An Integrated Solution for Sustainable Care for Multimorbid Elderly Patients with Dementia

CAREPATH

WP8: Impact Promotion, Dissemination, Exploitation and Business Planning

D8.5: Reports on Dissemination and Communication Plan and Activities Second Release

Contractual Date of Delivery to the EC: 30 June 2024

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Participant(s): [4]UoB, [1]EXYS, [2]Fraunhofer, [3]SKB, [5]UHCW, [6]SESCAM, [7]UCLM, [8]CITST, [9]SRDC, [10]OCT

Author(s): [4]Theodoros N. Arvanitis, [4]Omid Pournik, [1]Jaouhar Ayadi, [2]Yehya Mohamad, [2]Carlos Velasco, [3]Henrike Gappa, [3]Wolfgang Schmidt-Barzynski, [3]Antje Steinhoff, [5]Tim Robbins, [6]Pedro Abizanda Soler, [7]Ana Magdalena Vargas Martínez, [7]Luz María Peña Longobardo, [8]Oana Cramariuc, [9]Mert Gencturk, [10]Lionello Ferrazzini

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Executive Summary

The present document aims at reporting on the dissemination and communication plan of the project and detailing the activities that have been conducted to achieve this in the first period of the project, as part of Task 8.3.

D8.5 Release 1 was the first of three reports from the project, that reported on dissemination activities throughout the project, initially at Month 18. This release, which is the second release of the T8.3, is the updated version of release 1 and we integrate all activities and outputs by month 36th of the project.

Section 1 covers a brief introduction to the task and its characteristics.

In Section 2, we present the methodology for the dissemination strategy for the content, audience and levels. In recognition of the importance of the key stakeholders for the project, we are working closely with Task 8.1 and Task 8.2 for the identification of stakeholders and for the main messages in targeting these groups.

Section 3 describes the communication channels we use for the dissemination and lists the publications event participation and collaborations of the project by the end of Jun 2024.

Finally, in Section 4, we outline the dissemination and communication plan for the next period of the project.

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1 Introduction

The objective of Task 8.3 is to communicate and raise awareness of the approaches and results of the CAREPATH project and engage with relevant stakeholders in the areas of technical innovation and associated impacts on healthcare. In this dissemination report, we not only specify the updated strategy that the project consortium will follow to ensure the effective and efficient dissemination of the project. We outline the stakeholder groups that are relevant to the project and the dissemination plan for these groups. We also report on the communication approaches used in the project and the dissemination activities that project partners have participated in. Dissemination and publication plans for the next period are also outlined. The dissemination and communication plan is a living document and updates will be reported in a further release of this deliverable at Months 48.

2 Dissemination Strategy

2.1 Objectives

The key objective of the CAREPATH dissemination strategy is to identify and organise the activities to be performed to promote the widest dissemination of knowledge from the project. It also aims at maximizing the impact and the market uptake to support the exploitation activities in Task 8.2. Specifically, the dissemination and communication plan sets the following objectives:

- To **raise public awareness** and ensure maximum visibility of the project's key facts, outputs and findings among the public at large;
- To support the **presentation of the project's main results** in key stakeholders (e.g., market service providers, technology sector firms, civil rights movements organizations), EC and general media;
- To **enhance the commercial potential** of the results;
- **Inform patients** about the relevance of the project's outcomes;
- **Promote collaboration** with similar EU and national-level projects;
- **Ensure long-term impact** by establishing appropriate communication channels to maximize influence on policy and decision-makers within targeted communities (healthcare, research, academia).

Figure 1. Dissemination and communication plan objectives

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2.2 Methodology

This section delineates the comprehensive methodology employed for WP8: Impact Promotion, Dissemination, Exploitation, and Business Planning, particularly focusing on the preparation and execution of dissemination and communication strategies as documented in D8.5.

The methodology outlines the systematic approach taken to ensure effective dissemination and communication of CAREPATH's results and experiences, thereby maximizing the project's reach and impact across various target audiences within the European region.

The methodology is segmented into three critical areas:

1. **Goal Determination, Content, and Branding (What?)**: This segment addresses the development and customization of dissemination materials aimed at different audience groups, ensuring content is tailored to their specific needs and levels of understanding.
2. **Targeted Audience Identification and Profiling (Who?)**: This segment identifies and profiles the diverse stakeholders targeted by CAREPATH, encompassing policy makers, healthcare organizations, practitioners, ICT providers, academia, and general public.
3. **Dissemination Levels and Phases (When?)**: This segment outlines the phased approach to dissemination activities, detailing the strategies deployed at various stages of the project lifecycle to build awareness, engage stakeholders, and promote the adoption and commercialization of CAREPATH solutions.

Figure 2. The segmented dissemination methodology

2.2.1 Goal determination, content and branding (what?)

Dissemination material will be produced to share CAREPATH results and experiences beyond the limits of the project's partnership with the maximum number of potential beneficiaries (e.g., home care providers, technology providers, healthcare provider organizations, patients) in the whole European region. To ensure real impact, CAREPATH dissemination content will be customized and aligned with different target audience classes and differ from the general public to decision-makers. For example, the language style used in the different products will vary, generally becoming more specialised at deeper levels utilizing technical language and terms. The objectives of this customized dissemination strategy will be:

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1. **Creating Awareness**. First, we will develop content for those target audiences that do not require a detailed knowledge of the project, but it is helpful for them to be aware of the activities and outcomes. Creating such an awareness message of CAREPATH work will help to build a wide recognised identity and profile. We will create dissemination materials for the general public that are easy to understand.
2. **Introduce the CAREPATH Solution**. We will develop content for those audiences that need to be targeted directly because they can benefit from what the CAREPATH project has to offer. Creating such content will help build a deeper understanding of the project's work.
3. **Engage Commitment and Action**. It is important to develop content for those audiences that can adopt or use any product/approach/output offered by the CAREPATH project. Creating such content will help those people that are able to act in some way. Decision makers need information that relates to their policymakers (e.g., how and to what level measures contribute to their policy goals).

2.2.2 Targeted audiences' identification and profiling (who?)

The CAREPATH dissemination target groups include:

- **Policymakers** as drivers for the implementation of the recommendations and IT-supported Integrated Care models. The "policy drivers" include the EU government and more specifically national and regional health departments,
- **Public and private healthcare organisations, hospitals and healthcare institutions**, **health insurers** that represent the demand for ICT-based integrated care solutions,
- **Practitioners/prescribers**, which can influence the former for integrating ICT-based Integrated Care systems. Among these, we will target practitioner organizations and associations,
- **ICT providers for the eHealth sector** that can potentially benefit and enhance the platform and can integrate easily into the proposed Integrated Care framework,
- **Academia and research**: healthcare and social researchers,
- **Patients, informal caregivers and society** at large.

Dissemination activities will be performed by all project partners, but they will differ according to their nature. The CAREPATH technological partners will approach relevant stakeholders and their client networks, while the academic and research partners will focus on disseminating the project results towards research institutes and universities across the enlarged Europe.

2.2.3 Dissemination levels and phases (when?)

The dissemination activities will be carried out in three main phases, spanning throughout the project duration and extended beyond it, with an increasing level of intensity. They will start with the creation of general awareness and will conclude with attracting potential supporters and customers/users of the project results. As a result, indicative activities at different stages of the CAREPATH project cycle will include:

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- **At the beginning of the project**: Our aim is to create general awareness and wide dissemination about the project objectives, ideas and approaches at the early stages of the project and get early feedback from the community related to requirements and early design of the architecture. We have drafted the dissemination plan (D8.5) describing the expected impact and deliverables and elaborating of how and to whom the outcomes will be disseminated.
- **During the project**: Our aim for dissemination at this phase is to prove our capabilities and attract potential scientific community, open-source groups, users and potential customers. We will be updating the dissemination plan with recent information on the project and results; contacting relevant media at the local or regional level; conducting regular activities such as information sessions, training, demonstrations, peer review journal and conference articles; assessing the impact on target groups; involving other stakeholders in view of transferring results to end users/ new areas/policies.
- **During the pilot phase and after the project**: Our aim is to present results, prove the benefits, attract potential investors and pave the way for commercialization. We will be continuing further dissemination; developing ideas for future cooperation; evaluating achievements and impact; contacting policymakers; create a market for the product.

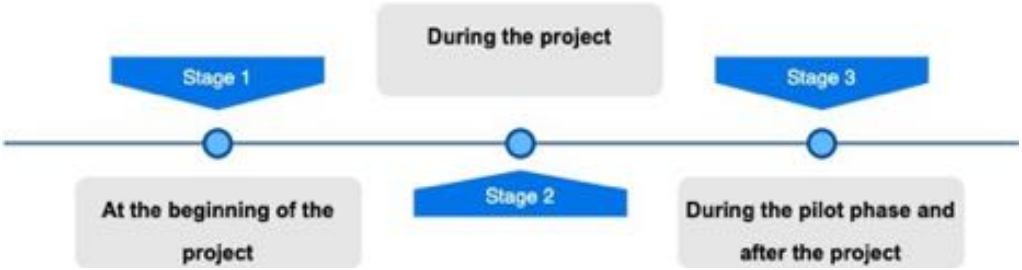

Figure 3. Dissemination Levels and Phases

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2.3 Key Stakeholder Messages

The table below summarises the main messages we seek to convey to the stakeholder groups. Some stakeholder messages are the same but will be delivered in appropriate language and with an appropriate level of clinical or technical detail for each group.

Table 1: Key messages for target audience groups

Target Audience	Key Messages	Communication Channels
Policymakers	Results of the CAREPATH clinical investigation and health economic assessment. Sharing of research and best practice.	Website Multi-stakeholder events Meetings with decision-makers, mainly at the national level
Public and private healthcare organizations, health insurers	The growing challenge of multi-morbidity and burden of dementia across Europe and the need for more integrated personalized care. Implications on healthcare efficiency, outcomes and costs. Availability of CAREPATH solution for adoption by health systems	Website Multi-stakeholder events Dedicated meetings with decision-makers
Health and care professionals	How aligned/holistic guidelines may alter first-line treatment and care planning choices. The knowledge assets of CAREPATH. The integrated care support is provided by the CAREPATH technical components. CAREPATH clinical investigation results. The demonstrated value to patients of the CAREPATH empowerment platform and home/health monitoring platform.	Website Multi-stakeholder events Clinical and healthcare-related conferences
Health ICT industry	The growing scale of multi-morbidity and burden of dementia across Europe and the need for more integrated personalized care. The potential of this as a market driver for interoperability standards, computerized clinical guidelines and AI-based decision support adoption. Details of the CAREPATH technical components e.g. FHIR repository, semantic interoperability tools, care plan management tool, patient empowerment platform, home/health monitoring platform, advanced early warning decision tools, and clinical decision support modules. Commercial relationships	Website Multi-stakeholder events
Academia and research	The Importance of health data and medical Knowledge Integration	Website

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Target Audience	Key Messages	Communication Channels
	CAREPATH approaches to semantic interoperability CAREPATH implementations of data standards and security standards Details of the CAREPATH technical components e.g. FHIR repository, semantic interoperability tools, care plan management tool, patient empowerment platform, home/health monitoring platform, advanced early warning decision tools, and clinical decision support modules. Relevant and novel areas of research in data analytics and AI.	Multi-stakeholder events Health informatics, data science, AI academic conferences and journals
Patients, informal caregivers and society	Explanation of what multi-morbidity is, and how it relates to mild cognitive impairment and dementia. Challenges in care coordination faced by health systems. The benefit of harmonizing clinical guidelines across diseases. Importance of engagement in care planning. Value of health monitoring, prevention and quality of life. CAREPATH solution and results of the clinical intervention.	Website Multi-stakeholder events Targeting of patient organisations and groups for diseases commonly associated with multi-morbidity and dementia

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3 Communication Channels

CAREPATH considers a wide set of outreach means expanding traditional means with interactive and online-based ones. The communication channels are selected to convey the key messages and key outcomes of the project to the stakeholders.

3.1 Visual Identity

The project's visual identity has been used since the beginning of the project (WP1) and is used through various communication channels and products. It includes:

Table 2. CAREPATH Project Visual Identities

Project logo	CAREPATH
Partner logos	ECLEXYS, Fraunhofer FIT, UK OWL Universitätsklinikum OWL der Universität Bielefeld Campus Klinikum Bielefeld, University of Birmingham, NHS University Hospitals Coventry and Warwickshire, sescam, UCLM, ITST, SRDC, Octilium
Template for minutes and reports	

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Template for PowerPoint presentations	
Template for WP deliverables	

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3.2 Project Website

The CAREPATH website (https://www.carepath.care/) is considered the hub for the project dissemination. It is the first point of contact with the project for a wide audience and includes full details of the project objectives, challenges, and the expected outcome of the project.
It also provides highlights of the internal as well as related external activities. Among these activities are monthly blogs, newsletters, events that a member of the project consortium might have attended. Newsletters are prepared and published to the project and subscribers to keep them updated on the project activities, as well as news and activities in the relevant research areas. Newsletters are also available via the project website. So far, we have published two newsletters.
More details about the number of website visitors are shown in the table below.

Figure 4. Website Home Page (10/06/2024)

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Table 3: Project website visitors

Year	Number of visitors	Expected visitors per year
2024 (Jan-Jun)	62160	2000
2023	48011	2000
2022	11264	2000
2021	9000	2000

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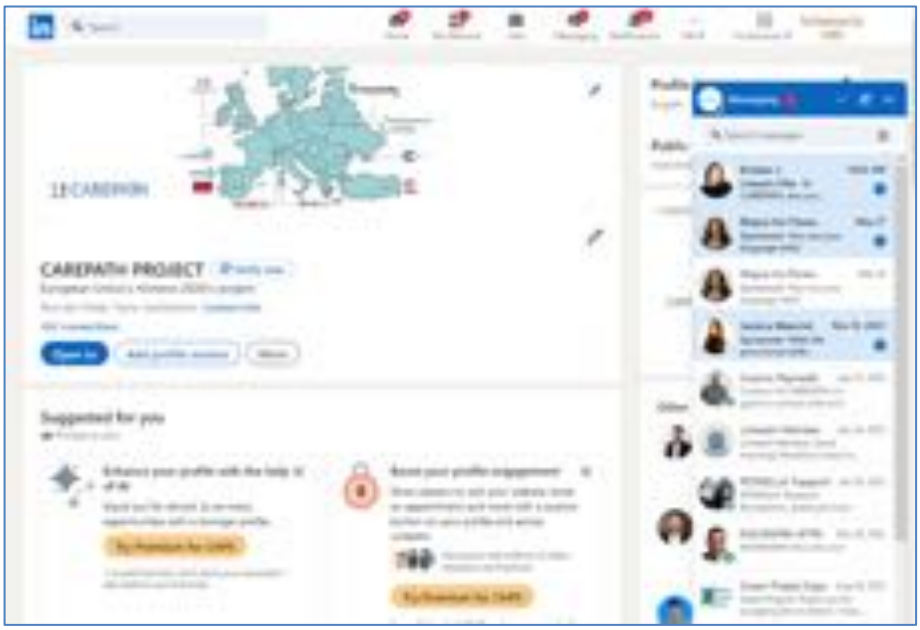
3.3 Social Media

The project has its profiles on the X platform (Former Twitter) (https://X.com/CAREPATH2021) and LinkedIn (https://www.linkedin.com/in/carepath-project/), these channels are used to connect the project with other people outside of the consortium. The project posts its activities and other related topics on these two platforms.

- X (Former Tweeter)

- LinkedIn



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The tables below summarise the social media platform statistics.

Table 4: Social Media Connections

Platform	Number of connected profiles	Expected number of connected profiles throughout the project
LinkedIn	464	200
X (Twitter)*	34	1000

* We acknowledge that we are currently below our target and will implement solutions to address this.

Table 5: Social Media Post Impressions

Platform	Number of posts	Impressions
LinkedIn	35	14654
Twitter	51	7861

The post impressions include activities that consortium members have participated in, project monthly blogs and reposting of other posts that are related to the project activities.

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3.4 CAREPATH Projects Newsletter

Our project 6-monthly newsletter serves as a vital communication channel to keep stakeholders informed about the CAREPATH Project. In each edition, we highlight key developments, research findings, and upcoming events. Here's what you can expect from our newsletters:

1. **Project Updates:**
   - Stay up-to-date with the latest progress, including milestones achieved, new collaborations, and breakthroughs.
   - Learn about ongoing research activities and how they contribute to our overall goals.

2. **Technical Insights:**
   - Dive into the technical aspects of our work. We'll share insights into algorithms, data models, and innovative solutions.
   - Explore how the CAREPATH approach addresses complex challenges in healthcare.

3. **Stakeholder Spotlights:**
   - Meet the people behind the project! Our newsletters feature interviews with team members, partners, and early adopters.
   - Discover their perspectives, experiences, and contributions.

4. **Events and Webinars:**
   - Find out about upcoming workshops, webinars, and conferences related to the project.
   - Participate, learn, and engage with the CAREPATH community.

5. **Call to Action:**
   - We encourage feedback, questions, and collaboration. Let's build a vibrant network together!
   - Reach out to us via the provided contact details.

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Figure 5. CAREPATH newsletter sample

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3.5 Multimedia Production (Animation Video Production strategy and plan)

The consortium will use online channels such as YouTube, to publish informative and demonstration videos and animations of the CAREPATH solution.

3.5.1 Features and Benefits

1. **Visual Storytelling:**
   - Animation allows us to convey complex ideas visually.
   - Abstract concepts become more accessible and engaging.
2. **Creative Freedom:**
   - Animation transcends real-world limitations.
   - We can create imaginative scenes, characters, and environments.
3. **Universal Appeal:**
   - Animated videos resonate with diverse audiences, regardless of language or culture.
   - They evoke emotions and leave a lasting impression.
4. **Explaining Abstract Ideas:**
   - Use animation to simplify technical topics.
   - Visual metaphors enhance understanding.
5. **Brand Consistency:**
   - Animated branding elements reinforce our identity.
   - Consistent visuals build recognition.

3.5.2 Steps in Animation Video Production

1. **Concept and Script:**
   - **Idea Generation:** Brainstorm concepts and themes.
   - **Scriptwriting:** Craft a concise, engaging script.
   - **Storyboarding:** Plan visual sequences.
2. **Design and Assets:**
   - **Character Design:** Create unique characters.
   - **Backgrounds and Props:** Design environments and objects.
   - **Voiceover Casting:** Choose suitable voices.
3. **Animation Production:**
   - **2D or 3D Animation:** Animate characters and scenes.
   - **Timing and Pacing:** Ensure smooth transitions.
   - **Sound Effects:** Add audio cues.
4. **Post-Production:**
   - **Editing:** Assemble animation sequences.
   - **Music and Soundtrack:** Enhance the emotional impact.
   - **Colour Grading:** Adjust colours for mood.
5. **Distribution and Promotion:**
   - **Platform Selection:** Decide where to showcase the animation (website, social media, YouTube).
   - **Engage Your Audience:** Encourage sharing and interaction.

3.5.3 3rd Party Video Production Partner

To produce the video for the CAREPATH project, after negotiating and analysing a couple of companies, we made a contract with the PIX Videos Production Company S.L. (pix-

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videos.com) based in Spain. The video aims to effectively disseminate the results and experiences of the CAREPATH project to a wide audience. Below is a detailed account of the steps taken, current status, and next phases in the video production process.
As per the contract dated September 27th, 2023, with the PIX Videos Production Company S.L., the following key activities are covered:

- **Script and Action on Screen**: Development and feedback incorporation.
- **Illustration Design**: Creation of high-quality 2D or 3D illustrations.
- **Animation and Sound Effects**: Production of engaging motion graphics and integration of sound effects.
- **Professional Voiceover and Background Music**: Selection and integration of appropriate voiceovers and music.
- **Subtitles**: Provision of subtitles in multiple languages (English, Romanian, Spanish, and German).

3.5.4 Video Production Progress Timeline and Milestones

- Initial Phase: February - Early May

1. **Project Commencement**:
   - Although we have started working on various parts of this task and prepared the required documents, the project's contract with a 3rd party company officially began in February 2024, initiating the scriptwriting and conceptualization phase.
2. **Script Development and Feedback Cycles**:
   - A draft script was developed and circulated among project partners for feedback.
   - Feedback was received in multiple cycles, with significant inputs and revisions culminating in a final version ready for action on-screen by May 9th 2024.

- Mid-Phase: May - Early June

1. **Finalization of Script and Action on Screen**:

   - The final document outlining the action on screen was delivered on May 14th 2024.
   - Additional feedback was received and incorporated on May 14th, May 29th, and June 4th.
   - The completely updated version, including the VIVIFRAIL program details, was finalized and delivered on June 5th 2024 as the final input to the document.
   - The final document is attached to this document as an appendix. Current Phase: June - Mid-July

2. **Illustration Development:**

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- We are currently working on the sample illustrations, which delivered on 10th June 2024.
- The full panel of illustrations is ready and is under review until the end of June.

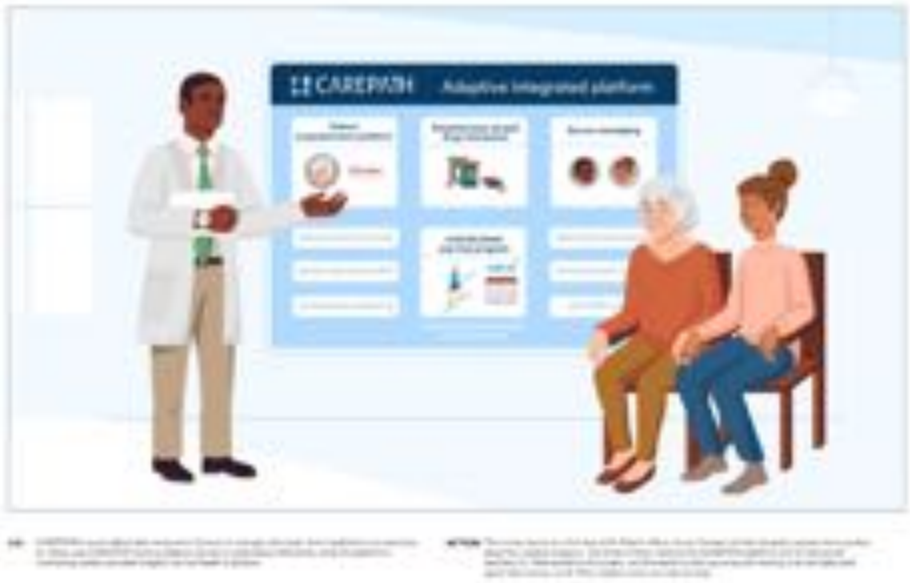

Figure 6. Sample CAREPATH illustration

3.5.5 Next Steps in the Video Production Process

- Finalizing Illustration Delivery
  - **Objective**: Provide a series of sample illustrations for review and finally for approval.
  - **Status**: In progress
- Full Panel of Illustrations
  - **Objective**: Complete the full set of illustrations for the entire 3-minute video.
  - **Timeline**: Expected completion by the end of June, pending timely feedback.
- Animation Phase
  - **Objective**: Transition from static illustrations to animated sequences.
  - **Timeline**: Scheduled to commence immediately after the illustration phase, with the first version of the video anticipated by mid-July.

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3.6 Blogs

Blog posts are published by consortium partners with a frequency of at least once per month, on the project website (https://www.carepath.care/articles), on LinkedIn and X (Twitter),Table 6.

