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CASE STUDY FOR COMPARISON OF SERVICE QUALITY BETWEEN PRIVATE AND GOVERNMENT HOSPITALS: A DATA MINING APPROACH

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Abstract: In Government hospitals, some of which are among the best hospitals in Tamilnadu, provide treatment at taxpayer expense. Government hospitals provide treatment either free or at minimal charges. But Hospital treatment costs in these hospitals depend on financial condition of the patient and facilities utilized by him but are usually much less than the private sector. For instance, a patient is waived full treatment costs if he is below poverty line. Another patient may seek for an air conditioned room, if he is willing to pay extra for it. The charges for basic in-hospital treatment and investigations are much less in public hospitals as compared to the private hospitals. Healthcare sector of a country needs special attentions from the government as quality of healthcare provides hope and relief to the patients and their dependents. The objective of this study is to compare the quality of health care services delivered by the public and private hospitals to gain patient satisfaction in Pakistan. Five service quality dimensions; empathy, tangibles, assurance, timeliness and assurance were used in order to measure the patient's perceptions about the service quality of public and private hospitals in TamilNadu. Due to the nature of this study only those respondents were included in the study having perceptions about both the hospitals. This study is taking of data mining techniques using Apriori Algorithm. Results showed that private hospitals are delivering better quality of services to their patients as compared to public hospitals.

Keywords: Data mining techniques, Apriori Algorithm, Association Rules

I. INTRODUCTION

The demand of health services in private hospitals is increasing because of the certain amenities and facilities that are provided by these institutions**.** Patients can choose a hospital according to what matters most to them, whether it's location, cost consideration, infrastructure availability, suggestion from friends, referred by doctors, etc. The present paper intends to find out customers priority for the selection of private hospital for their treatment. The paper aims to test the proportion of patients willing to seek a particular hospital (medical provider) is same across all the attributes for treatment. It also explores the factors playing significant role in customer preference for a private hospital. The findings of the present study would be an important aid for hospital administrators. Private hospitals do not have the same degree of service obligations as public hospitals, and have more scope to raise revenue from fees. The incentive for private (particularly for-profit) hospitals is to generate returns on their capital investment and labor force, for the benefit of owners/shareholders. However, not-for-profit private hospitals may be more strongly driven by other objectives. Around 60 percent of private acute and psychiatric hospitals operate on a for-profit basis, while the remainder is run by not-for-profit bodies, such as religious and charitable groups. Diversity exists not just between the public and private sectors, but also within them. For example, while many large metropolitan public hospitals provide a full range of services and have a large teaching role, many small public hospitals in remote areas offer fewer acute services and may be called upon to deliver other health services, such as primary care and aged care, to regional and remote communities. Many private hospitals specialize in a limited range of surgical procedures, although some offer services akin to the large public hospitals, including an increasing share of the clinical teaching load.

II. DATA ANALYSIS

- **Algorithm Used:**Data mining is the core process of knowledge discovery in database. It is the process of extraction of useful patterns from the large database. To analyze the Large amount of collected information, the area of Knowledge Discovery in Database (KDD) provides techniques which extract interesting patterns in

a reasonable amount of time data mining is the application of efficient algorithms to detect the desired patterns contained within the given data. Data mining is the extraction of hidden descriptive or predictive information from large databases.

- **Association Rule Mining :**Association rules mining are one of the major techniques of data mining. The purpose of association analysis is to figure out the hidden association and some useful rules of data base, and uses these rules to speculate and judge the unknown matter from the already known information. Association rule mining has many important applications in our life.
- **Association Rule:** An association rule is one of the forms x=>y. and each rule has two basic needs: support and confidence. Things that occur often together can be associated to each other. These together occurring things form a frequent itemset. Conclusions based on the frequent itemsets make associations rules.

