Ayekta: Translating Lessons from Existing EMR Frameworks into an Offline-First Solution for Surgical NGOs

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PURPOSE

This work aims to conduct a comprehensive literature review examining the design, implementation, and outcomes of EMR systems for low-resource, rural, and mobile healthcare settings, with specific attention to essential data categories, offline-first architecture, data quality and interoperability, comparative platform analyses, and implementation challenges. This is alongside an iterative effort through consistent piloting and feedback through Rutgers Global Health missions at NJMS. *Ultimately*, the goal of these efforts is to inform the development of **Ayekta**, a modular, FHIR-compliant, offline-first EMR tailored for surgical NGOs and rural clinics, with specific application to the International Surgical Health Initiative (ISHI), an NGO based at Rutgers New Jersey Medical School.

BACKGROUND

- Electronic medical record (EMR) systems offer transformative potential for improving care delivery in underserved, rural, and humanitarian contexts.[1]
- Existing platforms commonly lack offline functionality, modular flexibility, and validated clinical data frameworks suited to the needs of surgical NGOs and healthcare systems in low- and middle-income countries (LMICs).[4]
- Critical gaps in infrastructure, training, ethical guidance, and standardized data collection continue to limit the impact and scalability of current solutions.[3]
- Ergo: **Ayekta**—a social entrepreneurship initiative co-developed with the International Surgical Health Initiative (ISHI)—aims to deliver a best-in-class, offline-first EMR purpose-built for surgical NGOs and LMICs, prioritizing usability, interoperability, and local adaptability for sustainable global health impact.[5]

METHODS

Type of Review: Systematic literature review via thematic analysis (August-October 2025) followed by iterative environmental scans (September-)

Sources: Academic publications (PubMed, PLOS, SAGE, PMC), global health reports, case studies from OpenMRS, DHIS2, Bahmni, CommCare, Hikma Health, ISHI pre-pilot documentation and surveys

Period Covered: Literature published between 2019–2025; ISHI 10-day mission in Ghana (September 2025); planned pilot for Sierra Leone (December 2025).

Population Observed: Providers with ISHI and the patients they treat (rural hospitals, peri-urban health centers), low-income, limited prior EMR exposure, cared for by multidisciplinary, multilingual volunteer teams.

RESULTS

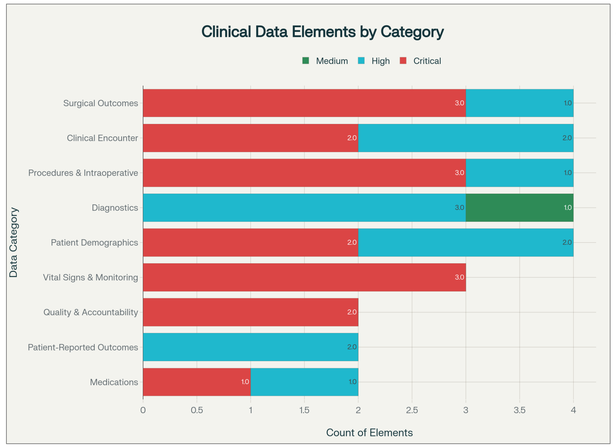


***Figure 1.* Distribution of Validated Clinical Data Elements by Category for Low-Bulk EMR Systems.**
Stacked bar chart showing the number of critical, high, and medium priority data elements needed for EMRs in resource-limited surgical and humanitarian care settings (n = 26). Most categories contain multiple critical elements, highlighting the core data requirements for effective documentation and continuity of care in low-resource environments. Priority assigned according to occurrence rate in literature.

