RESEARCH PAPER

Data Analytics in Healthcare: Improving Service Quality and Patient Outcomes in the Digital Age

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ABSTRACT
The healthcare sector generates an immense volume of data but often struggles to leverage this data effectively to improve patient outcomes and operational efficiency. Data analytics is pivotal in addressing these challenges by facilitating the translation of raw data into actionable insights. This paper explores the role of data analytics in healthcare, highlighting its capacity to simplify data sharing among healthcare professionals and external partners, enhance real-time projections, and foster innovation through automated data management. Data analytics tools are categorized into three types: software for data collection from diverse sources; programs for data cleaning, validation, and analysis; and applications that recommend actions based on analytical outcomes. These tools are essential not only for data management but also for safeguarding information and ensuring its usability for healthcare professionals. The use of data analytics is poised to transform various aspects of healthcare, including disease research, early diagnosis, operational automation, and personalized treatment plans. For example, Tempus employs analytics to integrate molecular and clinical data, aiding oncologists in personalizing cancer treatments. Similarly, public health experts use analytics to enhance disease prevention and identify at-risk populations. Tools like Linamarins leverage natural language processing to analyze unstructured data and identify high-risk patients based on lifestyle factors. This paper underscores the importance of collaboration between healthcare professionals and data analysts, emphasizing the need for accessible and effective analytics tools across the healthcare landscape.

Keywords: Data Analytics, Healthcare, Patients follow-up, Online healthcare applications.
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Research Objective

1. To find the effect of data analytics in improving the KRAs of healthcare services.
2. To compare the online health care applications with respect to the data analytics features in improving the KRAs of healthcare services.

Literature Review

Hersh (2014) explored the "Healthcare Data Analytics Learning Objectives" and highlighted the transformative potential of data analytics in the healthcare industry. As the volume of clinical and research data grows exponentially, advancements in analytical methodologies promise significant improvements in individual health outcomes, healthcare delivery, and biomedical research. Hersh emphasizes the necessity of enhancing both the breadth and quality of data, alongside pursuing research that effectively addresses real-world challenges. Effective data utilization will demand considerable human expertise in informatics, given the substantial rise in data due to the proliferation of electronic health records (EHRs). Analytical platforms are designed to process data from diverse sources, including clinical records, genomic data, financial systems, and administrative systems. The integration of analytics is crucial for converting data into meaningful insights, thereby impacting financial and clinical data analysis within accountable care organizations and emerging healthcare models. The healthcare sector currently faces a high demand for skilled data analysts with strong informatics backgrounds.

Raghupathi and Raghupathi (2014) examined the "Promise and Potential of Big Data Analytics in Healthcare" and noted that big data analytics has the capacity to revolutionize healthcare by enhancing the way providers extract valuable insights from their data repositories. They predict a significant increase in the adoption of big data analytics across healthcare organizations in the coming years. To realize this potential, issues related to privacy, security, standards, and tool advancements must be addressed. Although big data analytics is still in its early stages, ongoing progress in tools and platforms is expected to accelerate its development.

Subrahmanya et al. (2022) investigated "The Role of Data Science in Healthcare Advancements" and identified that comprehensive patient records from various sources, including surveillance, laboratories, genomics, and EHRs, require effective management and analysis to yield relevant insights. Big data has the potential to support long-term goals such as self-

management, improved patient care, and personalized medicine. Real-time predictive analytics can offer insights into disease processes and enhance patient-centered care. Effective integration of data from multiple sources is essential for accurate predictive analytics. Data science can transform medical therapy and personalized medicine by managing and analyzing vast data sets.

Patil (2022) analyzed "Big Data in Healthcare" and found that while the potential of big data to enhance outcomes and reduce costs is significant, challenges remain. Big data analytics could fundamentally alter how healthcare professionals derive insights from clinical and other data. The future adoption of big data analytics in healthcare will face hurdles related to security, privacy, standards, governance, and technological advancement. The field is still developing, but new platforms and tools are anticipated to evolve over time.

Sharma et al. (2022) conducted a review on "Big Data Analytics in Healthcare" and underscored the challenges associated with managing big data, such as ensuring data privacy, preventing leakage, and interpreting unstructured clinical notes. Despite these challenges, big data holds substantial promise for transforming healthcare administration. The review highlights a gap in the literature regarding big data in healthcare management and suggests that future research should focus on data governance complexities and innovative data visualization tools for improving decision-making.