2.1. Apriori Algorithm

Apriori algorithm is a fundamental algorithm mining association rule. It contains two processes: Detect all frequent itemsets by scanning db. Form strong association rules in the frequent itemsets. Process one needs to scan DB several times, which consumes a lot of time and space. As a result, what needs to be improved is the mining competency of frequent group of things in DB. Apriori algorithms is a significant algorithms for mining frequent itemsets for Boolean association rules. Apriori algorithms is formed by Agrawal and Srikantin 1994. It is the most fundamental and important algorithms for mining frequent itemsets. Apriori is used to detect all frequent itemsets in a provided database db. The keynote of Apriori algorithms is to form multiple passes over the database.It employs an repetitive approach called as a breadth-first search(level-wise search.

2.2 Key Concepts

Frequent Itemsets : The itemsets which minimum help(denoted by li for ith –itemsets),Apriori property:any subgroup of frequent things must be frequent.

Join Operation: to detect lk, a group of candidate k- group of things is developed by adding lk-l with itself.

- **Find All Frequent Itemsets.**
- **Get Frequent Things:** Things whose occurrence in database is more than or equal to the minimum help threshold.
- **Frequent Itemsets:** Develop candidates from frequent things. Prune the results to detect the frequent itemsets. Develop strong association rules from frequent. Rules which satisfy the minimum support and minimum confidence threshold.
- **Association Rules:** Association rule of data mining involves picking out the unknown inter-dependence of the data and finding out the rules between those items[3]. Agrawal introduced association rules for point of sale (POS)Systems in supermarkets. A rule is defined as an implication of the form A=>B. The left-hand side of the rule is called as antecedent. The right-hand side of the rule is called as consequent.
- **Support:** I={i1,i2,i3,……,im} is a collection of items. T be a collection of transactions associated with the items. Every transaction has an identifier TID[6]. Association rule A=>B is such that A C1,B C1.
  A is called as premise and B is called as Conclusion. The support, S, a is defined as the proportion of transactions in the data set which contains the item sets. **Support**(X=>Y)=Support(XUY)=P(XUY).
- **Confidence:** The confidence is defined as a conditional probability Confidence(X=>Y)=Support(XUY)/Support(X)=P(Y/X). Lift: is the ratio of the probability that L and R occur together to the multiple of the two individual probabilities for L and R, lift=pr(L,R)/Pr(L).Pr(R).

2.3. Sample Used

Association Rule mining algorithm in R

APRIORI is a level-wise breadth-first algorithm which counts transactions to find frequent itemsets and then derive association rules from them I apriori() in package arules. Confidence minvals max are maval original Support supportmin lenmax len target
0.8 0.1 1 none FALSE
TRUE 0.1 1 10 rules

Electricity cannot be removed from human life. Still in Theni district, we can find villages without electricity and villages without street light. We can find poor illiterate village people find it difficult to approach the EB office for their requirement. A department which is managed by the government shows this much of non-customer center mentality cannot be profitable. This information is presented in line graphs, histograms, bar charts, pie charts etc. so that it is easy to quickly make sense of the information. Information processing refers to the collection, storage, manipulation, distribution and presentation of data, usually by electronic means. Computers are used widely in business for information processing. So the department can propose proper customer management strategies for its better revenue.

Algorithmic control:

filter tree heap memopt load sort verbose
0.1 TRUE TRUE FALSE TRUE 2 TRUE
set item appearances ...[0 item(s)] done [0.00s].
set transactions ...[329 item(s), 501 transaction(s)] done [0.00s].
sorting and recoding items ... [4 item(s)] done [0.00s].
creating transaction tree ... done [0.00s].
checking subsets of size 1 2 3 done [0.00s].
writing ... [12 rule(s)] done [0.00s].
creating S4 object ... done [0.00s]

The support confidence level of data was analyzed for the data using the statistical tool.

lhsrhs support confidence lift
1 {} => {0} 0.9880240 0.9880240 1.0000000
2 {} => {1} 1.0000000 1.0000000 1.0000000
3 {15000} => {0} 0.1556886 1.0000000 1.0121212

4 {15000} => {1} 0.1556886 1.0000000 1.0000000
5 {10000} => {0} 0.2934132 0.9865772 0.9985357
>plot(rules)

