Application & Challenges Of Big Data Technologies In Albanian Health Care System

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Abstract

In today's world, technology is one of the most significant and debated areas about its application within healthcare systems. Technology holds the potential to revolutionize healthcare by enabling more advanced research on diseases, their causes, and cures. It can make treatment faster, more efficient, cost-effective, and simpler for healthcare professionals to administer. However, the challenges associated with its implementation should not be overlooked. Key concerns include the need for staff training, the potential for technological errors, and issues related to patient data privacy and hacking. This research focuses on the readiness and capacity of the Albanian healthcare system to adopt Big Data technologies. Big Data analytics refers to the process of analyzing large datasets to uncover patterns, trends, and preferences, leading to informed decision-making (Pouyanfar, Yang, Chen, Shyu, & Iyengar, 2018). Although technological tools have been gradually introduced in healthcare, numerous barriers to their full implementation still exist. This study includes a questionnaire distributed to various healthcare system employees in Albania, focusing on the technological innovations implemented, the advantages gained, and the challenges they have encountered. The data collected were analyzed and displayed graphically, resulting in conclusions and recommendations for future research.

Keywords: *Big Data, health system, medical sciences, applied technology, data analysis*

1. Literature Review

This research paper explores the potential of Big Data use in healthcare, particularly in the Albanian healthcare system. The healthcare system faces significant challenges due to an aging population and increasing patient expectations. Big Data offers a promising solution by analyzing large volumes of information to improve patient care and healthcare efficiency. However, several barriers limit its widespread adoption, including concerns over data privacy, high initial and ongoing costs for infrastructure and personnel, and the potential for biased algorithms that could reinforce social

inequalities. The study focuses on the Albanian healthcare system, where there has been limited research on the specific challenges of implementing Big Data. Big Data has the potential to transform healthcare but requires careful management of data privacy, financial costs, and algorithmic bias. The challenges identified in Albania align with global barriers, though further study is needed to develop localized solutions. The paper emphasizes the need for cooperation among healthcare actors and targeted research to enable effective Big Data integration in healthcare.