Singh and Khan (2022) reviewed "An Effective Data Management Framework for Healthcare: Big Data Perspective" and observed that the healthcare sector is poised to leverage new technologies to enhance patient care and reduce costs. With the rise of digital data due to digitization, effective use of this data can lead to improved outcomes and cost savings. The application of appropriate analytical tools is crucial for harnessing the potential of healthcare data. The review suggests that addressing the concerns and optimizing technologies will be key to successful data analytics in healthcare.

This body of literature underscores the critical role of data analytics in enhancing key result areas (KRAs) within healthcare services. Effective data management and analysis have the potential to revolutionize healthcare delivery, improve patient outcomes, and support informed decision-making across various aspects of healthcare.

Limitation

The current study was confined to healthcare organizations engaged in delivering services, supplying pharmaceuticals, and providing diagnostic solutions through digital platforms, including Tata1mg, PharmEasy, Practo, Apollo, and similar entities.

Hypotheses

- H01: There is no significant difference of online health care application with respect to the customer satisfaction in improving the KRAs of healthcare services.

• H11: There is a significant difference of online health care application with respect to the customer satisfaction in improving the KRAs of healthcare services.

• H02: There is no significant difference of online health care application with respect to the well-being in improving the KRAs of healthcare services.

• H12: There is a significant difference of online health care application with respect to the well-being in improving the KRAs of healthcare services.

• H03: There is no significant difference of online health care application with respect to the user engagement in improving the KRAs of healthcare services.

• H13: There is a significant difference of online health care application with respect to the user engagement in improving the KRAs of healthcare services.

• H04: There is no significant difference of online health care application with respect to the performance of online health applications in improving the KRAs of healthcare services.

• H14: There is a significant difference of online health care application with respect to the performance of online health applications in improving the KRAs of healthcare services.

• H05: There is no significant difference of online health care application with respect to the cure of diseases & ailment in improving the KRAs of healthcare services.

• H15: There is a significant difference of online health care application with respect to the cure of diseases & ailment in improving the KRAs of healthcare services.

• H06: There is no significant difference of online health care application with respect to the patient satisfaction in improving the KRAs of healthcare services.

• H16: There is a significant difference of online health care application with respect to the patient satisfaction in improving the KRAs of healthcare services.

• H07: There is no significant difference of online health care application with respect to the patient's confidentiality in improving the KRAs of healthcare services.

• H17: There is a significant difference of online health care application with respect to the patient's confidentiality in improving the KRAs of healthcare services.

• H08: There is no significant difference of online health care application with respect to the patient follow-up in improving the KRAs of healthcare services.
• H18: There is a significant difference of online health care application with respect to the patient follow-up in improving the KRAs of healthcare services.

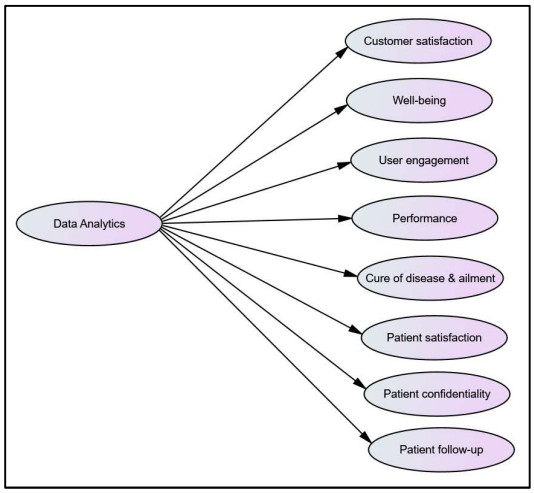


Figure 1: Conceptual Research Model
Source: AMOS 23.0

The figure depicts the latent independent variable is the data analytics (DA). The eight dependent latent variables are customer satisfaction (CS), well-being (WB), user engagement (UE), performance of online healthcare application (POHA), cure of disease & ailment (CDA), patient satisfaction (PS), patient confidentiality (PC), and patient follow-up (PFU).

Conceptual Research Model Figure shows there is one independent latent variable as data analytics with ten items. There are eight dependent latent variables, each also having 10 items.

Research Questions

The research questions of this study are as follows:

- What is the contribution of data analytics in making KRAs of healthcare services more future ready?
- What is the effect of data analytics in improving the KRAs of healthcare services?
- What is the comparative analysis on the online health care applications with respect to the data analytics in improving the KRAs of healthcare services?

