BIG DATA CAPABILITIES FOR HOSPITAL

A SYSTEMATIC LITERATURE REVIEW

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CONTENT

INTRODUCTION

Big Data plays a vital role in developing a business, and decision-making process, cultivating new opportunities. These new opportunities could be leveraged in hospitals such as medical research, design prevention methods, and handling disease emergence [1].

Other studies have been conducted to merge BD with other technology such as Artificial Intelligence (AI) [2] and Machine Learning (ML) [3]. The second reference leverage BD-AI to support the management of COVID-19 pandemic cases, such as diagnosis, control, treatment, and prevention. Meanwhile, the third reference has successfully made an ML model to detect miRNA biomarkers in breast cancer based on 10.000 cancer patients with 33 different types of cancer.

[1] Dias MNR, Hassan S, Shahzad A. (2021) “The impact of big data utilization on Malaysian government hospital healthcare performance” *International Journal of eBusiness and eGovernment Studies* **13**: 50–77

[2] Dong J, Wu H, Zhou D, Li K, Zhang Y, Ji H, et al. (2021) “Application of Big Data and Artificial Intelligence in COVID-19 Prevention, Diagnosis, Treatment and Management Decisions in China” *Journal of Medical Systems* **45 (9)**: 84

[3] Jourquin J, Reffey SB, Jernigan C, Levy M, et al. (2019) “Komen big data for breast cancer initiative: how patient advocacy organizations can facilitate using big data to improve patient outcomes” *JCO Precision Oncology* **3**: 1-9

INTRODUCTION

Big Data (BD) is necessary for any industry such as hospitals. In this study, we will discuss the impact and how the utilization of BD Analytics (BDA) is implemented in the hospital.

RESEARCH QUESTION

- What are the key factors to determine the effectiveness of BDA in enhancing hospital performance?
- What are the data sources needed to support hospital performance?
- How can BDA help to improve patient satisfaction with the services?
- What are the challenges that hinder the use of BDA for hospital performance?

RELATED WORKS

01 THE CURRENT NEEDS

The authentication of the capabilities of BD using BDA is indispensable for any development of current needs in hospitals [4].

02 IMPACT & UTILIZATION

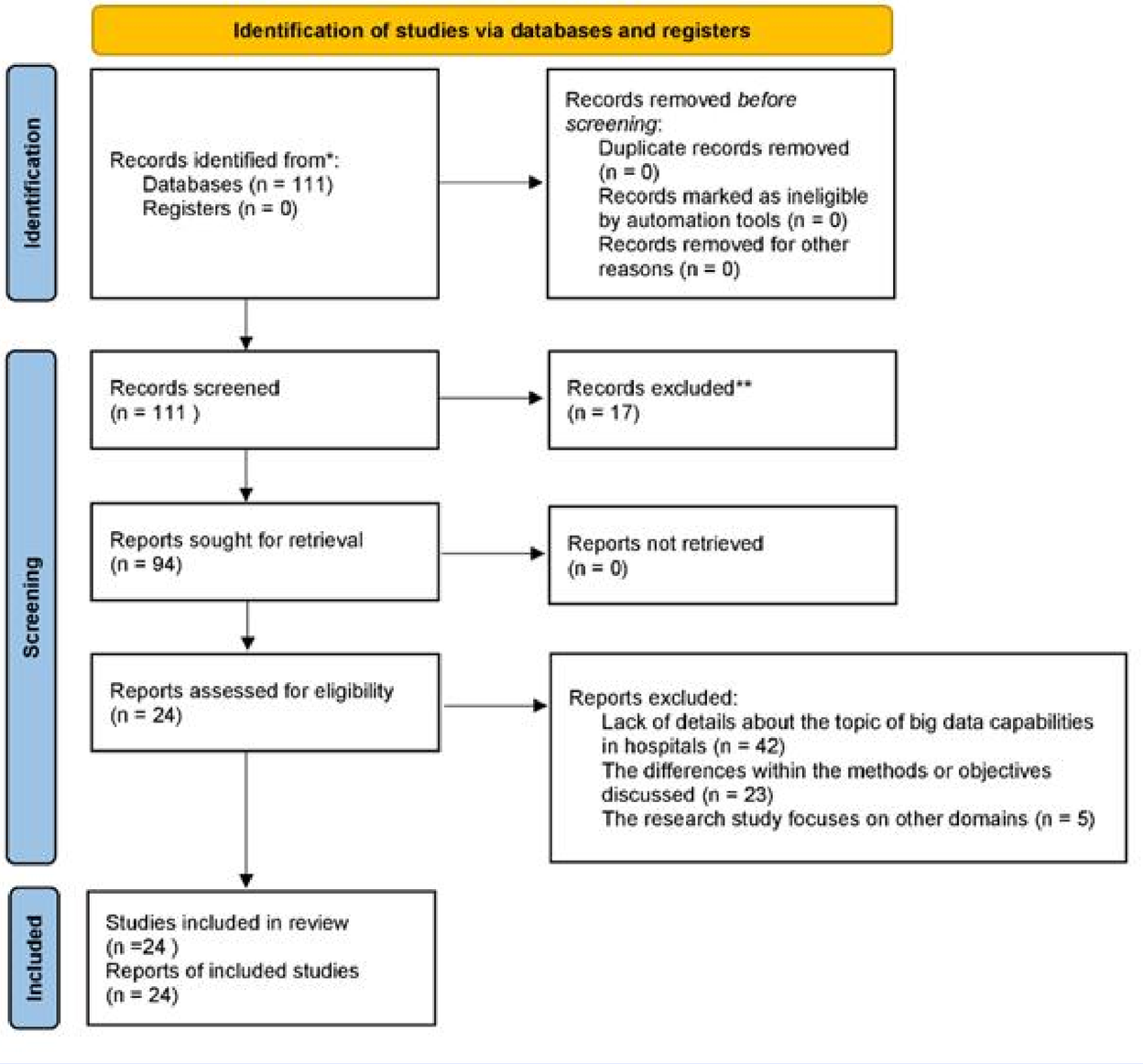
There is a deficiency of BDA in their utilization which could lead to reduced hospital performance and potentially have a cascading effect on the hospital system [5-7].

