Argumentation-based Decision Support for Patient Self-Management

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The provision of health care to people with chronic conditions and multiple morbidities is a growing challenge as the proportion of the UK population suffering from such conditions is increasing. Multiple morbidities can result in conflicts between different clinical practice guidelines used to treat each disease, interactions between diseases and their treatments, and confusing advice. Research has established that involving patients in the management of their own chronic conditions has long-term health benefits [6]. Advances in low-cost sensor technologies make it practical and easy for patients to collect a wide range of health and wellness data without direct clinical supervision, including blood pressure, heart rate and activity. The use of tablets and smart phone technologies to provide targeted decision support and advice can assist patients as they self manage their conditions by leveraging the updated sensor data to refine any recommendations made in conjunction with the relevant clinical practice guidelines.

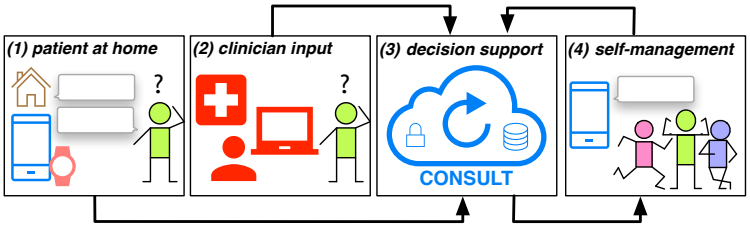

Figure 1. Overview of CONSULT and the Self-Management Process

The **CONSULT** (Collaborative Mobile Decision Support for Managing Multiple Morbidities) project aims to establish a proof-of-concept system that can assist patients suffering from chronic diseases with multiple morbidities self-manage their treatment in collaboration with health care professionals and carers. Figure 1 provides an overview of the self management process and the role CONSULT's decision support will fulfill. A patient may be overwhelmed by the diverse information tracked by the wellness sensors (1), and in the case of multiple morbidities, conflicting treatment guidelines can arise for the clinician treating the patient (2). CONSULT aims to apply computational argumentation-based decision support (3) based on the patient's electronic health record (EHR), clinical guidelines, wellness sensor data and input from patients, their carers and clinicians. The recommendations made are communicated in a fully explainable manner

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through mobile devices. Users (i.e. patients or clinicians) will be able to query the reasoning behind these recommendations (4); this will increase both the understanding and confidence in the recommendations given.

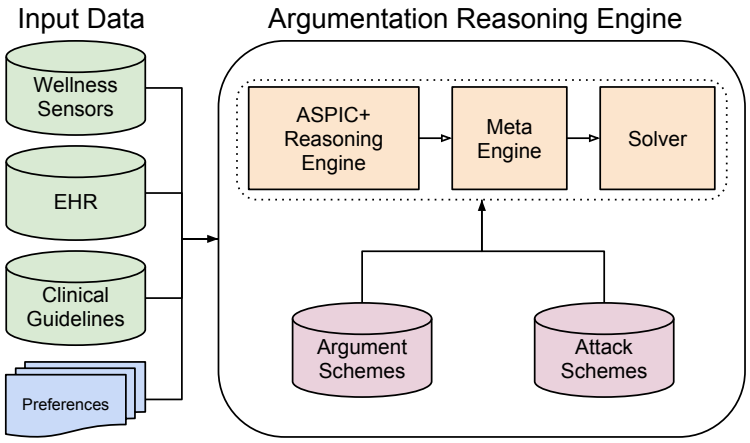

Figure 2. The Architecture for CONSULT

CONSULT's argumentation engine will detect conflicts in treatment guidelines that frequently arise in the management of multiple morbidities, and will provide advice regarding which treatment options to follow and when the conflicts can be resolved through further inputs by the patient or a clinician, such as having the patient expressing a preference towards one of several alternative treatments. As shown in Figure 2, the argumentation reasoning engine receives data from wellness sensors, the patient's EHR, clinical guidelines and the preferences of stakeholders (i.e. the patient and health care professionals). For example, clinical guidelines pertinent to a patient's diagnosis will dictate the possible treatments and the number of treatments to prescribe concomitantly. The argumentation reasoning engine, which is based on ASPIC+ [4], uses the received data to instantiate argument schemes and attack schemes; and it constructs arguments and attacks to support any self management or treatment query related to the patient [1]. CONSULT will make use of an Answer Set Programming (ASP) approach to: (i) transform an object-level argumentation framework (AF) to a metalevel AF (MAF) [3,7], (ii) find the justified arguments and attacks in a MAF, which will support specific treatments or actions [2]. The argumentation results are then shared with the stakeholders via personalized dashboards.

We will evaluate CONSULT on a use case focusing on secondary stroke prevention. We have recruited a cohort of stroke survivors, health care professionals and carers to guide us through the process of designing CONSULT, in particular how the information and recommendations can be displayed in an intuitive manner, and what the barriers and facilitators are for stroke survivors to adopt this technology [5]. After building CONSULT, we will evaluate its performance through a appropriate user study. CONSULT will thus be a step towards providing data-driven, personalised and transparent treatment guidance to help patients self-manage their chronic multiple morbidities.

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