Weakness	Platform Context	Impact Level
Limited interoperability across platforms/national health info systems	Multiple platforms (OpenMRS, Bahmni, DHIS2)	*High*
Insufficient advanced diagnostics integration (DICOM, lab imports)	Hikma Health, general EMRs	*Medium*
Dependency on external technical support for customization/maintenance	OpenMRS, Bahmni	*High*
Data standardization and completeness challenges	DHIS2, general EMRs	*High*
Complex setup requiring significant IT expertise	OpenMRS, Bahmni	*Medium*

***Table 1 (above).* Heatmap of Major Weaknesses of Low-Resource EMR Platforms for Humanitarian and NGO Surgical Missions.**
This table summarizes critical weaknesses commonly encountered in current EMR platforms, including interoperability limitations, reliance on external technical support, incomplete data standardization, and integration challenges for diagnostics.[2] Mapped to impact level.

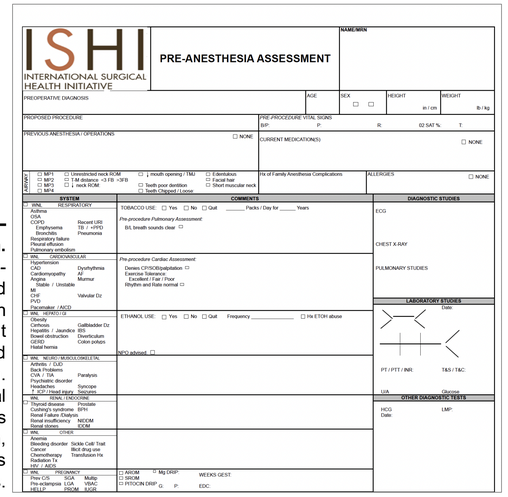

ISHI
INTERNATIONAL SURGICAL HEALTH INITIATIVE
PRE-ANESTHESIA ASSESSMENT

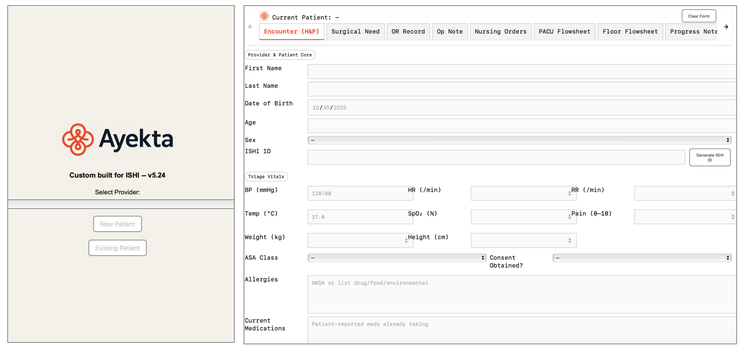
Figure 2. ISHI Pre-Anesthesia Assessment—Current Manual Paper Form.
This figure depicts the standardized pre-anesthesia assessment form currently completed by ISHI clinical teams during surgical outreach trips. The form illustrates the pertinent demographic, clinical, diagnostic, and perioperative fields prioritized for documentation. These data elements directly inform the essential requirements and workflow priorities for Ayekta's electronic medical record (EMR) design, supporting targeted digital transformation of ISHI's field documentation processes.

DISCUSSION

There is consensus in literature and field experience that EMR systems for low-resource, humanitarian contexts must emphasize: (a) a validated minimal data set, (b) robust offline capability, (c) modular, locally-adaptable workflows, (d) FHIR compatibility, and (e) simple, scalable training and data governance.
Other critical gaps—such as integration with diagnostics, ensuring ethical data use and stewardship for transient populations, and training for high-turnover environments—are not adequately addressed in most platforms.
Field experience during ISHI's Ghana pilot confirms the need for a fit-for-purpose tool addressing these precise gaps, supporting continuity, documentation quality, and effective measurement of surgical outcomes in preparation for the Sierra Leone rollout and beyond.

CONCLUSION

The focused development and pilot of **Ayekta**, guided by these evidence-based findings, aims to fill a key shortfall in global surgery and humanitarian health informatics. Future directions include leveraging ongoing feedback from clinical deployments to drive improvements to establish a model for groups seeking robust, flexible EMR solutions under extreme resource limitations. Below is a UI mock-up for the software currently available for pilot to ISHI and other NGO partners.[6]



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