1. Title

Situational awareness and services acceptance in home care treatments

2. Key words

Home care practice environment, Therapy, Patient behavior, situational awareness, self-diagnostic, Business Process, Big Data, service acceptance, Path-finding, care optimization, human centric approach.

3. Context

Advances in several subfields of information and communication technology (ICT), including social computing, sensor networks, the Internet of Things, and intelligent information processing, have given rise to “a world of data” with fast and pervasive analytics at scale. In recent years, there has been a growing interest in collecting and analyzing data about several aspects of our life, especially for home care. This emerging context has implications for how home health care may need to change to meet future needs.

In the context of home care, the adaptation of medical treatment to the Activities of Daily Living (ADL) remains a huge challenge when the knowledge about user lifecycle covers several dimensions: past activities, behavior, beliefs, values, occupation, experiences, attitudes, etc. many health care data exist but that almost no information on home health care is available.

Currently, the definition of the specific user context and related services depends on the medical treatment prescribed and the patient's known environment. The variability of this specification is strongly caused by omitted aspects such as location, treatment schedule, medical interfaces, home isolation conditions, specific situations, etc.

The notion of personalized care has been an important factor underlying the provision of quality care and a central consideration in the design of health and social services for the home clinical treatments. Personalized care places emphasis on the individual needs of a person rather than on efficiencies of the care provider or the sophistication of technologies for care support; builds upon the strengths of a person as an individual rather than on their weaknesses as a care receiver; and honors their values, personal choices, and preferences. An overarching goal was to support care receiver to maintain a sense of self.

Therefore, the proposed project aims to integrate the user characteristics in the definition of personalized services to optimize the treatment acceptance and to highlight how personalization of care has become a particularly huge challenge as we develop more automated care services and IT-based solutions to serve the home care receivers.

3.1. Company presentation

The Linde Group is a world leading supplier of industrial, process and specialty gases. Linde is one of the most profitable engineering companies proposing products and services in nearly every industry in more than 100 countries. A success story that began with the separation of air.

Linde Homecare France, a subsidiary company for homecare business, is specialized in patients’ following-up with different chronical pathologies (respiratory, infusion, nutritional, etc.). In a permanent purpose of well-being and respect of treatments compliance, the company is totally

engaged in a e-health strategy supported by connected devices and a new clinical approach for patients.

3.2. Research lab presentation

DISP-lab (Decision & Information Systems for Production systems, EA4570), gathers researchers from the "Université de Lyon" around a double expertise in Industrial Engineering and Enterprise Information Systems.

The DISP lab brings to this project specific competences in:

- IoT and IoS
- Data analytics
- Service lifecycle management with dedicated efforts in service design, development, implementation, deployment and performance assessment (quantitative and qualitative)
- Business process modeling and optimization
- Risk and total quality management
  Software engineering

3.3. Research objectives and expected results

The proposed research project targets the following objectives:

- Propose methods to measure the treatment acceptance: ensure the coherence between medical prescription of home treatments and receivers perception of a successful application
- Propose methods to self-diagnostic of treatment efficiency: define adapted services scaling the efficiency at the earlier stages of treatments
- Propose methods for path-finding: provide feedback to medical prescribers about the best treatment path as perceived from receivers

In coherence with the proposed objectives, the research project targets a close loop human centric approach for treatment acceptance with optimized earlier efficiency.

The expected application domain concerns the sleep apnea pathology with a scaling perspective to the other Linde covered pathologies.

The proposed research problem promotes a very challenging healthcare problem covering the following scientific interests:

- Guide data analytic effort for new home clinical service development.
- Adapt services to optimize health treatment and patient treatment path
- Detect long term health risks
- Constitute open patient profile repository to qualify targeted healthcare problems

3.4. Socio-economic interest

In the local regulation, compliance is the first challenge to empower the patient with his treatment and a basis for the refund of receivers. The job environment is moving from an obligation of means to results requirements. Therefore, the main targeted socio-economic interests are:

- Detect nighttime and daytime symptoms: High blood pressure, Irregular heartbeat, Heart disease/heart attack, Stroke, etc.
- Improve patient well been
- Reduce treatment cost

- Improve the efficiency of the ecosystem: the treatment prescriber, the patent as treatment receiver and Linde as the treatment operator.

4. Research methodology

To support the development of this research project, we identify from the literature three research topics to investigate and develop in an integrated methodology:

Big Data analytics in healthcare

Big Data is identified in recent research projects and publications as inevitable analytic capabilities that can integrate several shared clinical data sources and repositories to create new knowledge about medical treatments and patients. Implementing related technologies covers different data varieties (structured, semi-structured, unstructured, and probabilistic), acquisition, organization, analytic and new values classifications and specifications. In the context of clinical data exploration, Big Data may serve risk elicitation and opportunity, cost estimation, service innovation, preventive / predictive / prescriptive analytics, etc.

Patient profile lifecycle

The development of patient-centric approaches for clinical treatment is widely promoted as the most relevant path for successful medical treatment. The design of patient pattern requests consolidated knowledge about user health problem (cluster) and related parameters as activities of daily living, home occupation, user experiences and behavior, past activities before the diagnostic of the health problem, personalized requirements, existing regulations for user safety and security, etc.

The identification of these patterns will accelerate the analysis of new user context and then maximize the quality of patient support during his treatment. Ontological modeling may present advantages for dynamic pattern definition and exploitation. Patient profile lifecycle can be improved for example by machine learning or other technics.

Dynamic service detection and definition

According to the evolution of patient treatment, self-diagnosis and monitoring services are expected to detect events during long medication period. The proposition of situational analyzer will help to identify personalized user requirements, deduce relevance factors and propose adapted reminders, recommendations and projection for a successful treatment. User context covers effective criteria as well as emotional aspects such as trust, comfort, apprehension, etc. The relevance of proposed services when integrating user context remains the key enabler for the acceptance of the medical prescription at the earlier stages of the treatment. Hence, we expect to reduce the rate of deserting patients.

From the technology perspective, an analytic effort is expected to classify available proprietary and open source solutions to build the most relevant technology foundation as support for the implementation of the proposed methodology.

5. Project Environment

To support the development of the proposed research project, the both partners involve the support of the following resources.

5.1. Linde Homecare France Company

- Olivier Grasset: Scheduling and clinical center manager with competences in operational process development and assessment.

5.2. DISP Lab

- Néjib Moalla: Associate-Professor and HDR in computer science with competences in Big Data, service lifecycle management and software engineering.
- Aicha Sekhari Seklouli: Associate-Professor in computer science with competences in process modeling, service lifecycle management, risk management and total quality management.

The PhD student will integrate the Linde Homecare France as IT researcher for 36 months in CIFRE contract http://www.anrt.asso.fr/fr/cifre-7843 (the salary will be fixed according to the HR rules). The research project will be developed within the Linde HomeCare France - Clinical Coordination team (60%) at Bourg-en-Bresse and the DISP research Lab (40%) at University Lumière Lyon 2 – Bron.

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7. Application

For application in this PhD position, applicants are invited to communicate:

- An updated CV
- A motivation letter with explicit interest in this research project
- The last academic transcripts
- The last produced report
- At least two recommendation letters

For applications and further request of information, please contact:

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