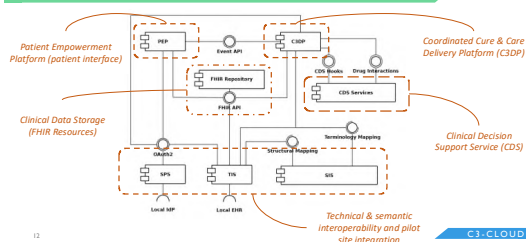
THE OBJECTIVE

- 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 ARCHITECTURE AT A GLANCE



C3-CLOUD ARCHITECTURE AT A GLANCE



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 Jamtland Harjeladen
 - 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 HetOP 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

HL7 FHIR AS THE COMMON DATA MODEL

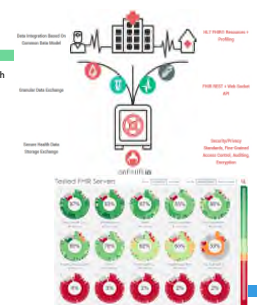
Used FHIR Resources:

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

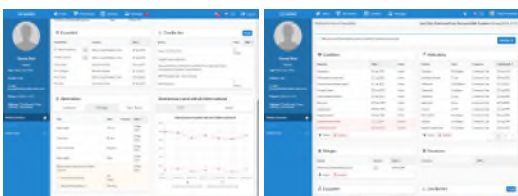
Resource	Version	URL	Description
Condition	4.0.1	https://fhir.org/Condition	Condition (e.g. Diabetes Mellitus, Hypertension, etc.)
Observation	4.0.1	https://fhir.org/Observation	Observation (e.g. Blood Glucose, Blood Pressure, etc.)
MedicationStatement	4.0.1	https://fhir.org/MedicationStatement	Medication Statement (e.g. Patient taking Metformin)
MedicationRequest	4.0.1	https://fhir.org/MedicationRequest	Medication Request (e.g. Request for Metformin)
ProcedureRequest	4.0.1	https://fhir.org/ProcedureRequest	Procedure Request (e.g. Request for Surgery)
DeviceRequest	4.0.1	https://fhir.org/DeviceRequest	Device Request (e.g. Request for Insulin Pump)
Device	4.0.1	https://fhir.org/Device	Device (e.g. Insulin Pump, Glucose Monitor)
CommunicationRequest	4.0.1	https://fhir.org/CommunicationRequest	Communication Request (e.g. Request for Consultation)
Communication	4.0.1	https://fhir.org/Communication	Communication (e.g. Consultation Note)
Questionnaire	4.0.1	https://fhir.org/Questionnaire	Questionnaire (e.g. Patient Survey)
QuestionnaireResponse	4.0.1	https://fhir.org/QuestionnaireResponse	Questionnaire Response (e.g. Survey Results)

ONFHIR - HL7 FHIR® BASED SECURE DATA REPOSITORY

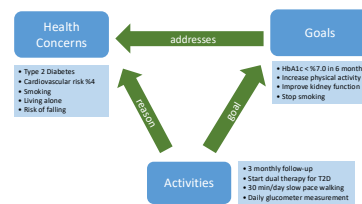
- **Common, standardized, HL7 FHIR® compliant way for health data access and storage**
 - Highest scores in FHIR testing tools Crucible and Touchstone
- **Dynamically configurable**
 - Everything is configured from the original FHIR specifications (i.e. definitions)
 - Can support a new version of FHIR within an hour
 - Support for new custom FHIR operations via a library
- **Security & Privacy**
 - OAuth2.0 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 JSON manipulation with MongoDB
- **For more information: onfhir.io**



CARE PLAN AT THE HEART OF C3-CLOUD



THE BASICS OF A CARE PLAN

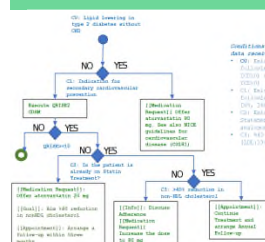


CLINICAL DECISION SUPPORT (CDS) SERVICES

Types of CDS Services in C3-Cloud:

