Achieving Interoperability Between the University of Ghana Medical Centre's Electronic Health Records and RXclaims System

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Abstract

This paper examines and identifies the difficulties and probable solutions for leveraging the implementation of Electronic Health Records with the RXclaims system. Therefore, based on the analysis of technical dissimilarities, data standardisation problems, and difficulties in interaction between two crucial systems, the purpose is to bring two systems together. We examine standards and protocols related to Health Level Seven (HL7) and Fast Healthcare Interoperability Resources (FHIR) and use case studies and practical experience to refine the integration. Consequently, this research aims at improving patient outcomes, reducing healthcare costs, and increasing the efficiency of health care delivery resulting from interoperability between Electronic Health Records (EHRs) and insurance systems.

1. Introduction

In modern healthcare, the need for comprehensive and long-lived patient records has never been more critical. Events in one medical centre may be vitally important information for another in entirely different specialities. Given the degree of information involved, the sharing and portability of this information have become a necessity for medical and insurance providers alike (Dubovitskaya et al., 2020). Solution vendors are bringing products to market that utilise electronic data interchange to share information about verified claims in order to achieve operational efficiency for medical and insurance providers. However, a smooth means of exchanging Electronic Health Records between medical providers and insurers remains an ongoing challenge (Baribeau et al., 2020).

Medical practitioners not only need a flexible means of interfacing with their practice management systems, but they also need to interface with external systems in the provision of accurate and current health data to outside entities such as insurers. Conversely, there is a desire to facilitate the ease with which hospitals are able to seek pre-determination on health procedures with verified benefits. The difficulty in integrating disparate information systems within the healthcare domain has made operations within the sector inefficient. Fitness for purpose would be enhanced if the institution's EHR and RXclaims system were able to effectively share verified claims through a seamless interaction between their health

records systems. As a result, we propose that providing a novel approach to interoperability would aid insurers and hospitals in providing more efficient and purposeful healthcare (Tran et al., 2021).

1.1. Background of the University of Ghana Medical Centre (UGMC)

Established in 2018, Ghana's leading quaternary hospital is the University of Ghana Medical Centre (UGMC). The Centre is a treatment facility and a teaching hospital offering quality medical services in almost all specialities and subspecialties to patients from Greater Accra, Ghana, and the African sub-region. UGMC has working relationships with health service providers in regional and district hospitals in order to provide comprehensive patient care and is the leading and largest hospital for postgraduate training for the University of Ghana's Medical and Allied Health Science students (Kodua-Ntim et al., 2020). UGMC's clinical departments comprise thirty-nine; each department is composed and supported by different units, and to improve multidisciplinary care, cross-speciality care, and expert advice, a doctor's appointment would need to be booked by the patient. The services offered are part of the modernisation programme, which is integrated with digital technology to dramatically improve patient care by computerising patient management, focusing on time, and providing higher data integrity, enhancement, availability, and decision-support functionality.

The EHR at UGMC was developed with the help of healthcare professionals and focuses on clinic practices. The organisation's custom outpatient EHR system includes patient registration, patient vitals, patient progress, diagnosis, drug history, investigative results, treatment given, lab results, doctor's note, outpatient prescription, patient flow, pharmacy refill, treatment, and follow-up clinic carried out in a typical Ghanaian hospital before and after late-night clinic days. Allergy records, biometrics, visit attendance/readmissions, referenced resident doctors, finance, and electronic reports are to be added (Mensah et al., 2023). Providing accurate and timely information at the point of patient care, the EHR at UGMC has been adopted because of its benefits. Being a fully digitised hospital, UGMC has embraced information technology to bring quality, effective, efficient, and customer-centric patient care. The automatic system of drugs and supplies and the partnership of the Ministry of Health, University of Ghana, Penn State, and Mayo Clinic, among others, are efforts to enhance the institution's operations. By extension, the telehealth architecture is an additional initiative.