Table 6. CAREPATH Blog Posts

Publication	Title	Impr. in X[1]	Impr. In Linkedin[2]
October 2021	Sustainable care for multimorbid elderly patients with mild cognitive impairment	117	-
December 2021	Pain Assessment in Patients with Minimal Cognitive Deficit and Mild Dementia	65	-
January 2022	Security, Ethics, Legal and Privacy aspects of AI in the Health domain	228	-
February 2022	Dementia, Comorbidity and ICTs	210	-
March 2022	The challenge of reconciling multiple clinical guidelines in the context of multi-morbidity	98	-
May 2022	The role of economic evaluation in the CAREPATH project	55	-
June 2022	Patient Empowerment Platform for older multimorbid patients with mild dementia or mild cognitive impairment (MCI)	164	-
August 2022	Machine Learning for dementia early detection	142	270
October 2022	Clinical Decision Support Systems (CDSSs) and their applications in daily clinical practice and CAREPATH project	363	520
November 2022	Security aspects of AI in the Healthcare sector	134	423
December 2022	CAREPATH: Converting Polypharmacy Guidelines into Computer Interpretable Rules	357	1168
January 2023	Silver surfers versus low digital literacy among older people	44	530
First reporting period ↑	Second reporting period ↓		
June 2023	Software as Medical Device (SaMD)	-	1550
July 2023	The ethics of artificial intelligence in healthcare	-	1627
August 2023	CAREPATH: the need for new guidelines in multimorbid older adults with mild cognitive impairment or mild dementia	-	430
September 2023	Economic evaluation of technology-based interventions for people with dementia care support and their caregivers: Current situation	26	140
October 2023	The relevance of digital accessibility for seniors	-	264
November 2023	The CAREPATH Approach for Enhancing Medication Management for Older Adults with Cognitive Impairment: Innovations and Challenges	-	-
December 2023	Safeguarding eHealth: Cybersecurity in IoT	-	-
January 2024	Exploring the Top Smart Bracelets with Open Data Access	18	340
February 2024	CAREPATH: Usability of eHealth Apps for Elderly and Persons with Disabilities	13	461
April 2024	Digitalization in the healthcare sector in Germany: current status	18	640
April 2024	Enhancing Elderly Care with Home Automation and Environmental Sensors: A Benefit for Patients with Mild Cognitive Dementia and Multimorbid Conditions	125	445
May 2024	Navigating the Complex Terrain of Drug-Drug Interactions: Leveraging ICT and CDS for Safer Prescribing	20	246
May 2024	The role of Library & Knowledge Services in Modern Healthcare Research	31	361

[1] Figures are updated at 15 June 2024
[2] Ibidem

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3.7 Publications

This section includes classical means of knowledge transfer such as articles in topic-specific journals, brochures, publications in broadcast media and business papers focusing on the dissemination of the project results, mainly to experts and professionals. It will increase the level of information needed and involvement and invite the interactive participation of interested parties. It will guarantee a high degree of knowledge promotion within targeted groups. (A sample of all published articles is attached in **Appendix 2. CAREPATH publications)**

Publication in the second reporting period:

- **2024**
  - Advancing Healthcare through Interoperability: Implementing Scalable Solutions for Patient Data Integration (Accepted)

    Authors: Shramika GOUR, Ashley PEAKE, Chao TONG, James CHURM, Bilal AHMAD, Omid POURNIK, Theodoros N. ARVANITIS
    Publication date: Accepted for publication in MIE 2024
    Journal: IOS Press

  - Accessible, Smart and Integrated Healthcare Systems for Elderly and Persons with Disabilities (accepted)

    Authors: Yehya Mohamad, Carlos A. Velasco
    Publication date: 12 July 2024 (Accepted in ICCHP 24, JKU)
    Journal: Springer Nature

  - Developing a Help Desk Service for Enhanced Coordination in Health Informatics Projects: A Sharepoint and Power Automate Approach (Accepted)

    Authors: Omid POURNIK, Bilal AHMAD, Shramika GOUR, Ashley PEAKE, Chao TONG, James CHURM and Theodoros N. ARVANITIS
    Publication date: Accepted for publication in MIE 2024
    Journal: IOS Press

  - Transforming evidence-based clinical guidelines into implementable clinical decision support services: the CAREPATH study for multimorbidity management (1)

    Authors: Mert Gencturk, Gokce B Laleci Erturkmen, A Emre Akpinar, Omid Pournik, Bilal Ahmad, Theodoros N Arvanitis, Wolfgang Schmidt-Barzynski, Tim Robbins, Ruben Alcantud Corcoles, Pedro Abizanda
    Publication date: 2024/5/27
    Journal: Frontiers in Medicine

- **2023**
  - Interoperable E-Health System Using Structural and Semantic Interoperability Approaches in CAREPATH (2)

    Authors: Omid Pournik, Bilal Ahmad, Sarah N Lim Choi Keung, Ashley Peake, Shadman Rafid, Chao Tong, Gokce B Laleci Erturkmen, Mert Gencturk, A Emre Akpinar, Theodoros N Arvanitis

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Publication date: 2023
Book: Healthcare Transformation with Informatics and Artificial Intelligence
Pages: 608-611
Publisher: IOS Press

Publication in the first reporting period:

- **2022**
  - Key scenarios, Use Cases & Architecture of an E-health Homecare Instance (3)

    Authors: Yehya Mohamad, Henrike Gappa, Naguib Heiba, Mustafa Yuksel, Carlos A Velasco, Mert Gencturk, Pedro Abizanda, Gokce B Laleci Erturkmen, Antje Steinhoff, Jaouhar Ayadi, Theodoros N Arvanitis, Bilal Ahmad, Omid Pournik, Ioannis Kyrou, George Despotou, Timothy Robbins, Sarah Lim Choi Keung, Khoi Le, Wolfgang Schmidt-Barzynski
    Publication date: 2022/8/31
    Book: Proceedings of the 10th International Conference on Software Development and Technologies for Enhancing Accessibility and Fighting Info-exclusion
    Pages: 25-30

  - Protocol for Creating a Single, Holistic and Digitally Implementable Consensus Clinical Guideline for Multiple Multi-morbid Conditions (4)

    Authors: Timothy David Robbins, Devavratha Muthalagappan, Bridgette O'Connell, Jagdeep Bhullar, Leigh-Jayne Hunt, Ioannis Kyrou, Theodoros N Arvanitis, Sarah N Lim Choi Keung, Helen Muir, Omid Pournik, Antje Steinhoff, Wolfgang Schmidt-Barzynski, Oana Cramariuc, Cristiana A Ciobanu, Gokce B Laleci Erturkmen, Mert Gencturk, Mustafa Yuksel, Elena Gómez-Jiménez, Almudena Avendaño Céspedes, Elisa Belén Cortés Zamora, Ruben Alcantud Córcoles, Pedro Abizanda, Yehya Mohamad, Jaouhar Ayadi, Harpal Randeva
    Publication date: 2022/8/31
    Book: Proceedings of the 10th International Conference on Software Development and Technologies for Enhancing Accessibility and Fighting Info-exclusion
    Pages: 1-6

  - The design of a mobile platform providing personalized assistance to older multimorbid patients with mild dementia or mild cognitive impairment (MCI) (5)

    Authors: Mert Gencturk, Gokce B Laleci Erturkmen, Henrike Gappa, Wolfgang Schmidt-Barzynski, Antje Steinhoff, Pedro Abizanda, Timothy Robbins, Omid Pournik, Bilal Ahmad, Harpal Randeva, Oana Cramariuc, Theodoros N Arvanitis, Jaouhar Ayadi, Yehya Mohamad, Mustafa Yuksel
    Publication date: 2022/8/31
    Book: Proceedings of the 10th International Conference on Software Development and Technologies for Enhancing Accessibility and Fighting Info-exclusion
    Pages: 37-43

  - CAREPATH methodology for development of computer interpretable, integrated clinical guidelines (6)

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Authors: Omid Pournik, Bilal Ahmad, George Despotou, Sarah N Lim Choi Keung, Yehya Mohamad, Henrike Gappa, Gokce B Laleci Erturkmen, Mustafa Yuksel, Mert Gencturk, Wolfgang Schmidt-Barzynski, Antje Steinhoff, Timothy Robbins, Ioannis Kyrou, Harpal Randeva, Jaouhar Ayadi, Theodoros N Arvanitis, Rubén Alcantud Córcoles, Pedro Abizanda, Khoi Le, Elena Gómez Jiménez, Almudena Avendaño Céspedes, Ezgi Kaba, Helen Muir
Publication date: 2022/8/31
Book: Proceedings of the 10th International Conference on Software Development and Technologies for Enhancing Accessibility and Fighting Info-exclusion
Pages: 7-11

- CAREPATH: developing digital integrated care solutions for multimorbid patients with dementia (7)

  Authors: Omid Pournik, Bilal Ahmad, Sarah N Lim Choi Keung, Omar Khan, George Despotou, Angelo Consoli, Jaouhar Ayadi, Luca Gilardi, Gokce Banu Laleci Erturkmen, Mustafa Yuksel, Mert Gencturk, Henrike Gappa, Martin Breidenbach, Yehya Mohamad, Carlos A Velasco, Oana Cramaiuc, Cristiana Ciobanu, Elena Gómez Jiménez, Almudena Avendaño Céspedes, Rubén Alcantud Córcoles, Elisa Belén Cortés Zamora, Pedro Abizanda, Antje Steinhoff, Wolfgang Schmidt-Barzynski, Timothy Robbins, Ioannis Kyrou, Harpal Randeva, Lionello Ferrazzini, Theodoros N Arvanitis
  Publication date: 2022
  Journal: Advances in Informatics, Management and Technology in Healthcare
  Volume: 295
  Pages: 487-490
  Publisher: IOS Press

- Making person-centred health care beneficial for people with mild cognitive impairment (MCI) or mild dementia – results of interviews with patients and their informal caregivers (8)

  Authors: Henrike Gappa, Yehya Mohamad, Martin Breidenbach, Pedro Abizanda, Wolfgang Schmidt-Barzynski, Antje Steinhoff, Timothy Robbins, Harpal Randeva, Ioannis Kyrou, Oana Cramariuc, Cristiana Ciobanu, Theodoros N. Arvanitis, Sarah N. Lim Choi Keung, Gokce Banu Laleci Ertürkmen, Mert Gencturk, Mustafa Yüksel, Jaouhar Ayadi, Luca Gilardi, Angelo Consoli, Lionello Ferrazzini & Carlos A. Velasco
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  Journal: Advances in Informatics, Management and Technology in Healthcare
  In: Miesenberger, K., Kouroupetroglou, G., Mavrou, K., Manduchi, R., CovarrubiasRodriguez, M., Penáz, P. (eds.) ICCHP-AAATE 2022. LNCS
  Volume: 13341
  Pages: 468-474
  Publisher: Springer, Cham (2022). https://doi.org/10.1007/978-3-031-08648-9_(8)

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3.8 Conference Participations

Conference participation in the second reporting period:

- **21st International Conference on Informatics, Management and Technology in Healthcare (ICIMTH23), Athens, Greece, 1-3 July 2023**

Omid Pournik (UoB) presented the project at this conference in Greece.
O Pournik, B Ahmad, S Lim Choi Keung, A Peake, R Shadman, C Tong, GB Laleci Erturkmen, M Gencturk, AE Akpinar, TN Arvanitis
Title: Interoperable E-Health System using Structural and Semantic Interoperability Approaches in CAREPATH

Figure 7. Dr Omid Pournik presenting at ICIMTH 2023

Conference participation in the first reporting period:

- **18th International Congress of the European Geriatric Medicine Society, London, United Kingdom, 28-30 September 2022**

Rubén Alcantud Córcoles (SESCAM) gave a presentation on the work in WP6 on "Clinical guidelines and best practices to improve the management of elderly patients with dementia and multimorbidity. A systematic review".

Figure 8. Screenshot of event website: https://eugms2022.com/

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Figure 9. Rubén Alcantud Córcoles presenting at 2020 EuGMS

- **Software Development and Technologies for Enhancing Accessibility and Fighting Info-exclusion Conference (DSAI 2022), Lisboa, Portugal, 31 August 31 – 2 September 2022**

  Yehya Mohamad and Carlos Velasco (Fraunhofer) organized a special track at DSAI 2022 on Accessible, Smart, and Integrated Healthcare Systems for Elderly and Disabled People. The special track brought together contributions from international researchers and practitioners focusing on design, development, testing and application of information technologies to healthcare sector, pervasive, mobile, and ubiquitous healthcare systems, pandemic research, accessibility, usability and user experience of medical apps & devices, human behaviour, integrated healthcare approaches, patient empowerment systems, eHealth data standards and interoperability (e.g. HL7/FHIR), medical device and clinical investigation regulatory frameworks, as well as privacy and security.
  8 papers were presented, 6 of them from Horizon 2020 projects:
  CAREPATH with 4 papers: https://www.carepath.care/
  ESCAPE with 1 paper: https://escape-project.org/
  ADLIFE with 1 paper: https://adlifeproject.com/

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Figure 10. Screenshot of conference website: **http://dsai.ws/2022**

The 4 papers presented from CAREPATH:

- CAREPATH Protocol for Creating a Single, Holistic and Digitally Implementable Consensus Clinical Guideline for Multiple Multi-morbid Conditions, by Tim R. Robbins et al., presented by Tim Robbins (UHCW) on the work in WP6.
- CAREPATH methodology for development of computer interpretable, integrated clinical guidelines, by Omid Pournik et al., presented by Omid Pournik (WARWICK) on the work in WP3.
- Key scenarios, Use Cases & Architecture of an E-health Homecare Instance, by Yehya Mohamad et al., presented by Yehya Mohamad (Fraunhofer) on the work in WP2.
- The design of a mobile platform providing personalized assistance to older multimorbid patients with mild dementia or mild cognitive impairment (MCI), by Mert Gencturk et al., presented by Mert Gencturk (SRDC) on the work in WP4.

- **20th International Conference on Informatics, Management and Technology in Healthcare (ICIMTH22), Athens, Greece, 1-3 July 2022**

  Omid Pournik (WARWICK) presented the project at this informatics conference in Greece.

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Pournik, O., Ahmad, B., Lim Choi Keung, S. N., Khan, O., Despotou, G., Consoli, A., Ayadi, J., Gilardi, L., Laleci Erturkmen, G. B., Yuksel, M., Gencturk, M., Gappa, H., Breidenbach, M., Mohamad, Y., Velasco, C. A., Cramariuc, O., Ciobanu, C., Gómez Jiménez, E., Avendaño Céspedes, A., Alcantud Córcoles, R., … Arvanitis, T. N. (2022). CAREPATH: Developing Digital Integrated Care Solutions for Multimorbid Patients with Dementia. Studies in health technology and informatics, 295, 487–490. https://doi.org/10.3233/SHTI220771

- **Joint International Conference on Digital Inclusion, Assistive Technology & Accessibility (ICCHP-AAATE 2022), Lecco, Italy, 11-15 July 2022**

  Henrike Gappa (Fraunhofer) presented WP2 work, to understand the user requirements of patients and their informal caregivers and was achieved in CAREPATH by interviews.
  Gappa, H. et al. (2022). Making Person-Centred Health Care Beneficial for People with Mild Cognitive Impairment (MCI) or Mild Dementia – Results of Interviews with Patients and Their Informal Caregivers. In: Miesenberger, K., Kouroupetroglou, G., Mavrou, K., Manduchi, R., Covarrubias Rodriguez, M., Penáz, P. (eds) Computers Helping People with Special Needs. ICCHP-AAATE 2022. Lecture Notes in Computer Science, vol 13341. Springer, Cham. https://doi.org/10.1007/978-3-031-08648-9_54

Figure 11. Screenshot of website: **https://www.icchp-aaate.org/**

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- **International Conference on Informatics Revolution for Smarter Healthcare (IRSH'2021), 14-15 October 2021**

  At this virtual conference, Angelo Consoli (EXYS) and Tim Robbins (UHCW) gave a keynote on "Sustainable care for multimorbid elderly patients with mild cognitive impairment".
  Abstract:
  The provision of effective health and social care for people with multi-morbidity represents one of the greatest emerging challenges for both healthcare and health-tech providers. Where dementia is present within the multi-morbid conditions, there are additional challenges related to cognitive decline. CAREPATH represents an ambitious EU-funded Horizon 2020 project that proposes an ICT-based solution for the treatment and management of multimorbid patients with mild cognitive impairment or mild dementia. In this presentation, we consider the technical ICT-based privacy, data compliance, data processing and security constraints relevant to multimorbidity care in the context of cognitive impairment alongside a consideration of how these interact with front-line clinical challenges.

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3.9 Events Participations

Interactive dissemination offers a chance for personal interaction in academic, commercial and socio-economic conferences and workshops, EU-organised events, trade fairs and exhibitions. It is intended for target groups with a high level of information need and involvement and provides information tailored to highly targeted audiences. It also includes possible interviews in radio or TV stations, as well as concertation activities with other European and/or International funded projects in the domain, which shall be established timely, to ensure a useful exchange and could take the form of a common workshop.

Event participation in the second reporting period:

- **Fraunhofer FIT is going to present CAREPATH at the final event of the VR2CARE project, a Horizon2020-funded project. This is part of synergy building between Horizon2020 research projects targeting elderly and disabled persons.**

Figure 12. Fraunhofer FIT is going to present CAREPATH at the final event of VR2CARE project

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- **DMEA Trade Fair April 2023 & 2024 Halle 2.2 B, booth D 107[3]: The Fraunhofer team presented concepts and prototypes of CAREPATH 2023 and 2024 at the DMEA trade fair. DMEA is one of Europe's most important events for digital health. Experts from the digital health industry meet in Berlin. In addition to a comprehensive market overview, DMEA offers all players a wide range of opportunities for intensive exchange, targeted networking and effective customer acquisition.**

Figure 13. DMEA Trade Fair April 2023 & 2024, The Fraunhofer team presented concepts and prototypes of CAREPATH

[3] https://www.dmea.de/de/

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Event participation in the first reporting period:

- **MEDICA 2022, medical trade fair, Düsseldorf, Germany, 14-17 November 2022**

  Yehya Mohamad (Fraunhofer) has participated in this event and has been talking about the CAREPATH project in his presentations.
  More than 81,000 visitors from various sectors of the global healthcare industry came to Düsseldorf, Germany, to attend MEDICA 2022, the world's leading medical trade fair, and COMPAMED 2022, the international No. 1 for the medical technology supply sector.

Figure 14. Screenshot of event website: **https://www.medica-tradefair.com/** (left); Yehya Mohammad (right in photo) at the event (right)

- **Quality Circle, GP Initiative meeting, Bielefeld, Germany, 16 November 2022**

  Wolfgang Schmidt-Barzynski (SKB) presented the CAREPATH project to a group of about a dozen General Practitioners in the region of Bielefeld, Germany, at their quality circle meeting. This introduction to the project has provided key information about the project and study for the involvement of these healthcare professionals and support in recruiting patients to the study.

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3.10 Collaborations and Networks

3.10.1 Related Projects

Projects related to CAREPATH are continuously being identified to raise awareness of innovations and shared lessons within the project, as well as to increase potential collaborations. We monitor other projects working in the same clinical or technical fields and do our best to collaborate with them.
As described before, a joint workshop was organized that featured three EU projects focused on integrated care. In addition to CAREPATH, the other two projects included were ADLIFE and ESCAPE.
Another relevant project we found was VIVIFRAIL. The Vivifrail project is an international reference program for the promotion of physical exercise, targeting community and hospital interventions to prevent frailty and falls in the elderly. Now we are using their product as part of our PEP module.

Table 7. Projects Connected to CAREPATH

Relevant projects	
ESCAPE	ESCAPE: Evaluation of a patient-centred biopsychosocial blended collaborative care pathway for the treatment of multi-morbid elderly patients (H2020-SC1-BHC-2018-2020)
GERONTE	GERONTE: Streamlined Geriatric and Oncological evaluation based on IC Technology for holistic patient-oriented healthcare management for older multimorbid patients (H2020-SC1-BHC-2018-2020)
ADLIFE	ADLIFE: Integrated Personalized Care for Patients with Advanced Chronic Diseases to Improve Health and Quality of Life (H2020-SC1-DTH-2019)
OPEN DEI	OPEN DEI: Aligning Reference Architectures, Open Platforms and Large-Scale Pilots in Digitising European Industry (H2020-DT-2018-2)
VIVIFRAIL	VIVIFRAIL: PROMOTE PHYSICAL EXERCISE IN FRAIL ELDERLY https://vivifrail.com/ (556988-EPP-1-2014-1-ES-SPO-SCP)
INTEGRATE4CARE	INTEGRATE4CARE: Digital integrated health and social care with IT-supported home care counseling visits as specified in §37.3 SGB XI - funded by the European Union from the European Regional Development Fund (EFRE) and the State of Rhineland-Westphalia (Germany) (grant agreement number EFRE-0801905).

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VR2CARE	The VR2Care is a Horizon2020 funded project. The target user group is elderly and the ecosystem of VR2CARE is a technological response to the factors that condition the practice of physical exercise, designed using co-creation methodologies. https://www.vr2care.eu/ H2020-ICT-2019-3 GRANT AGREEMENT 951978
WARIFA	WARIFA is focused on the prevention of melanoma skin cancer, complications of diabetes and lifestyle risk factors for chronic conditions. AI-based combined early risk assessment can empower citizens to adopt healthier habits and a better lifestyle by providing personalized recommendations on how to change their risk behavior. The benefits of early risk assessment, prevention and intervention will be evident at both individual and healthcare levels. **https://www.warifa.eu**

3.10.2 Standardisation

CAREPATH seeks to raise awareness and contribute to relevant standardization work from its project results. CAREPATH is involved in ISO standardisation, by having some project members on the British Standards Institution (BSI Group) IST/35 - Health Informatics Committee and promoting know-how in the development of specific standards in the domain of health informatics. Through BSI/IST/35, there is association and routes to the International Organization for Standardization (ISO) and in particular to the ISO/TC 215/Health Informatics Committee. Some of the work can provide input to the following working groups: ISO/TC 215/WG 01 "Architecture, Frameworks and Models", ISO/TC 215/WG 02 "Systems and Device Interoperability" and ISO/TC 215/WG 04 "Security, Safety and Privacy".
To ensure the sustainability and impact of research, CAREPATH partner Fraunhofer has been involved since 15 years in different Working Groups of the World Wide Web Consortium (W3C). The World Wide Web Consortium (W3C) is an international community where Member organizations, full-time staff, and the public work together to develop Web standards. Led by Web inventor Tim Berners-Lee, W3C's mission is to lead the Web to its full potential. Fraunhofer participation also ensures that its teams are up-to-date with the leading-edge developments of the web and can influence new directions of the web in collaboration with leading industrial partners.
Additionally, CAREPATH, through its members, is involved in a CEN Workshop Agreement (CWA 17933) entitled “Digital Health Innovations — Good practice guide for obtaining user consent for personal health information”. The CWA will define a guideline for obtaining the most suitable consent for the use of digital health innovations. The guideline will describe which aspects should be considered when asking for consent. It will also cover the usability of a consent form especially regarding the patient-friendly presentation of informed consent choices. Another aspect of this CWA will focus on how to handle the subject’s access

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requests or withdrawal during a pilot evaluation. The planned CWA (to be completed in 2023) is intended to be used as a guideline for Horizon Europe research and innovation projects and other market participants when consent is needed for the use of digital health innovations.

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4 Dissemination and Communication Plan

In the next period of the project, the following dissemination and communication activities are being planned.

4.1 Publication Plan

Several manuscripts are currently in progress for publication in journals:

- Subject: A scientific paper presenting the CAREPATH architecture at a high level and its association with the policy recommendations

  Authors: Not yet finalized (Lead by SRDC)
  Publication status: Invited paper by European Society of Medicine
  Journal: Medical Research Archive

- Leveraging Drools Workbench for Effective Clinical Decision Support System Design

  Authors: Chao TONG, Omid POURNIK, Shramika GOUR, Ashley PEAKE, , James CHURM and Theodoros N. ARVANITIS, Gokhan YILMAZ, Jessica CABALLERO GARCIA, Araitz LARGO ARANA
  Publication status: Plan for submission in DSAI2024
  Journal: ACM Press

- Advancing Healthcare through Interoperability: Implementing Scalable Solutions for Patient Data Integration (Accepted, awaiting publication)

  Authors: Shramika GOUR, Ashley PEAKE, Chao TONG, James CHURM, Bilal AHMAD, Omid POURNIK, Theodoros N. ARVANITIS
  Publication status: Accepted for publication in MIE 2024 by UoB
  Journal: IOS Press

- Developing a Help Desk Service for Enhanced Coordination in Health Informatics Projects: A Sharepoint and Power Automate Approach (Accepted, awaiting publication)

  Authors: Omid POURNIK , Bilal AHMAD, Shramika GOUR, Ashley PEAKE, Chao TONG, James CHURM and Theodoros N. ARVANITIS
  Publication status: Accepted for publication in MIE 2024 by UoB
  Journal: IOS Press

4.2 Dissemination Plan

In the next period, the following dissemination activities will be organized:

- Pilot site partners will be planning public information events in order to recruit patient and general physician participants to take part in the Clinical Investigation.
- Continue to publish regular blog posts and newsletters.
- Finalizing video production and other demonstrations of the CAREPATH solution.

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- Participating at Medica 2024 https://www.medica-tradefair.com/ and presenting CAREPATH there

The following conferences/events are being targeted for future dissemination activities by the project:

- Medical Informatics Europe 2024, https://www.mie2024.org/
- ISIH 2024 - Intelligence, Sustainability, and Innovation in Healthcare https://confscience.com/isih
- DSAI'24 — Software Development and Technologies for Enhancing Accessibility and Fighting Info-exclusion https://dsai.ws/2024/
- International Conference on Computers Helping People with Special Needs - ICCHP 24, JKU Linz, Austria, July 8 -12, 2024 https://www.icchp.org/

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5 Conclusions

In this deliverable, we have outlined the project dissemination strategy for communicating the project's results and progress. We have identified the key stakeholders and started to develop the key messages for each group and the communication channels to use.
During the first and second reporting periods, the project members have participated in a number of conferences, workshops, exhibitions and meetings to raise awareness of the project and to communicate the results so far. The project has also identified related projects for collaborations in similar topic areas and has contributed to standardization work.
Finally, we describe the dissemination plan for the next period with targeted events and publications in the pipeline.

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Appendices

Appendix 1. CAREPATH final on-screen Script and action

CAREPATH

Script and action on screen

Carmen, 80 years old, was recently diagnosed with mild dementia, only 3 years after being diagnosed with diabetes and heart failure. While waiting for the scheduled appointment with her doctor, Carmen and her daughter Anna were preparing for the worst.
The video opens with a full shot of Carmen, an older white woman appearing in her 60s, and her daughter Anna, a young woman of mixed ethnicity in the waiting room of Dr. Peter's office, sharing an intimate moment with expressions of concern on their faces. Carmen appears tired and sad, while her daughter Anna looks deeply worried. As the narration discusses Carmen's health diagnosis, we see a close-up of her hands holding documents and medical records. Both characters then look at each other.