[4] Lv Z, Qiao L. (2020) “Analysis of healthcare big data” *Future Generation Computer Systems* **109**: 103-110
[5] Galetsi P, Katsaliaki K, Kumar S. (2019) “Values, challenges and future directions of big data analytics in healthcare: A systematic review” *Social Science and Medicine* **241**: 112533
[6] Baek ES, Lee C kun, Chang JS, Choi JE, Shin SJ. (2021) “The Awareness and Usage of Big Data for Cancer in Korea: A Survey Study” *Journal of Health Informatics and Statistics* **46 (2)**: 171-180
[7] Khennou F, Khamlichi YI, Chaoui NE. (2018) “Improving the use of big data analytics within electronic health records: a case study based OpenEHR” *Procedia Computer Science* **127**: 60-68.

METHODOLOGY

Table 2. Number of publications related keywords and databases

Based on Related Keywords		Based on Databases	
Keywords	Number of Papers	Databases	Number of Papers
Healthcare	47	Google Scholar	40
Hospital	16	Scopus	20
Big Data	50	IEEE Xplore	16
Big Data Analytics	46	Semantic School	24
Disease	8	Springer Link	11
Other derivatives	10	Total	111



RESULTS

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References

OUR FINDINGS

These results represent the proposed research questions before

Utilization

Data Sources

Ability

Challenges

UTILIZATION

THE VALUE OF BD

The value of BD is an indispensable part of a hospital such as the decision support system and improving the efficiency of healthcare service performance. This statement is supported in part of Table 3. Meta-Analysis.

THE MAIN KEY FACTORS

According to Table 3, most research papers reveal that the main key factors in determining how the BD would be effective in its utilization are high-level Data Integration (DI) and Data Quality (DQ). These crucial factors hold the potential to yield accurate decisions in disease analysis and other sectors.

Table 3. Meta-analysis

Paper	Year	Data Source	Method	Aim of Study	Performance
The path from big data analytics capabilities to value in hospitals: a scoping review [33]	2022	Scopus and Web of Science	Scoping Review	Explain how BDA can provide value and benefits to healthcare and hospital managers.	BDA has the potential to provide value and benefits in hospitals. However, challenges can hinder the use of BDA in hospitals, so it requires strategy, technology, and organizational capabilities to encourage the use of BDA.
Leveraging big data analytics in healthcare enhancement: trends, challenges and opportunities [5]	2022	Google Scholar, CLEF, Cancer Imaging Archive, Gen-Bank, Framingham Heart Study, and other databases.	Systematic Review	Provides detailed background information, advantages, and architecture of BDA in healthcare improvement.	BDA plays a vital role since it has rapidly increased in the progression of healthcare practices. On the other hand, BDA implementation in five sub-disciplines also plays a vital role due to the enormous amount of data.
The use of Big Data Analytics in healthcare [12]	2022	Healthcare Organizations	Questionnaire (Likert Scales)	The possibilities of BDA on healthcare in Poland.	From 217 entities it was confirmed that medical facilities are moving towards data-based healthcare. A comprehensive analysis of their Likert Scale tables shows that 3-4 which this score shows us healthcare starts to leverage in BDA.
A Data Analytics Suite for Exploratory Predictive,and Visual Analysis of Type 2 Diabetes [23]	2022	Biological Markers, Type 2 Diabetes	Pyramid Analytics, Heatmap, SVM Prediction	Association between biological markers and T2D complications.	The SVM method accuracy for predicting the survival probability is 73,3%
A Knowledge Based Analysis on Big Data Analytics in Optimizing Electronic Medical Records in Private Hospitals [34]	2021	EMRs in Private Hospitals	Qualitative Approach	Analyze the use of BDA in optimizing EMRs in hospitals and healthcare centers.	It significantly improves the cycle of EMRs which means BDA provides the capabilities of EMR for further work such as promising programming levels for medicine and medical healthcare utilization.
The Awareness and Usage of Big Data for Cancer in Korea: A Survey Study [16]	2021	Healthcare Organizations in South Korea	Questionnaire (Likert Scales)	Awareness and demand of BD for cancer research.	The total of responses that are used is 164 and resulting in high awareness of cancer but not being sufficiently utilized at present.
Big Data Analytics for Prediction Modelling in Healthcare Databases [35]	2021	Females in Australia	Linear Regression Model	Estimating the incidence and mortality counts of breast cancer in Australia	The results of linear regression are invariable which we can use for further research or decision-making.
The Impact of Big Data Utilization on Malaysian Government Hospital Healthcare Performance [4]	2021	Malaysian Government Hospital	Questionnaire (Likert Scales)	Investigating the role of BD and its relationship between the independent and dependent variables	The author finds that Data Quality (DQ) and Data Integration (DI) have a significant direct relationship. However, Data Governance does not have a significant direct relationship with BD.
Chronic Disease Progression Prediction: Leveraging Case-Based Reasoning and Big Data Analytics [36]	2021	US Department of Veterans Affairs (VA) Hospital	Regression, mgcv library in R, Examination of Comorbidities	Prediction of chronic disease based on EHRs	The author finds that their findings are better than popular data mining and statistical methods. ES and ARIMA had a 2.25 mean value in MAPE, on the other hand, iCBR has 1.54 points which means iCBR performs better than those methods.

