

Improving Healthcare Delivery System using Business Intelligence

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Abstract

Healthcare organizations focus more on data and information for the wellbeing of the patients. They also look forward to improving the business process, business trends, and operational performance using Business Intelligence tools. Business Intelligence tools are used in collecting data, storing data, examining data, and formatting records in an easy way. Business Intelligence can give new business insights and analysis-based predictions. These new business insights help managers and supervisors in decision-making. Now many healthcare organizations are using Business Intelligence to improve the quality of healthcare services and the healthcare delivery system over the competitiveness in the global healthcare scenario. This paper proposes a reasonable structure of healthcare organizations and the result analysis of OPD and IPD patients in the eight healthcare organizations.

Keywords: Healthcare, Healthcare System, Healthcare Organizations, Business Intelligence, Business Intelligence System

1. Introduction

Information is a mixture of disorderly raw facts and figures. Assembling this information into a particular setting produces data. Valuable data comprises information that prompts better decisions-making. The process of gathering information for decision-making is referred to as Business Intelligence. Business Intelligence has drawn in impressive consideration as it leads to business esteem improvement [1]. Managers or Supervisors can utilize exact and convenient information to settle on the right choices. Providers access this common information to guarantee their acquisition and conveyance are on schedule and right.

In spite of the advantages of sharing information, the implementation of IT for medical services applications isn't without its issues [3].

In recent years, the way to deal with business the board across the whole globe has profoundly changed. The organizations have perceived the significance of upholding the accomplishment of the objectives characterized by their system through measurement-driven administration [7]. Administrators are concern about keeping up with patient security while embracing IT answers for the health care systems include a few key regions like authoritative issues, staff issues, verification issues, protection issues etc. Patient risk of security is a very important and ongoing concern, acceptance of cutting-edge data innovations in the healthcare service industry is fundamentally significant for no less than two reasons: First is saving costs and second is developed healthcare delivery of service [3].

The Healthcare system has a fundamental and proceeding with liability regarding individuals' wellbeing all through the life expectancy. They are pivotal to the sound improvement of Society, people, and families all over the place. Generally, medical clinics and nursing staff have been the most well-known and predominant wellbeing administrations associations occupied with the conveyance of wellbeing administrations [9]. For effective decision-making healthcare organizations enable the administration and staff members with business intelligence tools for critical thinking and patient management. Healthcare managers and administrators want to know how to further develop results however much as could reasonably be expected [10]. Generous expense reserve funds in the utilization of IT medical services, in expanded efficiencies for current therapies, yet in addition in the help for growing new healthcare models for improving efficiency [6].

The general healthcare system functions: [9]

1. National healthcare system management
2. Healthcare administrations
3. Healthcare staff training
4. Healthcare financing
5. Healthcare resources production
6. Research and advancement

2. Business Intelligence Trends

A few stage innovation patterns are applicable to business analytics. Some of them are, Machine Learning, Cloud Computing, and Business Intelligence are of basic significant

[4]. The Business Intelligence system in any health organization stores an enormous measure of Digital Health Records (DHR), other authoritative information, hierarchical data, and different organizational information [5]. Business Intelligence's significant goals are to empower intuitive and simple admittance to assorted information, empower control and change of this information, and give business supervisors and experts the capacity to lead suitable examinations and perform activities [2]. Prediction plays an important role in the Business Intelligence system, prediction, and future trends patterns from historical data and real-time data will help BI system. Many organizations are using different types of applications to predict results and forecasting future results. Training of the Business Intelligence system is also needed by the staff members from time to time to know about the updates and issues coming in the system [11].

By Business Intelligence creativities organizations are acquiring experiences from the developing volumes of exchange, stock, client, contender, and industry information produced by big business-wide applications, for example, ERP, CRM, SCM, HCM etc. [5]. Today there are different-different data sources are available, each produces yields in various constructions and organizations. In addition, organizations are progressively managing unstructured information (text records, sound, and video), henceforth the need for rebuilding and removal of information. For data preparation and integration, the ETL tool gives all functionalities. Three significant parts of the BI framework are: [1]

1. Extract
2. Transform
3. Load

Advanced level of data extraction, data mining, time-collection evaluation strategies, and subject matter identification may be carried out to standard business intelligence enterprise records for numerous accounting, finance, and advertising applications, inclusive of employer chance evaluation and management, credit score and evaluation, company occasion evaluation, inventory and portfolio overall performance prediction, viral advertising evaluation, and so on [5].

A huge measure of organization, industry, and customer data can be accumulated from both undertaking data sets and the Web. This information is then coordinated and imagined through different information planning and Web gateway. Given that a cutting-edge

business intelligence system needs to intensely rely on information examination, it is opportune to embrace business insight and investigation [2].