The EU's healthcare system recognises its limitations in effectively managing the care of patients with multiple conditions, especially when dementia is involved. Currently, healthcare providers lack the resources needed to provide personalized treatment for the multiple patients they see every day. With an ageing population, managing these diverse medical needs is becoming increasingly critical. There are currently 9.1 million patients over the age of 60 who are living with dementia in the EU alone.
A silhouette of Europe with the health symbol inside appears on screen. When it mentions patients with dementia, the silhouette of a head appears, and an abstract ball with tangled and intertwined lines (representing confusion and forgetfulness) emerges inside it. The scene then shows doctors demonstrating denial or sadness to their patients receiving the news in a somber manner. Following this, silhouettes of characters gradually appear one by one, depicting elderly individuals with different genders and physiques. The camera pans upward to reveal the text "9.1 million patients" above them.

CAREPATH is a groundbreaking project that uses innovative Information and Communication Technologies solutions to address the complex healthcare needs of older adults, just like Carmen, who suffers from multiple health conditions, particularly mild cognitive impairment or mild dementia.
With a seamless transition, the CAREPATH logo appears on screen, followed by Carmen smiling as she observes this new solution.

At its core, CAREPATH adopts a patient-centered integrated care approach. This means developing a flexible and modular system that considers each patient's unique needs while providing tailored interventions to enhance their quality of life and independence.
Carmen's face becomes an icon and moves to the center of the frame. Various puzzle pieces appear around her, each containing some of Carmen's needs like medication (represented by some tablets, a glass of water and a clock), exercise (we see some exercise accessories), nutrition (we see some healthy diet ingredients according to Carmen's profile), and cognitive stimulation (we see some abstract balls like the one previously shown with minimalist representation of mental activity, like memory exercises, puzzles, and crosswords. These are related to gamification). These pieces slightly change shape, rotate, and fit together to demonstrate the flexibility and modular quality of CAREPATH. The pieces come together in the center and fit perfectly.
On the screen, we see the title "Recommendations for Carmen" centered at the top.

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For instance, clinicians can create personalised patient care plans, utilising clinical decision support recommendations within the Adaptive Integrated Care Platform, or AICP. Patients themselves can access their individualised care plans through the Patient Empowerment Platform, allowing them to review their care plan's daily tasks, like medication intake and exercising, report symptoms and message care team members, among other uses.
Next, we see Dr. Peter, a black middle-aged man, holding a document in his hands. Behind him, there is a screen displaying the text "Adaptive Integrated Platform" and a minimalist representation of the platform. When the voice says "Patients themselves can access…" Dr. Peter exits the frame, and then all the services appear, one by one:

1. "Patient Empowerment Platform", with Carmen's name (when we hear "through the patient empowerment platform").
2. "Polypharmacy drug & drug interaction" with a list of medications appearing on screen and "Individualized exercise program" with the text on screen: "Based on the international VIVIFRAIL program" along with the VIVIFRAIL logo and an illustration of specific types of exercise designed to Carmen's functional capacity. On the side, a calendar checking the remaining tasks (when we hear "medication intake and exercising")
3. "Secure messaging with care team members and patients", with Dr. Peter and Anna appearing as an icon on screen and smiling (when we hear "Message care team members")
4. "Advanced Early Warning Smart Decisions Tools", "Intrinsic Dementia Profile", "Home/Health Monitoring Platform", "Clinical Decision Support Services", "Remaining Tasks Calendar", all these appear a little bit faster to complete the layout of the platform (when we hear "Among other uses").

Moreover, patients can use medical devices for home measurements in their routine, contributing to their monitoring and management. Through placed sensors within patients' homes, CAREPATH collects live patient data, allowing clinicians to see care plan adherence, intrinsic capacity, health and home parameters, as well as early warnings in AICP, facilitating a change in the care plan accordingly.
On the screen, we see Carmen's wrist wearing a smartwatch that tracks her vital signs. This image is enclosed in a frame that moves to the left, revealing a second frame with environmental/domotic sensors. The two frames then shift again, making way for three images of Carmen around her home: one where she looks a bit lost inside her bathroom, another showing her having a fall in the kitchen, and a third where she is sleeping, and on her bedside table there's a family portrait of her with a young Anna and her late husband, a black man. We can observe how real-time data is collected and how adjustments are made to Carmen's personal plan.

Carmen will start her CAREPATH journey guided by Dr. Peter and supported by her daughter Anna. CAREPATH's personalized care plan empowers Carmen to manage daily tasks, from medications to exercises. Dr. Peter uses CAREPATH tools to balance Carmen's medications effectively, while the platform's monitoring system provides insights into her health indicators. Carmen and Anna find utility in the platform's educational features, and remote monitoring with Dr. Peter ensures continuous care. Together, they navigate Carmen's health journey with confidence and empowerment.
Dr. Peter is seen smiling and looking to his side. Then, we see a close-up of Anna, smiling back when mentioned in the narration. The scene returns to a full shot of Dr. Peter's office, where Carmen and her daughter appear more positive about her medical situation. The three of them observe the CAREPATH platform and its mentioned sections. Dr. Peter points to the screen, and the sections start growing and moving in an amicable and game-like manner, as Dr. Peter explains each one step by step.
Next, the video shows a medium shot of Carmen and Anna happily looking at the viewer, with Carmen's phone visible within the CAREPATH platform, displaying her name and profile and the "educational features" section clearly visible.

Overall, CAREPATH seeks to enhance the patient's quality of life, improve caregiver support, and optimize healthcare delivery for this vulnerable population.

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The CAREPATH logo is shown in the center, with some of the elderly characters shown before standing below it, happy to have the solution they needed.

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Appendix 2. CAREPATH publications

1. Gencturk M, Laleci Erturkmen GB, Akpinar AE, Pournik O, Ahmad B, Arvanitis TN, et al. Transforming evidence-based clinical guidelines into implementable clinical decision support services: the CAREPATH study for multimorbidity management. Frontiers in Medicine. 2024;11.
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3. Mohamad Y, Gappa H, Heiba N, Yuksel M, Velasco CA, Gencturk M, et al., editors. Key scenarios, Use Cases & Architecture of an E-health Homecare Instance. Proceedings of the 10th International Conference on Software Development and Technologies for Enhancing Accessibility and Fighting Info-exclusion; 2022.
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5. Gencturk M, Laleci Erturkmen GB, Gappa H, Schmidt-Barzynski W, Steinhoff A, Abizanda P, et al., editors. The design of a mobile platform providing personalized assistance to older multimorbid patients with mild dementia or mild cognitive impairment (MCI). Proceedings of the 10th International Conference on Software Development and Technologies for Enhancing Accessibility and Fighting Info-exclusion; 2022.
6. Pournik O, Ahmad B, Despotou G, Lim Choi Keung SN, Mohamad Y, Gappa H, et al., editors. CAREPATH methodology for development of computer interpretable, integrated clinical guidelines. Proceedings of the 10th International Conference on Software Development and Technologies for Enhancing Accessibility and Fighting Info-exclusion; 2022.
7. Pournik O, Ahmad B, Lim Choi Keung SN, Khan O, Despotou G, Consoli A, et al. CAREPATH: developing digital integrated care solutions for multimorbid patients with dementia. Advances in Informatics, Management and Technology in Healthcare. 2022;295:487-90.
8. Gappa H, Mohamad Y, Breidenbach M, Abizanda P, Schmidt-Barzynski W, Steinhoff A, et al., editors. Making Person-Centred Health Care Beneficial for People with Mild Cognitive Impairment (MCI) or Mild Dementia–Results of Interviews with Patients and Their Informal Caregivers. International Conference on Computers Helping People with Special Needs; 2022: Springer.

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Appendix 3. Sample presentation slides and papers

ICIMTH2022 Conference Paper

CAREPATH: developing digital integrated care solutions for multimorbid patients with dementia

Omid POURNIK[a], Bilal AHMAD[a], Sarah N. LIM CHOI KEUNG[a], Omar KHAN[a], George DESPOTOU[a], Angelo CONSOLI[b], Jaouhar AYADI[b], Luca GILARDI[b], Gokce Banu LALECI ERTURKMEN[c], Mustafa YUKSEL[c], Mert GENCTURK[c], Henrike GAPPA[d], Martin BREIDENBACH[d], Yehya MOHAMAD[d], Carlos A. VELASCO[d], Oana CRAMAIUC[e], Cristiana CIOBANU[e], Elena GÓMEZ JIMÉNEZ[f], Almudena AVENDAÑO CÉSPEDES[f,g], Rubén ALCANTUD CÓRCOLES[f], Elisa Belén CORTÉS ZAMORA[f,g], Pedro ABIZANDA[f,g,h], Antje STEINHOFF[i], Wolfgang SCHMIDT-BARZYNSKI[i], Timothy ROBBINS[j], Ioannis KYROU[k], Harpal RANDEVA[l], Licinello FERRAZZINI[b], Theodoros N. ARVANITIS[a,j,1]

[a] *Institute of Digital Healthcare, WMG, University of Warwick, Coventry, UK*
[b] *Eclexys S.A.G.L, Switzerland*
[c] *Software Research Development and Consultancy Cooperation, Ankara, Turkey*
[d] *Fraunhofer Institute for Applied Information Technology FIT, Germany*
[e] *Centrul IT pentru Stiinta si Technologie, Romania*
[f] *Complejo Hospitalario Universitario de Albacete, Servicio de Salud de Castilla-La Mancha (SESCAM), Albacete, Spain*
[g] *CIBERFES, Instituto de Salud Carlos III, Madrid, Spain*
[h] *Facultad de Medicina de Albacete, Universidad de Castilla-La Mancha, Spain*
[i] *Universitätsklinikum OWL, Klinikum Bielefeld, Germany*
[j] *University Hospitals Coventry and Warwickshire NHS Trust, Coventry, UK*
[k] *Octylium, Switzerland*

Abstract. CAREPATH project is focusing on providing an integrated solution for sustainable care for multimorbid elderly patients with dementia or mild cognitive impairment. The project has a digitally enhanced integrated patient-centered care approach clinical decision and associated intelligent tools with the aim to increase patients' independence, quality of life and intrinsic capacity. In this paper, the conceptual aspects of the CAREPATH project, in terms of technical and clinical requirements and considerations, are presented.

Keywords. Clinical Decision Support System, Multimorbidity, Dementia

1. Introduction

In the last decade, development of Clinical Decision Support Systems (CDSSs) has become popular in the health informatics domain[1]. Implementation of CDSS in daily

[1] Corresponding Author, Theodoros N. Arvanitis, International Digital Laboratory, Warwick Manufacturing Group, University of Warwick, Coventry, UK, E-mail: T.Arvanitis@warwick.ac.uk

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medical practices is believed to improve healthcare providers' performance on clinical decision-making, quality of care and patient safety, although there has been disadvantages and limitations in their clinical implications[1]. Meanwhile, healthcare providers face challenges in conciliating recommended tasks and activities of different guidelines in multimorbid patients[2]. The heterogeneity of patients accompanied by the complex nature of their health condition makes the existing guidelines, with disease-oriented approaches incapable of providing the same level of improved patient outcomes in this group of patients[3]. This has highlighted the importance of patient-specific recommendations for multimorbid patients, which are frequently provided through computer-interpretable guidelines (CIGs)[3].

Such co-existence of multimorbid conditions can be very well demonstrated in diagnosis and management of dementia, where most guidelines have focused on managing dementia as a single disease[5]. The existing guidelines have been developed to provide the necessary advice on supporting people with dementia and their caregivers in health and social care, without holistic consideration of their implications on other morbidities and intrinsic capacity of the patient. At the level of "best practice", we are facing increased challenges and difficulties in the use of good clinical guidelines due to the co-existence of dementia with other morbidities[6]. These challenges can include but are not limited to polypharmacy, adverse drug reactions, and frequent non-adherence to treatments[3].

In Europe, the single-disease oriented health system and ageing population, which increases the risk of multimorbidity[7], has affected healthcare costs and efficacy and the sustainability of health systems[8]. When dementia is present, the situation becomes even more complicated[6]. The CAREPATH project is a research project within Horizon 2020 that focuses on the enhancement of healthcare interventions for the management of elderly multimorbid patients suffering from dementia. It aims at developing ICT solutions with integrated patient-centered approaches to care for patients with multimorbidity to increase their independence, quality of life and intrinsic capacity (9). In this paper, we are discussing the conceptual aspects of the CAREPATH project in terms of technical and clinical requirements and considerations.

2. The Holistic CAREPATH Solution

CAREPATH will provide a holistic environment that efficiently addresses multimorbidity and dementia challenge in the elderly population, by delivering three complementary components: (A) A *Home and Health Monitoring* platform implemented at the patients' homes integrated with *Advanced Early Warning Smart Decision Tools*, providing environment aware services with natural and comfortable interfaces for older adults for continuously collecting real time data for early detection of onset and changes in functioning, autonomy, underlying cognitive and physiological functions and to derive dementia profiles and intrinsic capacity of these patients, (B) A *Patient Empowerment Platform* providing personalized assistance to the patients, guidance and reminders about care plan goals and activities, present educational materials for reinforcing treatment adherence, collect feedback from the patients and their informal caregivers via PROMs for carrying out geriatric assessments and (C) An *Adaptive Integrated Care Platform* to be used by health professionals, enabling implementation of adaptive care plans for managing multimorbidity based on evidence from clinical guidelines, but prioritising and reconciling them with the help of clinical

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decision support systems, processing patient's most recent context from the home monitoring environment and Electronic Health Records for calculating risk scores for comorbidities and monitor disease progression and intervention effects and tackling polypharmacy management.

3. Steps for developing integrated patient-centered solutions

Team building: It is of crucial importance to identify and build partnerships with all stakeholders in the CDSS domain. For the CAREPATH project, a consortium is composed of ten organizations (universities, clinical organizations, and SMEs) from six countries (Germany, Romania, Spain, Switzerland, Turkey and UK). The team members have expertise in clinical, technical, health economic and ethical aspects relevant to the project. The clinical investigations will be carried out in Germany, Romania, Spain and UK, four countries with diverse health and social care systems.
Clinical Aspects: The clinical teams are expected to provide patient-centered best practice guidelines based on existing evidence, reviews, legislations, and expert consensus. They should also develop or approve the polypharmacy management services to be implemented in the CDSS. Clinical teams will also support collecting the user requirements and determine characteristics of various target users, as well as instrument specifications in the clinical setting. The clinical teams are also expected to provide a variety of probable scenarios and use cases to be tested during the integrated care plan development and pilot phase.
Technical Aspects: The main task expected from the technical team is to design and introduce a generic reusable architecture. This holistic, cross-sectoral and interdisciplinary patient-centered care model of personalized care services is built on existing prototypes of IONIS, C3-Cloud and inergo®-ICP (10). The system is intended to provide patients, healthcare providers and caregivers with smart early warning CDS services and home and health monitoring capability. There will be critical security and privacy issues to be dealt with during this process to help patients and caregivers better manage health related conditions. Finally, the integrated care solution would be presented in accordance with present standards such as HL7/FHIR, using comprehensive, multilingual clinical healthcare terminologies e.g., SNOMED. The functions will be performed by means of APIs for exchanging electronic health record based on CDS Hooks specification for describing the RESTful APIs and interactions to integrate Clinical Decision Support (CDS) between CDS Clients and CDS Services.
Economic and Ethical Aspects: A Health economic study and analysis is an important part of this project. The acceptability and sustainability of the project is partially determined by the success of adjustments made based on the findings of the health economic studies. The project endures important ethical considerations. An ethical team is required to participate in all phases of the development process to ensure all requirements are met.

4. Concluding Remarks

The health and social needs of ageing populations are often complex and ongoing, spanning a range of areas of functioning and fluctuating over time. Traditional care models for people in later life are frequently fragmented and inefficient[11]. Even in

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countries with reasonably well-developed health and social care provision, treatment of dementia patients with multimorbidity is generally provided without careful monitoring of the current intrinsic capacity and dementia profile of the patient. There is a need to employ fundamental changes to the focus of clinical care for older people from treating specific symptoms in a disjointed fashion to adapting holistic approaches according to older people's physical and mental capacities. CAREPATH will follow an integrated patient-centered approach, in order to develop a flexible and modular system that will provide a viable solution for improving the management of multimorbid elderly patients with dementia and possibly improving intrinsic capacity, by delivering a system of care adapted to their needs.

Acknowledgements. The work presented in this paper have been supported the European Union's Horizon 2020 research and innovation programme, under grant agreement No 945169, CAREPATH Project.

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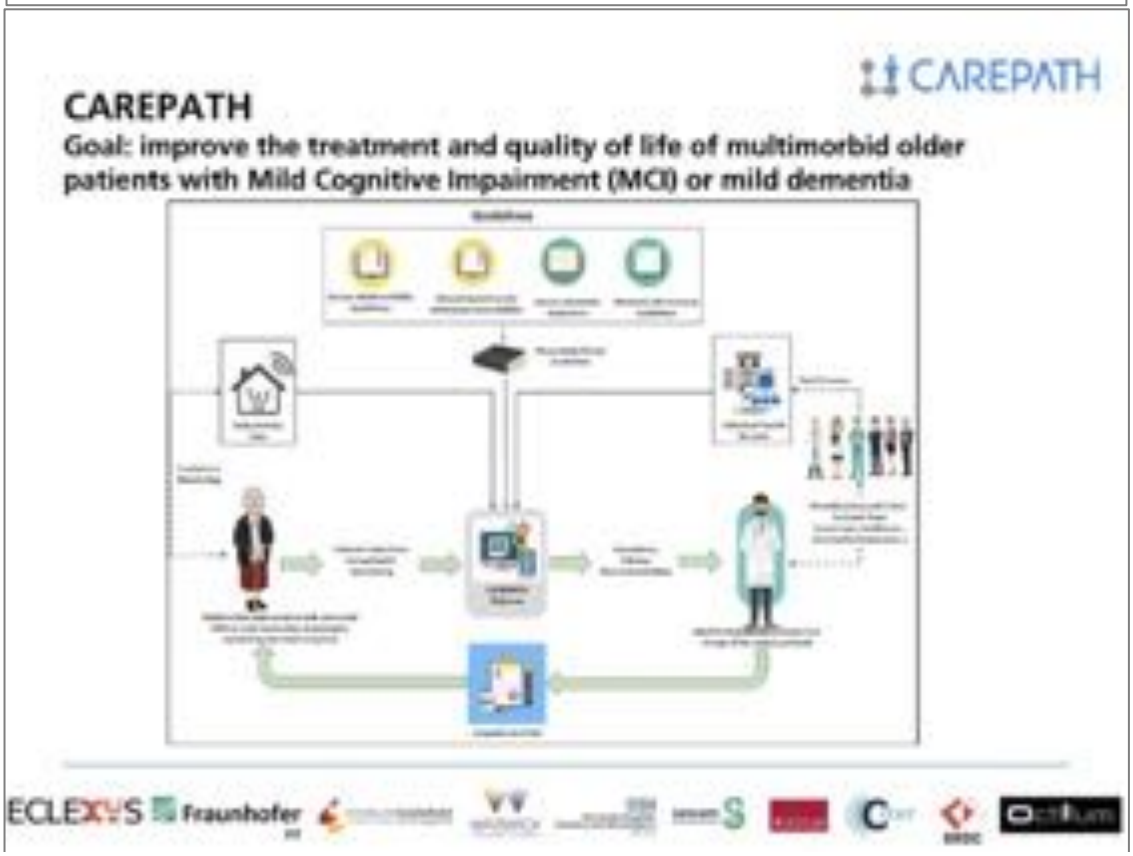
DSAI22 conference materials

- **Y. Mohamad et al. Key scenarios, Use Cases & Architecture of an E-health Homecare Instance**

Presentation slides:



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2 SCENARIOS AND USE CASES FOR INTEGRATED CARE

Fraunhofer

CAREPATH

Participating clinicians

- 4 pilot sites in
  - Rumania,
  - Spain,
  - UK and
  - Germany

Fraunhofer

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Key Scenario Template

Subject	Action
Scenario	Provide a short description of the use scenario, so workflow and context-of-use become alive for all partners
User roles involved	GP ☐ Geriatrician ☐ Nurse ☐ PT/OT ☐ Dietician ☐ Social worker ☐ Patient ☐ Informal caregiver ☐ Other (specify) ☐ .....
User tasks	List user tasks depicting the workflow
Design in-/output of CAREPATH services	Describe here whatever is important to mention in regard to how a CAREPATH service should be presented to users enabling them to fulfil their tasks. For example, if input is required from a user, how shall the system be designed to collect this input. If the system provides output such as an early warning or analysis of a patient's health measurements, how shall this information be presented to the user.

Fraunhofer

Example of a filled key scenario template I

Action: early warnings (health professional view)

- **Scenario:** Carmen is a 71-year-old patient with obesity (BMI >30), diabetes, hypertension, sarcopenia, frailty and mild cognitive impairment. She has been included in the CAREPATH program for a few weeks. The H/HMP has been recording data correctly.
- Several Early Warnings have been triggered in the last 24 hours:
- - Risk of insomnia, and other sleep/circadian rhythms disturbances
- - Risk of hyper/hypoglycemia
- In addition, the H/HMP has recorded a fever of 38°C; in addition to changes in the movement pattern with nocturnal wandering, which has also been reflected in the sleep recording.
- The comments of his informal caregiver are also noted, who refers to an episode of disorientation at home.
- In the last two days Carmen has reported a "bad mood".

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Example of a filled key scenario template II

User roles involved	GP x Specialist x Nurse x PT/OT/Sport □ Dietist Social worker □ Patient x Informal caregiver x Other (specify) □ .....
User tasks	List of user tasks, depicting the workflow

Health professional	Patient	Informal caregiver
• View eMH	• Comments	• Comments
• AICP/EW	PEP	PEP
• CDSS		

Design of in-/output CAREPATH services	Based on these data Peter reviews all the records and decides to order a urine and blood test to rule out urine infection or other organic condition that could be altering Carmen. Carmen and her informal caregiver are alerted to the need for these tests. Information on alerting conditions is presented to health professional Out-of expected range results are highlighted

Fraunhofer

Example of a filled key scenario template III

Related user requirements	• CARE-21 Health professionals shall be pointed specifically to alerting risks of their patients (early warnings) and corrupted/lost data from H/HMP • CARE-31 All results from patient's health data collected on H/HMP and PEP are presented to health professionals • CARE-32 Health professionals need to be supported in analysis and interpretation of results from patient's health data collected on H/HMP and PEP

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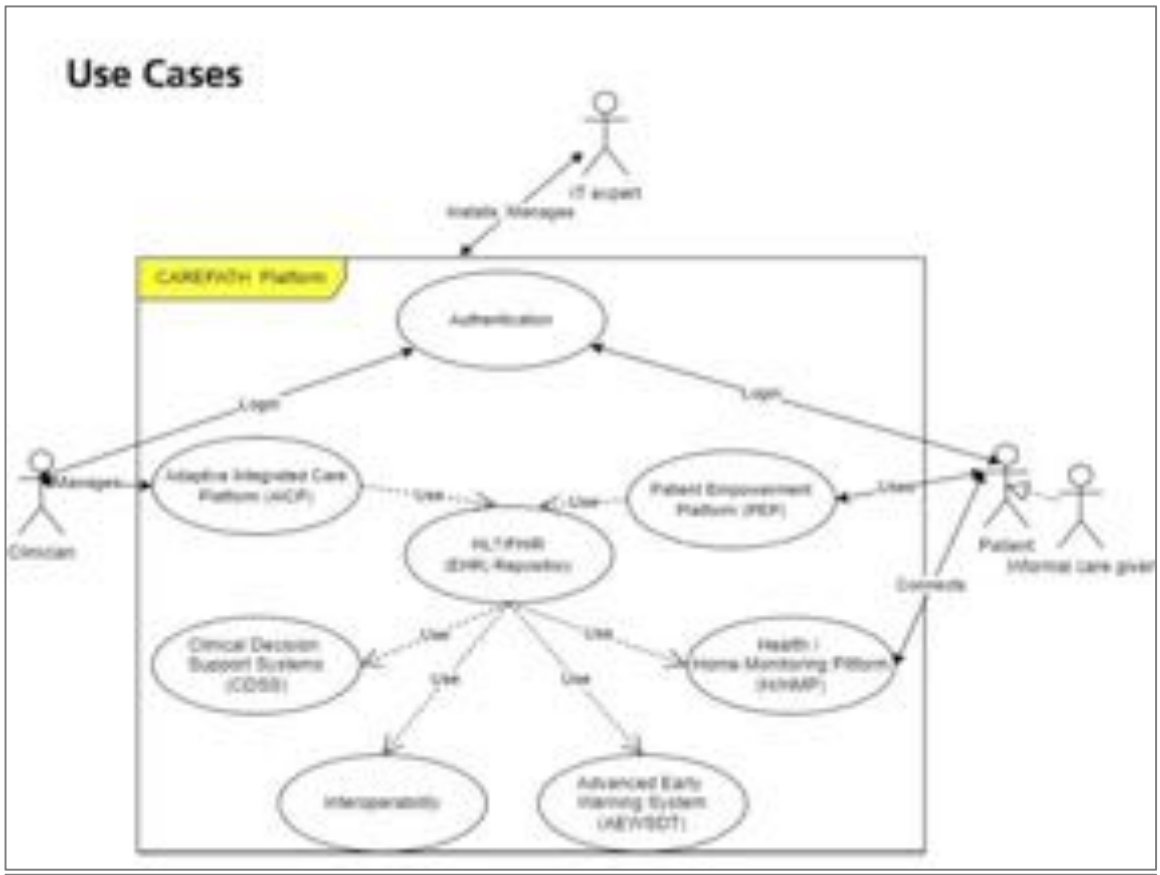

