Review Article

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Electronic Health Record (EHR) Systems Integration

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ABSTRACT

Healthcare delivery has been hindered by several challenges, including the lack of cohesive patient data across various healthcare systems. This article explores the challenges of fragmented patient data and proposes interoperable EHR systems as a solution. By adopting interoperable EHR software, healthcare providers can standardize patient data and ensures several benefits such as improved patient care, reduced errors, and better workflow efficiency. The article discusses the strategy for implementing interoperable systems and the critical factors for successful integration. It outlines expected results, emphasizing improved patient outcomes, reduced medical errors, and more streamlined workflows.

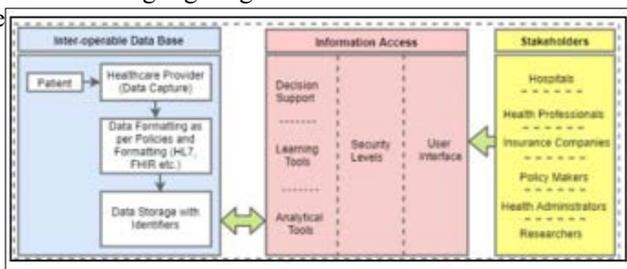***Corresponding author**
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Introduction

The global healthcare system is facing challenges in consolidating fragmented patient data. Patients often receive care from multiple healthcare providers, leading to fragmented medical records that are dispersed across different entities [1]. The lack of reliable data hinders care coordination and leads to inefficiencies such as redundant tests, delayed diagnoses, and medical errors [1]. In addition, data security breaching is also another critical challenge that the global healthcare system is facing. These challenges of fragmented data lead to other issues, including dissatisfaction among the patients and decreased quality of care.
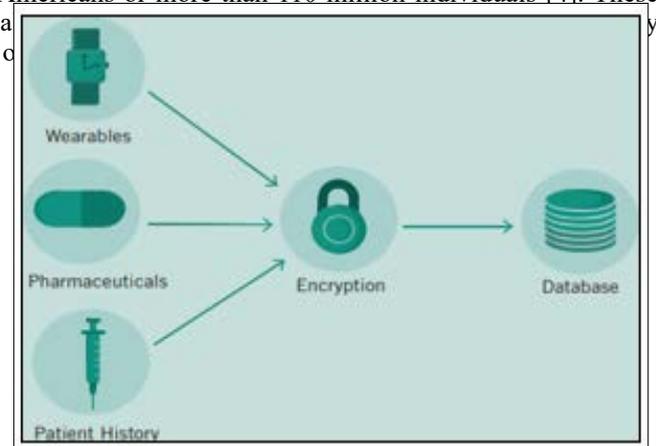
This article aims to shed light on these issues and explore solutions that a centralized record system can offer. Further, it will also develop a roadmap for the implementation of the system while highlighting certain areas of consideration during the

Figure 1: Conceptual overview of the EHR system [2].

Background

The healthcare system is home to a significant amount of data, which is sensitive and complex in nature. The sensitivity and complexity of the datasets make it critical to ensure a strong framework that can help in securing the datasets. However, even after having several frameworks and policies, the industry has

been exposed to significant challenges. For instance, in 2021, the global healthcare system has witnessed more data-breaching events than in any other year [3]. Further, multiple data breaches were reported with more than 133 million records exposed or impermissibly disclosed [3]. These data breaches not only impact the patients' health but also their personal lives.

In addition to the data breach, another challenge that the healthcare system faces in the context of data is scatteredness, which occurs due to the involvement of multiple healthcare providers in the treatment of patients [1]. Further, cyberattacks on the healthcare data system are lethal with significantly negative impacts. For instance, Ascension a healthcare company located in the USA witnessed a ransomware attack, causing massive disruptions to professionals across the country [4]. The attack affected 1 in 3 Americans or more than 110 million individuals [4]. These cha...

Figure 2: Patient Data Usage Model Based on EHR [1].

Problem Statement

The key problem that this research article delves into is the

fragmentation of patients' data across the different parts of the healthcare system. The absence of standardized patient data within healthcare systems presents a major barrier leading to inefficiency in coordination. Inconsistency in the electronic health record (EHR) systems impedes access to a complete overview of the medical history of patients by the healthcare system [5].