Research Objectives

The objectives of this study are as follows:

- To explore the contribution of data analytics in making KRAs of healthcare services more future ready.
- To find the effect of data analytics in improving the KRAs of healthcare services.
- To compare the online health care applications with respect to the data analytics features in improving the KRAs of healthcare services.

Sampling Method/Technique
Given the extensive population of users and patients engaging with digital healthcare platforms such as Tata1mg, PharmEasy, Practo, and Apollo Pharmacy, a non-probability snowball sampling technique was employed for the final respondent selection.

Sample Size
The pilot study comprised a sample size of 40 participants. For the main study, 407 responses were collected via a web-based Google Form survey from users and patients of the aforementioned digital healthcare platforms.

Sources of Data
Primary data was gathered through a meticulously designed web-based Google Form survey distributed to users and patients of digital healthcare platforms including Tata1mg, PharmEasy, Practo, and Apollo Pharmacy. Structured questionnaires were utilized to collect primary data from state and central government employees across various organizations. Secondary data was obtained by reviewing significant research papers published in national and international journals. This secondary data was sourced from databases such as Scopus, Google Scholar, and J-Gate, among others.

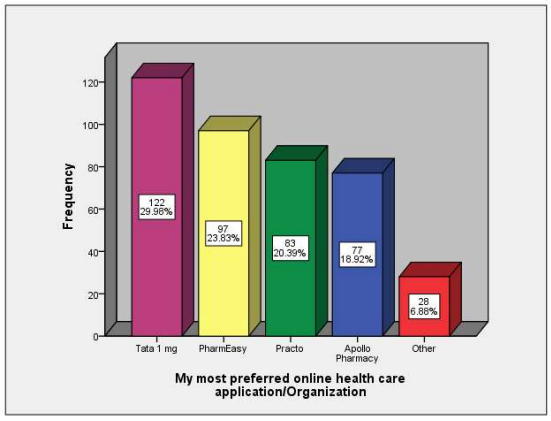
Statistical Technique
The IBM-SPSS 23.0 version statistical software was used in the data analysis and interpretation. The variable creation, data entry, value label, data coding, and simple calculation like reliability, factor analysis and frequency analysis, correlation & regression analysis, One-Sample Kolmogorov-Smirnov Test (Normality Test), Independent t test/ Mann Witney T Test were performed using SPSS 23.0. The significance level was set in advance at 5% means that we would be 95% confident in our decision making or

accepting/ rejecting hypothesis. The decision rule as follows: If Sig value is less than 0.05, then reject null hypothesis. If Sig. value is more than 0.05, then accept null hypothesis.

Table No. 1: Most preferred online health care application/Organization

	Frequency	Percent
Tata 1 mg	122	29.98
PharmEasy	97	23.83
Practo	83	20.39
Apollo Pharmacy	77	18.92
Other	28	6.88
Total	407	100.00

Chart No. 1



Source: Research Work

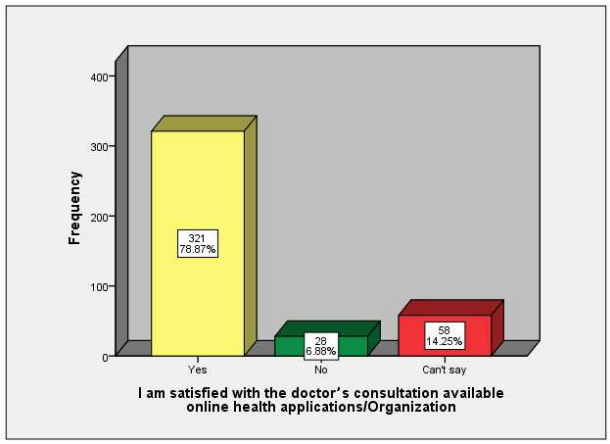
Based on the data presented in the Table No. 1 and Chart No. 1, it is evident that 29.98% of respondents were using Tata1mg, 23.83% of respondents were using PharmEasy. 20.39% respondents were using Practo, 18.92% respondents were using Apollo Pharmacy and 6.88% respondents were using other health care digital web applications. Therefore, it can be concluded that the majority of respondents (29.98%) were using Tata 1 mg digital health care applications.