2.1 BI Benefits

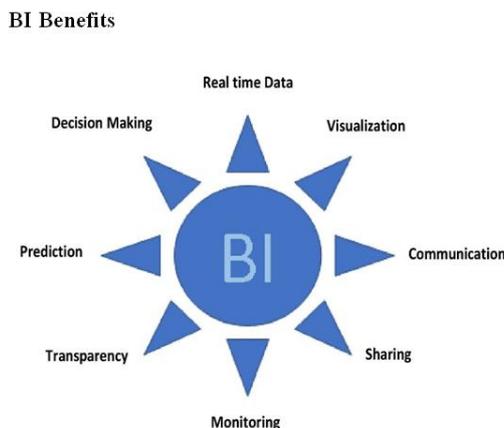


Figure 1. Benefits of Business Intelligence

Above figure 1 Benefits of Business Intelligence include eight components: Real-time Data, Visualization, Communication, Sharing, Monitoring, Transparency, Prediction, and Decision Making.

3. Business Intelligence Healthcare Information

Healthcare BI is characterized as the limit of a business to utilize all accessible information; besides it is the capacity to exploit from advances to take advantage of this information [1]. Healthcare information and data are massive. It incorporates patient-driven information, asset the executive's information, and changed information. Treatment records of millions of patients can be saved in the healthcare system and information mining strategies might help in noting a few significant and basic inquiries identified with medical care [10]. Business Intelligence systems have pressure to fulfill the current healthcare needs of the organizations, analysis of historical data, and predict the result on the basis of these data and information [11]. Massive healthcare information and data can be converted into Business Intelligence arrangement data and information, which can help, control, and keeps up with top caliber of patient consideration. Healthcare organizations have the capacity to investigate information and incorporates Patient driven information and Aggregate information [10].

Information and data virtualization suggests and gives total, top caliber, and noteworthy data through virtual coordination of information across various, divergent inward and outer sources [8]. Clients or users at various levels of the health organization are probably going to have distinctive data prerequisites just as various information inactivity requests, and comprehend these. At the strategic levels, the information dormancy required is that of conventional BI. Administrators, Managers, and users need low dormancy exchange information, concerning the monetary legal examiners [11]. With the far and wide utilization of clinical data frameworks including data sets, there is an unstable development in their sizes, Doctors are challenged with the issue of utilizing stored information and data. The conventional manual information investigation has gotten lacking and techniques for proficient computerization helped examination irreplaceable [10].

Key suggestions that can altogether upgrade healthcare frameworks' patient experience enhancements, from utilizing tolerant experience as an equilibrium measure to utilizing creative innovation.

1. Use new technology and innovative idea.
2. Use patient satisfaction as a tool.
3. Use healthcare experts to understand data and information.
4. Analyse and evaluate the staff members from time to time.
5. Evaluate the workload of staff and manage it.

Fraud detection is one of the most sensitive issues in any organization, by the help of Business Intelligence; managers in the organization can easily detect it and timely prevented. Users most value at the operational level, in terms of decision making. Further, decisions can be taken faster without having to refer every decision to a superior [11].

4. Healthcare Delivery System

The healthcare system has subsidized massively to better wellbeing for the greater part of the worldwide populace during the twentieth century. Nowadays, the healthcare system, in all nations, poor and rich, middle class and upper- middle class assume a greater and more powerful part in individuals' lives than any time in recent memory [9].

Healthcare is turning into the biggest developing area of India due to its enormous exposure and offering service assistance. In India development of private clinics or hospitals

as well as government hospitals has completely changed the situation of medical services. The Healthcare system is expanding its responsibilities to development in medical care conveyance. Tragically, a number of frameworks are overseeing a whole class of advancements that are unassuming in size, low in hazard, and an almost win-win situation for the patients and management. Improving the health-care delivery service is an extremely uncommon help measure including complex human exercises and decision making. Particularly, OPD and ED as the entryway and the significant wellspring of outpatients in clinics or hospitals, have encountered a yearly expansion in patient visits and flooded, which endangers the nature of care. It's a well-known fact that clinic and hospital managers are searching for imaginative approaches to contain costs while improving execution results in non-clinical help departments i.e., canteen, laundry, administrative services, and transportation. It's likewise no mystery that innovation and technology are changing medical care and can be the key part in significantly improving these ideal results.