1.2. Overview of RXclaims System

The RXclaims system is a creative and technology-driven strategy to enhance systems and processes. An initiative pioneered by Nationwide Medical Insurance, a private commercial health insurance company registered under the laws of Ghana and established by the National Health Insurance Authority (NHIA), working with fifteen insurance firms to provide health insurance plans to corporate companies, groups, associations and individuals. This allows for the real-time submission of claims and conveys consumption details to clients, removing the necessity for physical claim form submission. Its mandate includes making it easy for patients to get the proper medication and the most appropriate medical services at the best prices.

Additionally, medical insurance, including personal accident, inpatient, outpatient and vehicle insurance, is provided to give subscribers peace of mind, knowing that their financial liability is covered if and when they need healthcare services. RXclaims has licensed 600 healthcare providers across the country to offer the services within its purview, plus three licensed health facilities to manage and follow through with the accident and emergency cases referred from the walk-in treatment centres. These healthcare facilities and their backroom activities include processing claims – capturing disease conditions and treatment given by the attending nurse or doctor.

The constraints and challenges with collaborating with the University of Ghana Medical Centre were mapping the data of the various services rendered by RXclaims to that of the UGMC's services and the resultant cost implications for the policyholder at the end of the workflow. On one breath, Nationwide Insurance, the outfit that birthed RXclaims, was stuck and had no intention of upscaling from the International Classification of Diseases, Tenth Revision (ICD-10) standard. At the same time, the UGMC had migrated to embrace the latest version of the International Classification of Diseases, Eleventh Revision (ICD-11) standard. It made reconciliation, synchronisation and payment of the ascribed service cumbersome and paper-based.

We exploited our strong area of technology, cognizant that RXclaims is a cloud-based system, and UGMC's EHR is an on-prem system capable of connecting to the previous system via an Application Programming Interface (API). The RXclaims system includes modules that use patient membership ID, encounter ID, members' claims, deductibles, laboratory service, pharmacy service and payment of medical bills. If the data from the RXClaims system is synchronised electronically with the Centre, all the services, as mentioned earlier, including patients' final discharge, can be completed seamlessly. A claim is automatically generated when a patient visits the hospital during the point of creating an encounter; if the EHR determines that the encounter is within the ambit of RXClaims, the EHR, through the API, posts the patient's RXClaims *memberID* and the RX cross-matched consultation the patient wishes to access. RXClaims, upon receipt of these data, verifies the patient's membership and determines if the patient qualifies for the consultation he/she wishes to access. Upon meeting all the criteria successfully, the RXClaims responds with claimID for that specific encounter. For each item in every transaction at each revenue centre (such as pharmacy, laboratory, radiology and nursing centre), the EHR is constantly communicating with the RXClaims system (posting the Rx cross-matched equivalent of the selected item), querying whether based on the diagnosis given by the doctor, the patient qualifies for the item under the current consultation the patient is on. Just as with the encounter set-up, RXClaims responds, indicating whether the patient is eligible for the item or not. If RXClaims does not grant permission for that item, the revenue centre would have to exclude the item from the transaction to be able to save that transaction successfully. The bottom line is that RXclaims needs, as a matter of urgency, a secure and protected integration for a seamless data flow and claim generation. The process will include double-checking insurance when patients come to the Centre for outpatient services and also for their full comprehensive inpatient service selected by the Centre (Nationwide Medical Insurance, 2023).

2. Importance of Interoperability in Healthcare

Interoperability continues to play a key role in ensuring the effective functioning of healthcare systems. The ability to share data between different healthcare entities can help in more precise patient care analysis, thereby leading to improved patient outcomes. Timely access to comprehensive health information by healthcare providers can lead to better and informed clinical decision-making, leading to better patient care. Improving the connectivity in healthcare systems could reduce medical errors and duplicated tests. Guarantors and health service providers can save operational costs if data can be shared easily. From an epidemiologic point of view, interoperability would benefit continuity of care, especially for chronic diseases (Torab-Miandoab et al., 2023).

When data flows easily between healthcare systems, there are a number of both direct and indirect benefits. Firstly, healthcare providers can receive results back sooner and are also able to make more informed decisions about a course of treatment based on the more reliable data provided (Cerchione et al., 2023).

