

Impact of FHIR Data Format in Healthcare Interoperability

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Abstract: Specifically, there has been a growing focus on standardising data sets into a uniform format to make it easier to construct standardised models and make data querying possible. Enabling FHIR - enabled smooth data interchange within the healthcare setting supports patient - centred care continuity and well - informed decision - making. Older buildings often have monolithic designs, therefore architectural incompatibility may be the primary barrier in addition to financial constraints and regulatory problems. The proper application of FHIR resources in healthcare settings is aided by strategic decision - making.

Keywords: Fast Healthcare Interoperability Resources, service architecture, data security, data integrity

1. Introduction

The Fast Healthcare Interoperability Resources (FHIR) represents an interoperability protocol that offers an architecture for integrating information from various healthcare providers to facilitate successful decision - making. The health industry is now typified by a large number of proprietary systems built on multiple standards that seldom ever interact with one another among devices [1].

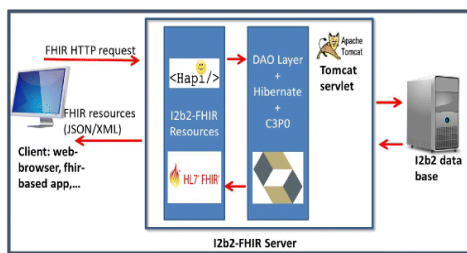


Figure 1: The server architecture of FHIR (Source: Boussadi and Zapletal, 2017)

It is developed by Health Level 7 (HL7) and it has a positive impact on the improved exchange of data which can further foster healthcare interoperability. This process facilitates the assurance of the effective handling of patient data across various healthcare platforms for data consistency and comprehension.

2. Literature Review

2.1 Overview of FHIR data formats

The medical disciplines have been more digitally transformed, which has led to a rise in the attempts to standardise and harmonise clinical data. Specifically, there has been a growing focus on transforming information sets into a uniform format to enable standardised model creation and make the information queryable [4]. The goal of the FHIR standard is to simulate the real clinical setting as precisely as possible. This was done in response to the shortcomings of the HL7 variations 2 and 3 medical document norms, which had previously been established [3].

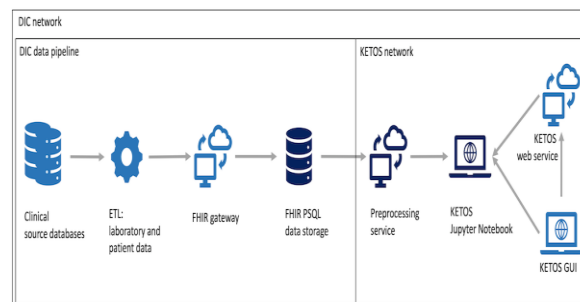


Figure 2: Load and transformation analysis of FHIR (Source: Gruendner et al., 2021)

Moreover, connection with compact web services is made simpler by its compact layout and explicit usage of standard information formats, such as JSON as well as XML. Therefore, it can be determined that FHIR standards strive to transform medical data into queryable formats.

2.2 Impact of FHIR on patient - centric care

FHIR plays a crucial role in handling patient - centric care which is multifaceted and facilitates the enhanced accessibility of data in the sharing of data. FHIR helps the healthcare settings to have improved access for the gathering of comprehensive information of the patients. FHIR involves seamless data sharing in the clinical workspace, and it, therefore, leads to informed decision - making processes, and involvement in the continuity of patient - focused care.

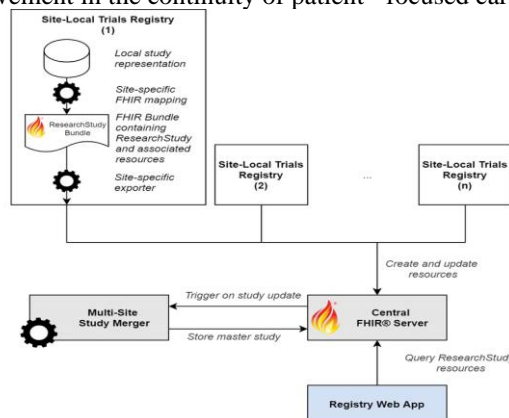


Figure 3: Trial registry based on FHIR (Source: Gulden et al., 2020)