Essential points to improve better healthcare delivery system:

1. Patient is the center point of the whole system.
2. Implement healthcare software in the clinic or hospital.
3. Develop a system for the delivery of care and services.
4. Management skills needed in work distribution.
5. Dedicated staff members for delivery of care.
6. Transparency in patient care and billing system.
7. Follow up and guidelines for patients.

Good healthcare delivery of service to patients ensues in an assortment of authoritative settings. Healthcare managers and administrations is a super durable countrywide arrangement of setting up organizations, the multipurpose goal of which is to adapt to the different wellbeing needs and requests of the populace and consequently give medical care to people and the local area, including a wide range of preventive and remedial exercises, generally, multipurpose wellbeing workers [9].

5. Proposed Healthcare Structure

Hospitals and Healthcare organizations will need to make more their work processes increasingly proficient so as to satisfy needs. Hospitals are managed by the Managing Director (MD) or Manager depend upon the hospital policy. In which management take care

of hospital staff and doctors. There are different categories of doctors and staff in the hospital depending on the structure of the hospital i.e., if the hospital is big then it requires more staff and in the case of a small hospital, it requires less staff. The healthcare system conceptual model shows the flow of the management, doctor, staff, and patients in the hospital. Staff is available to assist doctors and take care of the patients.

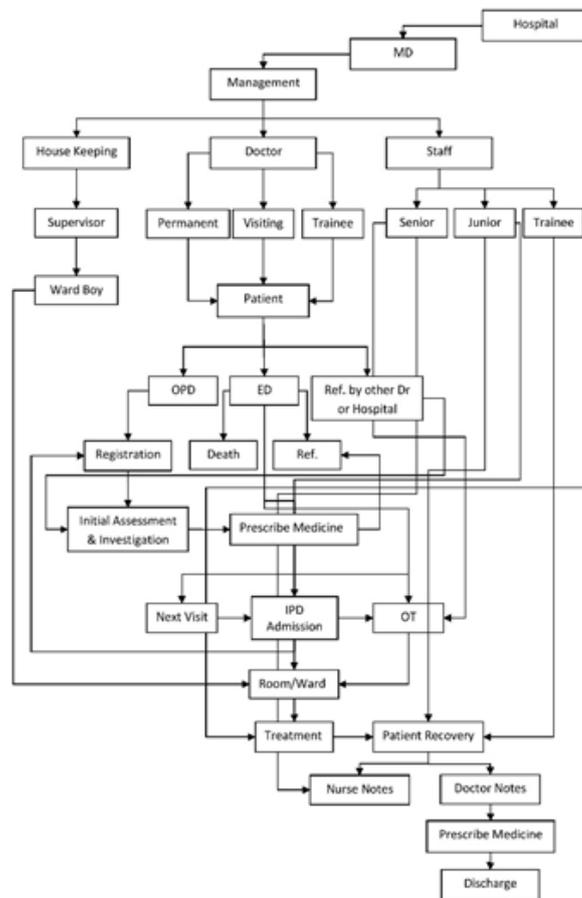


Figure 2. Healthcare System Conceptual Model

Individual patients who have been diagnosed with some condition unexpectedly, ordinarily leave the clinic or hospital with a helpless comprehension of what they need to do. Regardless of whether the clinic or hospital staff has adequate opportunity to teach them, the patients are commonly terrified and weakened. So, they may not have a lot of information. They may not understand the significance of their medications, make basic adjustments to their eating routine, and react as fast varying to changes in indications. After discharge, the patient's thought is that doctor may not be accessible immediately and might not have a satisfactory chance to overall prepare the patient. Therefore, avoidable trauma center visits and readmissions to the medical clinic are normal.

The following are some points for an administration that will influence quick and important change for any clinic or hospital, regardless of whether it's through innovation and technology essentially reshaping their cycles and frameworks.

1. Use the latest technology and devices in the delivery of service.
2. Availability of managers in every department.
3. Educate and training of staff members from time to time.
4. Accountability of nursing staff and other staff members.
5. Provide after discharge schedule, medication, and procedure.

6. Result Analysis

Below figure 3 shows the basic required OPD facilities percentage in the hospitals. It is clear from the figure that the Medical Store/Pharmacy is the only facility among 14 which is 100% available in all the eight hospitals. X-Ray facility is available in 87.5% of hospitals. Sonography and Nebulizer machine facilities are available in 75% of hospitals. ECG Machine and Laboratory facilities are available in 62.5% of hospitals. EEG Machine, TMT Machine, and Echo are available in 25% of hospitals. X-Ray (Dental), 2D Echo, and Blood Bank facilities are available in 12.5% of hospitals. CT-Scan and MRI Machine are not available in any hospitals, but these two are the basic required OPD facilities must be available in the hospitals.

