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

WP3: Foundations of the Clinical Decision Support Services for the management of multimorbid elderly patients with dementia

D3.3: Machine learning and AI models used to provide early warning smart decision tools

Executive Summary

This deliverable will provide the design and development of smart decision tools, incorporating advanced technologies such as artificial intelligence and machine learning, to provide dynamic early warning about the development of the condition as well as the suitability of the treatment. In particular, it focuses on the description of the processing algorithms (ML algorithms, AI model, but also other types of data processing) selected, designed, and developed to provide AEWSDT.

Task 3.3 collaborates with WP6 to provide personalized predictions and warnings about the development of patient's health condition. Furthermore, it takes from T3.1 and T3.2 the CIG specification with CDS Hooks (using HL7 CDS Hooks standard interfaces), from which synchronous and asynchronous CDS engines will then be integrated in the Adaptive Integrated Care Platform of the CAREPATH system (Task 3.4).

The main objectives of T3.3 are reported in Table 1.

Table 1: Task T3.3 objectives.

Objective	How the objective is achieved
Estimating trends to generate warnings and initiate preventive actions already when the user's behavior begins to deteriorate. This will be an input to the Adaptive Care Planner to adapt the care pathway based on the current dementia profile of the patient.	Through a selected and tested set of algorithms, designed to estimate trends in evolution of dementia, intrinsic capacity and morbidity of patients.
Monitoring and estimating the changes in intrinsic capacity of the patient following the models proposed by WHO. Parameters are gathered from the continuously acquired quantitative information from Home/Health Monitoring Platform, calculated dementia profile of the patient, the data gathered from patients via PROMs and clinical parameters retrieved from EHRs. Changes in intrinsic capacity of the patient are then derived in a timely manner.	Through a selected and tested set of algorithms, designed to estimate the changes in intrinsic capacity, taking as input data coming from H/HMP, from PROMs and clinical parameters retrieved from EHRs.
Early identification of changing needs of the patient, longitudinal trajectories of intrinsic capacity and their dementia profile will facilitate adapting the care plan and interventions at the Adaptive Integrated Care Platform and wherever possible, to slow down and even partially reverse the progression and prevent sequelae/disability	Through a selected and tested set of algorithms, designed to the early identification of patient's longitudinal trajectories of intrinsic capacity and dementia profile.
Effectiveness of medication during treatment of the patient, and detection of possible side-effects.	Through the CAREPATH CDSS Drug-Drug Interaction Service (DIAS), and the Drug Interactions Advisory Service Ontology.
Development of a risk stratification model[1] in collaboration with WP6 and definition of how the risk categories will be monitored by the various tools;	Ref. Section 2.1.2

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[1] Risk Stratification is the process of identifying the right level of care and services required by a distinct group of patients.

Architecture and components of AEWSDT are described in Section 3.7 of D2.5: Specifications of all Components and Customisation Requirements, where in particular it is described a fundamental H/HMP's module, the Smart Rule Engine, that is used by AEWSDT to produce early warnings. Also, description of functional and integration tests is provided D4.6 Test Specifications of CAREPATH platform.

This deliverable focuses on the description of selected machine learning and AI models used to provide early warning smart decision tools and deepens the description of the methodology and technologies employed that were provided in D2.5.

Remarks:

1) Both intrinsic capacity and dementia profile are very well developed and established metrics that are defined around golden standards (see Section 2.1.3 of this document), and rely completely on clinical evaluation requiring direct interaction with the caregiver. Such procedures might therefore be very time consuming and represent a heavy burden for specialists. In this deliverable, it is presented a set of ideas and new metrics that attempt to circumvent as much offline clinical evaluations to the profit of monitored data through the CAREPATH facilities. The absolute reference and baseline remain however defined by the golden standards that will take place during the clinical trials.

2) Due to the absence of enough meaningful data and of the incomplete development of the platform functionalities at this stage of the project, an effective demonstrator can currently not be produced. A demonstrator will be prepared later in the course of the project implementation, with all the features foreseen by the project and reported in this document.

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