# Overview and Instructions

When Digital Square issue a call for applications, applicants can upload concept notes to Digital Square’s public-facing Open Application Process (OAP) [platform](https://proposals.digitalsquare.io). In the first phase of the [Open Application Process](https://wiki.digitalsquare.io/index.php/Procurement_Processes), applicants will submit concept notes. Concept notes should be **three pages or less**in length and include the following sections:

1. Title
2. Two-Sentence Overview
3. Executive Summary
4. Consortium Team
5. Project Description

Please create your concept note directly in this document. *Please delete all “Instructions for the applicants” prior to submitting the application for review.*

When submitting the concept note to the [OAP platform](https://proposals.digitalsquare.io), applicants will need to copy sections the first three sections into the [OAP platform](https://proposals.digitalsquare.io) application page and list the consortium team organization(s), as applicable. The platform will also ask you to provide digital health atlas registration confirmation (required), tagging, geographic reach, and source code, as applicable.

Digital Square requires that the global good is registered as a software in the [Digital Health Atlas](https://digitalhealthatlas.org/en/-/) (DHA). This ensures that users of the DHA can reference it in future project registrations.  If the digital health tool is registered, please include a screenshot of the entry under “Attachments.”  If it is currently not part of the taxonomy to register the software, please register by contacting Maeghan Orton at maeghan.ray@gmail.com and include a copy of this email under “Attachments” in [OAP platform](https://proposals.digitalsquare.io).

Should you have questions about the guidance provided in this document, please reach out to your Digital Square point of contact or [digitalsquare@path.org](mailto:digitalsquare@path.org) for additional guidance.

If your concept note is selected to move forward into the application phase, you will need to complete the [technical application template](https://wiki.digitalsquare.io/images/0/0b/Technical_Application_Template_FINAL.doc).

Please navigate to [procurement processes](https://wiki.digitalsquare.io/index.php/Procurement_Processes) for more information on funder investment mechanisms. For more information on the overall process for selected applicants, please review [investment process for global goods](https://wiki.digitalsquare.io/index.php/Global_Good_Investment_Process).

# Towards an Integrated HIE Approach to Patient-Level Indicator Reporting

## Two-Sentence Overview

To support with an integrated approach to patient level monitoring, we propose the use of a health information exchange that supports onboarding of multiple digital health systems through HL7 FHIR-based interfaces, providing a common way to connect and register data to a longitudinal client record, on which indicator calculations are performed.

This work will be achieved through a consortium of partners working together on a shared vision and architecture, leveraging each partner’s individual strengths while limiting overlap, and optimising investment through an integrated, extensible approach, enhancing existing global goods towards a solution that supports multiple Point of Service applications and Health Information Exchange components able to support patient-level indicator reporting.

## Executive Summary

The Digital Square investment will be used to bring together a consortium of partners to collaborate on solution to patient-level monitoring that is appropriate and scalable for low and middle income countries (LMICs). We propose the use of a standards-based architectural framework and integrated solutions to patient-level monitoring. Our vision of an integrated approach adopts the use of international architectural patterns (OpenHIE) to provide a mature solution that is both instantiable and reusable, through the use of an extensible framework able to support a multitude of Point of Service (PoS) applications in an integrated patient level monitoring system.

The consortium aims to use the Digital Square investment to support FHIR profiling activities to specify the data model, resource mappings, terminologies and indicator definitions relevant to the priority use case, supporting the development of HL7 FHIR interfaces in the selected PoS applications and IOL, and demonstrating the end-to-end feasibility of the paired and integrated approaches to extracting indicator data from a Minimum Data Set Message or a shared longitudinal data store.

## Consortium Team

Jembi Health Systems will lead and oversee a consortium consisting of technology organizations OpenMRS Inc., BlueSquare, Open Concept Lab (OCL), and IntelliSOFT. In this role, Jembi will set up a central Health Information Exchange (HIE) sandbox for testing, and ensure the platform provides FHIR-based end points for Point of Service applications to submit demographic and clinical data, and enable extraction of indicators from a longitudinal FHIR server. OpenMRS Inc. will work to ensure OpenMRS supports integrated patient-level monitoring architecture, and similarly, BlueSquare will focus on openIMIS, Open Concept Lab on the OCL suite of tools, and IntelliSOFT on Bahmni.