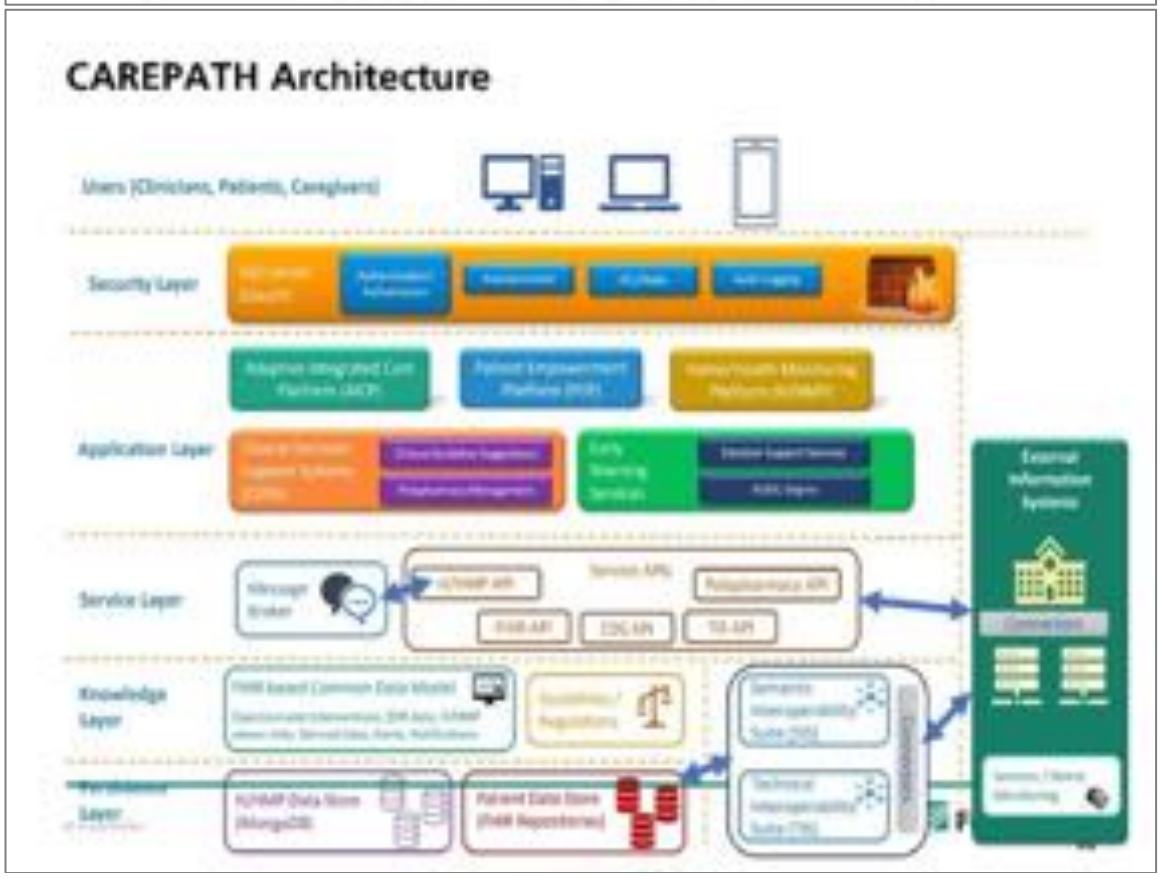

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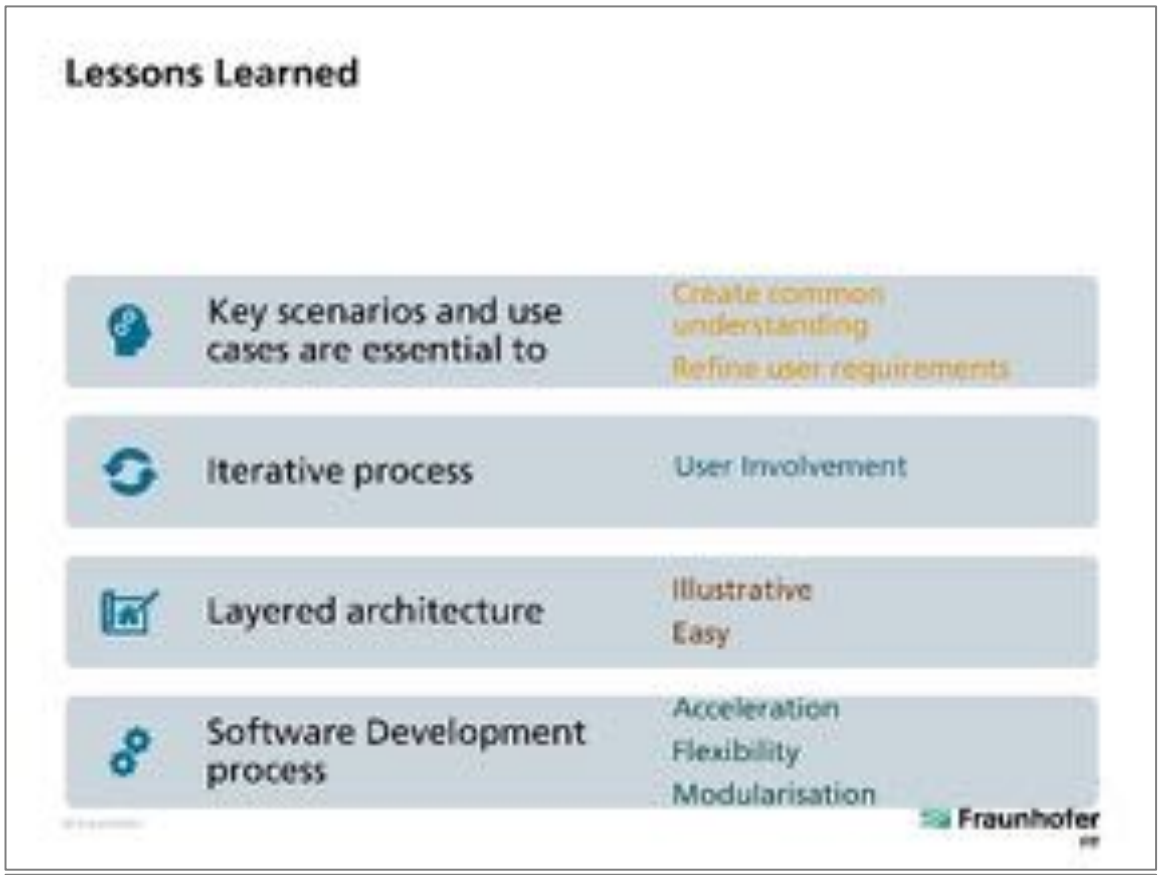

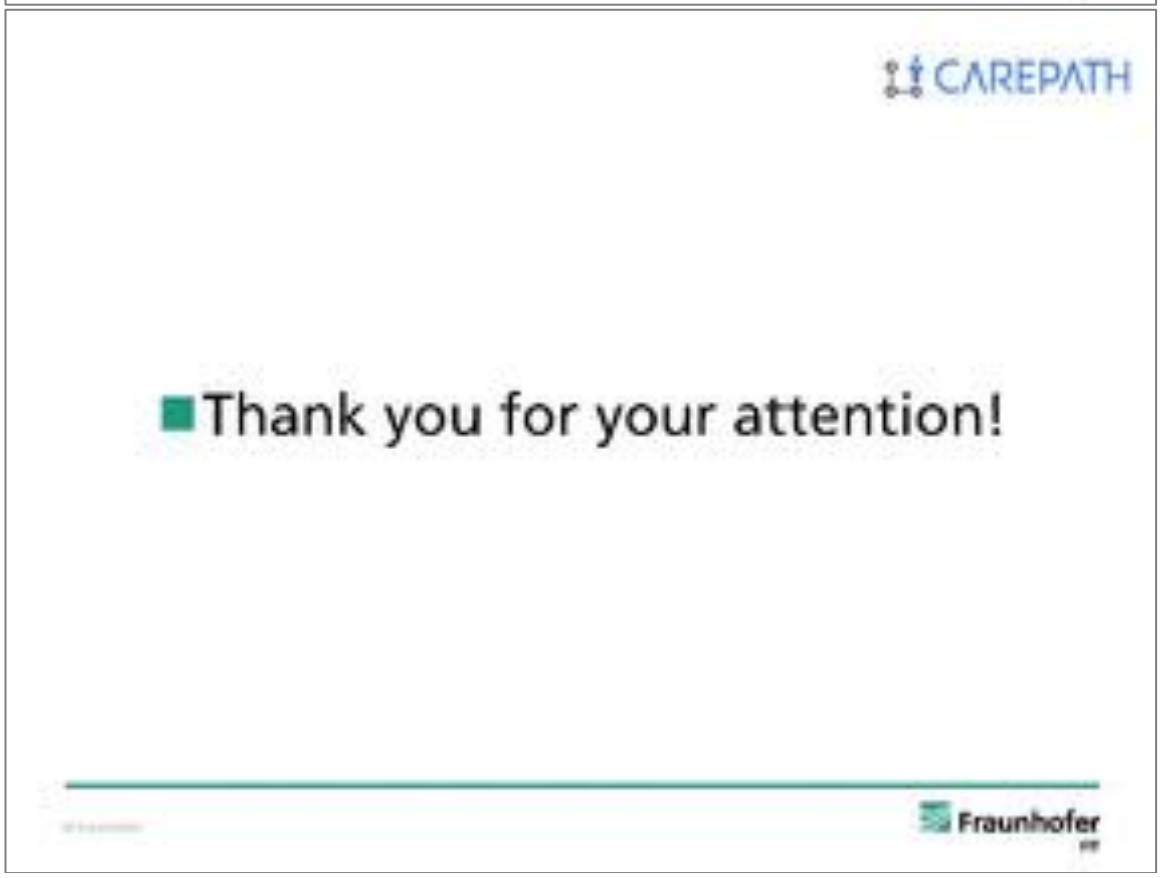

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- **O. Pournik et al. CAREPATH methodology for development of computer interpretable, integrated clinical guidelines**

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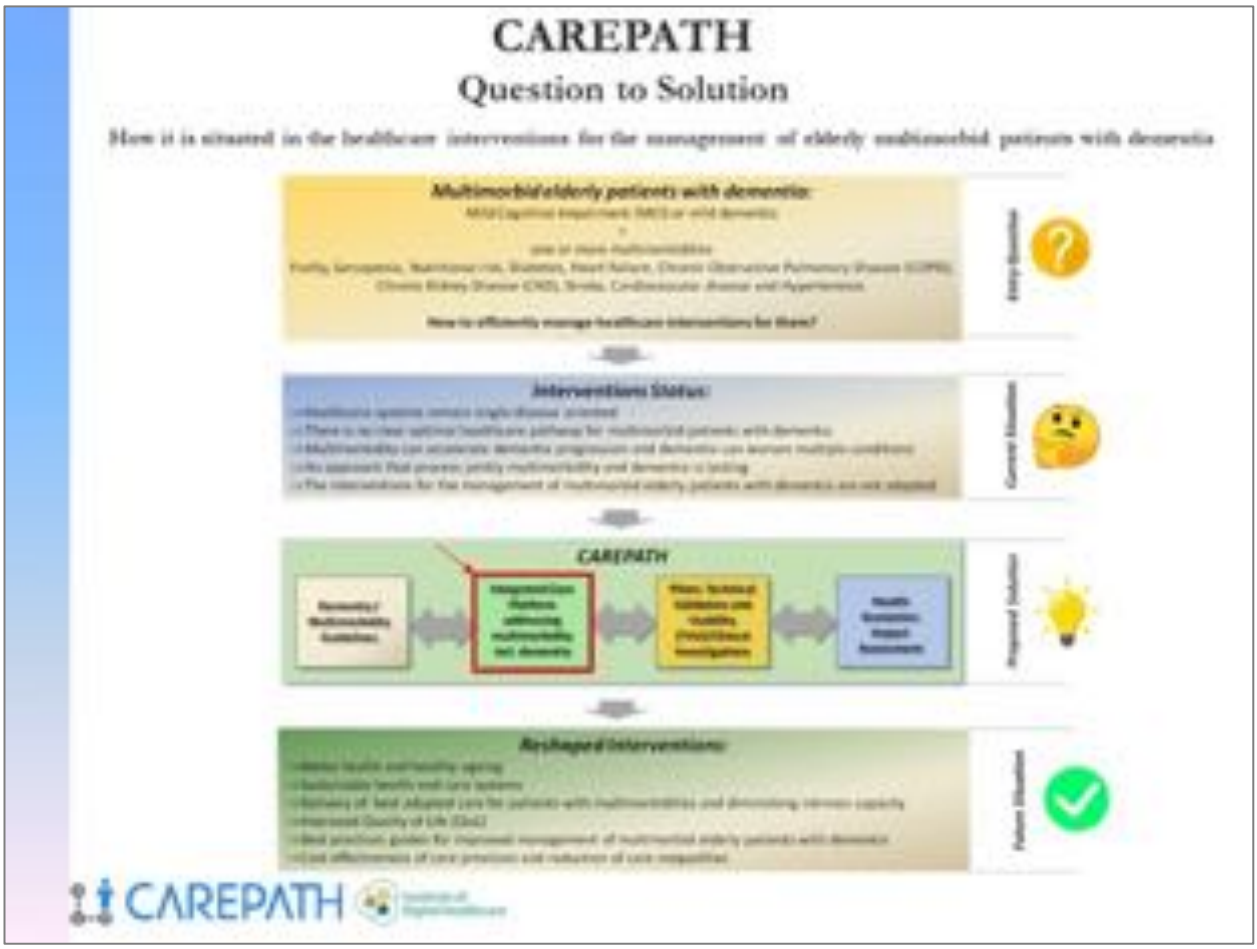

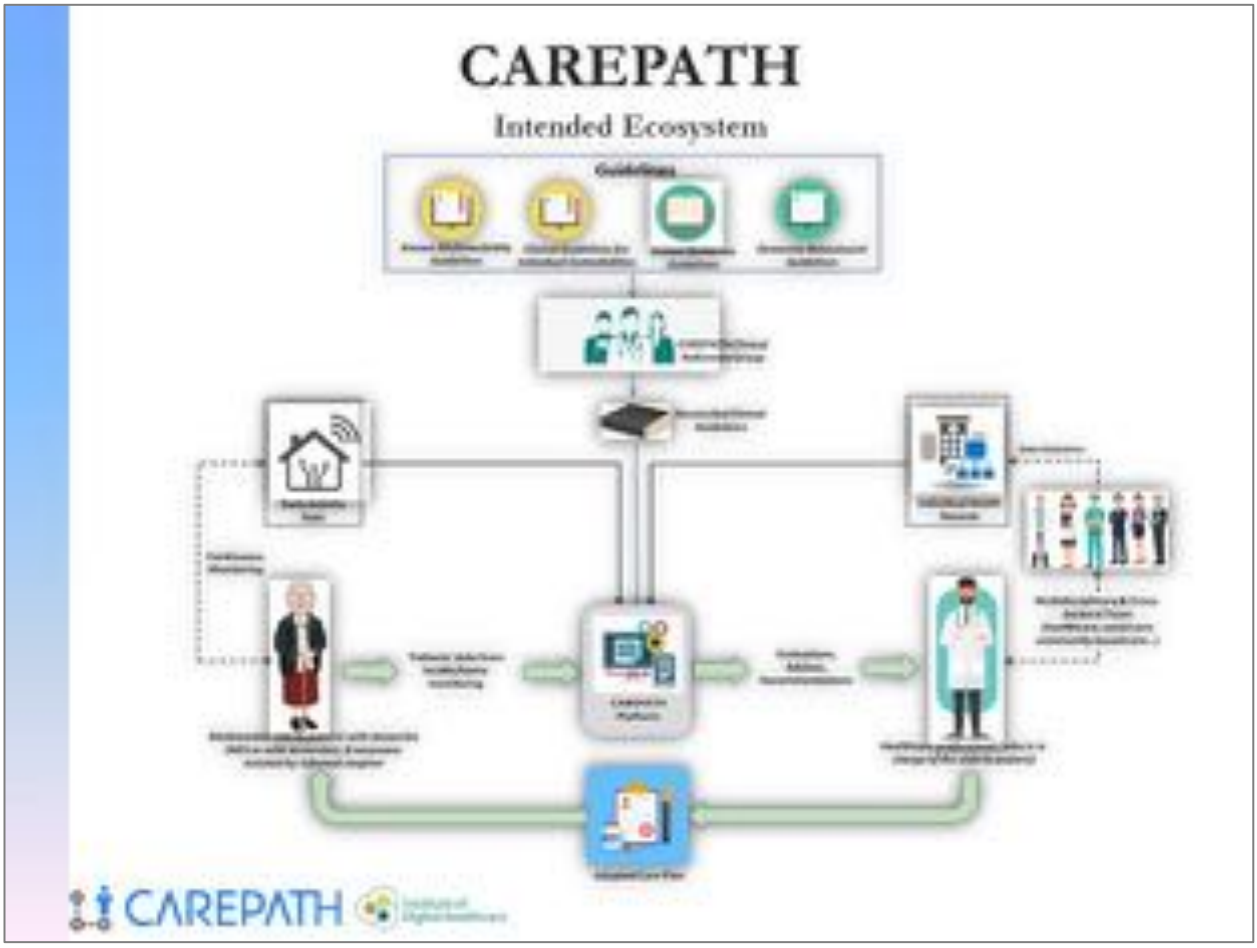

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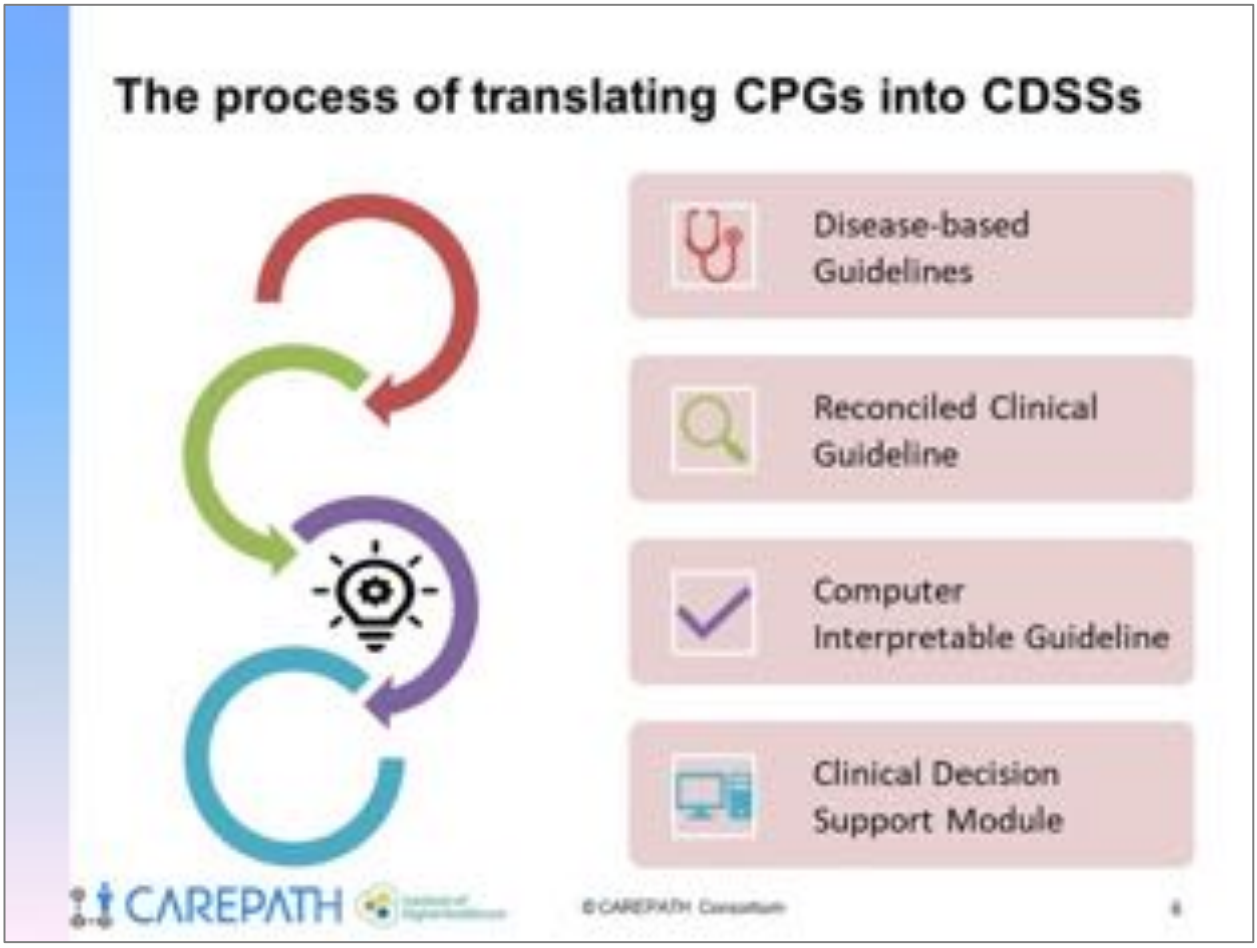

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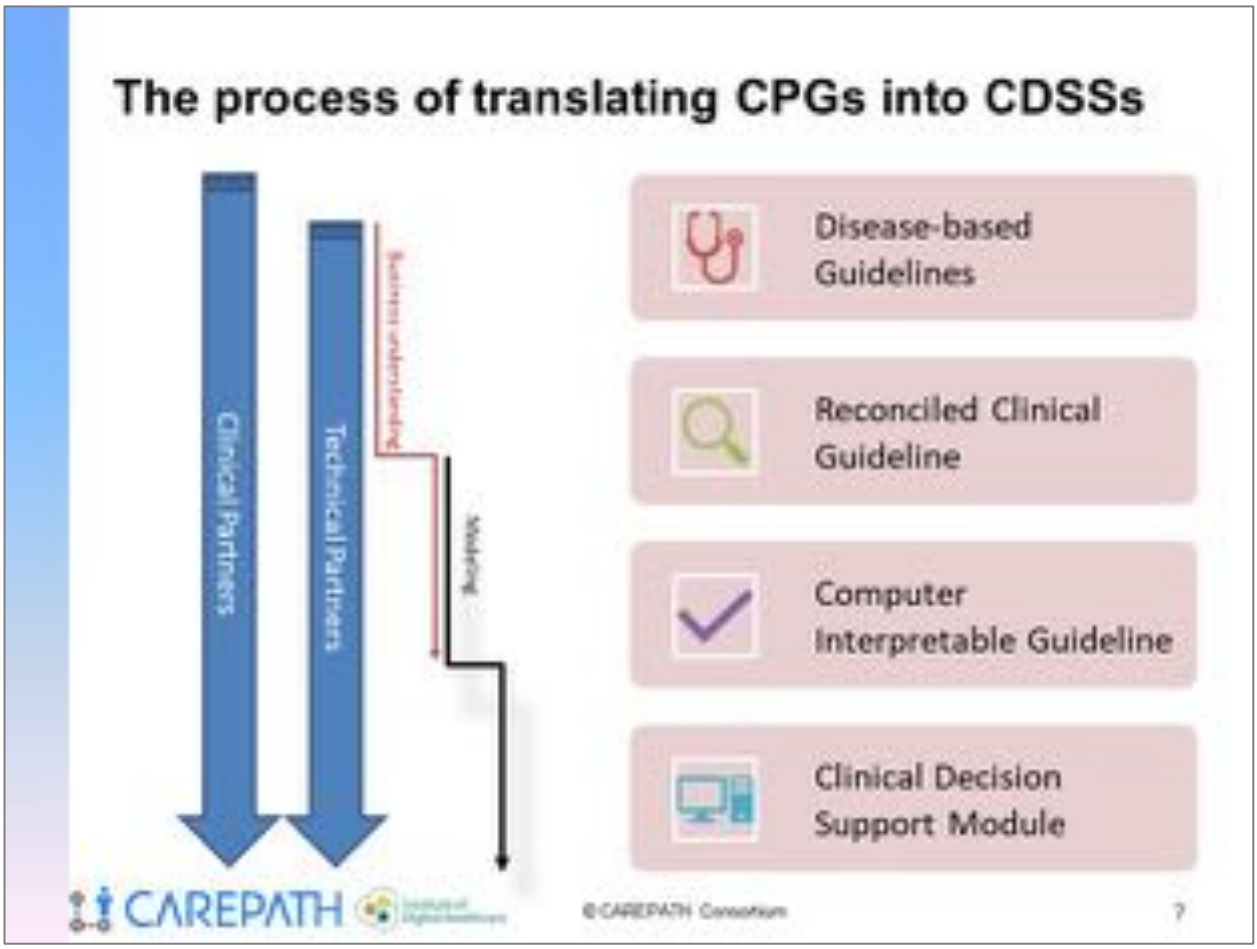

