Customised computerised clinical protocol guidelines for medical education: the case of Chronic Kidney Disease (CKD) using domain-specific languages

ABSTRACT

Educating healthcare professionals to correctly manage long-term conditions such as Chronic Kidney Disease (CKD) can be complex [1]. Converting theoretical understanding of clinical concepts into logical steps for identifying and managing a disease is not straightforward [2]. There is a risk to patients if guidelines and protocols are not followed correctly, for example through not identifying a condition like CKD in a timely fashion [3] or sub-optimally managing key risks such as hypertension [4]. In addition, during both initial training and in later professional development, professionals need to adapt to changing clinical guidelines and emerging findings from research [5]. Therefore, there is a strong need to support medical professionals with learning and adopting current and emerging clinical protocol guidelines, particularly for complex conditions such as CKD.

From the technical perspective, and although specialised software solutions that are customised for complex clinical protocols and verified by medical professionals can be extremely valuable tools towards this aim, there are several challenges. More rigorous validation and verification processes for the software developed are required to ensure correctness [6]. The whole software development process and the resulting artefact need to be "understandable" and "accessible" by the non-technical users to ensure validity and adoption.

Domain-specific languages (DSLs) are an advanced technique that can address both above issues. They allow "correct-by-constriction" software development [7] and non-technical domain users to interface with complex technological systems bringing technology to non-technical audiences [8].

In this project, using CKD as an exemplar, we used open-source DSL for the development of clinical protocol software: the Guidelines Definition Language (GDL) DSL [9] by Cambio CDS [10]; the PROforma [11] and a custom DSL developed in our research group. Commercial DSLs, such as those developed by Voluntis [12], also exist.

Initial evaluation of the developed artefacts will take place within the University of Southampton medical school. Experiential software engineering methods through surveys and co-creation workshops with co-developed domain-specific criteria was the approach followed. This is a new approach developed and trialled in this project. All existing approaches focus on DSL usability aspects [13] and are too hard to introduce. They also ignore the domain-specific focus of the DSLs. The initial results from this project's outcomes will be presented at the conference as experimentation at the time of writing this paper is still ongoing.

Concluding, our plans include the design and development of a custom simulator on top of the presented software. The domain-specific languages technology will be also used for this to provide a customised simulator and enable medical professionals to contribute directly to the software development [14].

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Keywords— domain-specific languages, clinical protocols, chronic kidney disease, medical education, computerised clinical protocols

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