Based on Figure (3), the trial registry of the healthcare can be done in prototypical settings to facilitate patient - centric coordination. This helps to tailor the major treatment according to the needs of the patients focused on accurate as well as timely interventions of the treatments

2.3 Involved technological innovation in FHIR

Integration of the blockchain module in the FHIR applications may offer distinct advantages such as security, integrity of data, and interoperability. The blockchain module involves technological advancements which help healthcare settings to improve the privacy and data security of data [7]. Blockchain technology involves decentralisation as well as robust encryption and this ensures the collection of sensitive medical information [8]. Immutable records of health are also ensured by the integration of FHIR as it confirms the audit trail that can protect the health records and ensure the integrity of the data and accuracy of the medical records.

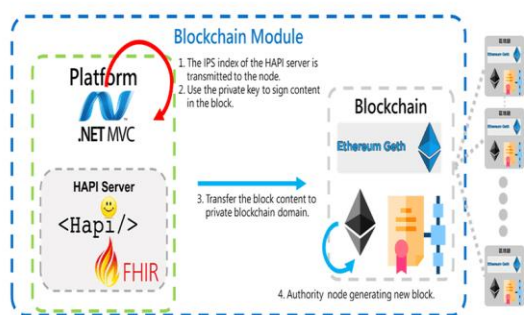


Figure 4: Blockchain - based technological advancements in FHIR (Source: Lee et al., 2020)

3. Methodology

In this analysis, the secondary qualitative data collection method has been involved. The analysis of the relevant themes which are focused on the variables of the research have been performed. The secondary data analysis involves the evaluation of the prior studies which have already focused on similar subject contexts [9], [10]. The collection of the information has been done based on the previous studies, oriented by the inclusion and exclusion criteria. The papers which are published between the time phase of 2016 - 2021 and are published in the English language, have only been involved in the outcome generation of the research. The papers which did not follow these inclusion criteria have not been involved in gathering the key notion of the implication of FHIR on the healthcare industry to address interoperability.

4. Results and Discussion

4.1 Statistical analysis of healthcare interoperability in global healthcare settings

The capacity of various systems within the healthcare system to obtain, exchange, integrate, and analyse data collaboratively is referred to as interoperability. It is possible to accomplish this across national, regional, and organisational boundaries [23]. In order to guarantee that patient data that is critical to their treatment may be

transmitted between various healthcare systems, possibly utilising different operating systems better interoperability in the healthcare industry is needed. By the final month of 2021, a significant portion of doctors throughout the globe, 71% in the United States (US) agreed that the amount of patient data at their disposal was excessive [11]. Although over 50% of American hospitals stated that handling this kind of information would represent the largest obstacle to enhancing healthcare interoperability and providing a better - connected care offering [11] [22].

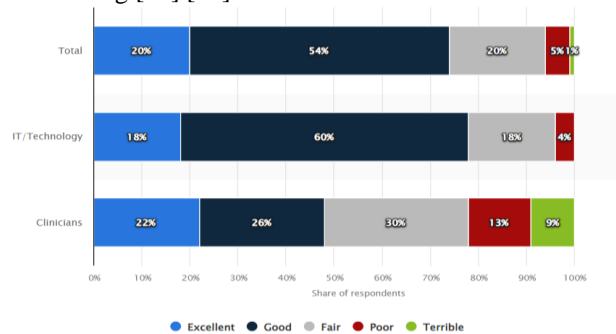


Figure 5: Efforts of interoperability in the healthcare system in 2019 (Source: Stewart, 2019)

The effort of health interoperability is highest among Information Technology professionals (60%) compared to clinicians [12]. However, the clinicians interpret that the activities of health interoperability are practised excellently in healthcare settings, resulting in assessing the positive impact of health interoperability in the health care settings of the world.