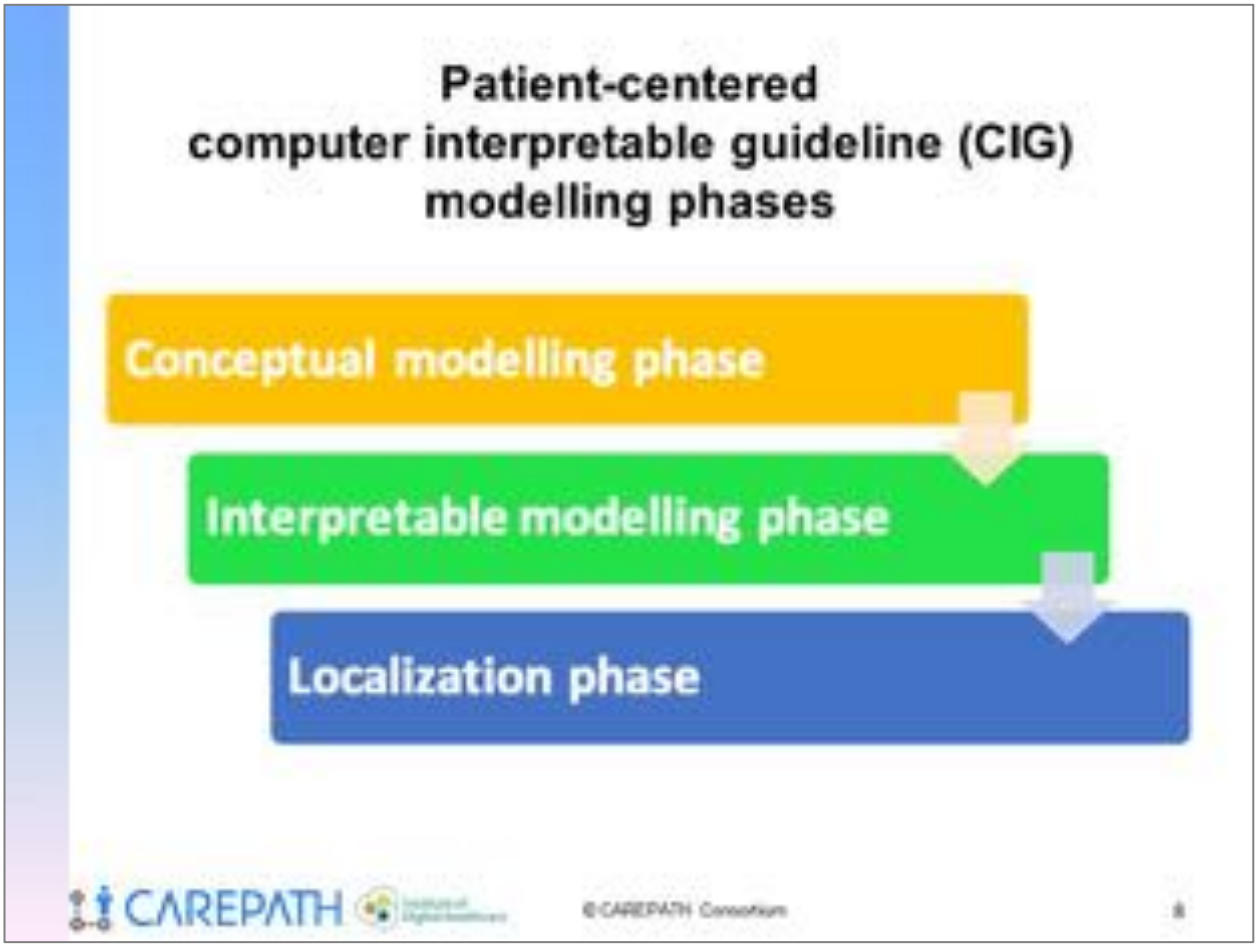

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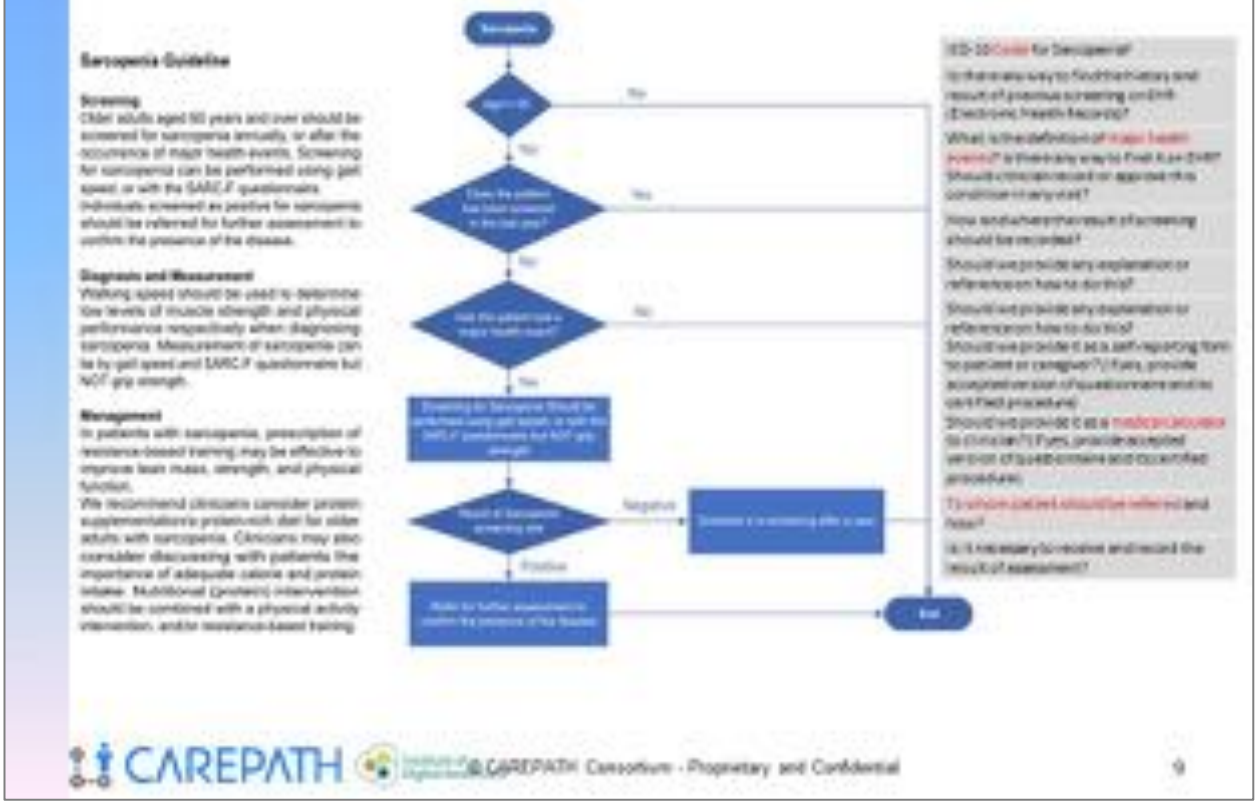
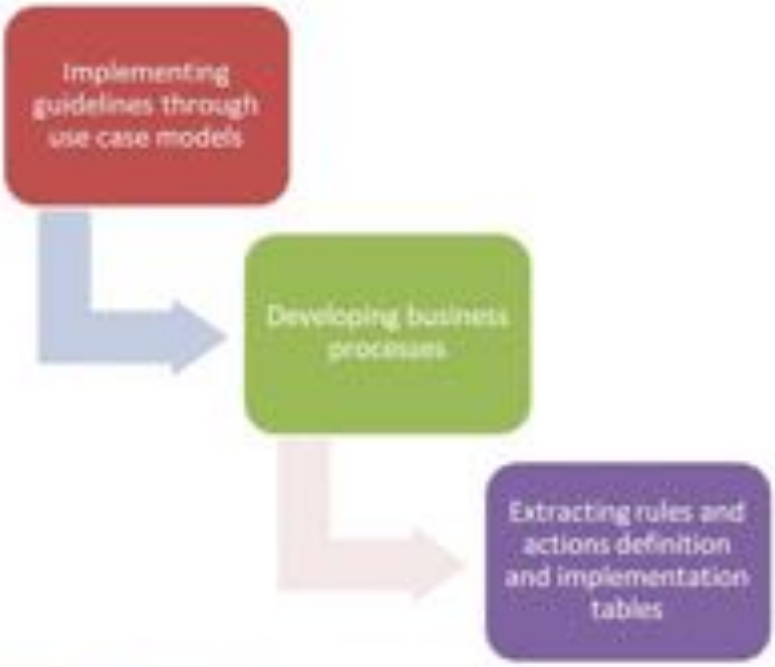
Conceptual modelling phase



Interpretable modelling phase STEPS



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Interpretable modelling phase (1st Step)

- Implementing guidelines through use case models
  - Triggers: Any new condition or input can result in a series of suggestions based on the integrated guideline which can include medications, further evaluations, lifestyle modifications and patient education among the others
  - Actors:
    - Human users (e.g., clinicians, patients, informal caregivers)
    - Data sources or software (such as Electronic Health Record, Clinical Assessments)
    - Systems and services: including Polypharmacy management service, Patient Empowerment Platform
    - Devices and sensors: like Home monitoring sensors and other similar services
  - Scenarios: Interaction between the main or secondary actors and the CDS system. It is described by a set of scenarios to meet a fundamental goal in the system.

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Interpretable modelling phase (2nd Step)

- Developing business processes
  - Using business processes in combination with guideline flowcharts to extract
    - These may include but are not limited to
      - Decision tree pathway identification
      - The trigger event in any decision node
      - Switching and changing in states and actors and the expected results or targeted objectives.
      - The input
      - The output parameters to be conceptualized based on the CDS Hooks specification.

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Interpretable modelling phase (3rd Step)

- Extracting rules and actions definition and implementation tables
  - Using business processes in combination with guideline flowcharts to extract
    - These may include but are not limited to
      - Decision tree pathway identification
      - The trigger event in any decision node
      - Switching and changing in states and actors and the expected results or targeted objectives.
      - The input
      - The output parameters to be conceptualized based on the CDS Hooks specification.

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Diabetes - Blood Pressure Management

CAREPATH ©CAREPATH Consortium 58

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Part of the BP management flowchart

CAREPATH
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Blood pressure management module condition table

Condition No.	Condition Clause
C1	If one of the following conditions exists: ICD[E11.2A, E11.2B, E11.4B, E11.4C, E11.4D, O63.2] OR If albumin secretion in urine is 1-30 mg/l OR 120 µg/min OR 100 mg/24h (depending how it is presented)
C2	If systolic blood pressure (LOINC[8480-6]) < 140 and diastolic blood pressure (LOINC[8462-4]) < 80 (both from SS284-4)
C3	If medication ATC[C09] exists
C4	If systolic blood pressure (LOINC[8480-6]) < 130 and diastolic blood pressure (LOINC[8462-4]) < 80 (both from SS284-4)
C5	If medication ATC[C09AA or C09CA] exists
C6	If medication ATC[C08] exists
C7	If medication ATC[C03] exists
C8	If condition ICD[T46.4X5A] or allergy ATC[C09AA] exists
C9	If observation LOINC[8423-8] (current smoker) has 37309600[1] (yes)
C10	If observation LOINC[74013-4] (alcoholic drinkoper day) > 0

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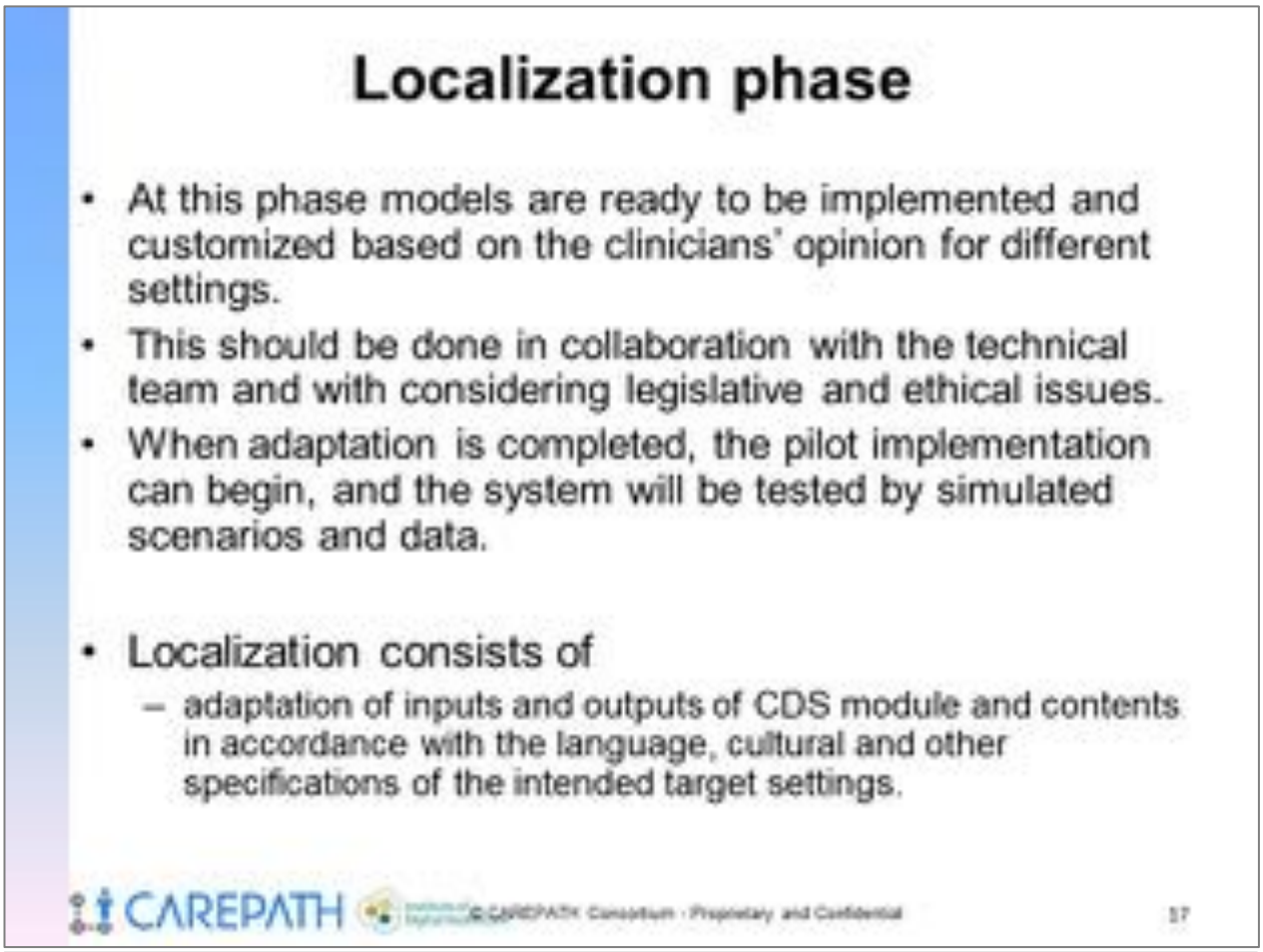

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- **M. Genkturk et al. The design of a mobile platform providing personalized assistance to older multimorbid patients with mild dementia or mild cognitive impairment (MCI)**

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Outline

- Problem
- CAREPATH project
- Methodology
- Design considerations
- Design of CAREPATH Patient Empowerment Platform (PEP)
- Conclusion

Problem

- Management of multimorbidity is complex
- The situation becomes more complex, when multimorbidity is associated with dementia.
  - Multimorbidity can affect their dementia, impacting on its clinical course
  - Dementia can impact management of their multiple conditions, by hindering their effective management

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CAREPATH project

- Enhancement of healthcare interventions for the management of conditions of older multimorbid patients suffering from mild dementia or MCI through several platforms

CAREPATH

CAREPATH Patient Empowerment Platform (PEP)

- Provides personalized assistance and guidance to patients
- Sends reminders about care plan goals and activities
- Collects feedbacks from the patients via Patient Reported Outcome Measures (PROMs)

- In this work:
  - Human-centered design process of the CAREPATHPEP
  - Design challenges, iterative mock-ups
  - Target user group: Older multimorbid patients with mild dementia or MCI

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Methodology

- Collected user requirements through interviews
  - 16 patients over 65 years of age, living with mild dementia or MCI and with at least one chronic condition
  - 16 informal caregivers
  - 16 healthcare professionals
- Key scenarios & literature survey
- Identified main components and designed mock-ups
  - Daily tasks, Medications, Diet, Exercises, Appointments, Custom Tasks, Surveys, Symptoms & Events

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Design considerations

- Designed the app only for tablets
  - Reduces the cognitive load as it eliminates the use of an external keyboard or mouse
  - Larger screen, larger texts
    - Default font size 18pt as recommended by the Web Accessibility Initiative (WAI) of the World Wide Web Consortium (W3C) in the Web Content Accessibility Guidelines (WCAG) 2.1
- Built each screen in the same format
  - Consistency across the app is beneficial in improving patients' cognitive function in daily use
  - Minimizes the amount of information patients need to remember and learn, thereby avoiding disorientation and anxiety

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Design considerations

- Easy and clear language
  - Simple, direct and precise texts in order not to cause confusion
  - Avoided complex expressions and abbreviations
- Avoided using scrolling feature as much as possible
  - Dementia can cause motor impairment
  - People with reduced motor skills often have trouble using scrolling, resulting in disorientation

Design of CAREPATH PEP – Daily tasks

- The first three designs:

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Design of CAREPATH PEP – Daily tasks

- Feedbacks retrieved:
  - Patients found the screen **very complex**. It was very tiring and incomprehensible to have too many items on the screen.
  - Patients found the **use of different colors confusing**. The purpose was to evoke patients of the task at a glance, but it did not create the desired impact when there are too many colors on a single screen.
  - Both the **design with checkbox** and **design with Yes/No buttons** were **appreciated**.

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Design of CAREPATH PEP – Daily tasks

- The final design:

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Design of CAREPATH PEP – Medications

Design of CAREPATH PEP – Push notifications

- One of the key components of CAREPATH PEP as they remind patients doing a task on time.
- How to clearly present a reminder message to patient is important.
- Send push notifications in question-form rather than order-form.
  - "Take your medication" -> NO
    - Patient could take the same medication again without remembering that he took it before.
  - "Have you taken your medication?" -> YES
    - Force the patient to remember and reduce the risk of taking the same medication twice.

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Design of CAREPATH PEP – Diet, Exercise, Calendar

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Conclusion and Future Work

- The application has been developed to run on Android tablets.
- A technical validation and usability study will be performed with 16 patients with mild dementia or MCI.
- Then, the application will be used by 208 patients and their informal caregivers in a clinical investigation study that will be conducted in four European countries
  - Spain, Romania, Germany, and the United Kingdom for two years within the scope of the CAREPATH project

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Appendix 4. D8.5 Release 1

An Integrated Solution for Sustainable Care for Multimorbid Elderly Patients with Dementia

WP8: Impact Promotion, Dissemination, Exploitation and Business Planning

D8.5: Reports on Dissemination and Communication Plan and Activities

Contractual Date of Delivery to the EC: 31 December 2022
Actual Date of Delivery to the EC: 31 December 2022
Participant(s): [4]**WARWICK**, [1]EXYS, [2]Fraunhofer, [3]SKB, [5]UHCW, [6]SESCAM, [7]UCLM, [8]CITST, [9]SRDC, [10]OCT
Author(s): [4]Sarah N. Lim Choi Keung, [4]Theodoros N. Arvanitis, [4]Omid Pournik, [4]Bilal Ahmad, [1]Aboubacar Mchangama, [1]Jaouhar Ayadi, [2]Yehya Mohamad, [2]Carlos Velasco, [2]Henrike Gappa, [3]Wolfgang Schmidt-Barzynski, [3]Antje Steinhoff, [3]Khoi Le, [5]Tim Robbins, [6]Pedro Abizanda Soler, [7]Ana Magdalena Vargas Martínez, [7]Luz María Peña Longobardo, [8]Oana Cramariuc, [9]Mert Gencturk, [10]Lionello Ferrazzini
Type (P-prototype, R-report, O-other, ORDP-Open Research Data Pilot, DEM-Demonstrator, ET-Ethics): R-report
Dissemination level (PU-Public, CO-Confidential): PU-Public
Version: Release 1, version 1v4
Total number of pages: 49

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Executive Summary

The present document aims at reporting on the dissemination and communication plan of the project and detailing the activities that have been conducted to achieve this in the first period of the project, as part of Task 8.3. D8.5 Release 1 is the first of three reports from the project, that reports on dissemination activities throughout the project, initially at Month 18.

In Section 2, we present the methodology for the dissemination strategy for the content, audience and levels. In recognition of the importance of the key stakeholders for the project, we are working closely with Task 8.1 and Task 8.2 for the identification of stakeholders and for the main messages in targeting these groups.

Section 3 describes the communication channels we use for the dissemination and also lists the publications and event participation and collaborations in this first reporting period of the project.

Finally, in Section 4, we outline the dissemination and communication plan for the next period in the project.

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7 Introduction

The objective of Task 8.3 is to communicate and raise awareness of the approaches and results of the CAREPATH project and also engage with relevant stakeholders in the areas of technical innovation and associated impacts on healthcare. In this first dissemination report, we specify the strategy that the project consortium will follow to ensure the effective and efficient dissemination of the project. We outline the stakeholder groups that are relevant to the project and the dissemination plan for these groups. We also report on the communication approaches used in the project and the dissemination activities that project partners have participated in. Dissemination and publication plans for the next period are also outlined. The dissemination and communication plan is a living document and updates will be reported in a further two releases of this deliverable at Months 36 and 48.

8 Dissemination Strategy

8.1 Objectives

The key objective of the CAREPATH dissemination strategy is to identify and organise the activities to be performed in order to promote the widest dissemination of knowledge from the project. It also aims at maximizing the impact and the market uptake to support the exploitation activities in Task 8.2. Specifically, the dissemination and communication plan sets the following objectives:

- To raise public awareness and ensure maximum visibility of the project key facts, outputs and findings among public at large;
- To support the presentation of project's main results in key stakeholders (e.g., market service providers, technology sector firms, civil rights movements organizations), EC and general media;
- To enhance the commercial potential of the results.

8.2 Methodology

8.2.1 Goal determination, content and branding (what?)

Dissemination material will be produced to share CAREPATH results and experiences beyond the limits of the project's partnership into the maximum number of potential beneficiaries (e.g., home care providers, technology providers, healthcare provider organizations, patients) in the whole European region. To ensure real impact, CAREPATH dissemination content will be customized and aligned with different target audience classes and differs from: General public to Decision makers. For example, the language style used in the different products will vary, generally becoming more specialised at deeper levels utilizing technical language and terms. The objectives of this customized dissemination strategy will be:

4. **Creating Awareness**. First of all, we will develop content for those target audiences that do not require a detailed knowledge of the project, but it is helpful for them to be aware of the activities and outcomes. Creating such an awareness message of CAREPATH work will help to build a wide recognised identity and profile. We will create dissemination materials for general public that is easy to understand.
5. **Introduce CAREPATH Solution**. We will develop content for those audiences that need to be targeted directly because they can benefit from what CAREPATH project has to offer. Creating such content will help build a deeper understanding of the project's work.

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6. **Engage Commitment and Action**. It is important to develop content for those audiences that are able to adopt or use any product/approach/output offered by CAREPATH project. Creating such content will help those people that are in a position to act in some way. Decision makers need information that relates to their policy makers (e.g., how and to what level do measure contribute to their policy goals).

8.2.2 Targeted audiences' identification and profiling (who?)

The CAREPATH dissemination target groups include:

- **Policy makers** as drivers for the implementation of the recommendations and IT-supported Integrated Care models. The "policy drivers" include EU government, and more specifically national and regional health departments,
- **Public and private healthcare organisations, hospitals and health/care institutions**, **health insurers** that represent the demand for ICT-based integrated care solution,
- **Practitioner/prescribers**, which can influence the former for integrating ICT-based Integrated Care systems. Among these we will target practitioner organizations and associations,
- **ICT providers for the eHealth sector** that can potentially benefit and enhance the platform and can integrate easily in the proposed Integrated Care framework,
- **Academia and research**: health and social researchers,
- **Patients, informal caregivers and society** at large.

Dissemination activities will be performed by all project partners, but they will differ according to their nature. The CAREPATH technological partners will approach relevant stakeholders and their client networks, while the academic and research partners will focus on disseminating the project results towards research institutes and universities across the enlarged Europe.

8.2.3 Dissemination levels and phases (when?)

The dissemination activities will be carried out in three main phases, spanning throughout the project duration and extended beyond it, with an increasing level of intensity. They will start from the creation of general awareness and will conclude with attracting potential supporters and customers/users of the project results. As a result, indicative activities at different stages of the CAREPATH project cycle will include:

- **At the beginning of the project**: Our aim is creating general awareness and wide dissemination about the project objectives, idea and its approach at early stages of the project and getting early feedback from the community related with requirements and early design of the architecture. We have drafted the dissemination plan (D8.5) describing the expected impact and deliverables and elaborating of how and to whom the outcomes will be disseminated.
- **During the project**: Our aim for dissemination at this phase is proving our capabilities and attracting potential scientific community, open-source groups, users and potential customers. We will be updating the dissemination plan with recent information on the project and results; contacting relevant media at local or regional level; conducting regular activities such as information sessions, training, demonstrations, peer review journal and conference articles; assessing

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the impact on target groups; involving other stakeholders in view of transferring results to end users/ new areas/policies.

- **During the pilot phase and after the project**: Our aim is presenting results, proving the benefits, attracting potential investors and pave the way for commercialization. We will be continuing further dissemination; developing ideas for future cooperation; evaluating achievements and impact; contacting policy-makers; create market for the product.

