A Distributed Healthcare Quality and Outcomes Analysis Architecture

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Abstract

Patient-centred quality monitoring and reporting is needed to improve the cost effectiveness of health services. A multi-vendor and multi-professional accessible layered architecture can meet common requirements of both clinician- and patient-reported outcome measures (PROMs). A distributed modular, layered collaborative standards-based architecture permits ethical information exchange between any set of trusted nodes, leveraging the interoperability, privacy and infrastructure frameworks of the IHE. The approach enables wider reach and cost- effectiveness for large-scale distributed implementations along the entire 'patient path'. The emergent vendor-neutral, internationalised translational computing system supports data aggregation and analysis in EHR-derived healthcare quality improvement and longitudinal outcomes studies.

Keywords:

Distributed systems, Translational computing

Introduction

Stakeholder requirements

Health services across the world are in a continual process of reform as they respond to pressure to deliver the 'highest quality' and 'best outcomes' for patients with diminishing resources. From analysis of requirements, four key features have emerged: (i) a 'geographically agnostic' information management system that is 'quick, simple and understandable' by all named steholders (ii) an ability to *embed* or to become *routine* in whatever clinical system or scenario it is applied to (iii) minimum cost without the burden of expensive licensing 'on-costs' e.g. *dependence* on a given IT vendors application 'stack' (i.e. it must be able to work with *all* IT vendors systems ~ the 'vendor-neutrality' principle) and (iv) have condition-independence and be applicable across all healthcare domains, localities, institutions, or national borders (that might reasonably be encountered on the 'patient path'). The above suggests 'architecture' should not be 'monolithic' but 'layered' with fully-defined, open-standard (non-proprietary) interoperability between the layers, so that *many* global healthcare ICT vendors can participate in the model (i.e. supply products into the quality/outcomes system given detailed information on its interoperability specification). To make the model work, we assert it is essential to completely separate (a) the common knowledge model of the healthcare domain that is the focus of the multi-professional collaboration and (b) the technology solutions or 'ICT stack' chosen to implement the architecture. The separation of these concerns, plus a system design that has conceptual integrity are critical aspects for global 'scalability'. Such 'scalability' matters in research optimising healthcare system designs and where semantic aggregation of data is required for translational/discovery-driven clinical research.

Results

Standardised validated longitudinal EHR-based reporting (measurement) instruments

Validation data was collected coherent with the detailed requirements analysis. For common purposes, the instruments were focused in three different frequent-use routine monitoring scenarios that are all delivered in a distributed fashion by the common architecture: (a) Patient-reported outcome measures (PROMs) analysed what patients are concerned about or how they felt about things and/or whether they could do what they wanted. (b) Patient experience measures had a standardised metric response of asking the patient to signal their compassion-related experiential variables (ii) communication-related experiential variables and education for patients, their family and friends plus (iii) collaboration-related variables reflecting patient experience of clinical team working (c) Staff satisfaction measures sought to establish a *routine evidence base* for the experience of healthcare staff working in an organisation or division.

Core infrastructure for supporting distributed healthcare quality and autcomes analysis will be discussed on the poster. It includes capacity for universal CDA format data submissions / extractions along the patient path, an IEEE X73 standardised data input device service, a distributed linked pseudonymisation mechanism with localised information governance control, a distributed IHE XDS repository-registry network, standard data transformation functions (e.g. error-checking routines), longitudinal outcomes research tabulations in a global standard format (CDISC STDM – study data tabulation model, and various analytical toolbox developments (including standard statistical, outcomes modelling, PROM, data mining, visualisation and inferential analysis workflow programs). There are also longitudinal EHR interfaces (for advanced patient-level and aggregated semantic EHR queries) plus referral and rescheduling services for prioritised health service interventions supporting the outcomes research computational functions.