It often results in gaps in the care system, especially in the repetitive diagnostic procedures leading to unnecessary treatments. This lack of coherence also hinders the involvement of patients in their personal care system, as they are required to manually transfer their medical records between different providers. For instance, patients can possibly receive different treatment for the same issue due to the lack of uniformity in the dataset. Overall, this lack of interoperability negatively impacts the health outcomes of patients [2].
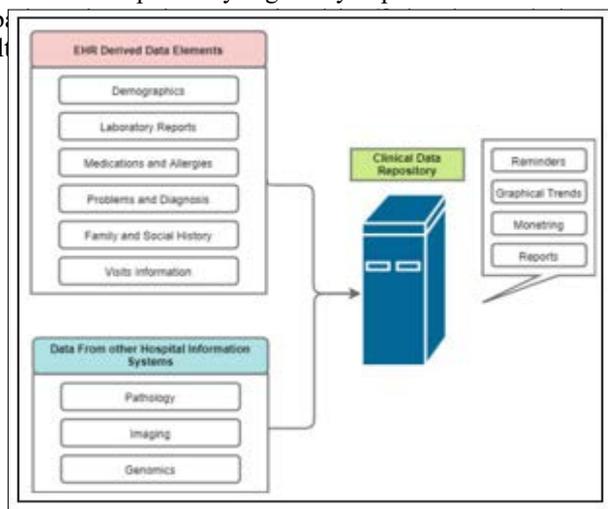

Figure 3: EHR as a Clinical Data Repository [2].

Proposed Solution
The proposed solution to the problems is the implementation of interoperable EHR software to centralize and integrate patient data for better care coordination. Healthcare institutions need to integrate interoperable electronic health record (EHR) software [6]. Interoperable EHR systems will enable a seamless exchange of data among healthcare providers, irrespective of the used software [7]. This integration of patient data will provide healthcare professionals with quick access to comprehensive medical records, improving decision-making and care coordination.

The interoperability of the EHR system can be achieved through the adoption of holistic and standardized data-sharing formats, which will allow uniform data exchange across the system [8]. Further, adherence to such a standardized data-sharing system will allow the development of an ecosystem where the data of patients is accessible and actionable. The implementation process is also associated with challenges like the difficulty of migrating legacy systems or the costs involved in upgrading healthcare facilities' technology. Overall, along with interoperability, the key benefits of the standardized EHR system, include increased scalability, privacy, security, and governance [8].
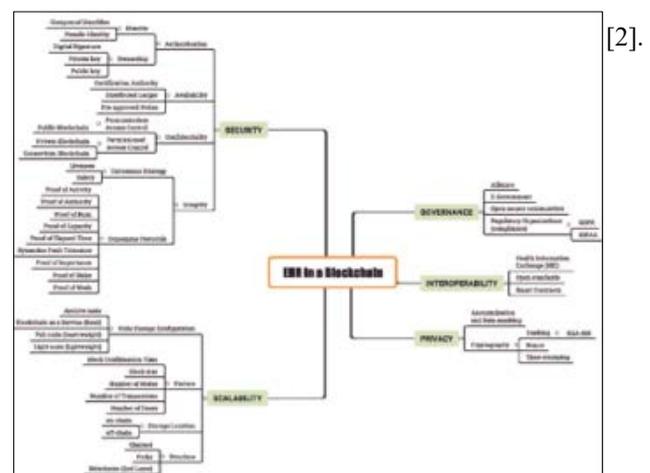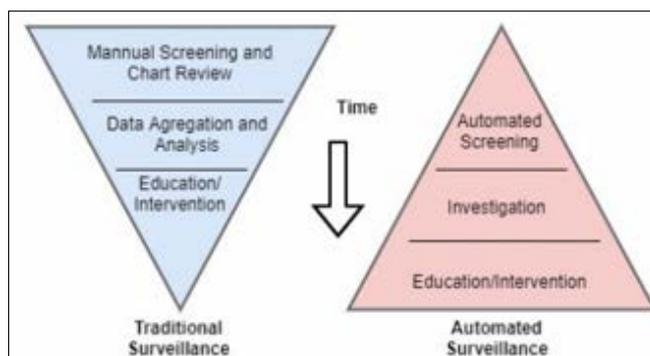

Figure 5: EHR in Blockchain Taxonomy [8].

Methodology
Implementation Process
The systematic approach to the implementation process of the system is described below:
Assessment of the Current System: The current or traditional system has a significant difference from the new one, requiring a strong need for assessment [2]. This assessment will allow the understanding of different departments and determine the integration system.

Interoperable System Adoption: The interoperable system will be implemented to ensure the standardization of the EHR system [6]. This system adoption will be key to ensuring consistency in the structure and sharing process across the system.

Data Integration: The existing records of patients will be migrated or transferred to the new system, ensuring no loss or corruption of the datasets [2]. This process will need strategic planning and accurate mapping. EHR data migration process will be used to pursue this strategy of data integration from normal method to cloud-based one.