The methodology used in this study focuses mainly on the review of literature that provides data on the use of technologies and big data in the healthcare system. Big Data analytics refers to the process of studying large data sets to uncover patterns, trends, and people's preferences for quality decision-making (Pouyanfar, Yang, Chen, Shyu, Iyengar, 2018). These analyses help companies gain better insights and a competitive advantage, so the implementations must be executed as accurately as possible. With the rise of technological innovation, traditional database management systems are ineffective in managing big data. Traditional software tools do not have the capability to collect and process big data, to store and manage them efficiently (Kubick, 2012). This aspect makes the entire process quite challenging. The reason for the increased use of Big Data is the fact that organizations and companies are collecting user data to generate new information (Baseman et al., 2017). We want to discuss the factors influencing the adoption of new technologies, particularly in the healthcare sector. The benefits versus costs of adopting new technologies are often uncertain due to suppliers' influence. The decision to adopt is shaped by individual attitudes, skills required, and infrastructure availability. In healthcare, technological tools, offers potential to improve efficiency, reduce costs, and manage patient data. However, there are significant barriers to innovation, such as the fragmentation of the healthcare system, where various stakeholders like patients, medical personnel, researchers, pharmaceutical companies, insurers, and the government have different goals and objectives. This fragmentation creates dynamic complexity, where each actor's decisions influence the overall system. Another barrier is resistance to change, with a preference for traditional techniques. Despite the potential of Big Data to revolutionize healthcare, its implementation faces challenges. With effective use of health data and analytics, healthcare could predict epidemics, improve treatments, and enhance the quality of life. Big Data in healthcare requires interdisciplinary collaboration for effective implementation. Technical challenges also exist, particularly in clinical integration and the utility of Big Data, which have been largely overlooked. Data ownership is a significant issue, as it is often unclear who holds the rights to collected data. Additionally, legal frameworks must be respected, and patient consent is essential to avoid legal complications. Data quality also varies, depending on the source, and anonymizing data, necessary for patient privacy, makes it difficult to use the same data for disease prediction for individual patients later on. Legal, ethical, and data ownership challenges must be resolved before wide-scale implementation. Clinical integration, utility issues, and technical standards need to be addressed. The integration of technology in healthcare, and the reduction of control over patient data privacy, has impacted the level of trust patients place in medical staff. To maintain this trust, patients must be consistently informed about their health, educated on their treatment options, and included in decision-making. These complexities create significant challenges in effectively applying Big Data in healthcare (Wang, 2019). Datasets from various sources are often complex, with many missing values. Moreover, data sharing and privacy remain ongoing challenges, as medical records contain sensitive health information, making access to these datasets an everyday challenge or sometimes impossible. A user-friendly interface and seamless integration with existing health information systems are equally important (Reddy, Fox, Purohit, 2019). Despite various barriers, the potential benefits of applying Big Data in healthcare are substantial. Early detection of diseases typically makes treatment much easier. Doctors usually review patients' medical histories and perform tests to assess health. However, with the support of computational and analytical frameworks for processing and analyzing large datasets, healthcare providers can gain deeper information into patient health through pattern recognition and data correlations. Big Data analysis models can identify trends that might be overlooked in smaller sample sizes. Also big data analysis can optimize healthcare processes by reducing diagnostic and treatment errors, eliminating unnecessary tests, improving resource distribution, lowering treatment costs, and detecting and preventing healthcare fraud by identifying suspicious health data (Shilo, Rossman, Segal, 2020). By tracking and analyzing risks early, failure can often be prevented through lifestyle changes. Early detection of chronic diseases significantly reduces the time and costs associated with treatment and recovery for both patients and healthcare institutions (Zhoua et al., 2020). Machine Learning technologies are now being used to diagnose symptoms like cardiovascular diseases and diabetes. The use of ML can reduce diagnostic costs while maintaining relatively high accuracy (Shailaja, Seetharamulu, Jabbar, 2018). Experts are exploring AI applications in medicine to enhance the effectiveness of disease analysis and treatment. AI can be utilized across various areas of healthcare, including administrative tasks, clinical decision support, patient monitoring, and healthcare interventions (Reddy, Fox, Purohit, 2019). The conclusions from the literature review can be compared with results gained from interviews. The combined findings reinforce the notion that the challenges and opportunities

related to Big Data in Albania's healthcare system align with those observed in other countries. At the same time, differing conclusions highlight where the application of Big Data in Albanian healthcare system may diverge from practices in other regions. These differences also help identify priorities for further research and studies. Data quality, inconsistency, and instability issues prevent Big Data's impact in Albanian healthcare.

2. Big Data in the Albanian Health System

The aim of this paper is to provide a comprehensive study of the possibilities and challenges associated with implementing Big Data technologies in the healthcare system of Albania. The study does not try to provide definitive answers but rather aims to offer an overview and guidance for future research. To achieve this, interviews were conducted with 250 healthcare professionals from various regions in Albania: 35 from Durres, 61 from Tirana, 18 from Elbasan, 19 from Shkodra, and 17 from Vlora, along with 100 IT specialists based mainly in Tirana. Part of the surveys were also 250 ordinary people, treated in the "Patient" group, the answers of which were analyzed to understand how much they are inside with the use of technologies. But the results of this part are not included in this study. These interviews were facilitated through an online questionnaire using the Google platform. Participants were asked about their views on the adoption of new technologies in healthcare, their experiences, and their proficiency in using such technologies. The findings from these interviews were compared with studies from other countries, focusing on the practical outcomes of Big Data applications in real-world settings. The questions directed to the medical staff were crafted to elicit clear insights into their perspectives. Interviewees were required to respond to each question concisely and clearly.
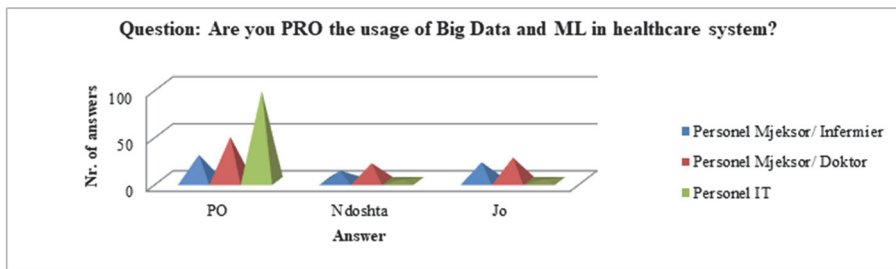

