Virtual Coaching Activities for Rehabilitation in Elderly

Call: H2020-SC1-2016-2017

Grant Agreement Number: 769807

D1.3 Narratives representation for automatic reasoning Extended summary

The **vCare** project starts from the assumption that rehabilitation provides an ideal setting for the adoption of a Virtual Coach. Rehabilitation at home, supported by virtual coaches, can improve a patient's transition from clinic to home.

This report provides a framework of the knowledge domain in which the **vCare** virtual coaching will operate. The conceptualisation described in this report refers to a clinical ontology, depicted for each of the four clinical profiles addressed in the **vCare** project. The clinical perspective provides an overview of the scope of the project. The team has identified the reasoning behind the **vCare** platform which could be considered for automation. The technical team starts from the premise that the reasoning described in this report is acceptable for this purpose.

The **vCare** methodological approach was developed in the project's first work package (WP1). The approach consists of two phases:

Clinical Concept (the design the overall user framework)

Piloting (testing and validation of the **vCare** solution).

The Clinical Concept is composed of three tasks:

Task 1.1: Healthy, Behavioural & Well-Being models

Task 1.2: Narratives for virtual coaching

Task 1.3: Knowledge representation requirements.

This report is the outcome of the third task of WP1 of the **vCare** project. The report can be usefully read in conjunction with deliverables D1.1 and D1.2. Deliverable D1.1 helps to have a general view on rehabilitation pathways and to understand the tables described in the operational block of knowledge representation. Deliverable D1.2, which is the narratives booklet, and its use cases, helps to understand the workflows described.

BACKGROUND

This report investigates the key elements of the clinical reasoning around patients' rehabilitation pathways. It provides a wide vision to the **vCare** technical partners of what could be automated from a clinical perspective. It is structured according to two main blocks, a theoretical block and an operational block:

- **Theoretical block**. This block is called the "narrative representation for automatic reasoning". It provides a number of definitions (i.e., automatic reasoning and ontology). It presents the approach to the ontology description, illustrating the classes included in the ontology from a general perspective.

- **Operational block**. This block is called "knowledge representation". It provides a description of the different dimensions of the ontology, according to the different rehabilitation pathways impacted. For each one of the four **vCare** clinical centres, the parameters of the different classes which compose the ontology are described.

A body of formally represented knowledge is based on a conceptualisation: the objects, concepts, and other entities that are presumed to exist in an area of interest and the relationships between them. A conceptualisation is an abstract, simplified view of the world. Every knowledge base, knowledge-based system, or knowledge-level agent is based, explicitly or implicitly, on a conceptualisation.

THEORETICAL BLOCK

An analysis of the existing literature on automatic reasoning and ontology as widespread concepts in artificial intelligence was conducted. As a result, a new **clinical pathway ontology**, based on the existing literature, was designed (see *Figure*).

The five dimensions which have been considered in the ontology follow. They are the personal conditions, environmental context, the flow of action, documents and evidence indicators, and feedback. (In brackets are the classes of the ontology to which these five dimensions correspond.)