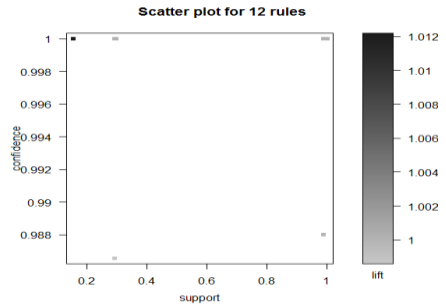


Figure 2.1: Scatter plot for 12 rules

>plot(rules,shading="order", control=list(main ="Two-key plot"));>plot(rules, method = "graph")

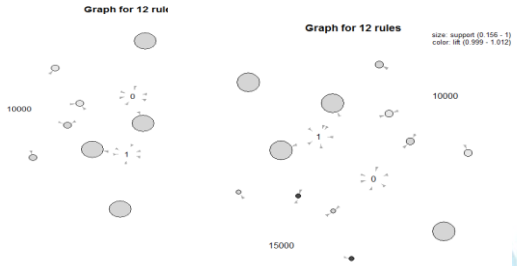


Figure 2.2 Graph for 12 rules

>plot(rules,method="graph",control=list(type="items"))
>plot(rules,method=

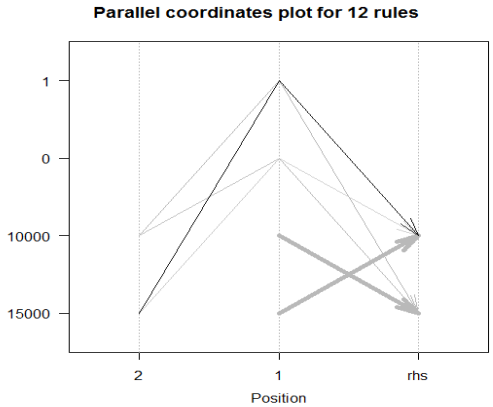
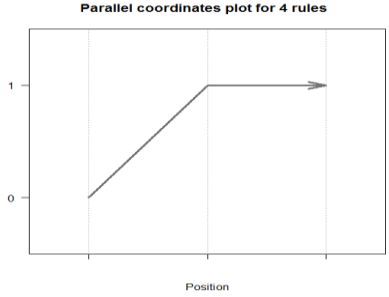


Figure 2.3: Parallel Coordination.



>plot(subrules2, method="paracoord");>head(quality(rules));
support confidence lift
1 0.9880240 0.9880240 1.0000000
2 1.0000000 1.0000000 1.0000000
3 0.1556886 1.0000000 1.0121212
4 0.1556886 1.0000000 1.0000000
5 0.2934132 0.9865772 0.9985357
>inspect(oneRule);
lhsrhs support confidence lift
1 {} => {0} 0.99 0.99 1
>head(singleSupport, n = 5);
576 955 739 317 185
0.122 0.084 0.074 0.062 0.063
Algorithmic control:
filter tree heap memopt load sort verbose
0.1 TRUE TRUE FALSE TRUE 2 TRUE
apriori - find association rules with the apriori algorithm
>inspect(rules)
lhsrhs support confidence lift
1 {} => {0} 0.9880240 0.9880240 1.0000000
2 {} => {1} 1.0000000 1.0000000 1.0000000
3 {15000} => {0} 0.1556886 1.0000000 1.0121212
4 {15000} => {1} 0.1556886 1.0000000 1.0000000
5 {10000} => {0} 0.2934132 0.9865772 0.9985357
6 {10000} => {1} 0.2974052 1.0000000 1.0000000
7 {0} => {1} 0.9880240 1.0000000 1.0000000
8 {1} => {0} 0.9880240 0.9880240 1.0000000
9 {0, 15000} => {1} 0.1556886 1.0000000 1.0000000

III.FINDINGS, INTERPERTATIONS, RECOMMENTATION AND SUGGESTIONS

3.1. Findings

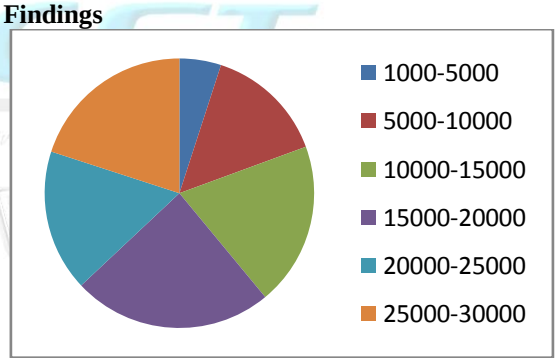


Figure 3.1: Imcome based Comparison

>image(tr)