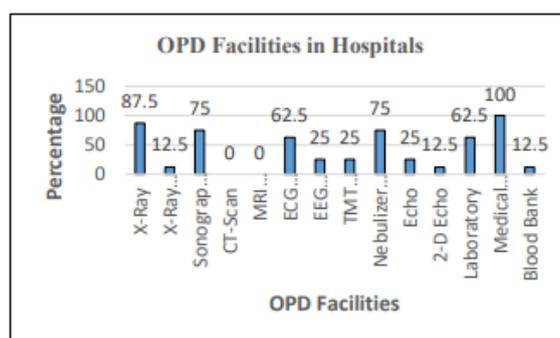


Figure 3. Basic requirements of OPD Facilities

From figure 4 it is clear that only two facilities OT and Medical Store/Pharmacy are 100% available in all eight hospitals. X-Ray facility is available in 87.5% of hospitals. Nebulizer machine facilities are available in 75% of hospitals. ECG Machine and Laboratory are available in 62.5% of hospitals. Central Line (O2) is available in 50% of hospitals.

Ventilator, C-ARM, Baby Warmer, and ICU are available in 37.5% of hospitals. These facilities are the basic facilities that are lacking in 62.5% of hospitals. The Echo facility is available in only 25% of hospitals. 2-D Echo, NICU, SNCU, Covid Ward, and Blood Bank are available in 12.5% of hospitals. CT-Scan is the only facility that is not available in any hospital out of eight hospitals.

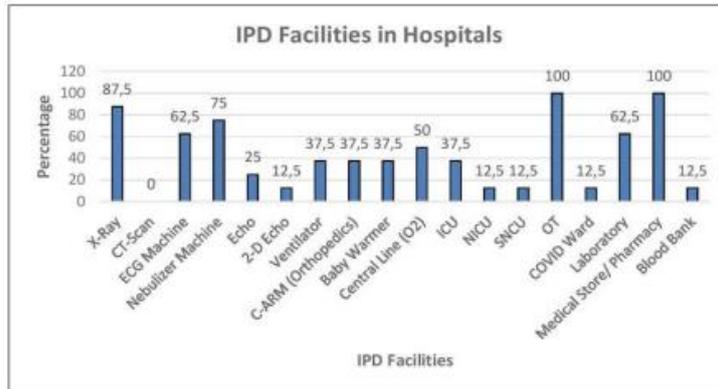


Figure 4. Basic requirements of IPD Facilities

Table 1. Services in Hospitals

Services	No. of Facilities
OPD	14
IPD	18
Emergency	11
Surgeries	12

Table1 represents OPD, IPD, Emergency, and Surgeries services in the hospitals.

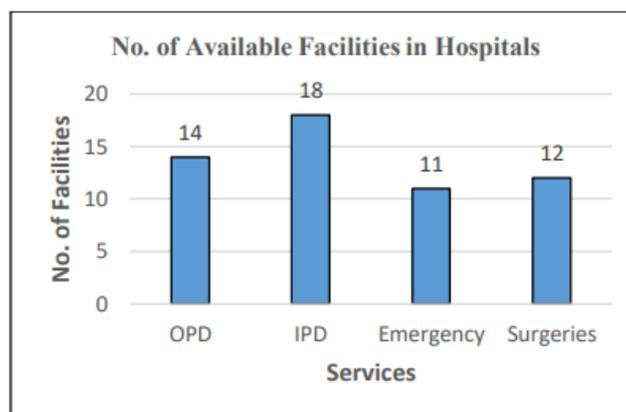


Figure 5. No. of available facilities

In the above figure 5 number of available facilities in hospital for OPD services are 14, IPD services are 18, Emergency services facilities are 11, and surgeries facilities are 12.

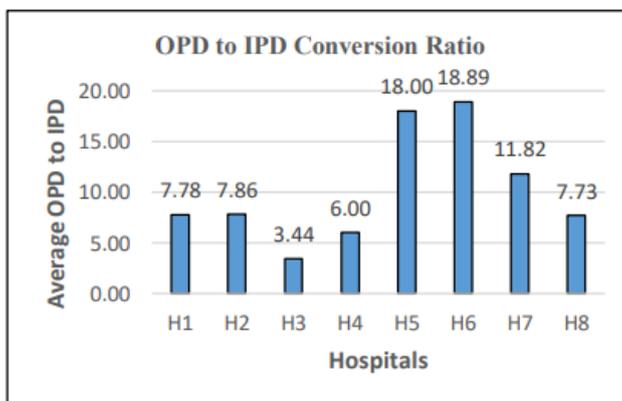


Figure 6. OPD to IPD conversion ratio

Figure 6 shows the OPD to IPD conversion ratio of patients in the hospitals. From the figure, it is clear that in hospital H1, H2, and H8 conversion ratio is under 8 patients. In hospital H7 it is under 12 patients. In hospital H4 this ratio is 6 patients. In hospital H3 it is under 4 patients. In hospitals H5 and H6, it is 18 and near about 19. This is the maximum conversion ratio of patients in the hospitals. This ratio shows that the available facilities in the hospital for IPD patient is less and the patients are referred in case of emergency to other hospitals out of the district.