This will, in effect, support the "Triple Aim" of the health system by improving the patient care experience and quality, improving the health of populations, and reducing the per capita cost of healthcare. Public health will be enhanced due to smooth public health data utilisation by receiving communicable disease notifications, health facility visits, maternal health data, morbidity data, and other public health reports for policy formulation and research (Basil, 2022).

2.1. Enhanced Patient Care

Interoperability between the Centre's EHRs and RXclaims system will lead to better patient care in several ways: First and foremost, with real-time patient data, including patient medical history, the most recent test results, and relevant clinical guidelines recommendations, all those who make clinical decisions on behalf of UGMC will have all the information they need to improve patient health outcomes significantly. Furthermore, in health care, the more information there is about a patient, the more it changes when and how data is captured and from where it is shared, contributing to a more complete holistic understanding of that patient's care. This can improve plan and treatment decision-making. When a patient's complete health record is available, it will make it easier for physicians, pharmacists, nurses, social workers, and other providers to work together to determine the care plan that will work best based on the patient's health history (Gavrilov et al., 2020).

Access to integrated and personalised patient data improves options for the care plan, which is most likely to lead to the recovery of good health. UGMC patients benefit from interoperability in their use of health information. The clinic and hospital specialities will be able to reconcile the medications being prescribed, and the pharmacy will have the medications being filled. That action also reduces the potential for adverse drug reactions to occur as a result of new drug interactions. The Centre's clinicians want patients to become more engaged and empowered about their health care. The more patients know and understand population health metrics and their condition, the more probable they will become incentivised by the improvements they can make. With readable access to their health information, they will be more capable of taking actions that respond to their personalised treatment plan (Alowais et al., 2023).

Proactive and consumer-based health care that provides patients with access to health information can be used to reduce doctor shopping and unnecessary emergency department use. Moreover, communication between these stakeholders needs to be improved and managed to establish that the physician can answer patient questions at the point of care. In addition, it will offer the ability to gauge an individual patient's treatment response and, in turn, achieve the desired reduction in symptoms more rapidly. Finally, the easier and more ready access to each of the Electronic Health Records that now make up a complete patient record or patient health overview of a clinical condition for different care providers reduces the potential for wasted care. When errors are identified, the direct cost of understanding each error will depend upon the level of contact required; obtaining additional data will frequently be essential. It could also be linked to the time required and personnel explaining benefit issues. We shall bear those costs if an error necessitates reversing an erroneous entry (Lee et al., 2021).

3. Challenges to Interoperability

A number of reasons have been identified as challenges and hurdles to achieving interoperability in healthcare, some of which are technical, while others are not. Technically, the challenges of achieving interoperability in healthcare can include disparate information from various systems that is stored in different incompatible data formats, some of which those systems have no application integration capabilities. In addition to the technical issues causing obstacles on the road to interoperability, some

various issues and challenges tend to get lost under the radar of more pressing discussions: the bureaucracy and paper reliance of modern healthcare practice, not only in developed markets but also in increasingly digitised environments in the developing world. In addition, public perception of patient data sharing and data privacy has necessitated the creation of complex regulatory regimes worldwide, making it a difficult challenge to reconcile competing jurisdictions internationally; it is noted that information needs to respect national borders. Patients must genuinely have some consent, either implied or expressed, on how their data is used, with consequent responsibilities resting on entities handling or processing that information (Abdou, 2021).

Above and beyond these limited generalisations, mutual professional resistance by clinicians and insurers is another major hindrance to system adoption, as no system would work effectively should these core entities refuse to interact meaningfully through the system (Sholler, 2020). Finally, the critical issue of financial support, particularly in developing countries, is to be addressed if the barriers to entry are to be minimised. Infrastructure demand for electronic data sharing is tremendous and often exceeds medium-term budgets (Randhawa et al., 2024). Healthcare systems are complex, intermeshed, and thoroughly entangled, requiring concerted, consensus-based, and globally harmonised efforts to unwind. What is more, they must be built entirely and over essentially the same infrastructure, which holds no appeal for nations that are desperate to lend a helping hand in building the healthcare infrastructure of the future. It is an incredible challenge to build infrastructure for harmonised global data management and rules in healthcare that can be used by all stakeholders in healthcare and which take into account and respect the infrastructure and regulation of all nations. However, building worldwide healthcare systems that operate without data silos and do so with a high degree of integration requires that these hurdles be overcome (Sharma et al., 2021).