Figure 1: Are you PRO to use Big data Technologies?

The table below presents information from the first part of the interviews with doctors, detailing their knowledge regarding the implementation of new technologies.

Table 1: The first part of the interview with the doctors

Question	Yes	No	Neutral
Do you have a positive opinion about new technologies?	75	45	30
Do you have a positive opinion about the application of technologies in the health system?	70	35	45
Do you have information about Big Data?	100	20	30
Do you use electronic files?	110	20	20
Are you ready to use electronic files?	135	5	10

Table 2 shows information about the data generated from the second part of the interview with doctors, what they know about Big DATA and how it can be implemented in health.

Table 2: The second part of the interview with the doctors

Question	Answers			
Do you see Big Data as an area of interest for the health system in Albania?	Yes (58)	No (12)		
Why do you think that Big Data is not an area of interest for the health system in Albania?	Patient privacy (6)	Creates conflicts with patients (3)	Frequent inaccuracy of data (3)	
If Big Data is applied, what is the biggest potential benefit?	The easiest way to find medications (26)	Prediction of diseases (20)	Cost reduction (13)	The confidence of patients increases (11)
Do you think that the application of these technologies will start widely within 3 years?	Yes (24)	No (46)		
What do you think is the main obstacle?	Cost (18)	Lack of institutional interest (14)	Infrastructure (9)	Lack of professionals (5)
Do you think you are ready?	Yes (6)	No (18)		
If you are not ready, what is the reason?	We need training (15)	We don't have the right technological infrastructure. (3)		

Just as we developed the interview for the medical personnel, a questionnaire was also developed for the IT specialists, to obtain information from the technical and professional side. Table 3 shows the answers given by IT specialists.

Table 3: Interview with IT specialists

Questions	Answers			
Do you have experience with Big Data?	Yes (70)	Sometimes (10)	No(20)	
How often do you work with Big Data?	Often (50)	Sometimes (18)	Rare (12)	
How often do you work with Big Data related to the field of medical sciences?	often (53)	Sometimes (21)	Never (26)	
What do you think is the main obstacle for the integration of these technologies?	Finance (35)	Telecommunications (23)	Marketing (35)	Medicine (7)
After 5-10 years the application of Big Data in the health system in Albania?	About the same (12)	Big Increase (75)	I can't predict (13)	
The main potential application of Big Data in the health system in Albania?	Predict the medication list (13)	Prediction of diseases (46)	Finding errors during procedures (24)	Identifying the diagnosis (18)
What is the biggest potential disadvantage?	Privacy (32)	Data security (46)	Errors in the process (10)	cost (12)
What is the biggest potential barrier?	Lack of staff (31)	Lack of interest (5)	Infrastructure (34)	Initial cost (30)
What do you think is the most suitable technology?	Mode (11)	Power Bi (47)	Apache Hadoop (29)	Databricks (13)
The biggest advantage of the technology implementation you recommend?	Familiarity (7)	Ease of learning (26)	Quality (40)	Privacy Security (27)
The biggest disadvantage of the technology implementation you recommend?	Difficulty to adapt (27)	Cost (23)	Infrastructure (36)	Medicine field (14)

Referring to the studies in this field, we see that the application of Big Data technologies in the health system, according to Frenzel et al. (2021) provide an overview of the results of the application of Big Data technologies in the health system in Ohio, USA, in the period 2014-2019. Table 4 below reflects the data (5000 studied cases) that show the diagnostic process for specific diseases, before and after the use of technological tools.