8.3 Key Stakeholder Messages

The table below summarises the main messages we seek to convey to the stakeholder groups. Some stakeholder messages are the same but will be delivered in appropriate language and with an appropriate level of clinical or technical detail for each group.

Table 8: Key messages for target audience groups

Target Audience	Key Messages	Communication Channels
Policy makers	Results of the CAREPATH clinical investigation and health economic assessment. Sharing of research and best practice.	Website Multi-stakeholder events Meetings with decision makers, mainly at national level
Public and private healthcare organsations, health insurers	The growing challenge of multi-morbidity and burden of dementia across Europe and the need for more integrated personalized care. Implications on healthcare efficiency, outcomes and costs. Availability of CAREPATH solution for adoption by health systems	Website Multi-stakeholder events Dedicated meetings with decision makers
Health and care professionals	How aligned/holistic guidelines may alter first line treatment and care planning choices. The knowledge assets of CAREPATH. The integrated care support provided by the CAREPATH technical components. CAREPATH clinical investigation results. The demonstrated value to patients of the CAREPATH empowerment platform and home/health monitoring platform.	Website Multi-stakeholder events Clinical and healthcare related conferences
Health ICT industry	**The growing scale of multi-morbidity and burden of dementia across Europe and the need for more integrated personalized care.**	**Website** Multi-stakeholder events

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Target Audience	Key Messages	Communication Channels
	The potential of this as a market driver for interoperability standards, computerized clinical guidelines and AI-based decision support adoption. Details of the CAREPATH technical components e.g. FHIR repository, semantic interoperability tools, care plan management tool, patient empowerment platform, home/health monitoring platform, advanced early warning decision tools, clinical decision support modules. Commercial relationships	
Academia and research	The importance of health data and medical knowledge integration CAREPATH approaches to semantic interoperability CAREPATH implementations of data standards and security standards Details of the CAREPATH technical components e.g. FHIR repository, semantic interoperability tools, care plan management tool, patient empowerment platform, home/health monitoring platform, advanced early warning decision tools, clinical decision support modules. Relevant and novel areas of research in data analytics and AI.	Website Multi-stakeholder events Health informatics, data science, AI academic conferences and journals
Patients, informal caregivers and society	Explanation of what multi-morbidity is, and how it relates to mild cognitive impairment and dementia. Challenges in care coordination faced by health systems. Benefit of harmonising clinical guidelines across diseases. Importance of engagement in care planning. Value of health monitoring, prevention and quality of life. CAREPATH solution and results of the clinical intervention.	Website Multi-stakeholder events Targeting of patient organisations and groups for diseases commonly associated with multi-morbidity and dementia

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9 Communication Channels

CAREPATH considers a wide set of outreach means expanding traditional means with interactive and on-line based ones. The communication channels are selected to convey the key messages and key outcomes of the project to the stakeholders.

9.1 Visual Identity

The project's visual identity has been used since the beginning of the project (WP1) and is used through the various communication channels and products. It includes:

- Project logo
- Partner logos
- Templates for minutes and reports
- Template for PowerPoint presentations
- Template for WP deliverables

9.2 Project Website

The CAREPATH website (https://www.carepath.care/) is considered the hub for the project dissemination. It is the first point of contact with the project for a wide audience and includes full details of the project objectives, challenges, and the expected outcome of the project.
It also provides highlights of the internal as well as related external activities. Among these activities are, monthly blogs, newsletters, events that a member of the project consortium might have attended. Newsletters are prepared and published to the project and subscribers to keep them updated on the project activities, as well as news and activities in the relevant research areas. Newsletters are also available via the project website. So far, we have published two newsletters. More details about the number of the website visitors are shown in the table below.

Table 9: Project website visitors

Year	Number of visitors	Expected visitors per year
2022	11264	2000
2021	9000	2000

9.3 Social Media

The project has its profiles in Twitter (https://twitter.com/CAREPATH2021) and LinkedIn (https://www.linkedin.com/in/carepath-project/), these channels are used to connect the project with other people outside of the consortium. The project posts its activities and other related topics in these two platforms. The tables below summarise the social media platform statistics.

Table 10: Social media connections

Platform	Number of connected profiles	Expected number of connected profiles throughout the project
LinkedIn	98	200
Twitter	29	1000

Table 11: Social media post impressions

Platform	Number of posts	Impressions
LinkedIn	15	286
Twitter	22	2468

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The post impressions include activities that consortium members have participated, project monthly blogs and reposting of other posts that are related to the project activities.

9.4 Multimedia Production

The consortium will use online channels such as YouTube, to publish informative and demonstration videos of the CAREPATH solution.

9.5 Publications

This channel includes classical means of knowledge transfer such as articles in topic specific journals, brochures, publications in broadcast media and business papers focusing on the dissemination of the project results, mainly to experts and professionals. It will increase the level of information need and involvement and invite interactive participation of interested parties. It will guarantee high degree of knowledge promotion within targeted groups.

9.5.1 International Conference on Informatics Revolution for Smarter Healthcare (IRSH'2021), 14-15 October 2021

At this virtual conference, Angelo Consoli (EXYS) and Tim Robbins (UHCW) gave a keynote on "Sustainable care for multimorbid elderly patients with mild cognitive impairment".

Abstract:

Provision of effective health and social care for people with multi-morbidity represents one of the greatest emerging challenges for both healthcare and health-tech providers. Where dementia is present within the multi-morbid conditions, there are additional challenges related to cognitive decline. CAREPATH represents an ambitious EU funded Horizon 2020 project that proposes an ICT based solution for in the treatment and management of multimorbid patients with mild cognitive impairment or mild dementia. In this presentation, we consider the technical ICT based privacy, data compliance, data processing and security constraints relevant to multimorbidity care in the context of cognitive impairment alongside a consideration of how these interact with front-line clinical challenges.

9.5.2 Joint International Conference on Digital Inclusion, Assistive Technology & Accessibility (ICCHP-AAATE 2022), Lecco, Italy, 11-15 July 2022

Henrike Gappa (Fraunhofer) presented WP2 work, to understand the user requirements of patients and their informal caregivers and was achieved in CAREPATH by interviews.

Gappa, H. et al. (2022). Making Person-Centred Health Care Beneficial for People with Mild Cognitive Impairment (MCI) or Mild Dementia – Results of Interviews with Patients and Their Informal Caregivers. In: Miesenberger, K., Kouroupetroglou, G., Mavrou, K., Manduchi, R., Covarrubias Rodriguez, M., Penáz, P. (eds) Computers Helping People with Special Needs. ICCHP-AAATE 2022. Lecture Notes in Computer Science, vol 13341. Springer, Cham. https://doi.org/10.1007/978-3-031-08648-9_54

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Figure 15: Screenshot of website: https://www.icchp-aaate.org/

9.5.3 20th International Conference on Informatics, Management and Technology in Healthcare (ICIMTH22), Athens, Greece, 1-3 July 2022

Omid Pournik (WARWICK) presented the project at this informatics conference in Greece.
Pournik, O., Ahmad, B., Lim Choi Keung, S. N., Khan, O., Despotou, G., Consoli, A., Ayadi, J., Gilardi, L., Laleci Erturkmen, G. B., Yuksel, M., Gencturk, M., Gappa, H., Breidenbach, M., Mohamad, Y., Velasco, C. A., Cramariuc, O., Ciobanu, C., Gómez Jiménez, E., Avendaño Céspedes, A., Alcantud Córcoles, R., … Arvanitis, T. N. (2022). CAREPATH: Developing Digital Integrated Care Solutions for Multimorbid Patients with Dementia. Studies in health technology and informatics, 295, 487–490. https://doi.org/10.3233/SHTI220771
See Appendix 8.1 for the conference paper.

9.5.4 Software Development and Technologies for Enhancing Accessibility and Fighting Info-exclusion Conference (DSAI 2022), Lisboa, Portugal, 31 August 31 – 2 September 2022

Yehya Mohamad and Carlos Velasco (Fraunhofer) organized a special track at DSAI 2022 on Accessible, Smart, and Integrated Healthcare Systems for Elderly and Disabled People. The special track brought together contributions from international researchers and practitioners focusing on design, development, testing and application of information technologies to healthcare sector, pervasive, mobile, and ubiquitous healthcare systems, pandemic research, accessibility, usability and user experience of medical apps & devices, human behaviour, integrated healthcare approaches, patient empowerment systems, eHealth data standards and interoperability (e.g. HL7/FHIR), medical device and clinical investigation regulatory frameworks, as well as privacy and security.
8 papers were presented, 6 of them from Horizon 2020 projects:

CAREPATH with 4 papers: https://www.carepath.care/

ESCAPE with 1 paper: https://escape-project.org/

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ADLIFE with 1 paper: https://adlifeproject.com/

Figure 16: Screenshot of conference website: http://dsai.ws/2022

The 4 papers presented from CAREPATH:

- CAREPATH Protocol for Creating a Single, Holistic and Digitally Implementable Consensus Clinical Guideline for Multiple Multi-morbid Conditions, by Tim R. Robbins et al., presented by Tim Robbins (UHCW) on the work in WP6.
- CAREPATH methodology for development of computer interpretable, integrated clinical guidelines, by Omid Pournik et al., presented by Omid Pournik (WARWICK) on the work in WP3.
- Key scenarios, Use Cases & Architecture of an E-health Homecare Instance, by Yehya Mohamad et al., presented by Yehya Mohamad (Fraunhofer) on the work in WP2.
- The design of a mobile platform providing personalized assistance to older multimorbid patients with mild dementia or mild cognitive impairment (MCI), by Mert Gencturk et al., presented by Mert Gencturk (SRDC) on the work in WP4.

Refer to Appendix 8.2 for the conference materials. DSAI 2022 proceedings will be published in the ACM International Conference Proceedings Series (ISBN: 978-1-4503-9808-4).

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9.5.5 18th International Congress of the European Geriatric Medicine Society, London, United Kingdom, 28-30 September 2022

Rubén Alcantud Córcoles (SESCAM) gave a presentation on the work in WP6 on "Clinical guidelines and best practices to improve the management of elderly patients with dementia and multimorbidity. A systematic review".

Figure 17: Screenshot of event website: https://eugms2022.com/

Figure 18: Rubén Alcantud Córcoles presenting at 2020 EuGMS

9.6 Events

Interactive dissemination offers a chance for personal interaction in academic, commercial and socio-economic conferences and workshops, EU organised events, trade fairs and exhibitions. It is intended for target groups with a high level of information need and involvement and provides information tailored to highly targeted audiences. It also includes possible interviews in radio or TV stations, as well as concertation activities with other European and/or International funded projects in the domain, which shall be established timely, to ensure a useful exchange and could take the form of a common workshop.

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9.6.1 MEDICA 2022, medical trade fair, Düsseldorf, Germany, 14-17 November 2022

Yehya Mohamad (Fraunhofer) has participated in this event and has been talking about the CAREPATH project in his presentations.
More than 81,000 visitors from various sectors of the global healthcare industry came to Düsseldorf, Germany, to attend MEDICA 2022, the world's leading medical trade fair, and COMPAMED 2022, the international No. 1 for the medical technology supply sector.

Figure 19: Screenshot of event website: https://www.medica-tradefair.com/ (left); Yehya Mohammad (right in photo) at the event (right)

9.6.2 Quality circle, GP Initiative meeting, Bielefeld, Germany, 16 November 2022

Wolfgang Schmidt-Barzynski (SKB) presented the CAREPATH project to a group of about a dozen General Practitioners in the region of Bielefeld, Germany, at their quality circle meeting. This introduction to the project has provided key information about the project and study for the involvement of these healthcare professionals and support in recruiting patients to the study.

9.7 Collaborations and Networks

9.7.1 Related projects

Projects related to CAREPATH are continuously being identified to raise awareness within the project of innovations and shared lessons; and to increase potential collaborations.
As described in Section 3.5.4, a joint workshop was organized and featured three EU projects, relating to integrated care. Besides CAREPATH, the other two projects are ADLIFE and ESCAPE.

Relevant projects
ESCAPE: Evaluation of a patient-centred biopsychosocial blended collaborative care pathway for the treatment of multi-morbid elderly patients (H2020-SC1-BHC-2018-2020)
GERONTE: Streamlined Geriatric and Oncological evaluation based on IC Technology for holistic patient-oriented healthcare management for older multimorbid patients (H2020-SC1-BHC-2018-2020)

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ADLIFE: Integrated Personalized Care for Patients with Advanced Chronic Diseases to Improve Health and Quality of Life (H2020-SC1-DTH-2019)
OPEN DEI: Aligning Reference Architectures, Open Platforms and Large-Scale Pilots in Digitising European Industry (H2020-DT-2018-2)
INTEGRATE4CARE: Digital integrated health and social care with IT-supported home care counseling visits as specified in §37.3 SGB XI - funded by the European Union from the European Regional Development Fund (EFRE) and the State of Rhineland-Westphalia (NRW), Germany (grant agreement number EFRE-0801905).

9.7.2 Standardisation

CAREPATH seeks to raise awareness and contribute to relevant standardization work from its project results. CAREPATH is involved in ISO standardisation, by having some project members on the British Standards Institution (BSI Group) IST/35 - Health informatics Committee and promoting knowhow in the development of specific standards in the domain of health informatics. Through BSI/IST/35, there is association and routes to the International Organization for Standardization (ISO) and in particular to the ISO/TC 215/Health Informatics Committee. Some of the work can provide input to the following working groups: ISO/TC 215/WG 01 "Architecture, Frameworks and Models", ISO/TC 215/WG 02 "Systems and Device Interoperability" and ISO/TC 215/WG 04 "Security, Safety and Privacy".
To ensure the sustainability and impact of research, CAREPATH partner Fraunhofer is involved since 15 years in different Working Groups of the World Wide Web Consortium (W3C). The World Wide Web Consortium (W3C) is an international community where Member organizations, a full-time staff, and the public work together to develop Web standards. Led by Web inventor Tim Berners-Lee, W3C's mission is to lead the Web to its full potential. Fraunhofer participation also ensures that its teams are up-to-date with the leading-edge developments of the web and is able to influence new directions of the web in collaboration with leading industrial partners.
Additionally, CAREPATH, through its members, is involved in a CEN Workshop Agreement (CWA 17933) entitled “Digital health innovations — Good practice guide for obtaining user consent for personal health information”. The CWA will define a guideline for obtaining the most suitable consent for the use of digital health innovations. The guideline will describe which aspects should be considered when asking for consent. It will also cover the usability of a consent form especially regarding the patient-friendly presentation of informed consent choices. Another aspect of this CWA will focus on how to handle the subject’s access requests or withdrawal during a pilot evaluation. The planned CWA (to be completed in 2023) is intended to be used as a guideline for Horizon Europe research and innovation projects and other market participants when consent is needed for the use of digital health innovations.

10 Dissemination and Communication Plan

In the next period of the project, the following dissemination and communication activities are being planned.

10.1 Publication Plan

Several manuscripts are currently in progress for publication in journals:

i. An Integrated Solution for Sustainable Care for Multimorbid Elderly Patients with Mild Cognitive Impairment or Mild Dementia (CAREPATH): A Study Protocol for a clinical investigation. Angelo Consoli et al. (under review)

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ii. Introducing CAREPATH project: Roadmap for an Integrated and Sustainable Care system for Elderly Patients with mild Dementia or mild cognitive impairment (MCI) (draft white paper)
iii. Economic evaluations of healthcare interventions for the management of elderly multimorbid patients with dementia: a review (draft paper)

10.2 Dissemination Plan

In the next period, the following dissemination activities will be organized:

- Pilot site partners will be planning public information events in order to recruit patient and general physician participants to take part in the Clinical Investigation.
- Continue to publish regular blog posts and newsletters.
- Produce videos and demonstrations of the CAREPATH solution.

The following conferences/events are being targeted for future dissemination activities by the project:

- Medical Informatics Europe 2023, https://www.mie2023.org/
- 21st International Conference on Informatics, Management, and Technology in Healthcare 2023, https://www.icimth.com/
- DMEA 2023 25 to 27 April in the Berlin exhibition halls - Connecting Digital Health - DMEA is one of Europe's most important digital health conference and trade fair. Once a year, experts from the digital health industry meet for three days in Berlin. In addition to a comprehensive market overview, DMEA offers all stakeholders a wide range of opportunities for intensive exchange, targeted networking, and effective customer acquisition, https://www.dmea.de/en/

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11 Conclusions

In this deliverable, we have outlined the project dissemination strategy for communicating the project's results and progress. We have identified the key stakeholders and started to develop the key messages for each group and the communication channels to use.
In the first period, the project members have participated in a number of conferences, workshops, exhibitions and meetings to raise awareness of the project and to communicate the results so far. The project has also identified related projects for collaborations in similar topic areas, and has contributed to standardization work.
Finally, we describe the dissemination plan for the next period with targeted events and publications in the pipeline.

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12 Appendix – Sample presentation slides and papers

12.1 ICIMTH2022 paper

CAREPATH: developing digital integrated care solutions for multimorbid patients with dementia

Omid POURNIK[a], Bilal AHMAD[a], Sarah N. LIM CHOI KEUNG[a], Omar KHAN[a], George DESPOTOU[a], Angelo CONSOLI[b], Jawahar AYADI[b], Luca GILARDI[b], Gokce Banu LALECI ERTURKMEN[c], Mustafa YUKSEL[c], Mert GENCTURK[c], Henrike GAPPA[d], Martin BREIDENBACH[d], Yehya MOHAMAD[d], Carlos A. VELASCO[d], Oana CRAMAIUC[e], Cristiana CIOBANU[e], Elena GÓMEZ JIMÉNEZ[f], Almudena AVENDAÑO CÉSPEDES[f,g], Rubén ALCANTUD CÓRCOLES[f], Elisa Belén CORTÉS ZAMORA[f,g], Pedro ABIZANDA[f,g,h], Antje STEINHOFF[i], Wolfgang SCHMIDT-BARZYNSKI[i], Timothy ROBBINS[j], Ioannis KYROU[k], Harpal RANDEVA[l], Licinello FERRAZZINI[b], Theodoros N. ARVANITIS[a,1]

[a]*Institute of Digital Healthcare, WMG, University of Warwick, Coventry, UK*
[b]*Eclexys S.A.G.L, Switzerland*
[c]*Software Research Development and Consultancy Cooperation, Ankara, Turkey*
[d]*Fraunhofer Institute for Applied Information Technology FIT, Germany*
[e]*Centrul IT pentru Stiinta si Technologie, Romania*
[f]*Complejo Hospitalario Universitario de Albacete, Servicio de Salud de Castilla-La Mancha (SESCAM), Albacete, Spain*
[g]*CIBERFES, Instituto de Salud Carlos III, Madrid, Spain*
[h]*Facultad de Medicina de Albacete, Universidad de Castilla-La Mancha, Spain*
[i]*Universitätsklinikum OWL, Klinikum Bielefeld, Germany*
[j]*University Hospitals Coventry and Warwickshire NHS Trust, Coventry, UK*
[k]*Ocrylium, Switzerland*

Abstract. CAREPATH project is focusing on providing an integrated solution for sustainable care for multimorbid elderly patients with dementia or mild cognitive impairment. The project has a digitally enhanced integrated patient-centered care approach clinical decision and associated intelligent tools with the aim to increase patients' independence, quality of life and intrinsic capacity. In this paper, the conceptual aspects of the CAREPATH project, in terms of technical and clinical requirements and considerations, are presented.

Keywords. Clinical Decision Support System, Multimorbidity, Dementia

1. Introduction

In the last decade, development of Clinical Decision Support Systems (CDSSs) has become popular in the health informatics domain[1]. Implementation of CDSS in daily

[1] Corresponding Author, Theodoros N. Arvanitis, International Digital Laboratory, Warwick Manufacturing Group, University of Warwick, Coventry, UK, E-mail: T.Arvanitis@warwick.ac.uk

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medical practices is believed to improve healthcare providers' performance on clinical decision-making, quality of care and patient safety, although there has been disadvantages and limitations in their clinical implications[1]. Meanwhile, healthcare providers face challenges in conciliating recommended tasks and activities of different guidelines in multimorbid patients[2]. The heterogeneity of patients accompanied by the complex nature of their health condition makes the existing guidelines, with disease-oriented approaches incapable of providing the same level of improved patient outcomes in this group of patients[3]. This has highlighted the importance of patient-specific recommendations for multimorbid patients, which are frequently provided through computer-interpretable guidelines (CIGs)[3].

Such co-existence of multimorbid conditions can be very well demonstrated in diagnosis and management of dementia, where most guidelines have focused on managing dementia as a single disease[5]. The existing guidelines have been developed to provide the necessary advice on supporting people with dementia and their caregivers in health and social care, without holistic consideration of their implications on other morbidities and intrinsic capacity of the patient. At the level of "best practice", we are facing increased challenges and difficulties in the use of good clinical guidelines due to the co-existence of dementia with other morbidities[6]. These challenges can include but are not limited to polypharmacy, adverse drug reactions, and frequent non-adherence to treatments[3].

In Europe, the single-disease oriented health system and ageing population, which increases the risk of multimorbidity[7], has affected healthcare costs and efficacy and the sustainability of health systems[8]. When dementia is present, the situation becomes even more complicated[6]. The CAREPATH project is a research project within Horizon 2020 that focuses on the enhancement of healthcare interventions for the management of elderly multimorbid patients suffering from dementia. It aims at developing ICT solutions with integrated patient-centered approaches to care for patients with multimorbidity to increase their independence, quality of life and intrinsic capacity (9). In this paper, we are discussing the conceptual aspects of the CAREPATH project in terms of technical and clinical requirements and considerations.

2. The Holistic CAREPATH Solution

CAREPATH will provide a holistic environment that efficiently addresses multimorbidity and dementia challenge in the elderly population, by delivering three complementary components: (A) A *Home and Health Monitoring* platform implemented at the patients' homes integrated with *Advanced Early Warning Smart Decision Tools*, providing environment aware services with natural and comfortable interfaces for older adults for continuously collecting real time data for early detection of onset and changes in functioning, autonomy, underlying cognitive and physiological functions and to derive dementia profiles and intrinsic capacity of these patients, (B) A *Patient Empowerment Platform* providing personalized assistance to the patients, guidance and reminders about care plan goals and activities, present educational materials for reinforcing treatment adherence, collect feedback from the patients and their informal caregivers via PROMs for carrying out geriatric assessments and (C) An *Adaptive Integrated Care Platform* to be used by health professionals, enabling implementation of adaptive care plans for managing multimorbidity based on evidence from clinical guidelines, but prioritising and reconciling them with the help of clinical

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decision support systems, processing patient's most recent context from the home monitoring environment and Electronic Health Records for calculating risk scores for comorbidities and monitor disease progression and intervention effects and tackling polypharmacy management.

3. Steps for developing integrated patient-centered solutions

Team building: It is of crucial importance to identify and build partnerships with all stakeholders in the CDSS domain. For the CAREPATH project, a consortium is composed of ten organizations (universities, clinical organizations, and SMEs) from six countries (Germany, Romania, Spain, Switzerland, Turkey and UK). The team members have expertise in clinical, technical, health economic and ethical aspects relevant to the project. The clinical investigations will be carried out in Germany, Romania, Spain and UK, four countries with diverse health and social care systems.
Clinical Aspects: The clinical teams are expected to provide patient-centered best practice guidelines based on existing evidence, reviews, legislations, and expert consensus. They should also develop or approve the polypharmacy management services to be implemented in the CDSS. Clinical teams will also support collecting the user requirements and determine characteristics of various target users, as well as instrument specifications in the clinical setting. The clinical teams are also expected to provide a variety of probable scenarios and use cases to be tested during the integrated care plan development and pilot phase.
Technical Aspects: The main task expected from the technical team is to design and introduce a generic reusable architecture. This holistic, cross-sectoral and interdisciplinary patient-centered care model of personalized care services is built on existing prototypes of IONIS, C3-Cloud and inergo®-ICP (10). The system is intended to provide patients, healthcare providers and caregivers with smart early warning CDS services and home and health monitoring capability. There will be critical security and privacy issues to be dealt with during this process to help patients and caregivers better manage health related conditions. Finally, the integrated care solution would be presented in accordance with present standards such as HL7/FHIR, using comprehensive, multilingual clinical healthcare terminologies e.g., SNOMED. The functions will be performed by means of APIs for exchanging electronic health record based on CDS Hooks specification for describing the RESTful APIs and interactions to integrate Clinical Decision Support (CDS) between CDS Clients and CDS Services.
Economic and Ethical Aspects: A Health economic study and analysis is an important part of this project. The acceptability and sustainability of the project is partially determined by the success of adjustments made based on the findings of the health economic studies. The project endures important ethical considerations. An ethical team is required to participate in all phases of the development process to ensure all requirements are met.

4. Concluding Remarks

The health and social needs of ageing populations are often complex and ongoing, spanning a range of areas of functioning and fluctuating over time. Traditional care models for people in later life are frequently fragmented and inefficient[11]. Even in

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countries with reasonably well-developed health and social care provision, treatment of dementia patients with multimorbidity is generally provided without careful monitoring of the current intrinsic capacity and dementia profile of the patient. There is a need to employ fundamental changes to the focus of clinical care for older people from treating specific symptoms in a disjointed fashion to adapting holistic approaches according to older people's physical and mental capacities. CAREPATH will follow an integrated patient-centered approach, in order to develop a flexible and modular system that will provide a viable solution for improving the management of multimorbid elderly patients with dementia and possibly improving intrinsic capacity, by delivering a system of care adapted to their needs.