Respondents Demographic

Table No. 2: Satisfaction with the doctor's consultation available online health applications/Organization

	Frequency	Percent
Yes	321	78.87
No	28	6.88
Can't say	58	14.25
Total	407	100.00

Chart No. 2



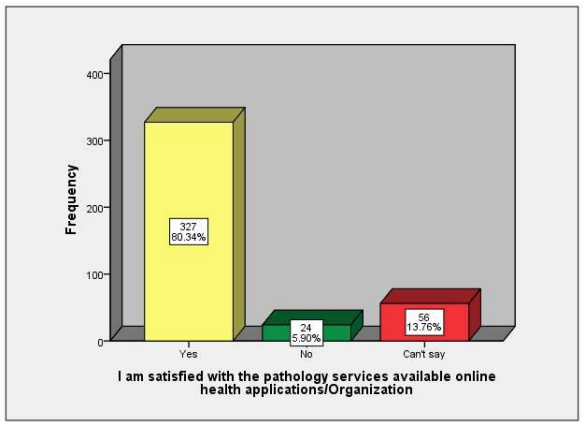
Source: Research Work

Based on the data presented in the Table No. 2 and Chart No. 2, it is evident that 78.87% of respondents were satisfied with the doctor's consultation available online health applications/Organization, 6.88% respondent were not satisfied with the doctor's consultation available online health applications/Organization, and 14.25% respondent could not say about the doctor's consultation available online health applications/Organization. Therefore, it can be concluded that the majority of respondents (78.87%) were satisfied with the doctor's consultation available online health applications/Organization.

Table No. 3: Satisfaction with the pathology services available online health applications/Organization

	Frequency	Percent
Yes	327	80.34
No	24	5.90
Can't say	56	13.76
Total	407	100.00

Chart No. 3



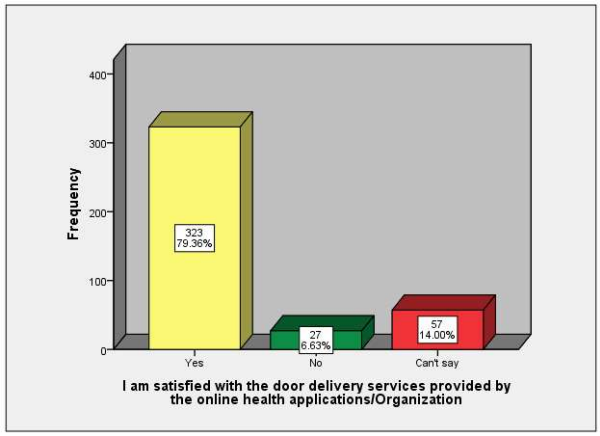
Source: Research Work

Based on the data presented in the Table No. 3 and Chart No. 3, it is evident that 80.34% of respondents were satisfied with the pathology services available online health applications/Organization, 5.90% respondent were not satisfied with the pathology services available online health applications/Organization and 13.76% respondents could not say about the pathology services available online health applications/Organization. Therefore, it can be concluded that the majority of respondents (80.34%) said yes in this study.

Table No. 4: Satisfaction with the door delivery services provided by the online health applications/Organization

	Frequency	Percent
Yes	323	79.36
No	27	6.63
Can't say	57	14.00
Total	407	100.00

Chart No. 4



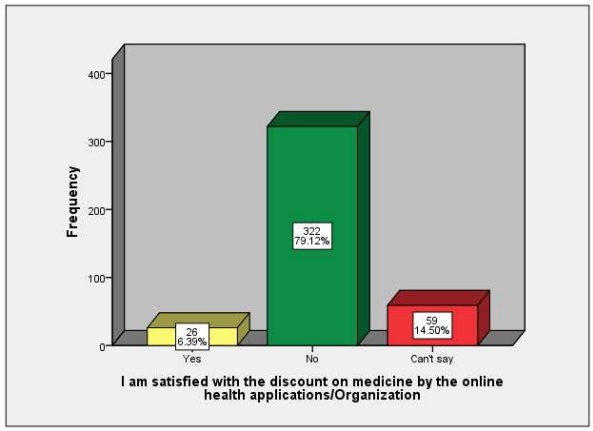
Source: Research Work

Based on the data presented in the Table No. 4 and Chart No. 4, it is evident that 79.36% of respondents were satisfied with the door delivery services provided by the online health applications/Organization, 6.67% respondent were not satisfied with the door delivery services provided by the online health applications/Organization and 14.00% respondents could not say about the door delivery services provided by the online health applications/Organization. Therefore, it can be concluded that the majority of respondents (79.36%) were satisfied with the door delivery services provided by the online health applications/Organization.

