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Hospital Information Management Systems (HIMS) - A Study of Efficacy in Indian Scenario

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Hospital Information Systems are vital to decision making and can play a crucial role in the success of a hospital. Computerization of the medical records and documentation has resulted in efficient data management and information dissemination for the users. Managers, Clinicians and other healthcare workers can now access the information without delay or errors. Present study reveals that the participants feel that healthcare Information Systems can bring about paradigm changes in the functioning of hospitals. Hospital Information management systems can also drastically improve the administrative capabilities of a hospital however, experience shows that most of these benefits will not occur automatically following system implementation. There may be several operational problems may exist that diminish information timeliness, accessibility, and accuracy. Again there may be several lacunae such as policies and procedures may not match the realities and intents of the systems, personnel may not be trained to use the systems to its optimum capability etc. In order to realize the full potential of information systems, health care organizations must plan for and implement strategies that are designed to maximize such benefits. This paper describes a method and research for developing benefits' maximization strategies.

Keywords: HMIS, Information Systems, System analysis and design, Management Information Systems.

Introduction

HIMS (Hospital Information Management Systems)

A Hospital Information Management System (HIMS) can be defined as a computerized system that is designed to meet all the information needs within a hospital. This includes diverse data types such as patient information, billing, finance and accounting, staffing and scheduling, pharmacy ordering, prescription handling, supplies, inventory, maintenance and orders management, diagnostic reports related to laboratory, radiology and patient monitoring as well as providing decision support. From admission to diagnostic and medical support services, the modern healthcare centers rely on wide range of software applications. Some of the distinctive advantages of HIMS include improved quality of patient care, improved communications within the hospital, increased productivity, reduced costs and reduced chances of errors and the enhanced ability to track patient records. Today HIMS and electronic medical records (EMR) have become the minimum prerequisites for delivering quality healthcare. (Kumar & Gomes, 2009)

Uses of HMIS

a) **For a patient:** The software provides the patient several advantages such as querying for preliminary symptoms of diseases, precautions and diet plans, alternate medicine and salt options, data on blood and organ donation initiatives, locations and availability of doctors, chemists etc, health insurance price analysis and comparisons and even options of health tourism. Some software even have built-in alarms to remind the patient to take their medicines. (Rajesh et al., 2009)

b) **For Healthcare Industry** Since the health records are saved electronically lots of analysis can be done on the data generated, such as attracting and managing patient traffic, finding and utilizing the patient needs with healthcare, medical, insurance matching services etc. (Wyatt, 2005)

Current Industry Scenario

The healthcare industry has witnessed an increased spending on IT with most of the hospitals and healthcare organizations shifting to electronically-based information systems. The demand for quality healthcare and the need to streamline processes have convinced hospitals to adopt centralized information systems and to adopt

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IT in their daily operations. Subsequently, Healthcare IT systems such as the Hospital Information Systems (HIS) have witnessed a great demand in the healthcare services sector. In case of hospitals with sister branches it was seen that most hospitals have centralized system. Records from all sister branch hospitals are stored centrally and can be retrieved anywhere with the particular patient ID.

Indian Scenario

Though India is the hub of HIMS software and development activity yet in many hospitals they have either disparate system running or some small system developed in-house and very few hospitals other than the corporate hospitals are totally paperless ie. The use of HIS application in Indian hospitals are still at the very initial phase, India less than 30 percent hospitals are using HIS applications for their information needs.

Issues and Challenges faced by Hospitals using HIMS.

There are an estimated 15,000 hospitals in India, including the private clinics and nursing homes. This factor should be enough to drive the hospital information systems (HIMS) market in India along with the corporatization of the healthcare provider space, growth in the health insurance market, and the development of medical tourism. On the contrary, the HIMS market in India is still in the early growth stage. It is a small market dominated by in-house implementations and customized solutions developed by small local software developers. In terms of technology adoption, the Indian market is far behind its Asia Pacific counterparts such as Australia, Japan, South Korea, Singapore, and Malaysia. (Shah & Amatyakul, 2008) Undoubtedly, Indian hospitals have been very late in realizing the advantages of information technology (IT). Lack of awareness, the low priority given to financing of IT-related investments, lack of suitable solutions, as well as the absence of professional decision making has led to low penetration of HIMS in this high-potential market. The various reasons for this can be listed as:

a) Low priority to spending on IT

Hospitals in India give IT budgeting a low priority as compared to equipment budgeting. They do not mind spending a large sum of money on a Computed Tomography scanners or Magnetic Resonance Imaging systems, but allocate small budgets for the implementation of HIMS solutions. A high-cost solution such as Picture Archiving and Communications System (PACS) is being implemented only in corporate hospitals or high-end private and charitable ones in India, while other hospitals are averse to accepting such high-cost solutions.