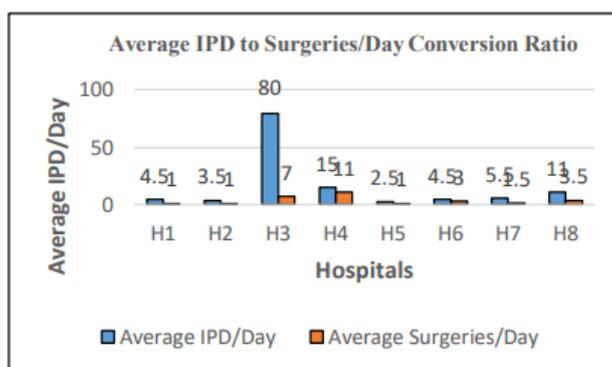


Figure 7. IPD to surgeries conversion ratio

Above figure 7 shows the average IPD to surgeries conversion ratio. Hospital H3 is having 80 IPD patients but the conversion ratio for surgeries is only 7 which is the second-highest number in the figure. Hospital H4 is having 15 IPD and the conversion ratio is 11 surgeries. Because this is an eye hospital and the available facilities for the eye are sufficient in this hospital for patients. This hospital is run by the trust, so the conversion ratio is good in

this hospital. Hospital H8 is having 11 IPD but the conversion ratio for surgeries is 3.5 patients. The remaining hospitals are having a conversion ratio for surgeries are 3 patients and less than 3 patients.

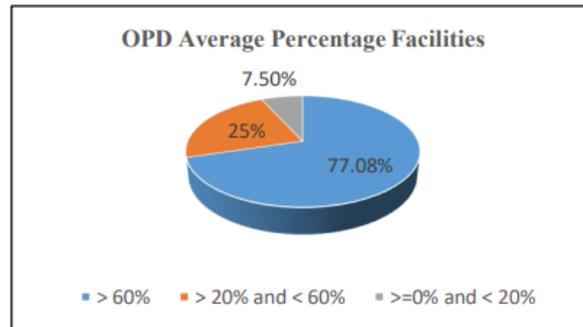


Figure 8. OPD Facilities

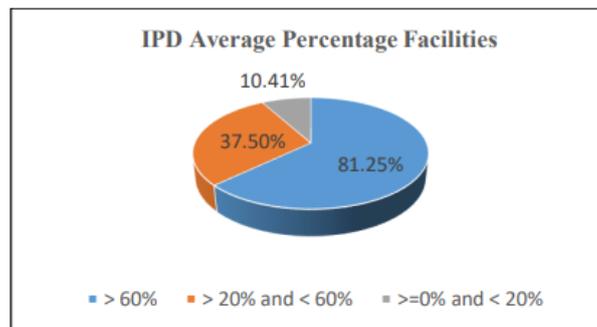


Figure 9. IPD Facilities

The above figure 8 and figure 9 represents available average OPD and IPD percentage facilities in the hospitals.

7. Conclusion

Business Intelligence (BI) has attracted interest in healthcare organizations, the sales & marketing industry, the computing industry, etc. due to the availability of massive information and new business needs of the organizations. BI gives basic business insight that assists organizations to make up-to-date decision-making. The number of available OPD services are 14, IPD services are 18, Emergency services are 11, and Surgeries services are 12 out of 23 facilities in the hospitals. There are more than 60% of OPD facilities available in 77.08% of hospitals, greater than 20% & less than 60% of OPD facilities available in 25% of hospitals and greater than equal to 0% and less than 20% of OPD facilities in just 7.5% of hospitals. Moreover, greater than 60% of IPD facilities are available in 81.25% of hospitals,

greater than 20% & less than 60% of IPD facilities are available in 37.5% of hospitals and greater than equal to 0% and less than 20% of IPD facilities are available in only 10.41% of hospitals. Business Intelligence Systems are applied in healthcare organizations for the better improvement of the healthcare delivery system. Health data and information are easily managed by the Business Intelligence system. Adopting Business Intelligence System for the competitive advantage of healthcare needs is the basic requirement of the business.

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