Table No. 5: Satisfaction with the discount on medicine by the online health applications/Organization

	Frequency	Percent
Yes	26	6.39
No	322	79.12
Can't say	59	14.50
Total	407	100.00

Chart No. 5



Source: Research Work

Based on the data presented in the Table No. 5 and Chart No. 5, it is evident that 6.39% of respondents were satisfied with the discount on medicine by the online health applications/Organization, 79.12% respondent were not satisfied with the discount on medicine by the online health applications/Organization and 14.50% respondents could not say about the discount on medicine by the online health applications/Organization. Therefore, it can be concluded that the majority of respondents (79.12%) were satisfied with the discount on medicine by the online health applications/Organization.

Data Analytics and Interpretation

Table No. 6: Data analytics is relevant and useful in making informed decisions in healthcare

	Frequency	Percent
Strongly Disagree	31	7.62
Disagree	51	12.53
Neutral	21	5.16
Agree	203	49.88
Strongly Agree	101	24.82
Total	407	100.00

Source: Research Work

According to the data presented in the Table No. 6, it is evident that 7.62% respondents strongly disagreed with the statement "Data analytics is relevant and useful in making informed decisions in healthcare." 12.53% of respondents disagreed, 5.16% of respondents neither agreed nor disagreed, 49.88% of respondents agreed, and 24.82% of respondents strongly agreed; hence, it can be inferred that a significant proportion of respondents agreed that data analytics was relevant and useful in making informed decisions in healthcare.

Table No. 7: Data analytics positively influences patient outcomes in healthcare

	Frequency	Percent
Strongly Disagree	29	7.13
Disagree	52	12.78
Neutral	18	4.42
Agree	229	56.27
Strongly Agree	79	19.41
Total	407	100.00

Source: Research Work

According to the data presented in the Table No. 7, it is evident that 7.13% of respondents strongly disagreed with the statement "Data analytics positively influences patient outcomes in healthcare." 12.78% of respondents disagreed, 4.42% of respondents neither agreed nor disagreed, 56.27% of respondents agreed, and 19.41% of respondents strongly agreed; hence, it can be inferred that a significant proportion of respondents agreed that data analytics positively influences patient outcomes in healthcare.

Table No. 8: The insights obtained from data analytics in healthcare are accurate and reliable

	Frequency	Percent
Strongly Disagree	29	7.13
Disagree	61	14.99
Neutral	19	4.67
Agree	187	45.95
Strongly Agree	111	27.27
Total	407	100.00

Source: Research Work

According to the data presented in the Table No. 8, it is evident that 7.13% of respondents strongly disagreed with the statement, "The insights obtained from data analytics in healthcare are accurate and reliable." 14.99% of respondents disagreed, 4.67% of respondents neither agreed nor disagreed, 45.95% of respondents agreed, and 27.27% of respondents strongly agreed; hence, it can be inferred that a significant proportion of respondents agreed that the insights obtained from data analytics in healthcare are accurate and reliable.

Table No. 9: Descriptive Statistics-Patient Follow-Up and Data Analytics

	Mean	Std. Deviation	N
Patient Follow-Up	3.6636	1.10405	407
Data Analytics	3.6914	1.14878	407

Source: Research Work

According to the Descriptive Statistics Table No. 9, it is clear that mean and standard deviation are (3.6636, 3.6914), (1.10405, 1.14878) for the items of Patient Follow-Up and Data Analytics construct respectively. The mean score is near to 4 points Likert scale, hence majority of respondents shown the agreed responses towards the items of Patient Follow-Up and Data Analytics in the healthcare organization.

Table No. 10: Correlations-Patient Follow-Up and Data Analytics

		Patient Follow-Up	Data Analytics
Pearson Correlation	Patient Follow-Up	1.000	.982
	Data Analytics	.982	1.000
Sig. (1-tailed)	Patient Follow-Up	.	.000
	Data Analytics	.000	.
N	Patient Follow-Up	407	407
	Data Analytics	407	407

Source: Research Work

The Pearson correlation coefficient is 0.982, hence the Data Analytics construct is positively high correlated with Patient Follow-Up construct in the

healthcare organization. Since the sig value is 0.000, therefore it is a significant correlation between Patient Follow-Up and Data Analytics in the healthcare organization.

Table No. 11: Variables Entered/Removed[a] -Patient Follow-Up and Data Analytics

Model	Variables Entered	Variables Removed	Method
1	Data Analytics[b]	.	Enter
a. Dependent Variable: Patient Follow-Up			
b. All requested variables entered.			