4. Strategies for Achieving Interoperability

In summary, the following strategies can be employed to tackle the challenges of achieving interoperability across the globe in terms of regulation and best practices in Health Information Technology (HIT):

1. Encourage and create interoperability organisations that work to create standardised procedures in Health Information Technology.
2. Create common health information models and data standards, allowing data transfer in standardised communicable formats between systems and not institutions or individual practices. These should be developed, maintained, tested, and utilised not only by data standards development organisations but by all stakeholders, including vendors, electronic practice management systems, Electronic Health Records, Health Information Exchanges, Health Information Management, medical records technology students, policymakers, clinicians, academics, and other individuals and entities seeking data.
3. Establish cooperative strategies between healthcare providers, insurance providers, vendors, and networks before acquiring networks and systems.
4. Modify search functionality to identify interoperable systems, since full interoperability is impossible.
5. Encourage the governments to write and sponsor legislation and financial reimbursement to entities using these standards to establish best practices and promote the continued use and adaptability of Health Information Technology and innovation (Al-Jaroodi, et al., 2020).

Ultimately, interoperability is not just the responsibility of technology developers but a responsibility that rests on the shoulders of many players engaging in protocols and workflow. The broader challenge is not the immediate feasible solutions that can be achieved but creating a best practice and a roadmap to reach the goal of interoperability. It is also recommended that existing health information transmission networks undergo a rigorous validation process as the proposed processes and standards are developed. In conclusion, collaboration is essential for sharing data in healthcare; however, processes must be implemented that allow frontline healthcare providers, HIT resources, and support to communicate better and operate more effectively and efficiently. Alongside these processes, discovery by patients, patient advocates, and healthcare consumers is key. As the puzzle pieces come together, there is apparent hope and resources to begin fostering a collaborative environment within IT infrastructure in healthcare (Benson et al., 2016).

4.1. Standardisation of Data Formats

One fundamental piece of achieving a high level of compatibility or interoperability between multiple, otherwise disparate enterprise systems is the standardisation of the shared data format. Still today, at least a half-dozen formats are in popular use, particularly with the electronic exchange of medical records. Proprietary file formats impose challenges for sharing and are against the principle of adoption of open standards. Additionally, proprietary file formats may become obsolete by the advancement of information technology or the evolving business environment. Though it is possible to transform one file format to another on the fly, resources on this source or target system to develop, deploy, or maintain the transformation process are complex and expensive. Since conversion between file formats is difficult, interoperability on the data exchange level may suffer (Hazra et al., 2021).

Smaller healthcare providers or players feel left out from broader integration or data exchange programs because of the development and implementation expenses of an entire standard framework and the transformation mechanism. There is no loose coupling between companies and organisations to exchange their business documents electronically without the practice of tight data integration. Business gateways or brokers facilitate secure electronic transactions between healthcare providers and insurance companies. Adherence to international standards within local enterprise systems in healthcare where extensive document exchanges are prevalent would expedite document and data exchange in achieving complete interoperability in healthcare systems (Katsikouli et al., 2021).

Widespread consensus, or acceptance, of data storage and exchange formats is a significant cornerstone of interoperability. Using a common data format for patient entries in hospitals, for example, rather than each hospital developing an internally customised format, eases the overall burden to ensure that hospitals and specialists have ready access to central records in the event of an emergency. Data accuracy can be improved if healthcare institutions adopt an electronic health record standard. Researching how organisations achieved standardisation may be beneficial. Mandatory data elements, field lengths, order, and output holders seem viable (Belchior et al, 2021).

5. Case Studies of Successful Interoperability Implementation

5.1.a. MModal and Indiana Health Information Exchange, Indianapolis, Indiana Implemented: 2013

In an attempt to overcome burdens, increase patient care, and achieve more secure data sharing, several other healthcare entities collaborated to establish system interoperability. For those seeking to accomplish a similar task, there were a variety of valuable lessons to be learnt. First, leadership and stakeholder

inclusion were crucial in driving interoperability. Moreover, planning, community implementation, and upfront engagement with stakeholders were essential to its success. An event where 20 Indiana HIE members convened to share ideas and promote discussion of MModal's technology and potential value to the HIE population serves as an example of focus for upfront engagement. In an effort to spread interoperability, the group is inspired to share their experiences (Shehzad et al., 2021).