Table 4: Diagnostic accuracy

The disease	Before	After
Hypertension	89%	97%
Diabetes	94%	96%
Arrhythmia	92%	98%
Cancer	88%	92%
Alzheimer's	72%	92%
Parkinson	76%	91%
Ischemia	81%	94%
Infections	92%	98%

The implementation of Big Data technologies significantly enhances the accuracy of initial diagnostics. Similar to traditional diagnostic methods, the effectiveness of Big Data varies depending on the specific diseases being assessed. Interviews with healthcare professionals reveal a consensus on the benefits of integrating new technologies into the health system; however, many lack sufficient knowledge about Big Data applications. Doctors are gaining experience with electronic health records, marking an important first step toward effective data collection and the application of Big Data. All interviewed individuals express readiness to use electronic files, and upon familiarization with Big Data, 68% of them recognize its potential value within the Albanian healthcare system. Conversely, the 19% who oppose its use cite concerns about privacy, potential conflicts with patients, and the risk of inaccurate data, and 13% are neutral.
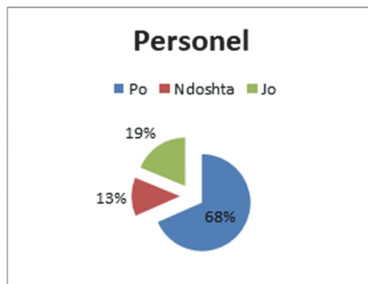

Figure 2: Answers of personel in %

In the short term, the primary obstacle is the perceived readiness of doctors to adopt Big Data technologies. In the long term, inadequate infrastructure remains a significant concern for many healthcare providers. This concern is valid, particularly given that Western countries generally have a more robust electronic and technological infrastructure in their health systems compared to Albania. The application of Big Data technologies in Albania is expected to reduce costs for both healthcare institutions and patients. However, additional research is necessary to better understand the cost benefits that Big Data can offer in Albania relative to Western countries, and how to maximize these advantages. For doctors unfamiliar with Big Data technologies, it may be more beneficial to consider the insights of IT specialists, who generally have extensive experience and familiarity with these tools. IT specialists maintain a positive outlook on the future of Big Data in Albanian healthcare, with half believing that its presence will significantly increase over the next 5-10 years. Overall, both IT specialists and doctors agree on the advantages of implementing Big Data in healthcare, such as improved treatment planning, disease prediction, error detection, and quicker, more accurate diagnoses. The identified disadvantages align with findings from existing literature.

3. Conclusion

The use of Big Data technologies in the healthcare system is expected to grow significantly over the coming years. However, there are barriers and challenges that need to be addressed. Key issues include concerns about patient privacy, errors in the data collected (which may arise from incorrect reporting by patients or mistakes made by medical staff), the inherent tendency for systems to evolve, and the challenges associated with staff training. In the context of the Albanian healthcare system, two notable barriers to implementing Big Data are cost and a lack of interest. While many doctors and some IT specialists cite cost as a barrier, this perspective is less supported by existing literature. Interviewees attribute some of these costs to infrastructure deficiencies in Albania, such as unreliable internet connectivity and outdated computer systems. This issue is particularly pronounced in Albania compared to other countries where Big Data applications in healthcare have been extensively studied, presenting opportunities for new research focused on these unique challenges. There is no doubt that adopting Big Data technologies in Albania's healthcare system could lead to cost reductions for both institutions and patients. However, further research is necessary to quantify the cost benefits that Big Data can bring to the Albanian healthcare system in comparison to Western countries and to explore ways to maximize its utility. Additionally, the identified barrier of a lack of interest is crucial and warrants targeted studies. This lack of interest stems from insufficient information among decision-makers and healthcare workers, a gap that IT specialists could help bridge.

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