Source: Research Work

According to the Variables Entered/Removed Table No. 11, the enter method of regression was used. The Data Analytics is independent variable and Patient Follow-Up is the dependent variable.

Table No. 12: Model Summary- Patient Follow-Up and Data Analytics

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.982[a]	.964	.964	.21016	.964	10799.802	1	405	.000
a. Predictors: (Constant), Data Analytics									

Source: Research Work

According to the model summary Table No. 12, the R^2 was 0.964 means it explained 83.3% of the variance that means it is good enough to select the model for further statistical interpretation.

Table No. 13: ANOVA[a] - Patient Follow-Up and Data Analytics

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	476.994	1	476.994	10799.802	.000[b]
	Residual	17.888	405	.044		
	Total	494.882	406			
a. Dependent Variable: Patient Follow-Up						
b. Predictors: (Constant), Data Analytics						

Source: Research Work

According to the ANOVA Table No. 13, F=10799.802 & Sig Value p value=0.000 less than 0.05 hence the model was highly significant.

Table No. 14: Coefficients[a] - Patient Follow-Up and Data Analytics

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	.181	.035		5.148	.000	.112	.250
	Data Analytics	.944	.009	.982	103.922	.000	.926	.961
a. Dependent Variable: Patient Follow-Up								

Source: Research Work

According to the coefficient Table No. 14, Data Analytics (Sig value 0.000<0.05) is significant at a 5% significance level. Since the eighth null hypothesis was (H08: There is no significant effect data analytics application of healthcare services on the patient follow-up.) Hence it is safe to reject the eighth null hypothesis; therefore it can be concluded there was significant effect data analytics application of healthcare services on the patient follow-up, therefore the regression equation would be in this case is Y (Patient Follow-Up) =0.181+(0.982)(Data Analytics) and it can be concluded that if there is an increase of one unit in the parameters of Data Analytics than there is an increase of 0.982 unit in the Patient Follow-Up, provided other variables are constant. The regression line is shown by the following graph:

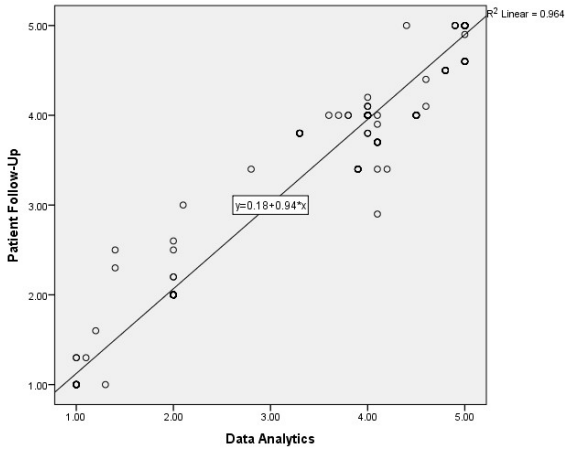


Figure No. 1: Patient Follow-Up and Data Analytics
Source: Research Work

Third Level Analysis

In this analysis, the comparative analysis of the online health care applications are checked with respect to the various test variables given below:
Comparative Analysis of the Online Health Care Applications
Test Variable-Customer Satisfaction
Grouping Variable - Online Health Care Applications
Hypothesis

- $H0_9$: There is no significant difference of online health care application with respect to the customer satisfaction in improving the KRAs of healthcare services.
- $H1_9$: There is a significant difference of online health care application with respect to the customer satisfaction in improving the KRAs of healthcare services.

Table No. 15: One-Sample Kolmogorov-Smirnov Test- Customer Satisfaction

		Customer Satisfaction
N		407
Normal Parameters	Mean	3.45
	Std. Deviation	1.293
Most Extreme Differences	Absolute	.185
	Positive	.145
	Negative	-.185
Test Statistic		.185
Asymp. Sig. (2-tailed)		.000

Source: Research Work

According to the One-Sample Kolmogorov-Smirnov Test Table No. 15, it I clear that sig value (0.000) is less than 0.05, hence the data of customer satisfaction was not normal. Therefore, to compare the Online Health Care Applications with respect to customer satisfaction, a non-parametric Kruskal-Wallis Test are used. The SPSS output of the Kruskal-Wallis Test are as follows:

Table No. 16: Test Statistics- Kruskal-Wallis Test-Customer Satisfaction

	Customer Satisfaction
Chi-Square	405.427
df	4
Asymp. Sig.	.000

Source: Research Work

According to the Test Statistics- Kruskal-Wallis Test Table No. 16, it is clear that the sig value (0.000) is less than 0.05, hence it is safe to reject the null hypothesis ($H0_9$: There is no significant difference of online health care application with respect to the customer satisfaction in improving the KRAs of healthcare services.), therefore it can be concluded that there was a significant difference of online health care application with respect to the customer satisfaction in improving the KRAs of healthcare services.