Acknowledgements. The work presented in this paper have been supported the European Union's Horizon 2020 research and innovation programme, under grant agreement No 945169, CAREPATH Project.

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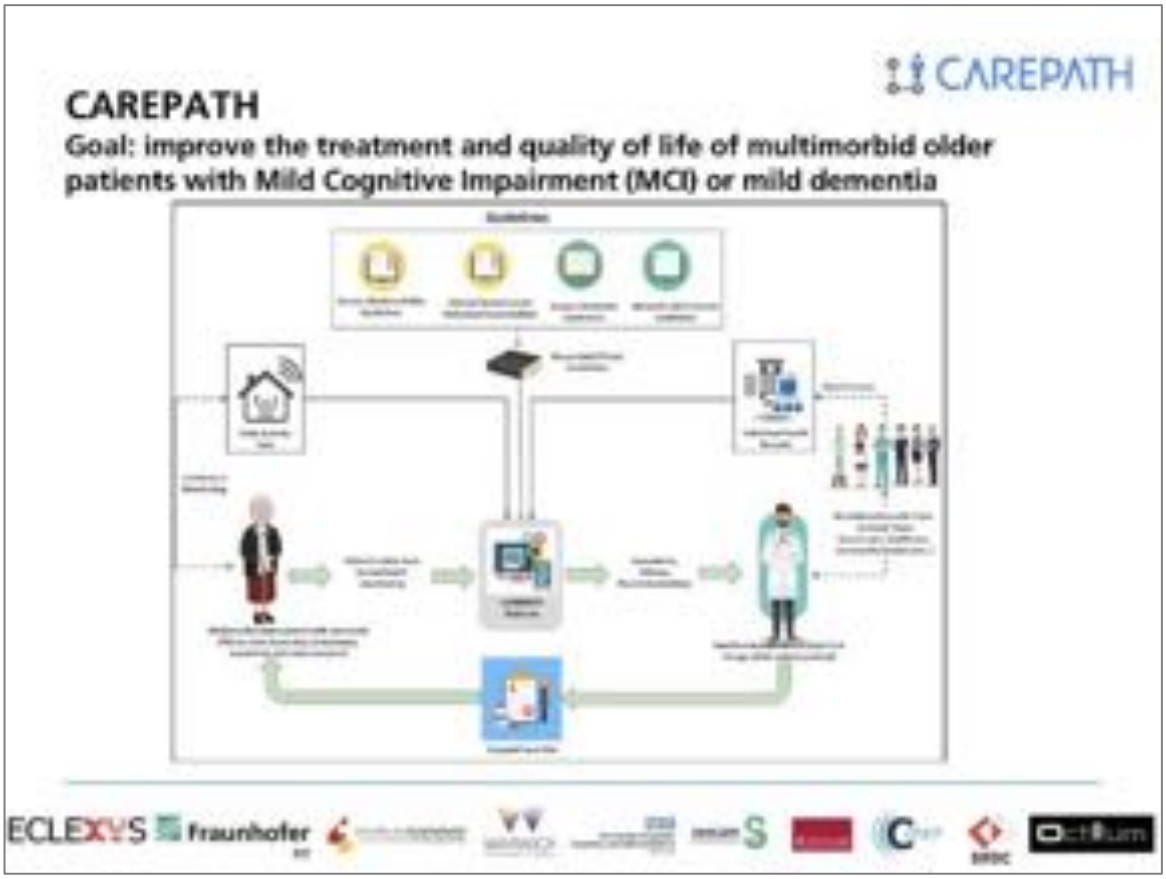
12.2 DSAI22 conference materials

12.2.1 Y. Mohamad et al. Key scenarios, Use Cases & Architecture of an E-health Homecare Instance

Presentation slides:



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2 SCENARIOS AND USE CASES FOR INTEGRATED CARE

Fraunhofer

CAREPATH

Participating clinicians

- 4 pilot sites in
  - Rumania,
  - Spain,
  - UK and
  - Germany

Fraunhofer

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Key Scenario Template

Subject	Action
Scenario	Provide a short description of the use scenario, so workflow and context-of-use become alive for all partners
User roles involved	GP ☐ Geriatrician ☐ Nurse ☐ PT/OT ☐ Dietician ☐ Social worker ☐ Patient ☐ Informal caregiver ☐ Other (specify) ☐ .....
User tasks	List user tasks depicting the workflow
Design in-/output of CAREPATH services	Describe here whatever is important to mention in regard to how a CAREPATH service should be presented to users enabling them to fulfil their tasks. For example, if input is required from a user, how shall the system be designed to collect this input. If the system provides output such as an early warning or analysis of a patient's health measurements, how shall this information be presented to the user.

Fraunhofer

Example of a filled key scenario template I

Action: early warnings (health professional view)

- **Scenario:** Carmen is a 71-year-old patient with obesity (BMI >30), diabetes, hypertension, sarcopenia, frailty and mild cognitive impairment. She has been included in the CAREPATH program for a few weeks. The H/HMP has been recording data correctly.
- Several Early Warnings have been triggered in the last 24 hours:
- - Risk of insomnia, and other sleep/circadian rhythms disturbances
- - Risk of hyper/hypoglycemia
- In addition, the H/HMP has recorded a fever of 38°C; in addition to changes in the movement pattern with nocturnal wandering, which has also been reflected in the sleep recording.
- The comments of his informal caregiver are also noted, who refers to an episode of disorientation at home.
- In the last two days Carmen has reported a "bad mood".

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Example of a filled key scenario template II

User roles involved	GP x Specialist x Nurse x PT/OT/Sport □ Dietist Social worker □ Patient x Informal caregiver x Other (specify) □		
User tasks	List of user tasks, depicting the workflow		
	Health professional	Patient	Informal caregiver
	• View eMH • AICP/EW • CDSS	• Comments PEP	• Comments PEP
Design of in-/output CAREPATH services	Based on these data Peter reviews all the records and decides to order a urine and blood test to rule out urine infection or other organic condition that could be altering Carmen. Carmen and her informal caregiver are alerted to the need for these tests. Information on alerting conditions is presented to health professional Out-of expected range results are highlighted		

Fraunhofer

Example of a filled key scenario template III

Related user requirements	• CARE-21 Health professionals shall be pointed specifically to alerting risks of their patients (early warnings) and corrupted/lost data from H/HMP • CARE-31 All results from patient's health data collected on H/HMP and PEP are presented to health professionals • CARE-32 Health professionals need to be supported in analysis and interpretation of results from patient's health data collected on H/HMP and PEP

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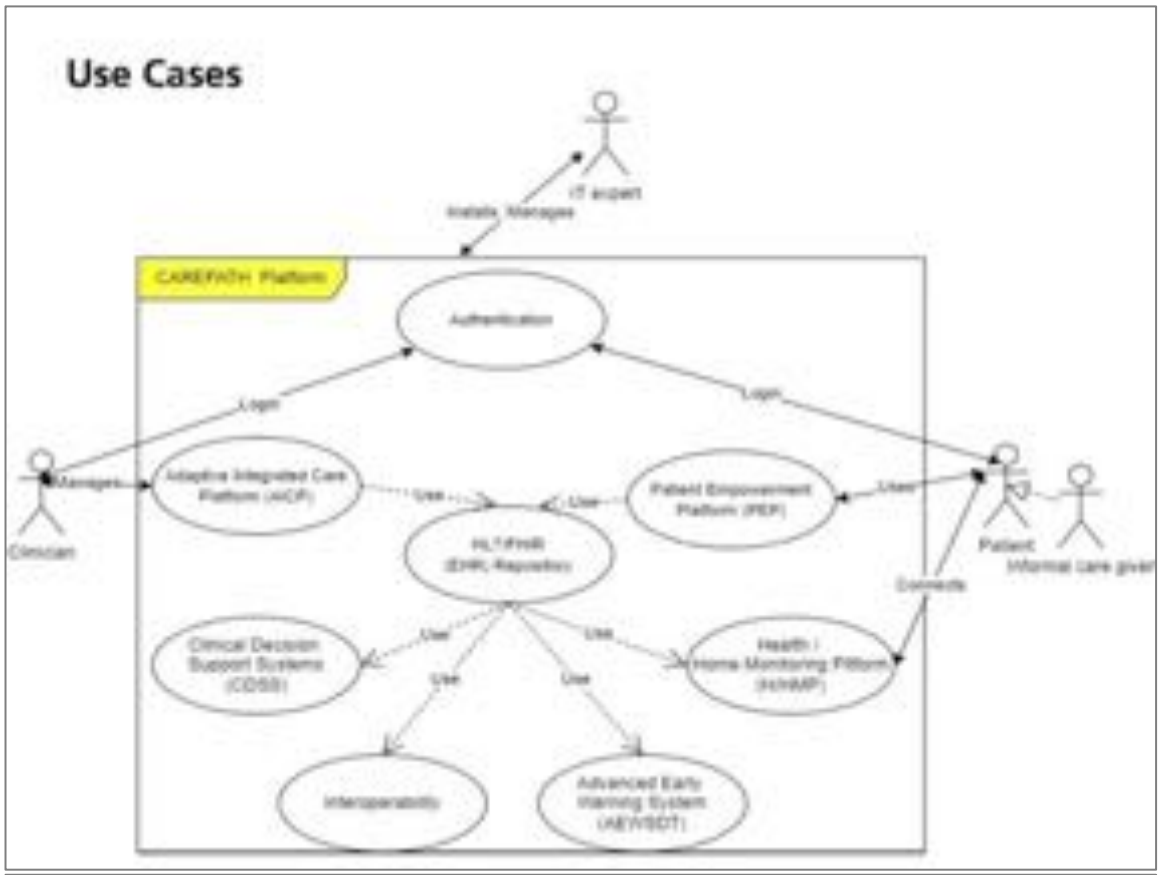

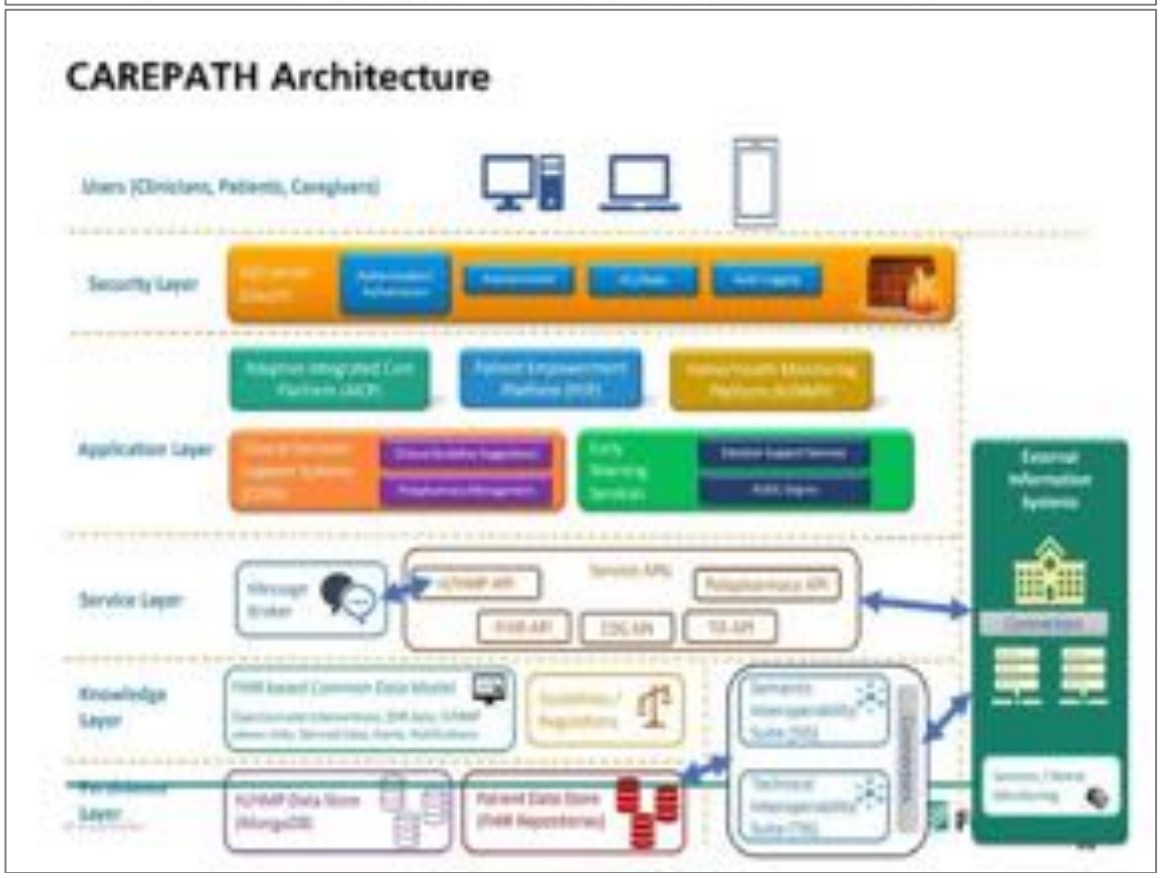

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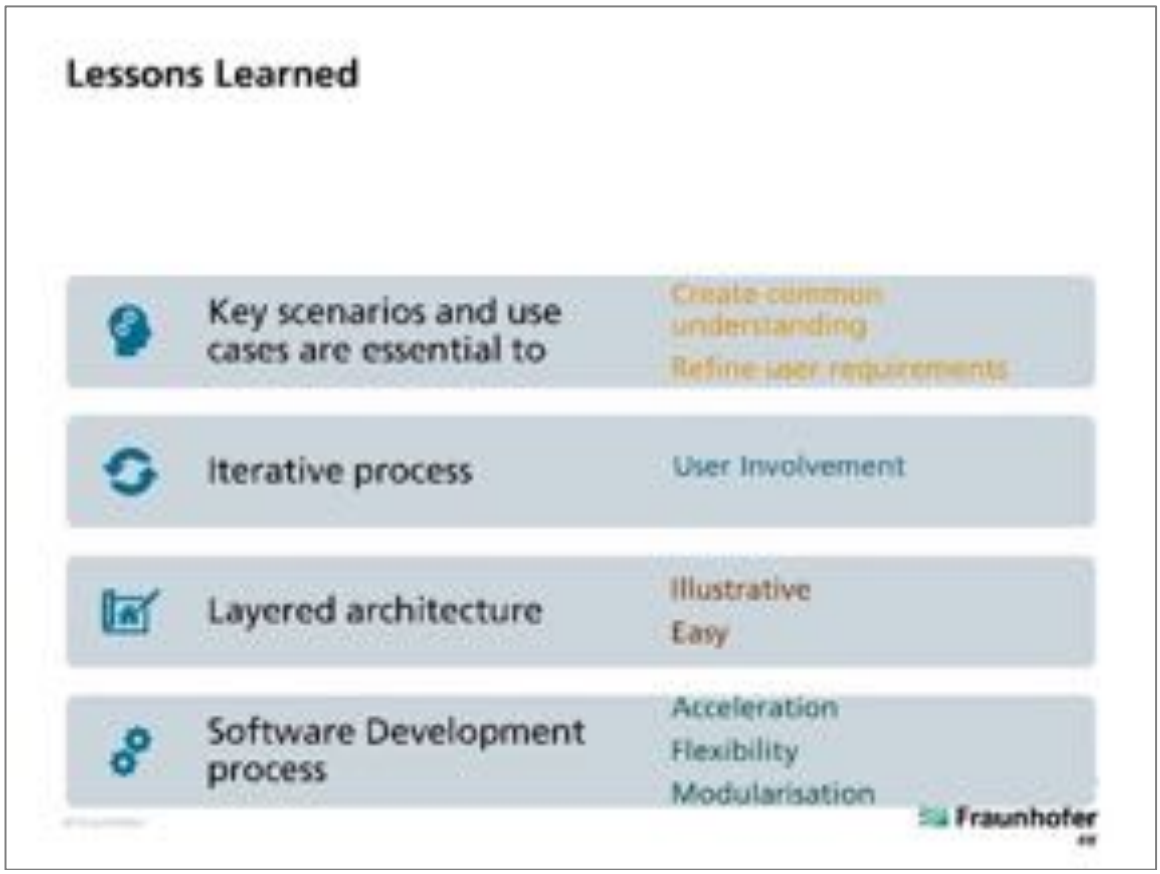

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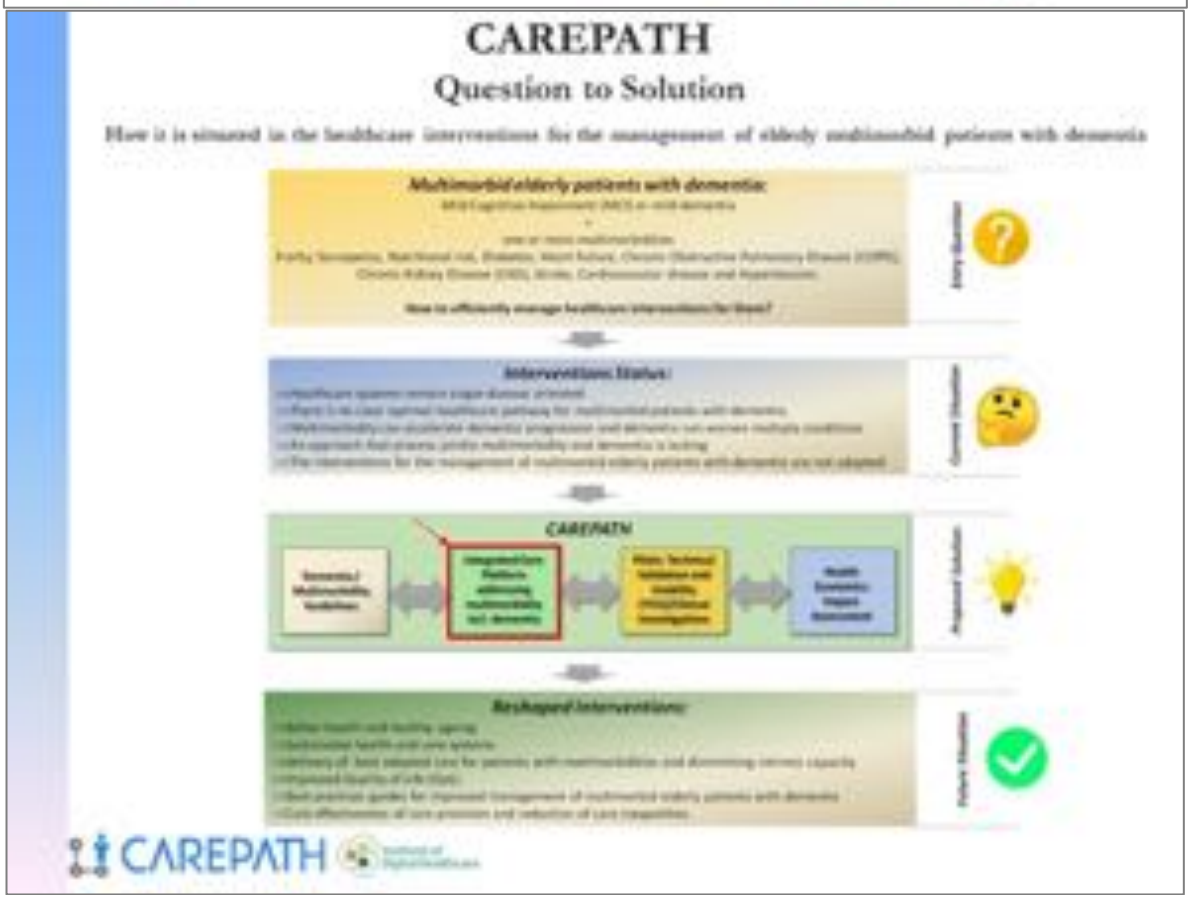
12.2.2 O. Pournik et al. CAREPATH methodology for development of computer interpretable, integrated clinical guidelines



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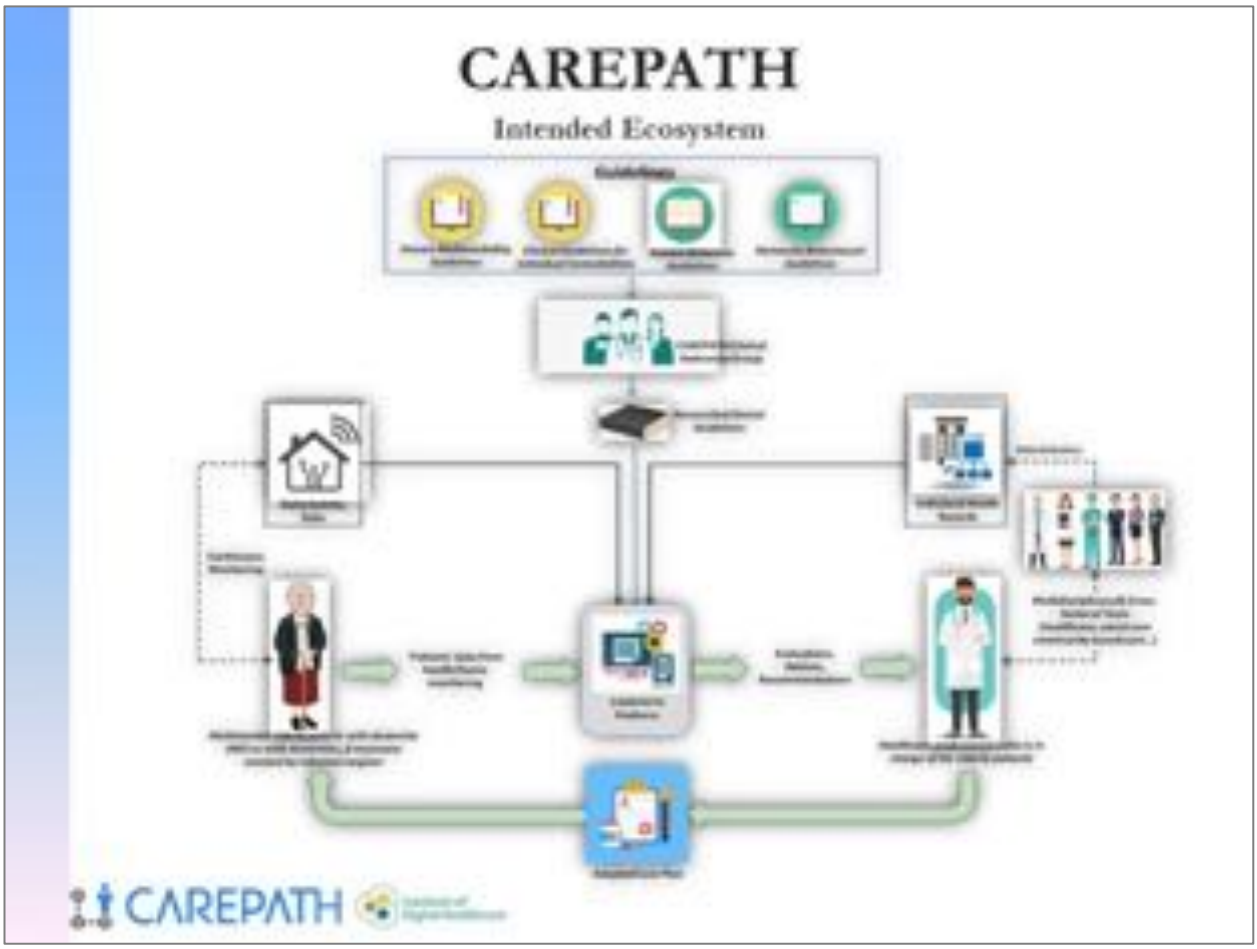