Training of Healthcare Providers: Training of healthcare providers and an emphasis on change management is key to supporting the integration of the new system. The professionals will be communicated with regarding the benefits and needs of the system along with the operations to eliminate potential resistance. For this purpose, a holistic method will be used by integrating online module or courses that support the process of training of
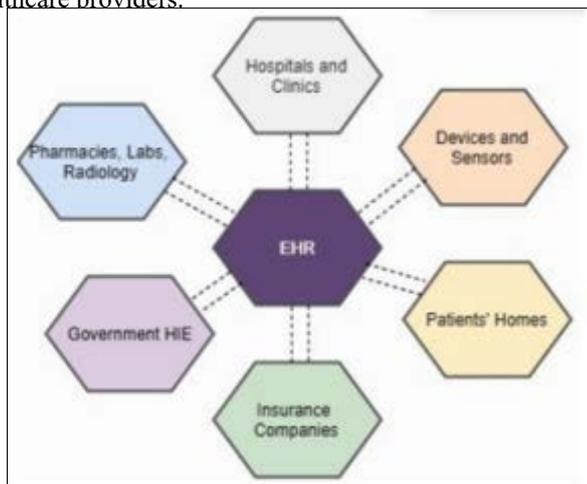
healthcare providers.

Figure 6: EHR Data Sharing Process [2].

Implementational Consideration
Although the implementation of the system has several benefits, there are certain areas which need to be considered or investigated to ensure successful implementation.

Cost: Though the system is cost-effective in the long run, the implementation requires upfront costs [9]. The new software, hardware, and costs of staff training and data migration need to be considered for successful implementation [9]. Therefore, it is important to first calculate the cost concerns by comparing the costs of the implementation of the system against the return on investment before initiating the implementation. However, referring to the benefits offered by the system, the return on investment is significantly high.

Data Security: As the growing threats of cybersecurity prevail, the privacy and security of patients' data must be prioritized [4]. Adherence to security standards of healthcare holds paramount rationale for the protection of patients' data from breaching events or unauthorized access [5].

Compatibility of the System: The healthcare system is complex and requires the integration of different aspects for the successful integration of standardized EHR [5]. The integration of the new system must be aligned with the existing systems. Therefore, necessary upgrades and replacements of different parts will be important to support the successful integration.

Change Resistance: Healthcare providers will go through significant change as they will require training. Therefore, the workload can result in resistance to change, which must be addressed with appropriate communication to successfully integrate
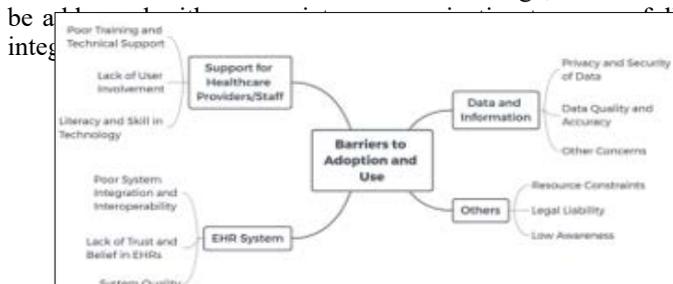

Figure 7: Barriers to EHR Adoption and Use [6].

Expected Results
The expected results of the system implementation are bi-faceted with both positive and negative impacts. These expected results are as follows:

Improved Coordination: The increased access to data will allow healthcare providers to communicate or coordinate positively. This coordination will not be restricted to other professionals only but the patients as well, leading to informed treatment decisions and accurate diagnosis [2].

Reduced Errors: The centralized data structure will reduce the possibility of human errors in every aspect of the system, including in prescribing medicines, tests, and others [2]. The reduced errors will increase patient safety.

Increased Efficiency: The administrative burden associated with the manual transportation of data will be reduced, leading to increased efficiency in the care system [5]. The increased efficiency will be followed by reduced wait time and operational costs [5].

Increased Workload: The healthcare providers will need to go through rapid change or training which will increase their workload [9]. Further, maintaining communication with other members will lead to increased workload as well.

Inefficient Workflow: The workflow of the healthcare system will be changed with the integration of the system. The change might be negative, especially at the beginning of the implementation
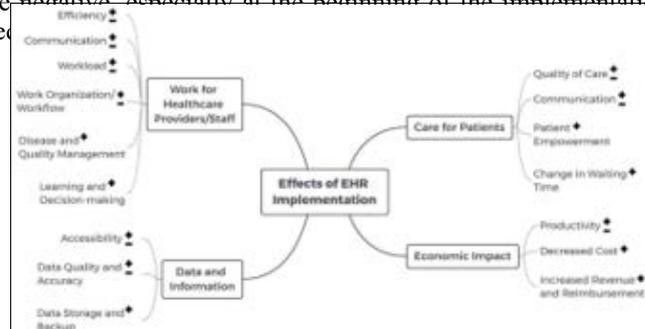

Figure 8: Positive and Negative Effects of EHR [6].

Conclusion
Improved data among healthcare providers can be achieved through the integration of interoperable EHR systems. It will also benefit by addressing the fragmentation of patient data in healthcare systems. Key benefits of interoperable EHRs include increased scalability, privacy, security, interoperability, and governance. It has challenges like increased cost, workload, requirement of training, and others. However, the long-term advantages of integrated EHR systems including reduced costs, improved quality of care, and seamless services make the investment justifiable for healthcare providers.

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