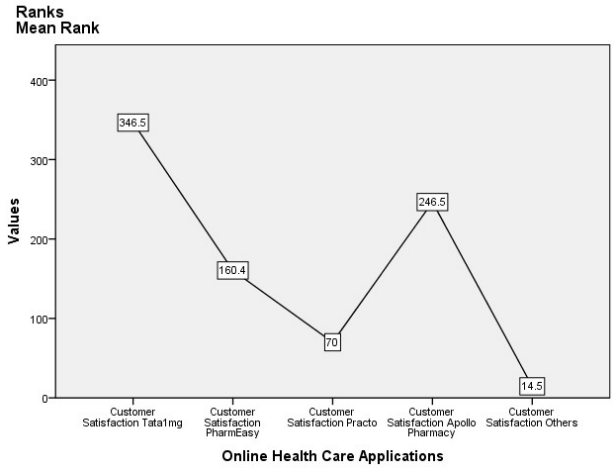


Figure No. 2: Comparison of Online Health Care Applications with respect to the Customer Satisfaction
Source: Research Work

According to the Ranks Mean Rank graph, it is clear that customer satisfaction for Tata1mg is the highest then Apollo Pharmacy, then PharmEasy, then Practo, and others online health care application are at the lowest level in the customer satisfaction.

Conclusion

The study highlights the transformative role of data analytics in enhancing healthcare services and improving key result areas (KRAs) across digital health platforms. The analysis reveals that the majority of respondents are satisfied with various aspects of online healthcare services, including doctor consultations, pathology services, and delivery options. However, dissatisfaction was noted in the area of medicine discounts, suggesting potential for improvement. The data underscores a strong positive correlation between data analytics and patient follow-up, indicating that effective analytics significantly enhances patient care and operational efficiency. This is supported by high satisfaction levels and agreement on the usefulness of data analytics in making informed healthcare decisions and improving patient outcomes.

Recommendations

1. Enhanced Integration of Data Analytics: Healthcare organizations should further integrate data analytics tools to streamline operations and improve patient outcomes. Leveraging predictive analytics and real-time data can enhance disease management and personalize patient care, as evidenced by the significant impact of analytics on patient follow-up.

2. Focus on Customer Satisfaction Areas: Address the gaps identified in patient satisfaction, particularly regarding medicine discounts. Implementing more transparent and competitive pricing strategies could enhance overall patient satisfaction and engagement.
3. Promote Data-Driven Decision Making: Encourage healthcare professionals to utilize data analytics for informed decision-making. Training and resources should be provided to ensure that both clinical and administrative staff can effectively use analytics tools to optimize healthcare delivery and operational processes.
4. Invest in Advanced Analytics Tools: Invest in advanced data analytics tools and technologies that offer comprehensive data collection, cleaning, and analysis features. This investment will support better management of healthcare data, improve accuracy, and provide actionable insights.
5. Strengthen Collaboration: Foster greater collaboration between data analysts and healthcare providers to ensure that analytics solutions are tailored to meet specific healthcare needs and challenges. This collaborative approach will help in the development of more effective data-driven strategies for improving patient care and service efficiency.