DATA SOURCES

DEFINITION OF BD IN THE CONTEXT OF BDA

BD encompasses diverse data sets from medical records, radiology images, genetic information, and population, offering valuable insights into the healthcare sector.

THE MAIN KEY IS DI

Large amounts of complex data pose a challenge to researchers and hospitals. High-level DI is key to addressing data complexity, integrating and processing data efficiently, improving healthcare performance.

UTILIZATION OF BDA IN MANAGING DATA

Several studies have proven that BDA can help manage and analyze data in the healthcare sector [8, 9]. The data scope in hospitals may be varied, such as Electronic Health Records (EHR), disease research, patient satisfaction feedback, and others.

[8] Dias MNR, Hassan S, Shahzad A. (2021) “The impact of big data utilization on Malaysian government hospital healthcare performance” *International Journal of eBusiness and eGovernment Studies* **13**: 50–77.
[9] Prince J, Arora S, De Vos M. (2018) “Big data in Parkinson’s disease: Using smartphones to remotely detect longitudinal disease phenotypes” *Physiological Measurement* **39 (4)**: 044005.

ABILITY

BD ABILITY

The ability of BD has been represented in a study that reveals that we may find a comparison between the cost of patient treatment and clinical benefits by comparing Laparoscopic Surgery (LS) and Open Surgery (OS) [10]. This study also correlated with the previous findings about the high-level DI and DQ [11].

BD AND BDA

The value of BD in decision support is helpful for healthcare organizations to enhance patient satisfaction. In this condition, BDA plays an essential role as the main factor to leverage the BD by implementing and embedding its analysis result in other technology infrastructures.

[10] Hwang H, Myung JE, Yi JW, Lee SS, Park J. (2020) “Laparoscopic surgery versus open surgery for gastric cancer: Big data analysis based on nationwide administrative claims data” *Annals of Surgical Treatment and Research* **99 (3)**: 138–45.

[11] Dias MNR, Hassan S, Shahzad A. (2021) “The impact of big data utilization on Malaysian government hospital healthcare performance” *International Journal of eBusiness and eGovernment Studies* **13**: 50–77.

CHALLENGES

BDA CHALLENGES IN HEALTHCARE

Managing data, ensuring security, and maintaining privacy are all challenges when it comes to BDA, which include the gaps in expertise in using BDA and limited access to the necessary supporting technologies. This challenge arises when dealing with large, complex, and diverse data volumes. Furthermore, the issues such as data management, security, and privacy must be considered.

NECESSARY NOTES

Handling heterogeneous data, data protection, infrastructure availability, and ethical, and legal considerations are all possible solutions, and the development and implementation of BDA algorithms also need to overcome these challenges.

CONCLUSION

Key Factors of BDA Capability

To properly evaluate the data, it is necessary to emphasize the values of data integration (DI) and data quality (DQ). We conclude that the high level of DI and DQ is the main factors to determine the capability of BDA.

The Importance of High Level DI and DQ

is well-equipped to assist in making accurate decisions and handling hospital issues such as patient diagnosis, further decisions, resource allocation, etc.

The Potential

BDA can assist hospital management in treating patients with specific diseases or other decision support they need more efficiently and accurately.

Limitation

The quality of research is limited to journals and the exclusion of studies from books.

FURTHER RESEARCH

Further research should be robustly conducted in terms of developing BD clinical benefits, cost-effective care, and a decision-support system to enhance the performance of the data-based hospital or the hospital with unsupportive infrastructure.

THANK YOU

Are there any questions?