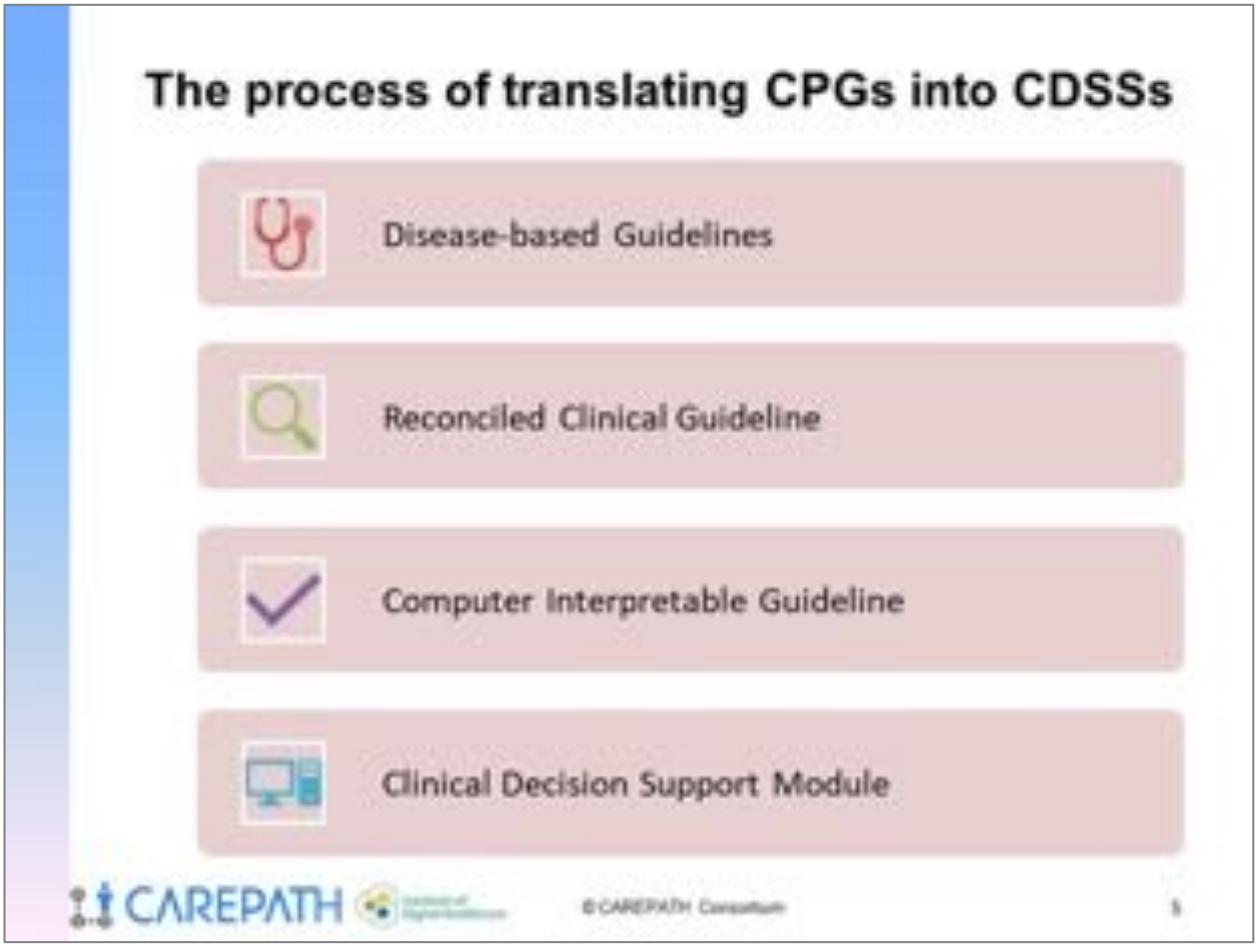

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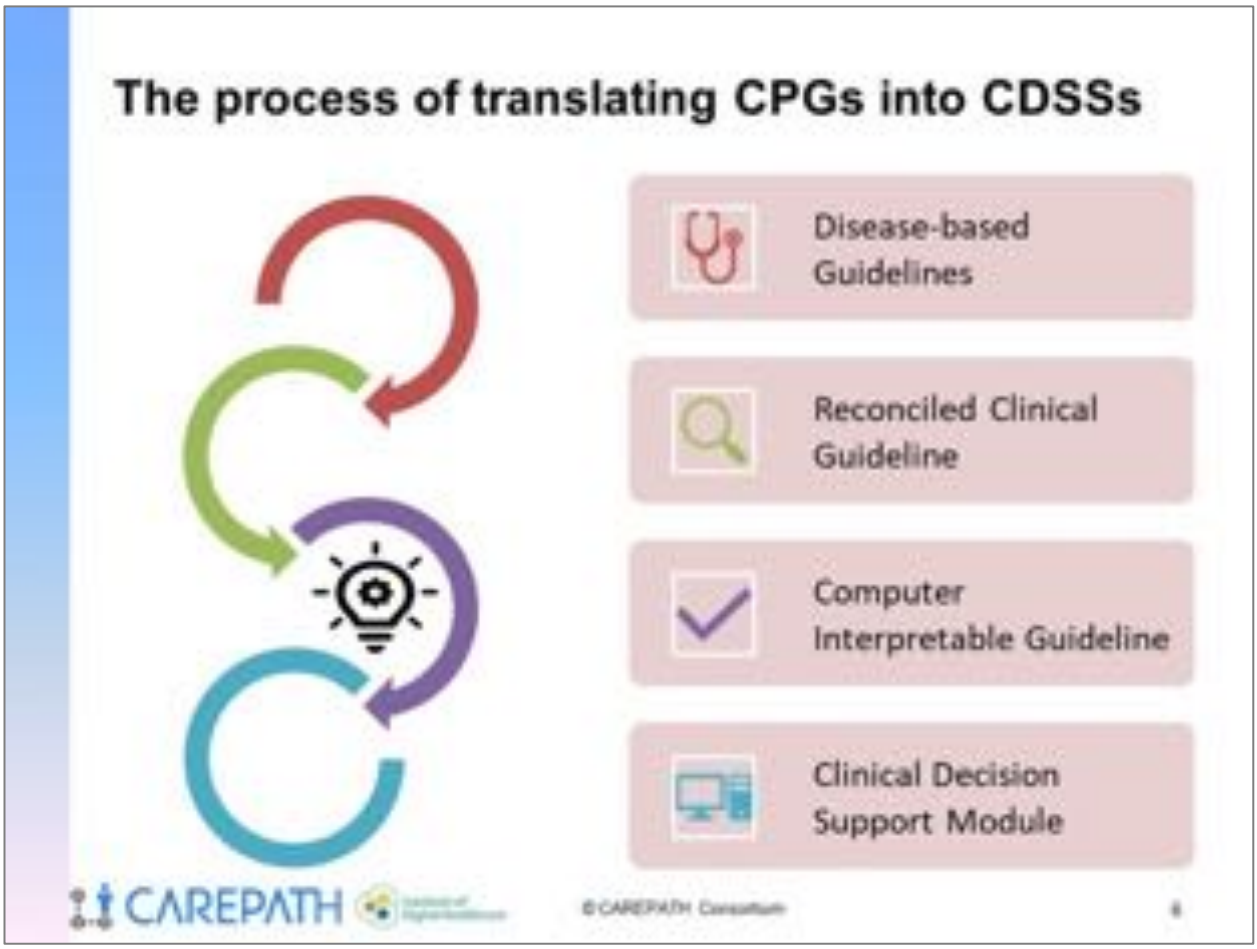

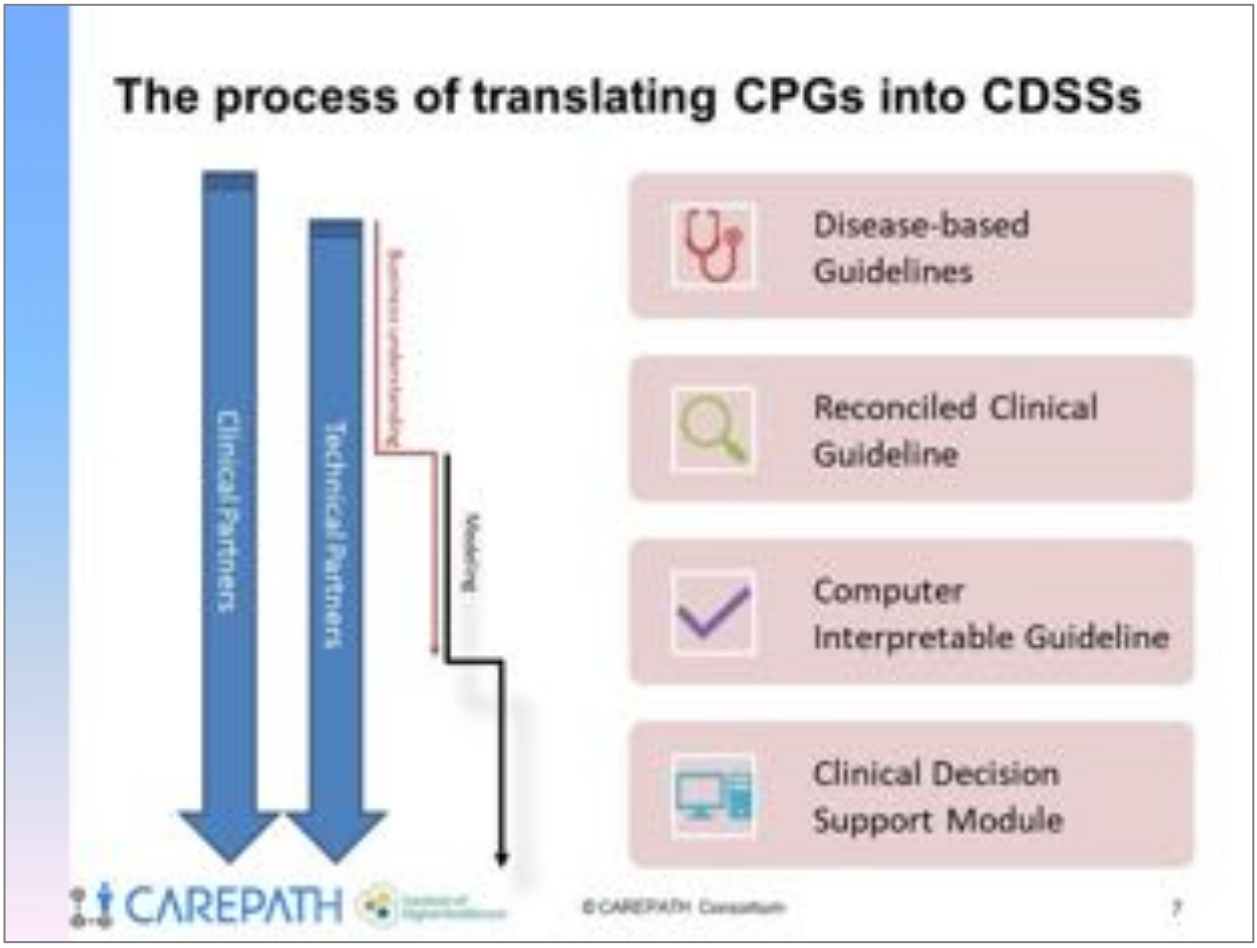

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Patient-centered computer interpretable guideline (CIG) modelling phases

Conceptual modelling phase

Interpretable modelling phase

Localization phase

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Conceptual modelling phase

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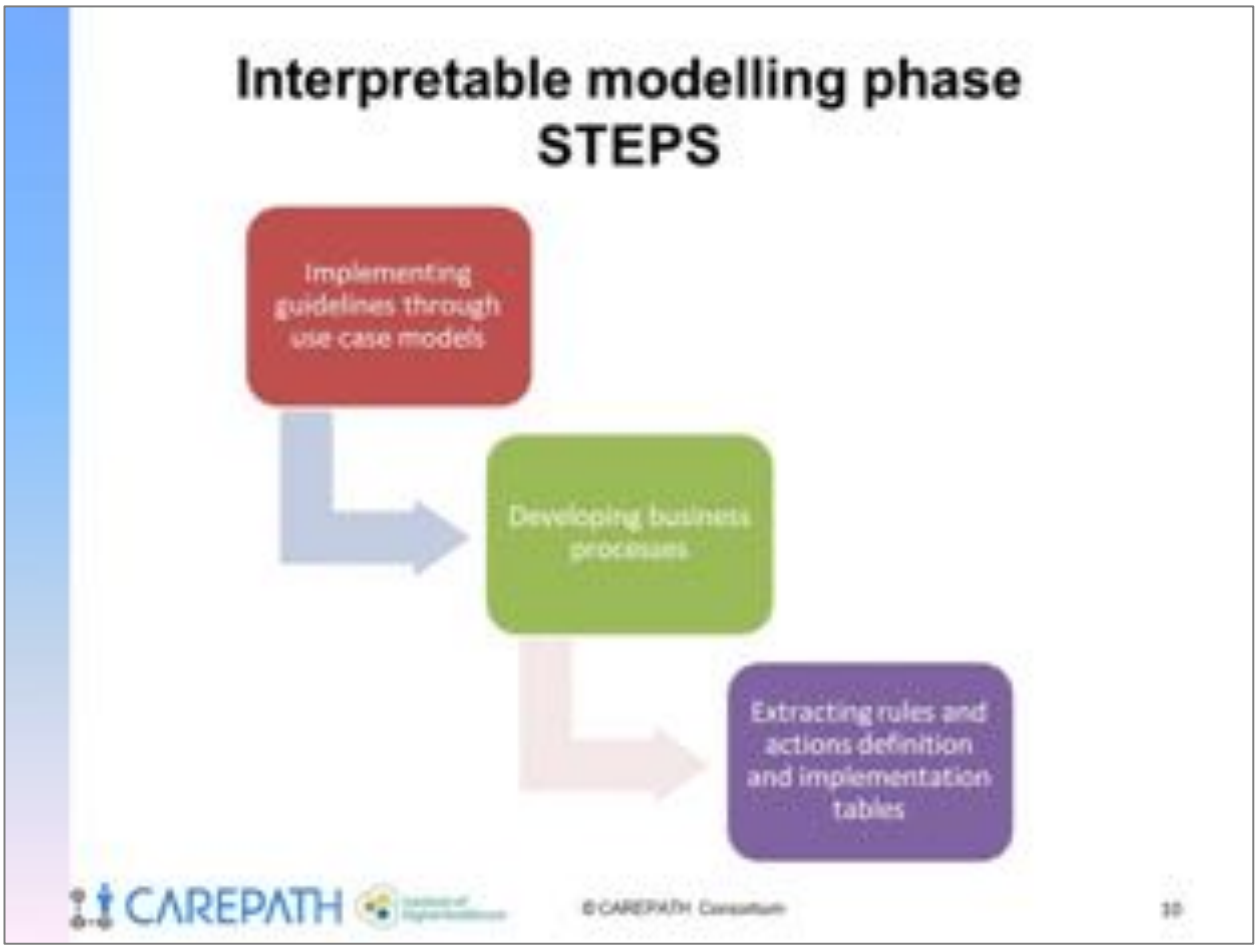

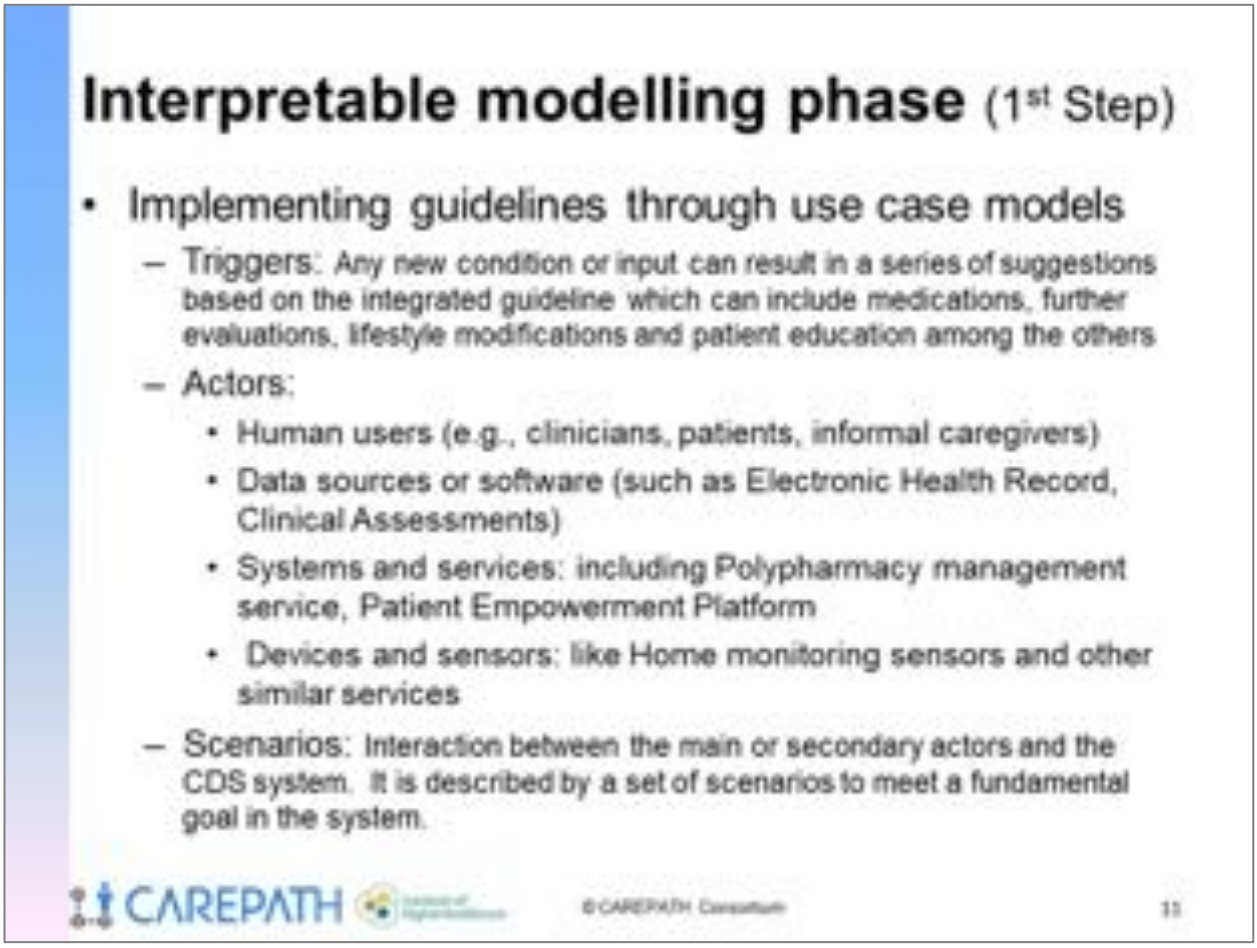

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Interpretable modelling phase (2nd Step)

- Developing business processes
  - Using business processes in combination with guideline flowcharts to extract
    - These may include but are not limited to
      - Decision tree pathway identification
      - The trigger event in any decision node
      - Switching and changing in states and actors and the expected results or targeted objectives.
      - The input
      - The output parameters to be conceptualized based on the CDS Hooks specification.

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Interpretable modelling phase (3rd Step)

- Extracting rules and actions definition and implementation tables
  - Using business processes in combination with guideline flowcharts to extract
    - These may include but are not limited to
      - Decision tree pathway identification
      - The trigger event in any decision node
      - Switching and changing in states and actors and the expected results or targeted objectives.
      - The input
      - The output parameters to be conceptualized based on the CDS Hooks specification.

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Diabetes - Blood Pressure Management

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Part of the BP management flowchart

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Blood pressure management module condition table

Condition No.	Condition Clause
C1	If one of the following conditions exists: ICD[E11.1A, E11.2B, E11.4B, E11.4C, E11.4D, O63.2] OR If albumin secretion in urine is 1-50 mg/l OR 120 µg/min OR 100 mg/24h (depending how it is presented)
C2	If systolic blood pressure (LOINC[8480-6]) < 140 and diastolic blood pressure (LOINC[8462-4]) < 80 (both from SS284-4)
C3	If medication ATC[C09] exists
C4	If systolic blood pressure (LOINC[8480-6]) < 130 and diastolic blood pressure (LOINC[8462-4]) < 80 (both from SS284-4)
C5	If medication ATC[C09AA or C09CA] exists
C6	If medication ATC[C08] exists
C7	If medication ATC[C03] exists
C8	If condition ICD[T46.4X5A] or allergy ATC[C09AA] exists
C9	If observation LOINC[64234-8] (current smoker) has 373066001 (yes)
C10	If observation LOINC[74313-4] (alcoholic drinks per day) > 0

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Localization phase

- At this phase models are ready to be implemented and customized based on the clinicians' opinion for different settings.
- This should be done in collaboration with the technical team and with considering legislative and ethical issues.
- When adaptation is completed, the pilot implementation can begin, and the system will be tested by simulated scenarios and data.

- Localization consists of
  - adaptation of inputs and outputs of CDS module and contents in accordance with the language, cultural and other specifications of the intended target settings.

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12.2.3 M. Genkturk et al. The design of a mobile platform providing personalized assistance to older multimorbid patients with mild dementia or mild cognitive impairment (MCI)

CAREPATH

The design of a mobile platform providing personalized assistance to older multimorbid patients with mild dementia or mild cognitive impairment (MCI)

DSAI 2022 Conference

1st September 2022

Mert Genkturk, [author block]

MERT GENCTURK received the B.S. and M.S. degrees in computer engineering from Middle East Technical University, Turkey in 2012 and 2015, respectively.

Ph.D. candidate in computer engineering at the same university.

Working as a technical manager and researcher at SRDC Corp located in Ankara, Turkey.

Research interests include machine learning, federated learning, interoperability, and their application in the healthcare domain.

- A spin-off company of the Middle East Technical University, Software Research and Development Center (METU-SRDC) (Founded in 1991)
- eHealth, Security, Factories of Future
- SRDC has been involved in 33 EU Projects since 1998
- In 9 of these, SRDC has acted as coordinator
- In H2020, SRDC has been involved in 11 Projects
- SRDC is the most successful SME in Turkey in FP6, FP7, H2020

SRDC

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Outline

- Problem
- CAREPATH project
- Methodology
- Design considerations
- Design of CAREPATH Patient Empowerment Platform (PEP)
- Conclusion

Problem

- Management of multimorbidity is complex
- The situation becomes more complex, when multimorbidity is associated with dementia.
  - Multimorbidity can affect their dementia, impacting on its clinical course
  - Dementia can impact management of their multiple conditions, by hindering their effective management

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CAREPATH project

- Enhancement of healthcare interventions for the management of conditions of older multimorbid patients suffering from mild dementia or MCI through several platforms

CAREPATH

CAREPATH Patient Empowerment Platform (PEP)

- Provides personalized assistance and guidance to patients
- Sends reminders about care plan goals and activities
- Collects feedbacks from the patients via Patient Reported Outcome Measures (PROMs)

- In this work:
  - Human-centered design process of the CAREPATHPEP
  - Design challenges, iterative mock-ups
  - Target user group: Older multimorbid patients with mild dementia or MCI

CAREPATH

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Methodology

- Collected user requirements through interviews
  - 16 patients over 65 years of age, living with mild dementia or MCI and with at least one chronic condition
  - 16 informal caregivers
  - 16 healthcare professionals
- Key scenarios & literature survey
- Identified main components and designed mock-ups
  - Daily tasks, Medications, Diet, Exercises, Appointments, Custom Tasks, Surveys, Symptoms & Events

CAREPATH

Design considerations

- Designed the app only for tablets
  - Reduces the cognitive load as it eliminates the use of an external keyboard or mouse
  - Larger screen, larger texts
    - Default font size 18pt as recommended by the Web Accessibility Initiative (WAI) of the World Wide Web Consortium (W3C) in the Web Content Accessibility Guidelines (WCAG) 2.1
- Built each screen in the same format
  - Consistency across the app is beneficial in improving patients' cognitive function in daily use
  - Minimizes the amount of information patients need to remember and learn, thereby avoiding disorientation and anxiety

CAREPATH

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Design considerations

- Easy and clear language
  - Simple, direct and precise texts in order not to cause confusion
  - Avoided complex expressions and abbreviations
- Avoided using scrolling feature as much as possible
  - Dementia can cause motor impairment
  - People with reduced motor skills often have trouble using scrolling, resulting in disorientation

Design of CAREPATH PEP – Daily tasks

- The first three designs:

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Design of CAREPATH PEP – Daily tasks

- Feedbacks retrieved:
  - Patients found the screen **very complex**. It was very tiring and incomprehensible to have too many items on the screen.
  - Patients found the **use of different colors confusing**. The purpose was to evoke patients of the task at a glance, but it did not create the desired impact when there are too many colors on a single screen.
  - Both the **design with checkbox** and **design with Yes/No buttons** were **appreciated**.

CAREPATH

Design of CAREPATH PEP – Daily tasks

- The final design:

CAREPATH

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Design of CAREPATH PEP – Medications

CAREPATH

Design of CAREPATH PEP – Push notifications

- One of the key components of CAREPATH PEP as they remind patients doing a task on time.
- How to clearly present a reminder message to patient is important.
- Send push notifications in question-form rather than order-form.
  - "Take your medication" -> NO
    - Patient could take the same medication again without remembering that he took it before.
  - "Have you taken your medication?" -> YES
    - Force the patient to remember and reduce the risk of taking the same medication twice.

CAREPATH

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Design of CAREPATH PEP – Diet, Exercise, Calendar

CAREPATH

Conclusion and Future Work

- The application has been developed to run on Android tablets.
- A technical validation and usability study will be performed with 16 patients with mild dementia or MCI.
- Then, the application will be used by 208 patients and their informal caregivers in a clinical investigation study that will be conducted in four European countries
  - Spain, Romania, Germany, and the United Kingdom for two years within the scope of the CAREPATH project

CAREPATH

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13 Review status

Deliverable leader:	Sarah N. Lim Choi Keung (WARWICK)
Contributors:	Sarah N. Lim Choi Keung, Theodoros N. Arvanitis, Omid Pournik, Bilal Ahmad, Aboubacar Mchangama, Jaouhar Ayadi, Yehya Mohamad, Wolfgang Schmidt-Barzynski, Antje Steinhoff, Khoi Le, Mert Gencturk, Lionello Ferrazzini
Reviewers:	Oana Cramariuc (CITST) Luz Maria Longobardo (UCLM)
Approved by:	Theodoros N. Arvanitis (WARWICK)

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Deliverable leader:	Omid Pournik (UoB) supervised by Theodoros N. Arvanitis (UoB)
Contributors:	Omid Pournik, Theodoros N. Arvanitis, Jaouhar Ayadi, Yehya Mohamad, Wolfgang Schmidt-Barzynski, Antje Steinhoff, Mert Gencturk, Lionello Ferrazzini, Luca Gilardi, Oana cramariuc, Timothy Robbins, Pedro Abizanda Soler
Reviewers:	Oana Cramariuc, Luz María Peña Longobardo
Approved by:	Angelo Consoli

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