References

1. Alsunaidi, S. J., Almuhaideb, A. M., Ibrahim, N. M., Shaikh, F. S., Alqudaihi, K. S., Alhaidari, F. A., Khan, I. U., Aslam, N., & Alshahrani, M. S. (2021). Applications of Big Data Analytics to Control COVID-19 Pandemic. Sensors, 21(7), 1–24. https://doi.org/10.3390/s21072282
2. Batko, K., & Ślęzak, A. (2022). The use of Big Data Analytics in healthcare. Journal of Big Data, 9(1). https://doi.org/10.1186/s40537-021-00553-4
3. Berros, N., El Mendili, F., Filaly, Y., & El Bouzekri El Idrissi, Y. (2023). Enhancing Digital Health Services with Big Data Analytics. Big Data and Cognitive Computing, 7(2), 1–23. https://doi.org/10.3390/bdcc7020064
4. Charitha, M., & Cholli, N. G. (2021). Big Data Analysis and Management in Healthcare. International Research Journal on Advanced Science Hub, 3(Special Issue 7S), 42–53. https://doi.org/10.47392/irjash.2021.208
5. Cozzoli, N., Salvatore, F. P., Faccilongo, N., & Milone, M. (2022). How can big data analytics be used for healthcare organization management? Literary framework and future research from a systematic review. BMC Health Services Research, 22(1). https://doi.org/10.1186/s12913-022-08167-z
6. Dash, S., Shakyawar, S. K., Sharma, M., & Kaushik, S. (2019). Big data in healthcare: management, analysis and future prospects. Journal of Big Data, 6(1). https://doi.org/10.1186/s40537-019-0217-0
7. Do Nascimento, I. J. B., Marcolino, M. S., Abdulazeem, H. M., Weerasekara, I., Azzopardi-Muscat, N., Goncalves, M. A., & Novillo-Ortiz, D. (2021). Impact of big data analytics on people's health: Overview of systematic reviews and recommendations for future studies. Journal of Medical Internet Research, 23(4). https://doi.org/10.2196/27275
8. Groves, P., Kayyali, B., Knott, D., & Van Kuiken, S. (2013). The 'big data' revolution in healthcare: Accelerating value and innovation. Center for US Health System Reform Business Technology Office, 1(August), 1–19.
9. Harerimana, G., Jang, B., Kim, J. W., & Park, H. K. (2018). Health big data analytics: A technology survey. IEEE Access, 6, 65661–65678. https://doi.org/10.1109/ACCESS.2018.2878254
10. Jolly, A., & Tripathi, P. (2019). Role of big data analytics in healthcare. International Journal of Engineering and Advanced Technology, 9(1), 4174–4177. https://doi.org/10.35940/ijeat.A1421.109119
11. Kaur, P., Sharma, M., & Mittal, M. (2018). Big Data and Machine Learning Based Secure Healthcare Framework. Procedia Computer Science, 132, 1049–1059. https://doi.org/10.1016/j.procs.2018.05.020
12. Khan, S., Khan, H. U., & Nazir, S. (2022). Systematic analysis of healthcare big data analytics for efficient care and disease diagnosing. Scientific Reports, 12(1), 1–21. https://doi.org/10.1038/s41598-022-26090-5
13. Khanra, S., Dhir, A., Islam, N., & Mäntymäki, M. (2020). Big data analytics in healthcare: a systematic literature review. Enterprise Information Systems, 14(7), 878–912.

https://doi.org/10.1080/17517575.2020.1812005

14. Mehta, N., Pandit, A., & Shukla, S. (2019). Transforming healthcare with big data analytics and artificial intelligence: A systematic mapping study. Journal of Biomedical Informatics, 100(November 2018), 103311. https://doi.org/10.1016/j.jbi.2019.103311
15. Raghupathi, W., & Raghupathi, V. (2014). Big data analytics in healthcare: Promise and potential. Health Information Science and Systems, 2(1), 1–10. https://doi.org/10.1186/2047-2501-2-3
16. Rehman, A., Naz, S., & Razzak, I. (2022). Leveraging big data analytics in healthcare enhancement: trends, challenges and opportunities. Multimedia Systems, 28(4), 1339–1371. https://doi.org/10.1007/s00530-020-00736-8
17. Shahbaz, M., Gao, C., Zhai, L. L., Shahzad, F., & Hu, Y. (2019). Investigating the adoption of big data analytics in healthcare: the moderating role of resistance to change. Journal of Big Data, 6(1). https://doi.org/10.1186/s40537-019-0170-y
18. Sharma, A., Malviya, R., & Gupta, R. (2022). Big data analytics in healthcare. Cognitive Intelligence and Big Data in Healthcare, 4(27), 257–301. https://doi.org/10.1002/9781119771982.ch10
19. Singh, S. R., & Khan, M. Z. (2022). An Effective Data Management Framework for Healthcare: Big Data Perspective: A Review. 11(7), 1382–1386. https://doi.org/10.21275/SR22711204346
20. Zhao, X., Zhao, M., & Xu, M. (2021). Big Data Analytics for Improving Healthcare Outcomes: A Systematic Review. Health Informatics Journal, 27(2), 283–300. https://doi.org/10.1177/1460458220961657