

Big Data Applications in Healthcare Administration

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ABSTRACT

The healthcare industry has a growing record of using big data-related technologies such as data analytics, internet of things, and machine learning, especially in the clinical areas. However, healthcare institutions must also perform all of the administrative processes just as any other organization. Thus, like many other industries, healthcare has begun to apply these same technologies to improve their understanding of these internal operations and use them to make better decisions and run a more effective operation. This study takes a structured literature review approach to describe the current state of this literature and identify the major themes and priorities of both the research community and the healthcare industry as a whole. The contribution made by this study is to provide a comprehensive analysis of the state of the literature to use as a foundation for the future research opportunities noted in the paper.

KEYWORDS

Administration, Big Data, Healthcare, Structured Literature Review

INTRODUCTION

As the concept of big data and the tools that surround it have matured, the world of business has witnessed an inexorable migration of these tools from the financial sector to other areas of commerce such as transportation and insurance. Shortly into this transition, these tools made their way to the healthcare industry. Some of the first areas within healthcare that big data techniques first appeared were in the clinical areas such as oncology, radiology, and genetics (Chang & Choi, 2016). However, healthcare organizations are also businesses with the same internal and external processes as any other business. These include the hiring of staff, the procuring of supplies, and the running of sometimes vast physical plant installations. So, it is not surprising that the healthcare industry has begun using big data techniques to improve their ability to perform these important, yet often out of the spotlight, activities.

There is a large and enthusiastic literature surrounding the clinical uses of big data in healthcare and there have been a number of reviews in these various areas (Pashazadeh & Navimpour, 2018; Otokiti, 2019). However, there is a much smaller, but still important, literature that describes the uses of big data in the administration of healthcare and hospital activities. The purpose of this paper is to review the literature regarding the uses of big data and its ancillary tools and processes in the

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improvement of healthcare processes. The term improvement can, of course, encompass many different aspects of healthcare and hospital administration. Improvement can involve the reduction of costs, the improvement of patient care and experience, the prediction of patient admission or readmission, and the allocation and management of hospital resources. In these and many other cases the use of big data techniques and tools has provided many options and opportunities for hospitals, healthcare systems, and other parts of the overall healthcare industry to create more effective and efficient methods for providing quality healthcare to their community and the nation.

BACKGROUND

When most people encounter the healthcare industry, they see mostly the clinical side of the process (except when it comes time to pay the bill). Many do not consider that healthcare is an industry and even if the facility they are using for provision of healthcare services is a non-profit organization, the business side of the healthcare equation is a crucial part of the overall system. Hospitals depend on well-trained and experienced personnel to perform their essential services, thus human resources is a critical activity. Even if they do not have shareholders to answer to, though many healthcare systems in the US are publicly traded companies, they still must monitor costs and revenues just as any other organization and therefore the financial processes of the organization is just as important as for any Fortune 500 firm. Issues of workflow streamlining, document management, and technology selection and implementation have very important roles in healthcare just as they do in any other organization.

Healthcare as a Business

Healthcare organizations face many of the same challenges as other firms. Cost reduction is a constant process. Large healthcare bureaucracies are inherently expensive to run, and with the high level of expertise in the clinical side of the organization and very expensive equipment to purchase and operate, cost reduction processes often take center stage. This is vitally important not just for the success of the enterprise, but for the healthcare system writ large. Workflow analysis allows the reduction of delays for patients to receive care and also reduce the overall complexity of the organization (Wolf, Herrmann & Rothermel, 2013). Increasing accuracy is a fundamental objective of healthcare administration as it is closely related to not just patient outcomes, but also the areas of cost reduction, asset utilization, and continuous process improvement (Cutler, Wikler & Basch, 2012).

Big Data Related Technologies

When organizations say they are using “big data,” it also means they are using some other tools to utilize that large collection of data. The simple collection of data, even in large amounts, is of little value unless actionable information can be extracted from them. Therefore, when reviewing the literature on the use of big data in the administration arm of healthcare, these ancillary but closely related technologies and tools must be included in the analysis. In the current study, the search for literature of big data in healthcare administration was combined with the following technologies to provide a more robust view of the literature:

- **Internet of Things (IoT):** The proliferation of sensors attached to machines, monitoring a process, and even measuring a patient’s vital signs, is the basis of much of the huge datasets that organizations are using to create new understandings of their processes. Therefore, even if big data is not explicitly mentioned, they are implicitly creating a big data environment;
- **Deep Learning:** A branch of machine learning that leads to tools such as Artificial Neural Networks (ANN) that can be trained to make decisions such as classifications or speech recognition. Related to big data because the datasets required to train and verify the algorithms are typically very large and commonly fall into the general definition of big data;

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