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Improving the Use of Big Data Analytics within Electronic Health Records: A Case Study based OpenEHR

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Abstract

Recently there has been an increasing adoption of electronic health records (EHRs) in different countries. Thanks to these systems, multiple health bodies can now store, manage and process their data effectively. However, the existence of such powerful and meticulous entities raise new challenges and issues for health practitioners. In fact, while the main objective of EHRs is to gain actionable big data insights from the health workflow, very few physicians exploit widely analytic tools, this is mainly due to the fact of having to deal with multiple systems and steps, which completely discourage them from engaging more and more.
In this paper, we shed light and explore precisely the proper adaptation of analytical tools to EHRs in order to upgrade their use by health practitioners. For that, we present a case study of the implementation process of an EHR based OpenEHR and investigate health analytics adoption in each step of the methodology.

*Keywords:*Electronic Health Records; EHRs; Analytic tools; Big Data; Health Practitioners.

1. Introduction

Electronic health record systems have brought instant benefit to medical organizations by reducing administrative activities, ensuring data availability, minimizing waste, enabling faster time to treatment, reducing costs and overall improving the quality of care within a health entity. The main purpose behind setting up an electronic health records is to be able to analyze voluminous, varied, unstructured health data and acquire meaningful insights through analytical

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and decision-making tools [1, 2]. Yet, while these systems have myriad advantages, they still bring up new challenges and complications to the healthcare community [3]. Indeed, we notice the existence of different and numerous big data tools, which makes it hard to choose the right fit for a specific EHR and to exploit them largely. This paper outlines research studies, which focus on the integration of analytic models into EHR systems. The purpose is to investigate the late adoption of analytics, along with proposing a novel systematic methodology. This will allow new researchers to follow a landscape and overcome the integration issues encountered at an early stage of the adoption process.

2. Related Work

While investigating in existing research studies, which aim at proposing a complete big data system for storing, processing and analyzing health data, we noted a remarkable shortfall in inspecting analytics integration to real EHRs.

The authors in [4] presented PARAMO, a parallel predictive platform using EHR systems. The goal was to develop a dependency graph of tasks for predictive analytics models. They focused more on testing the performance of their system with high workloads based on EHR datasets and Map Reduce, as a distributed processing platform. As for demonstrating how big data analytics can help in precision medicine, the authors in [5], followed the integration of -omic data for enhancing the understanding of cancer, then incorporated genomic knowledge into the EHR. In other research [6], the authors shed light on EHR challenges for visual analytics and depicted the main issues that need to be inspected, for instance data quality, scaling from single patients to cohorts, user interaction and cantered design. Their implementation has shown that new research studies should concert their effort in data integration process and patient similarity in order to simplify the EHR mining. A notable work has been initiated to verify claims data completeness [7], the researchers implemented different heuristic filters to calculate the biases between EHR and claims data. The goal was to make sure that sample datasets, which are used for practical analytic purposes, are complete and are not subject to include any missing data.

As part of these existing studies, we find very few research papers that evaluate the integration of analytic solutions within EHR systems [8]. Existing solutions focus generally on the development and the implementation of analytic algorithms and models in order to make predictions with the use of a specific database to test the proposed model. Failure to consider the integration of such solutions to real distributed EHR systems produces myriad analytic models that can be very efficient but unfortunately, they are not considered for deployment and thereby further integration.

3. Big Data Analytics for Healthcare

3.1. Electronic Health Records

Electronic health records are considered as the modern and the digital version of the health information system, which provides information on diseases, previous consultations and exam results, the EHR allows patients and healthcare professionals to store, process and share electronically medical data for the coordination of care. Through EHR systems, patient information is more easily accessible to the different departments of health care facilities for various basic health care systems. From preliminary interviews to exams, diagnostics, eventual follow- up examinations and treatment, healthcare providers can quickly have the right information in case of emergency. The blood type, allergies, diseases, possible medications or any other vital signs measurements, everything is centralized and searchable at a glance.

3.2. Analytics for Healthcare

Every second, dozens of terabytes of data are generated and accumulated from various sources, e.g. internet browsing, social networks, mobile transactions, online shopping and many others. Indeed, the big data paradigm has taken an expended shape, and the abundance of such structured and unstructured data has made it possible to be open to new perspectives. These new sources of data increase the chances of understanding one's behavior and motivations, identifying instant signals and triggers for someone’s interest in a specific offer or product. Getting meaningful insights from voluminous and varied amounts of data helps to understand and extract hidden information,