Clinical Decision Support Services

Functionality

The Clinical Decision Support (CDS) Services uses evidence-based clinical guidelines and combines them with patient-specific information to support clinicians in managing patients. For a user of the C3-Cloud solution, the functionality of the CDS Service is to provide advice and recommendations based on patient information from the EHR system as well as from information inserted from the clinician in the Coordinated Care & Cure Delivery Platform (C3DP).

As part of C3DP, the CDS Services access patient data from different sources to subsequently fuse and analyse all these data. As an output from the analyses, the CDS Services returns patient specific recommendations to the user in the management of e.g. poly-pharmacy and care plan goal setting. CDS Services has in the C3-Cloud project been developed to incorporate NICE guidelines in four different clinical areas: type 2 diabetes, renal failure, depression, and heart failure.

Solution Components

The typical C3-Cloud CDS Service components consist of:
- machine readable clinical information (such as clinical rules indicating thresholds, calculative formulas and other logic)
- Guideline Definition Language (GDL)[1] rules engine

Users

The type of user will be different depending on the purpose of the CDS Service, some apps are directed towards nurses, some towards general practitioners etc. In general, the user is a clinical worker. In the C3-Cloud project, the users of the C3DP are members of multidisciplinary care teams.

Benefits

The expected benefits are:
- Improved patient safety and treatment efficacy by facilitating evidence-based care
- Optimise care process by prompts/reminders and automate repetitive clinical tasks such as documentation or ordering
- Improve equality of care and reduce unnecessary variations of care
- Users receive relevant clinical information at relevant times at point of care
- Healthcare providers gain more control and assurance that evidence-based clinical practice guidelines are followed
- Reduce total ownership of cost of knowledge based by enabling sharing and reuse of informatics standards based clinical models across language and technical barriers
- Low maintenance cost due to cloud based CDS systems with rapid deployments whenever needed

---

[1] The Cambio-produced Guideline Definition Language is a part of *open*EHR's official specification for CDS.

Benchmarking

Compared to existing CDS solutions on the market, CDS Services developed with tools from the CDS Platform are:

- Based on open standards (such as *open*EHR archetypes or HL7 FHIR profiles)
- Agnostic to natural languages and reference terminologies
- Vendor neutral
- Easy to maintain and facilitate due to CDS Services are managed as stand-alone products

Limitations

The general limitations for CDS systems are:

- Clinical practice guidelines are not produced in a machine readable format so there is sometimes a need of translations and/or interpretations of clinical information
- Variations in how data is structured. Not all EHR systems provide standards-based structured clinical information

Business Model

The business model of providing the CDS Platform is a very flexible Software-as-a-Service (SaaS). The pricing model can either based on the total number of inhabitants or clinical professions as the end users depending on the nature of the subscriber of the CDS Platform.

Implementation

Implementing CDS Services is in general a straightforward process. The implementation effort varies depending on the context in which the CDS Services are to be implemented in. Important parameters that influence the implementation are:

- How well clinical data in an underlying system is structured and based on medical informatics standards
- What the integration capabilities from an underlying system provider are
- How well clinical rules and guidelines are documented

Dependencies

Technical and organisational dependencies are:

- One-off configuration of CDS in underlying healthcare information system (e.g. EHR system or another platform such as C3DP):
  - Firewall whitelisting of CDS service in the system client
  - Mapping of necessary datatypes such as keywords and search words in underlying system
- Users training
- Clinical expertise is required while translating clinical practice guidelines into computerised CDS models

Customisation

A healthcare provider organisation can decide where in their patient management flow to allow for clinical decision support. The CDS Service can for instance be implemented in:

- a care planning context,
- a referral process,
- a health risk assessment context, or
- an order management system/module (to check for contraindications while placing orders).