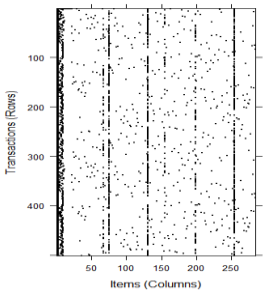


Figure 3.2: Transaction of items

library(arulesViz)
plot(rules,method="grouped")

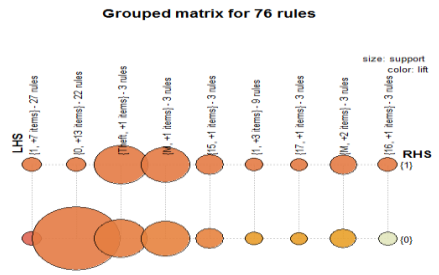


Figure 3.3. Group Matrix

plot(rules,measure=c("support","lift"),shading="confidence");

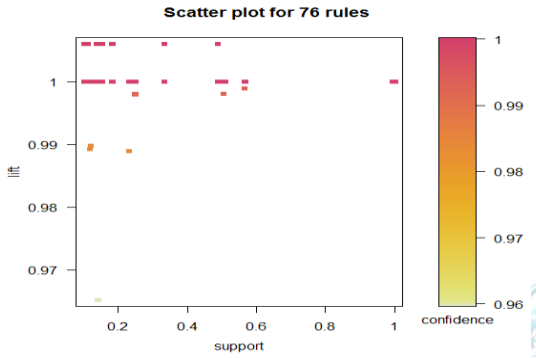


Figure 3.4: Scatter Plot

plot(rules,shading="order",control=list(main="two-key plot"));

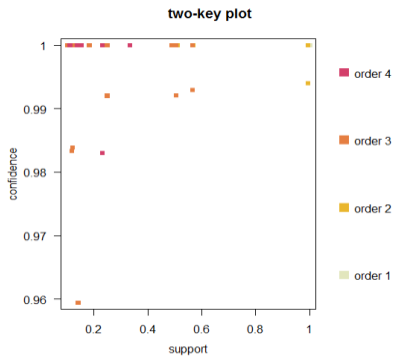


Figure3. 5: Two Key Plot

plot(rules,method="graph")

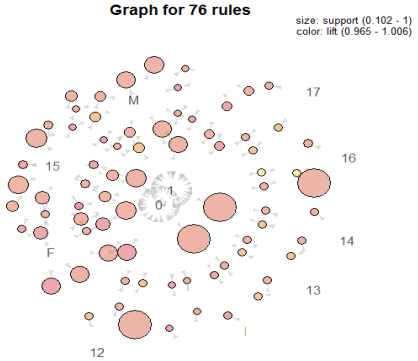


Figure 3.6: Graph for 76 rules

plot(rules,method="graph",control=list(type="items"))

Empathy: Empathy is the first service quality construct in this study, which actually represents the individual concern of doctors, staff, nurses and the management for patients in order to provide comfort to patients. It includes 4 items and these four items were measured against five point Likert scale ranging from 1= strongly disagree to 5= strongly agree. The reliability coefficient Cronbach Alpha, for the first construct for public and private hospitals is (0.81) and (0.86) respectively.

Assurance: The second service quality construct comprise of 6 items which include doctors expertise and skills about the field of specialization, qualified nurses and supporting staff, accurate lab and medical test results, availability of experts and special attention to emergency patients. These six items were measured against five point Likert scale ranging from 1= strongly disagree to 5= strongly agree. The reliability coefficient, Cronbach Alpha for the second construct for public and private hospitals is (0.84) and (0.87) respectively.