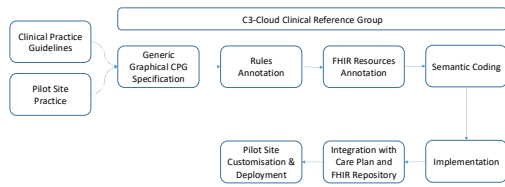
- Clinical guideline based CDS services recommending personalized goals and recommendations to health professionals
 - **Type 2 Diabetes: 80 clinical rules checking 108 different patient criteria and recommending 119 personalized goals and interventions**
 - **Renal Failure: 101 rules, 58 patient criteria and 35 personalized goals and interventions**
 - Further +50 rules for heart failure and depression
 - All based on NICE clinical guidelines with minor local deviations
 - Implemented in Guideline Definition Language 2 (GDL2) via the GDL2 Editor (www.gdl2.org)
 - Fully CDS Hooks compliant (<http://cds-hooks.org/>)
- Reconciliation rules analysed for the 4 major diseases: **52 more rules**
- Drug-drug interaction service based on NICE BNF database
 - **108,600 interactions and 26,403 side-effects for 1,009 substances**

GRAPHICAL GUIDELINES (CDS SPECIFICATION)

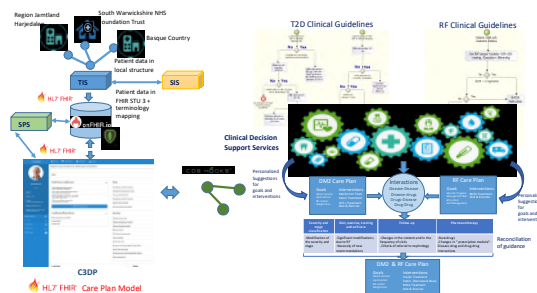


- Every time a plan loads
 - FHIR database checked for a number of rules
- Guidelines interpreted in graphical representation
 - Standardised
- Rules defined for IT implementation
- Produces FHIR resources

METHOD



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FHIR AND CDS IN C3-CLOUD

- C3-Cloud uses FHIR for data storage and communication
- Actions in CDS are described in terms of FHIR resources
- Generate resources automatically
 - Care plan logic will integrate resources accordingly
 - Advisory
 - Information
 - Medication change/request
 - Referrals
 - Goals
 - Each MDT member will see appropriate information based on the C3DP configuration

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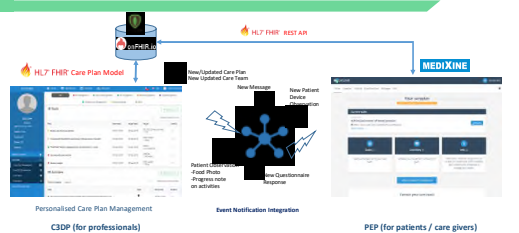
PATIENT EMPOWERMENT PLATFORM (PEP)

- The Web application providing access for a patient to the published care plan and its associated information
- Thus, it tries to increase patient and informal caregiver participation in decision making
- Based on the Medixine Suite PHR product of Medixine
- Core user functionalities:
 - Make published care plans available to the users.
 - Send reminders to patients to help them comply and stay on track with the interventions and activities included in the care plan.
 - Allow patients to actively collect data related to the care plan activities.
 - Allow health professionals and patients to communicate with each other using either messages or video appointments.
 - Provide patients with access to relevant self-management material.
 - Provide all PEP users with secure access to this information and functionality.

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CARETEAM – PATIENT COLLABORATION



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THE VIEWS OF THE USERS – PILOT AT BASQUE COUNTRY, SPAIN



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THE VIEWS OF THE USERS – PILOT AT REGION JÄMTLAND HÄRJEDALEN, SWEDEN



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THE VIEWS OF THE USERS – PILOT AT SOUTH WARWICKSHIRE, UNITED KINGDOM



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DISCUSSION I

➤ Discussion on business drivers for health system investments on better multimorbidity solutions

- Actionable Care Planning
- Clinical Practice Guideline (CPG) creation through CPGs in a machine readable format
- Patient empowerment and involvement
- Cost reductions on multiple fronts – less polypharmacy, less pressure on the healthcare, more efficient use of public taxpayer money

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DISCUSSION II

➤ Discussion on how the solution and its components can be adopted by systems vendors

- Interoperability Challenge
- Modular Design

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THANK YOU



Any questions?