Jembi is an African non-profit company specialising in digital health and open source software development and implementation. Jembi has a successful track record developing and implementing open source software in the health sector, including in a number of African countries. It has contributed to many open-source software development projects and communities of practice, including OpenMRS, Bahmni, OpenHIM, HEARTH and OpenHIE. Jembi is registered and headquartered in South Africa with country offices in Mozambique, Rwanda and Zambia.

OpenMRS Inc. provides oversight on the open source EMR, OpenMRS, and its associated community, which seeks to engage and motivate contributors and supporting organizations who actively engage in all aspects of the software development and implementation process.

Bluesquare is a Belgian data company founded in 2012, focused on digital health in emerging economies around the globe. Bluesquare, thanks to its proven experiences in designing and leading IT products in use in UHC sector, will reinforce the development team and ensure that the high level architecture is translated without distortion into concrete software components. Thanks to its involvement in the openIMIS re-architecture, which includes the provision of a native HL7 FHIR interface, Bluesquare will also facilitate a good integration with the coming openIMIS platform.

Open Concept Lab (OCL) provides an open-source suite tools to support terminology and metadata management, including the OCL Terminology Service, OCL Metadata Browser, and OCL for OpenMRS Authoring Interface. OCL is recognized as a digital global good and works in close partnership with the OpenHIE and OpenMRS communities. OCL is actively supporting PEPFAR’s demonstration project for TX\_PVLS to evaluate indicators directly from patient-level data.

IntelliSOFT Consulting Limited is a wholly owned Kenyan company with more than 8 years of experience. As a technology company, IntelliSOFT has deliberately focused on designing, developing, implementing, supporting and maintaining digital health solutions, particularly for Low to Medium-Income Countries. They have extensive experience in implementing appropriate digital health solutions running either on OpenMRS or Bahmni in resource constrained environments. IntellISOFT’s past and current projects are spread across Africa covering Kenya, Uganda, Tanzania, Zambia, Sierra Leone, Rwanda, Ethiopia, Mozambique & Zimbabwe.

## Project Description

This proposal proposes an integrated approach to patient level monitoring through the use of a health information exchange that supports onboarding of multiple digital health systems through HL7 FHIR-based interfaces, providing a common way to connect and register data to a longitudinal client record, share indicators across individual Point of Service applications through the use of HL7 FHIR profiles, and extract indicator data from patient level indicator calculations performed against a Minimum Data Set Message (paired approach) or on a longitudinal client record (integrated approach). In addition, a simplified paired approach can be supported through the generation of FHIR-based Minimum Data Set Messages from the PoS applications, which are submitted and evaluated through a CQL execution engine, as shown in Figure 1.



*Figure 1 – Paired Patient Level Indicator Reporting Architecture*

The integrated approach extends this through the use of a Health Information Exchange (HIE) with an Interoperability Layer (IOL) and Shared Health Record (SHR), with endpoints for Point of Service (PoS) applications to submit demographic and clinical data through the OpenHIM IOL, which is then stored in a longitudinal FHIR-based SHR, HEARTH, against which indicator calculations can be performed using a CQL execution engine. The proposal proposes setting up a reference HL7 FHIR-based HIE using existing HIE component technologies, that will enable submission of HL7 FHIR-based patient-level data from multiple transactional PoS systems, and demonstrate the ability to define and extract indicator data from a FHIR-based longitudinal data store, as shown in Figure 2.



*Figure 2 – Integrated Patient Level Indicator Reporting HIE Architecture*

Through multiple work packages, the consortium aims to use the Digital Square investment to a) support FHIR profiling activities to specify the data model, resource mappings, terminologies and indicator definitions relevant to the priority use case, and b) support further development of HL7 FHIR interfaces in the selected PoS applications, as well as c) OpenHIM mediator development that enables onboarding of FHIR data from source PoS applications. The consortium aims to demonstrate end-to-end feasibility of an integrated approach to extracting indicator data from a shared longitudinal data store, leveraging OCL as a terminology service for PoS applications and the HIE, and the submission of data from OpenMRS, openIMIS and Bahmni PoS applications in this approach. The project deliverables and timeframe for each work package is outlined below.