Tangible: Third service quality construct consists of 6 items, which include hygienic conditions, sterilization of equipments, healthy environment, waiting facility for patients, healthy and clean environment, availability of labs and pharmacy within the hospital premises. These six items were measured against five point Likert scale ranging from 1= strongly disagree to 5= strongly agree. The reliability coefficient, Cronbach Alpha of the third construct for public and private hospitals is (0.82) and (0.86) respectively.

Timeliness: Fourth service quality construct consists of 3 items which includes observation of patients according to appointment, availability of the doctors according to promised time, and delivery of reports according to promised time. These three items were measured against five point
Likert scale ranging from 1= strongly disagree to 5= strongly agree. The reliability coefficient, Cronbach Alpha for the fourth construct of public and private hospitals is (0.82) and (0.87) respectively.

Responsiveness: Fifth service quality construct comprised of 3 items which includes: how the doctors, nurses and supporting staff respond to patient call and availability of feedback mechanism and how the management respond to patient complaints. These three items were measured against five point Likert scale ranging from 1= strongly disagree to 5= strongly agree. The reliability coefficient, Cronbach Alpha for the fifth construct of public and private hospitals is (0.84) and (0.86) respectively. As reliability of the instrument helps to provides consistency in the results and the Cronbach alpha is used to measure the reliability of the data (Green et al., 2000). Overall Cronbach Alpha of public and private data along with service quality construct provides values greater than 0.70, as the values of Cronbach Alpha greater than 0.70 is acceptable (Nunnally, 1978).

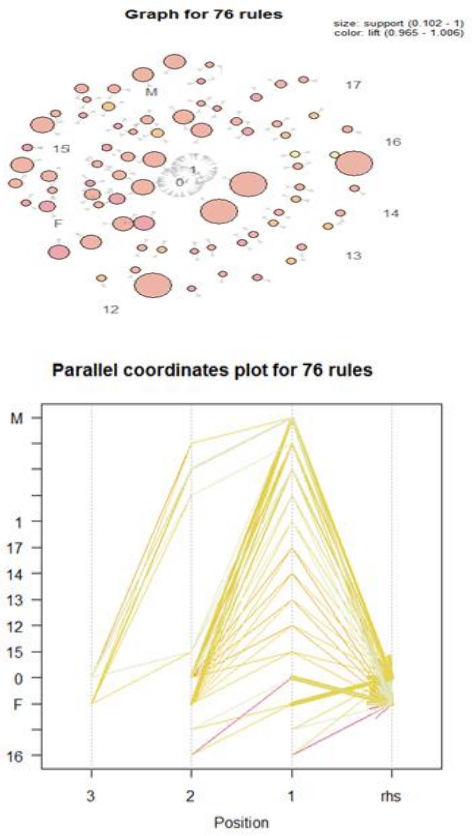


Figure 3.7: Parallel coordination

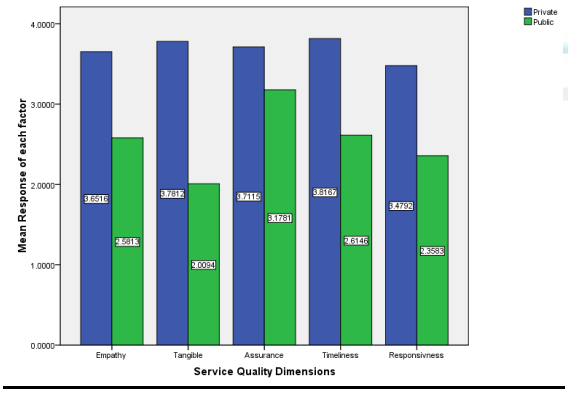


Figure 3.8: Comparision between Private and Government Hospitals.

3.2. Results and Discussions

To understand the difference between the service quality delivered by private and public hospitals in Tamilnadu descriptive statistics representing the mean, standard deviation and mean square error for each of the service quality construct was used in order to increase understanding regarding the difference in service quality delivered to patients by private and public hospitals against each of the Service quality dimension. Secondly, independent sample data mining Association rules was performed to calculate the values of The first – and most important – choice patients have to make in Tamilnadu is what level of health care they will use. The choice between private or public provider, first they give the preference for Private Hospitals.

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