A Chronic Ontology Model as TeleCare-Decision Support System for Longitudinal Monitoring of Bipolar Patients

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INTRODUCTION Bipolar Disorder (BD) is a severe psychiatric illness that exhibits a time-dependent recurrence. The dramatic mood swings between mania and depression that accompany BD cause impacts in every aspect of a patient’s life. The effectiveness of pharmacotherapy and therapeutic compliance in patients with BD increase the complexity of this chronic illness. Addressing these issues, we exploit Semantic Web Technologies (1) to develop AI-CARE, a TeleCare-Decision Support System based on evidence-based clinical guidelines and patient’s medical information. We present a chronic knowledge representation (ontology) model describing the scenario of mania that incorporates acute episode and treatment algorithms as well as patient-centered factors.

METHODS Considering the scenario of mania and relying on clinical guidelines and recommendations, our chronic ontology model integrates information from patients history, pharmacotherapy and other therapeautic interventions. The ontology encodes BD concepts, their relationships and their evolution in time. It applies clinical guidelines for the consistent management of these changes (2).

AI-CARE Clinical Decision Support System

GUI allows the users to interact with the recommendation system through graphical icons and visual indicators.

Considering the expert knowledge, the evidence based clinical guidelines, and the information availability about individual’s health record and patient-centered factors:

- Encodes the available information and links health observations with health knowledge
- Ascribes clinical recommendations/notifications to influence health choices by clinicians for improved health care
- Supports the longitudinal monitoring of the patient’s mental state
- Informs constantly the psychiatrist about the patient’s course of the disease
- Provides emergency scenarios alerting the psychiatrist for non-compliance with drug treatment, mood changes, possible recurrence
- Enhances the quality of medical health care
- Considers patient’s well being and improves the quality of life of patients suffering from the disease
- Considers privacy/security issues providing safety in patients’ health records.

Knowledge Representation

Class Diagram describes the structure of the system by showing the system’s classes, their attributes, operations (or methods), and the relationships among objects.

Ontology Elements

Classes: represent the concepts (e.g., Patient, Therapy etc.).
Properties: represent relationships between the concepts (e.g. Patient’s health record includes information about the medication the patient receives).
Individuals: represent objects in the domain of interest (e.g., Patient 1.2, Medicine 1.2.).

The time changes in the domain are reflected in the transition of the static concepts into dynamic concepts.

Rules encode the clinical knowledge in a computerized form. They are a set of asserted facts or axioms in a logical form that together comprise the overall theory that the ontology describes in its domain of application.

Rules engine, or simply reasoner, is a piece of software able to infer logical consequences from rules. The system reasons over the rules, the knowledge and information collected, and provides decisions and recommendations for the next steps of the treatment.

DISCUSSION We present the AI-CARE clinical decision support system for supporting online and interactive management of BD patients. The method allows clinicians to monitor patient’s condition and provide notifications on best treatment of the patient’s actual state.

AI-CARE enables clinicians to have a useful online tool, which may be requested to frequently monitor the patient’s condition or to provide notifications for critical shifts of the patient’s condition.

SELECTED REFERENCES

RESOURCE GUIDELINES and TREATMENT ALGORITHMS
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- Canadian Network for Mood and Anxiety Treatments (CANMAT) and International Society for Bipolar Disorders (ISBD) collaborative update of CANMAT guidelines for the management of patients with bipolar disorder
- The CANMAT task force recommendations for the management of patients with mood disorders and comorbid medical conditions
- National Institute for Health and Care Excellence (NICE) clinical guidelines 105: Bipolar disorder: the assessment and management of bipolar disorder in adults, children and young people in primary and secondary care
- Australian and New Zealand clinical practice guidelines for the treatment of bipolar disorder
- The Psychopharmacology Algorithm Project at the Harvard South Shore Psychiatry Program
- Clinical practice recommendations for bipolar disorder