*Work Package A: OCL Support*

This work package would enhance the Open Concept Lab (OCL) suite of tools to serve as an authoritative, FHIR-enabled source for codes, value sets, disaggregates, and other indicator metadata. A FHIR-enabled OCL would provide a level of support for all 3 data exchange scenarios (standalone, paired, integrated) and for all 3 levels of systems (PoS, HIE, and HMIS/DW). PoS applications would leverage OCL as a structured metadata reference (i.e .designing data models, interfaces, and CQL scripts against it), a subscription service (i.e. using the OCL subscription module to load required codes directly into OpenMRS), or a mapping and transformation service (i.e. to transform local data into the required MDSM format). The HIE would interface with OCL to look up and validate codes against relevant value sets or retrieve other structured indicator metadata (eg. disaggregates) required to support FHIR/mADX data exchange. OCL would use this award to support building a FHIR terminology services layer with basic support for the FHIR CodeSystem and ValueSet resources onto the existing OCL terminology server, publishing all codes, value sets, and other indicator metadata required by PoS and the HIE to demonstrate the mADX data exchange, and to enhance the OCL Metadata Browser to support intuitive browsing and downloading of the published indicator metadata.

*Work Package B: OpenMRS Support for Patient-Level Indicator Reporting*

This work package aims to provide a technical solution to support both paired and integrated system approaches. As possible, OpenMRS will leverage existing work done for related modules, such as DHIS reporting module, FHIR module, and Sync 2.0 module. OpenMRS will work towards supporting indicator reporting to a standalone system by developing the architectural design, and preparing CSV of person-level data using mADX messaging and according to specification and submit to OpenHIM mediator or directly to HMIS system. OpenMRS will work towards supporting indicator reporting to a paired system by developing an OpenMRS module to build and submit a FHIR bundle according to TX\_PVLS spec, using mappings defined in OCL for ETL into standard format, and subscribing to OCL for standard concepts that can be used during data capture in order to support data collection. OpenMRS will contribute work to the integrated approach by contributing to the architectural design of an integrated solution (documented architecture), utilizing the module from the “paired” scenario to build a FHIR bundle and submit to OpenHIM mediator, FHIR profiling activities, where relevant, adapting FHIR interfaces in OpenMRS to support the overall workflow, and submitting OpenMRS data to the HIE via published interfaces.

*Work Package C: openIMIS Support for Patient-Level Indicator Reporting*

This work package supports development of a technical solution for reporting patient-level data from openIMIS in both paired and integrated system approaches.

*Work Package D: Bahmni Support for Patient-Level Indicator Reporting*

This work package will lead to a technical solution for reporting patient-level data from Bahmni in such a way that complements the OpenMRS contribution and supports both paired and integrated system approaches.

*Work Package E*:Integrated HIE Approach to Patient-Level Indicator Reporting

This work package will bring together outputs from the other work packages into a cohesive architecture, using a central HIE interoperability platform to support the integrated solution. The central HIE platform will provide functionality for the storage and management of enterprise unique client identification and associated demographics, longitudinal health data storage for patients / clients, and mediators to support submission of demographic and clinical data through the OpenHIM IOL. The central HIE Interoperability platform will expose master patient index endpoints of the HIE and their associated standards (FHIR) to identify patients and register new patients, and longitudinal health data endpoints and associated standards (FHIR resources) to submit encounter data about patients. Each partner supporting a Point of Service application will work towards contributing to the architectural design of the solution, FHIR profiling activities (where relevant), adapting FHIR interfaces in the PoS application to support the overall workflow, and submission of PoS data to the HIE via published interfaces.

|  |  |
| --- | --- |
| **Deliverables** | **Timeframe** |
| Project teams establish project page with documented roles, responsibilities, and communication channels to be used during the project period. | Month 1 |
| Integrated Patient Level Monitoring Technical Architecture document: Documented architecture, indicator definitions, data model & FHIR mappings/profile, messaging specifications. | Month 1 - 2 |
| PoS application development to support for submission of patient and clinical data, and submission of calculated indicators. OpenHIM mediator development to support FHIR-based data interfaces. | Month 3 - 8 |
| HIE and FHIR implementation instantiated and configured with CQL queries implemented. | Month 7 - 10 |
| Integrated Patient Level Monitoring HIE configured end-to-end to support use case. | Month 11 - 12 |