- **Personal conditions** (personal state, clinical state and patient profile): Act as a starting point for the sphere of action of the "automatic reasoning" and are the result of the clinical activity inside the hospital. They represent the baseline to set up the actions of the Virtual Coach, thereby driving the dynamic adaptation of the clinical pathways.
- **Environmental context:** Together with patient profile, this lies outside the sphere of action of the "automatic reasoning". It nevertheless represents the baseline to set up the action of the Virtual Coach.
- **Flow of action** (process flow, actions, roles, time events): Some flows of actions have been depicted. They show the kind of reasoning behind the use cases. They include both the clinical and the automatic reasoning.
- **Documents and evidence indicators:** These documents and indicators are provided by clinical reports (which are usually represented in a standardised way, called "evaluation scales") and by instrumental parameters. The automatic reasoning compares the values included in the assessment document with the evidence indicators. Based on any discrepancies between the expected behaviour and the results of the actions performed, the reasoner (i.e., the virtual coach) selects the most appropriate suggestion and directions for the patient. These discrepancies will be analysed in order to find the appropriate treatment/suggestion for the patient.
- **Feedback:** This dimension gives responses and comments. As a result, virtual coaching should empower patients, according to the rules embedded in the automatic reasoning.
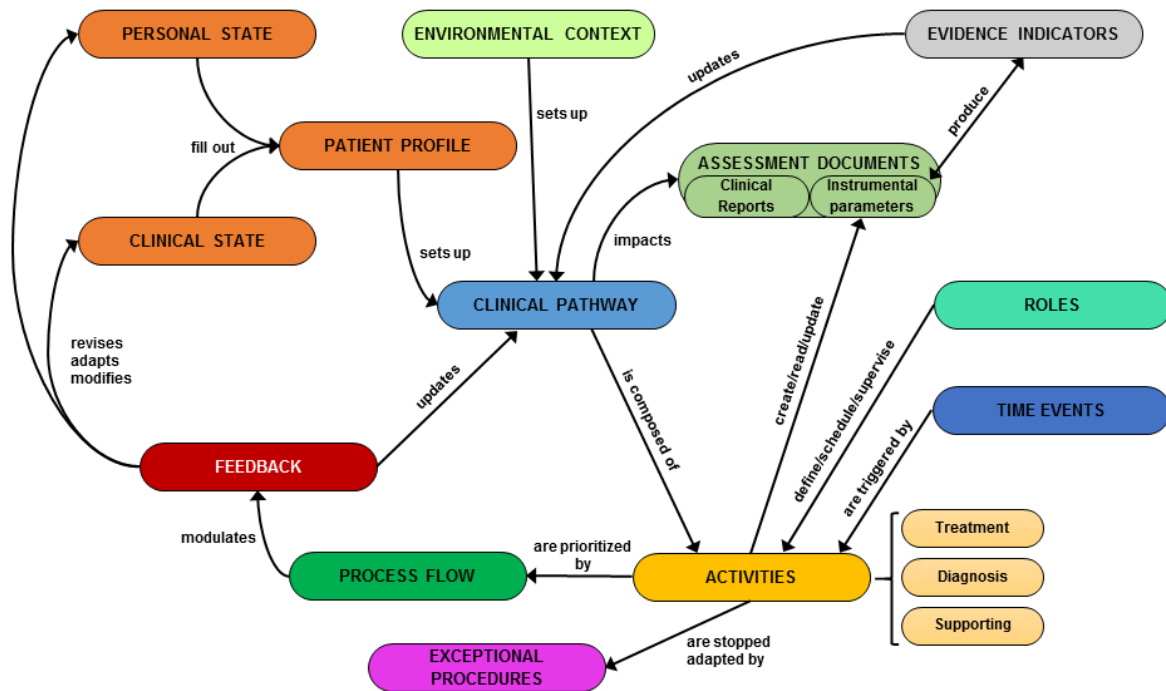
Figure: Proposed vCare Clinical Pathway ontology, based on Braun et al. 2014.

OPERATIONAL BLOCK

Once the reasoning ontology is defined, its classes will be described in relation to *vCare*'s four diseases and rehabilitation programmes.

All the information contents are laid out, for each pathology/disease, in a table. The table contents are to be interpreted according to the main three application areas of the *vCare* platform:

- **Health coaching**: Supports the rehabilitation of patients (with motor and/or cognitive rehabilitation).
- **Behavioural coaching**; Supports risk reduction and adherence to the care plan and lifestyle choices.
- **Well-Being coaching**. Promotes an active life, social activities and social relationships.

REFERENCES

Braun, Richard, et al. "BPMN4CP: Design and implementation of a BPMN extension for clinical pathways." *2014 IEEE International Conference on Bioinformatics and Biomedicine (BIBM)*. IEEE, 2014.