4.2 Impact of FHIR on healthcare interoperability

FHIR's primary goal is to provide an array of assets and create REST application programming interfaces (APIs) that rely on HTTP for users to connect to and utilise. FHIR accesses and processes patient medical information at the lowest level of detail using components known as sources [13]. Considering this functionality was absent from all prior iterations of the HL7 clinical document architecture (CDA), as well as HL7 (v2, v3) FHIR stands in contrast to any additional specifications [14].

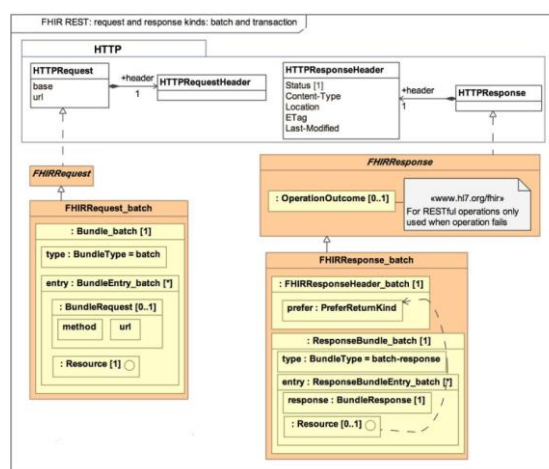


Figure 6: Influence of FHIR data on health interoperability (Source: Ayaz et al.2021)

Reducing operational complexities without sacrificing the confidentiality of data is the main focus of FHIR [15]. Furthermore, it is anticipated that this new standard would solve the shortcomings of the earlier HL7 (v2, v3, along with CDA) specifications while combining their benefits. Irrespective of the software platforms and technologies that the healthcare sector utilises, FHIR enables programmers to create standardised browser apps that let users receive medical information from any platform [16]. For instance, a user can use any device such as a smartphone, desktop, Android, Windows, or Linux to retrieve information from a healthcare organisation by launching a programme through a browser [21]. Therefore, it can be evaluated that the FHIR enables health interoperability by providing standardised API systems to facilitate seamless patient data - based access across separate devices and platforms.

4.3 Challenges faced by healthcare companies to apply FHIR

Many healthcare companies rely on systems of legacy that are not designed with contemporary interoperability standards in the healthcare system. Integration of FHIR systems with outdated procedures can be resource - intensive and complex [17]. Architectural incompatibility can be also determined as the key challenge, as the legacy system often involves monolithic architectures. This can make the implementation of FHIR difficult to implement as the new standards. As FHIR is designed for modular as well as flexible integration, thus, the architectural incompatibility can be determined in healthcare settings [18]. Moreover, the cost constraint can be another challenge that can be detected in the application of FHIR in medical care settings. The huge number of financial investments in the integration of the FHIR is crucial to optimising the application of FHIR, especially for small or medium - sized medical enterprises [19], [20]. The lack of funding opportunities can hamper the gaining of long - term healthcare interoperability. Moreover, regulatory as well as compliance challenges can also be observed in the application and navigation of the healthcare interoperability systems.

4.4 Strategies to implement FHIR in healthcare

Implementation of FHIR requires strategic decision - making by healthcare organisations to overcome crucial challenges and ensure a smooth transition. The minimisation of disruption is crucial to be overcome and focused on the integration approach. The initiation of different pilot projects is beneficial to be implied in different use cases and in different departments across the healthcare settings. Moreover, ensuring comprehensive mapping of data and transformation planning is also crucial in mapping the major legacy of the data to involve the FHIR resources [24]. The conduct of thorough audits of data can be beneficial to comprehend the healthcare data analytical landscapes [25]. The alignment of the legacy data with the FHIR standards is crucial to handle the effective mapping of data.

5. Conclusion

Based on the overall evaluation, it can be summarised that in particular, there has been an increasing emphasis on converting data sets into a common format in order to

facilitate the development of standardised models and enable querying of the data. Facilitating seamless data exchange across the clinical workplace with FHIR contributes to informed decision - making and patient - focused care continuity. Given that older structures frequently use monolithic architectures, architectural incompatibility can potentially be identified as the main obstacle along with the budget as well as compliance issues. Strategic decision - making helps in the proper implementation of FHIR resources in healthcare settings.

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