5.1.b. Kansas Health Information Network, Topeka, Kansas Implemented: 2019

With the aim to expand access to care, enhance care coordination, and break down silos between clinical and insurance-related healthcare entities, the Kansas Health Information Network initiated integration efforts with the goal of linking real-time electronic health records with prescription dispensing data. Lessons learned from this successful implementation process provide several suggested best practices for those seeking to engage in similar centre-to-insurance data-sharing endeavours:

1. The integration's implementation was carefully organised to enhance referral pathways and promote proper care transition, and paediatricians were widely engaged.
2. The data exchange agreement was specifically designed to keep patient care at the centre.
3. High physician and staff advocate support was required.
4. Practice, insight, and constant communication maintained the program.

Lessons learned from this successful implementation provide insight into issues that yet require attention. For example, while the system has successfully connected the records of patients with the services offered, there is a push for additional development to fully include all available data. On the whole, the conversation emphasises the importance of flexibility and the fact that different organisations will have different objectives for completing this kind of endeavour (Kawamoto et al., 2021).

5.2. Health Information Exchange (HIE) Projects

Over the years, many Health Information Exchange (HIE) initiatives have taken place. Among these initiatives, a few have succeeded in achieving the aim of interoperability to connect various health facilities and in scaling it to a continent as a potentially scalable interoperability model. HIE seeks to facilitate the electronic sharing of health-related information according to nationally recognised standards. HIE has significant potential to improve patient outcomes, efficiency of care, and public health by giving providers access to comprehensive and accurate records. Benefits include improved timely communication between providers, increased access to essential patient information, and reduced unnecessary and duplicate tests and visits, which can lower the cost of care through increased efficiency. Data availability is expected to result in reduced time, as clinical staff will no longer need to go and search for information to help with the care process (Esmaeilzadeh et al., 2024).

Interoperability is the technical capability of one information technology (IT) system, application, or product to connect to another IT system, application, or product within a healthcare setting. A coalition of stakeholders typically creates HIEs in a specific geographic location or healthcare sector to meet local requirements. HIE expansion has led to new partnerships and corporatisation of some HIEs, resulting in HIE mergers and acquisitions. Health systems often provide funding-seeking multi-organisational data-sharing capabilities at a state or regional level. HIEs have developed new business models, such as using HIE data to fuel initiatives in hospitals and research, with providers being utilised by the government for compliance with initiatives. More than 200 HIEs are currently operating across the United States. One such project is the national-level interoperability project launched in Uganda (Lee et al., 2021).

6. Conclusion and Future Directions

In conclusion, healthcare in the age of "big data" is a journey that is still evolving. The interoperability feature tops the agenda of the architect of this ever-changing healthcare ecosystem. The importance of interoperability in healthcare cannot be overstated. It has numerous benefits, such as improved patient care, reduced operational costs and risks, and operational efficiencies. Developing and deploying interoperable health information technology solutions promises many benefits; however, significant challenges include information blocking, ethics and professionalism, privacy and security, technical and standards gaps, lack of system and other relevant policy requirements, poor measuring methods, and certification testing design. Efforts to increase data sharing and aggregation have resulted in synthetic or marginal solutions rather than directed efforts in data interoperability.

There are no signs of slowing down healthcare reforms, with assurance from healthcare manufacturers on pricing and workflow sustainability, working backwards with sincere policies, and benefiting from new technology and capabilities that operate with precision at scale. With emerging blockchain, directed efforts are proposed to invite technical evaluations of integration within this type of technology. Directly involve other healthcare information technology stakeholders to contribute feedback, make instructional suggestions, and challenge with a multi-professional review board authority to address. This climate achieves trust, partnership, interoperability, and business responsibilities essential for risk, investment, governance of law, and other regulations.

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