Challenges of Health Analytics Utilization: A Review of Literature

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Abstract. The last four decades witnessed a huge progress in digitizing health information, representing an unmatched opportunity for utilizing health analytics in improving the quality of healthcare and reducing its costs. To learn more about different challenges facing the successful utilization of health analytics, a careful review of literature was conducted, and a qualitative analysis was used to explore and classify these challenges. Three main categories of challenges were identified. 1) Technological challenges; hardware, software, and data content, 2) Human challenges; knowledge, experiences, beliefs and attitudes, and end user behaviors, and 3) Organizational challenges; managerial, financial, and legal barriers to optimal utilization of health analytics. The non-technological problems seem to be harder to solve as well as more time consuming, including the existence of a specific business need and a clear vision to guide the project. In addition, health analytics should always be built with the end users in mind.

Keywords. Big Data, Business Intelligence, Health Analytics, Hospitals.

1. Introduction

Over the last four decades, we have witnessed a huge progress in digitizing health information through collecting data of clinical practice and medical research in different types of electronic resources. Clinicians and healthcare professionals can now see new potentials in utilizing big data and health analytics to improve their healthcare processes and clinical outcomes. Health analytics can enhance evidence-based decision making; improving the quality of healthcare and reducing its costs [1]. Health analytics has the potential to identify valuable information and knowledge hidden within large masses of data. Healthcare researchers can analyze such big data to explore effective treatments for specific conditions or specific patients, explore hidden patterns of medications side effects, hospital readmissions, or emergency department crowding [2]. Bates et al. (2014) used predictive analytics to identify and manage six practical cases, as examples of achieved value through reducing costs, including high-cost patients, readmissions, triage, deterioration, adverse events, and treatment optimization for diseases affecting multiple organ systems. In fact, as many as one-third of the readmissions in the United States have been assumed to be preventable and, therefore, to present a significant opportunity for improving care delivery [3]. Proper health analytics can help professionals and organizations to monitor performance indicators on an ongoing and regular basis and support troubleshooting bad performance and to

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identify root causes of problems. Health analytics can help users to design, develop, implement and evaluate different key performance indicators that can help continuous monitoring, identifying reasons of performance deviations and eventually improving performance. There are many new unmatched opportunities to use such methods to improve the quality and reduce the costs of healthcare [4]. It is very crucial to learn about challenges facing successful utilization of health analytics.

2. Methods

A careful review of literature was conducted through searching four databases; MEDLINE, EMBASE, CINAHL and Google Scholar. The main search terms included Health, Analytics, Big Data, Business Intelligence, Utilization, and Challenges. The search identified 631 studies, after removing duplicates from the retrieved results of the four databases. Among these, 513 studies found non-relevant, after screening titles and abstracts and 94 studies found non-eligible, after examining the full text. Only 24 studies found eligible for the review. Inclusion criteria focused on studies describing specific challenges and categories of challenges of implementing and/or utilizing health analytics. References of eligible studies as well as recent studies that cited them were also examined. Qualitative thematic analysis was used, to classify main challenges of health analytics into different categories and types, through five steps; generating initial codes, searching for themes, reviewing, defining, then writing the challenges.

3. Results

We identified three main categories of challenges that face the successful implementation and utilization of health analytics. 1) Technological challenges which include hardware, software, and data content, 2) Human challenges which include knowledge, experiences, beliefs and attitudes towards health analytics, in addition to end user behaviors, and 3) Organizational challenges which include managerial, financial, and legal barriers to optimal utilization of health analytics. Each identified challenge, within the three categories, was discussed by at least two of the 24 eligible studies, so we included only 12 studies in the references. Figure 1 shows the three main categories and detailed challenges facing health analytics utilization.
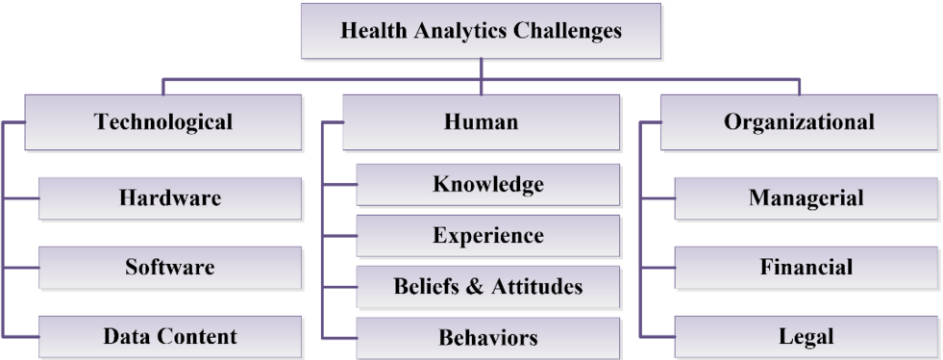

