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PainRE-Life: A FHIR Based Telemonitoring Ecosystem for the Management of Patients with Chronic Pain

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Abstract. Chronic pain is a condition in which the use of digital health technologies, ecological momentary assessments, and digital communication tools may boost patient's engagement and coping. Here we present the results of the PainRE-Life a project, financed by the Lombardy Region (Italy), aimed to develop a dynamic and integrated technology ecosystem based on big data management and analysis to allow care continuity in patients with pain, and able to act as a decision aid for patients and caregivers.

Keywords: chronic pain management, HL7 FHIR, patient reported outcome measures

1. Introduction

Chronic pain is a burdensome condition, with high social impact, with the patients experiencing a limited working capacity, psychiatric issues, and general disability, especially for the limited effects of pharmacological and nonpharmacological treatments. PainRE-Life is a project, financed by the Lombardy Region (Italy), aimed to develop a dynamic and integrated technology ecosystem based on big data management and analysis to allow care continuity in patients with pain, spanning throughout the whole care process, from diagnosis, to therapy, and to telemonitoring, as well as being able to act as a decision aid for patients and caregivers.

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2. System architecture

The PainRE-Life project involves a multidisciplinary team covering both technological skills and clinical expertise. From the technical side, Nuvyta Srl, a company providing advanced FHIR based solutions for modular and configurable electronic health record (EHR) systems, the University of Trieste, involved for the artificial intelligence and bioengineering expertise, and Zadig Srl, a company with long-term expertise in scientific communication and personalized digital health system development; from the clinical side, two clinical centers (the Casa di Cura del Policlinico Rehabilitation Center, and the Oncology Hospital Istituto Europeo di Oncologia), and a start-up company active in home-based telerehabilitation. The project developed three main technological assets integrated in a single digital GDPR compliant ecosystem: a FHIR (Fast Healthcare Interoperability Resources) based cloud platform (Nu Platform) that enables care pathway definition and data collection; a big data infrastructure connected to the FHIR server that analyzes data; an ecosystem of personalized applications for PROs data collection, digital delivery of interventions, and decision support of patients and caregivers. The infrastructure was designed considering clinical care pathways for selected use cases. The clinical care pathways were implemented starting from the analysis of available clinical guidelines and international recommendations, followed by a consensus between clinical experts involved in the project, and finally translated into clinical workflows through medical process modeling. The patient apps were developed following a user centered design based on the organization of patients', caregivers', and clinicians' focus groups.

3. Results, Discussion and Concludions

The system implements three digital care pathways for the management of pain in post-stroke, early breast cancer[1], and fibromyalgia (treated with transcranial direct current stimulation, tDCS) patients. Each care pathway involves the execution of a workflow in the Nu platform, that allows collecting all the data (pain severity scales, pain location, psychologic assessment) to be completed by the patient/caregiver at home or by the healthcare professional in the hospital setting. Three clinical centers, and a home-based telerehabilitation service provider served as case studies for the PainRE-Life platform. The system was tested on a total of 55 patients in three clinical studies.

Collectively, the results obtained so far showed that the PainRE-Life ecosystem allows full data collection and availability, through the integration of a clinical platform with mHealth apps for PROMs collection, thus supporting the chronic pain patient in the definition and execution of her/his care pathway even when pain is connected to different pathologies.

References

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