Figure 1. Health Analytics Utilization Challenges

4. Discussion and Conclusion

Even though health analytics can bring critical capabilities to healthcare, yet the implementation of such capabilities is often faced with many challenges. Health analytics projects are wrestling with different types of technological, human and organizational challenges. The non-technological problems seem to be harder to solve as well as more time consuming, including the existence of a specific business need and a clear vision to guide the project. Success depends on types of project funding, the value provided and the alignment of the project to the strategic vision of the organization [5]. Some studies classified challenges facing the implementation of health analytics and other informatics applications into six categories; human, professional, technical, organizational, financial and legal or regulatory challenges [6].

In the Human domain of challenges, we find it possible to explain the delay or unsuccessful implementation and utilization of health analytics by the poor acceptance or resistance of technology by healthcare professionals. The influence of the computers and IT knowledge, experience and skills of healthcare professionals and their beliefs about, and attitudes towards, using computerized systems in the healthcare environment can be considered among the major challenges to the successful implementation and utilization of such systems. Even highly regarded, industry-leading analytics and reporting systems can be challenging to use because of the multiplicity of functions, options and navigational tools [7]. Health analytics research often focuses on the design and implementation challenges, but not enough focus is given to how end users react to such systems. The success of systems lies beyond the level of a good design or the selection of a good technology. The degree of fitting the intended use by any system leads users to accept or reject such system [8]. Since health analytics is a newly emerging technology, it needs the efforts of highly trained, knowledgeable and experienced professionals with diverse new skill sets. These skills should not be limited to technical ones but should also extend to research, analytical, interpretive and creative ones, to support prescriptive analytics and advise organizations on possible outcomes and answer the question of what we should do next [9].

In the Technological domain we still can identify a lot of challenges related to data, such as the exploding volume, the velocity of data creation, which might be even more important than the volume, especially for the real-time analysis, and the variety of big data, in the form of text, voice, images and videos, which is a challenge for acquisition, processing and provision of useful information [10]. Technology related factors, such as hardware, software and data content, is more influential on descriptive analytics, while human related factors, such as knowledge, experience and skills can be more influential on prescriptive analytics. Similarly, the input of human knowledge and experience into strategic analytics is more important and influential than into operational analytics, which is more data driven [11]. The world of big data and analytics has two main challenge classes: engineering; efficiently managing data at large scales, where the technology challenges come first, and semantics; finding and meaningfully combining information that is relevant to our concern, where the human knowledge and experience challenges come first [12].

In the Organizational domain; developing and implementing health analytics is not only about technology, it is more about equipping organizations by tools that enable them to achieve their business objectives and providing users with technical capabilities that make new things possible and by engaging people into changing their behaviors to effectively use the new capabilities to generate the target results [13].

Leadership that sets smart goals, defines successful standards and asks the right questions is more important than having bigger or better data. The need for a human vision and insight will never be replaced by the power of analytics, since data content become cheaper and human input becomes more valuable. Changing the organization culture from "what we think" to "what we know" to identify organizational top-level management information needs [14]. The increased initial costs, operational and maintenance costs, and uncertain financial benefits of health analytics are frequently cited barriers. In addition, some ethical and legal concerns might be raised about the proper acquisition and utilization of systems, such as health information confidentiality [15]. Organizational leadership, managerial styles and other administrative and legal related factors, such as the financial issues, policies and procedures play an important role as mediating factors for other technology and human factors [16]. If the organization is not well prepared yet for transformation, in terms of cultural change and responsiveness, then all technology solutions and human efforts will not be enough to achieve this transformation and change, even if the best analytics were utilized and the most valid, accurate and comprehensive results are generated [17,18].

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