b) Lack of professional decision making

Ideally, the team involved in the decision making for the selection of HIMS should comprise the hospital administrator, an IT manager with knowledge of health informatics, and specialists from the medical background. However, even today, the officials assessing the IT requirements of hospitals in India are chief information officers (CIO) or IT managers who do not have knowledge of the functioning of hospitals. Evaluation of the HIMS is also a critical part in the decision-making process. However, only a few corporate and high-end hospitals initiate the evaluation process.

c. Lack of suitable solutions

The majority of hospitals in India have developed in-house solutions or built a customized one from some local software developer. Such low quality, disparate systems act as a big hindrance to the growth of the high quality, integrated HIMS market in India.

d. Lack of awareness

Many hospitals in India have still not realized the importance of implementing HIMS and are not aware of the fact that IT drives efficiency. They consider IT a capital-intensive investment with little or no returns. This apathy toward HIMS has proved to be a major discouragement. Hospitals allocate shoestring budgets for IT and develop in-house or customized solutions that fail to give them the desired results and do not meet the hospital's requirements. There are hospitals that have implemented HIMS but do not have end-user training.

Review of Literature

Hospital Information Management System (HIMS) is vital to decision making and plays a crucial role in the success of the organization. Computerization of the medical records and

documentation has resulted in efficient data management and information dissemination for the users. Managers, clinicians and other healthcare workers can now access the information without delay or errors (Kumar & Gomes, 2009).

The evolving paradigm shift resulting from IT, social and technological changes has created a need for developing an innovative knowledge-based healthcare system, which can effectively meet global healthcare system demands and also cater to future trends. The Hospital Information Management System (HIMS) is developed with this sole aim in mind, which helps in processing and management of hospital information not only inside the boundary, but also beyond the hospital boundary, e.g., telemedicine or e-healthcare. The HIMS is developed in a KM context, wherein users can share and use the knowledge more effectively.

The Hospital Management System can be entered using a username and password. The data can be edited and retrieved easily. The interface is very user-friendly. The data are well protected and makes the data processing very fast. Computerized physician order entry systems (CPOEs) can remove errors due to human carelessness and negligence. (Godfrey, 2005)

Effective computerized systems and procedures need to be implemented to ensure proper utilization of limited resources toward quality health care. Patient care management in Tata Steel has fully utilized the power of computers in Medicare, whereby network of integrated systems maintaining patient database for the hospital services in the areas of Pathology, Radiology, Medical Research, In-patient Admissions and Billing, Medical Stores & Pharmacy are operational. The implementation of the above modules has evolved user-friendly computerized systems which are loved and cared by all. (Rajesh et al., 2009)

Successful implementation of an integrated Hospital Information System in hospitals is a complex task calling for high level of coordination between, the software supplier and the hospital's management, administrative and specialist staff. As part of the implementation process various procedural, operational and policy matters should be reviewed and finalized so that the hospital can derive maximum benefit from the use of a flexible and integrated Hospital Information System. The way Hospitals select HMIS, varies, and the approach may also leads to major complication during the implementation phases.

Heterogeneity is inherent to hospitals. A hospital consists of various organizational units with differing tasks for various types of healthcare professionals. Since integrated care should be the aim, a high degree of interoperability has to be reached. This requires intensive internal communication among organizational units and healthcare professionals as well as external communication (e.g. to insurance organizations, general practitioners, etc.).

To increase the efficiency and better healthcare services to patients, hospitals are taking help of IT revolution, with centralizing their processes with hospital management system and Hospital ERP. Cranberry with its tie-up with well-known CRM and ERP companies are providing customized ERP solutions for healthcare industry in India. It is a complete set of software applications that automates patient management, eliminating redundant steps and manual error-prone interaction. The application is built on an object oriented multi tiered architecture.

Research Methodology

The researchers used a structured questionnaire for data collection. Data was collected from personal interviews and discussions with HIMS department of major hospitals

Sampling

- Target population- healthcare stakeholders
- Geographical spread of the target population (sampling frame)- population of west Delhi and patients from Kasturba hospital, BHEL, Bhopal.
- Sampling method used- convenience and snowball sampling.
- Sample size- 100

Hypothesis

H_0 - Customer satisfaction has no relation with ease of information of HIMS.

H_1 - Ease of Information about HIMS significantly affects customer satisfaction in hospitals.

Communalities	Initial	Extraction
Hospital location	1.000	.716
Established in	1.000	.379
Consultation fees	1.000	.821
Visiting hours	1.000	.615
Facilities	1.000	.665
Doctors specifications	1.000	.723
24 hour service	1.000	.375

Data analysis and Findings

- Generally, you want to extract the components on the steep slope.
- The components on the shallow slope contribute little to the solution.
- The last big drop occurs between the third and fourth components, so using the first three components is an easy choice.
- The rotated component matrix helps you to determine what the components represent.

Table 1- Extraction Method: Principal Component Analysis.
Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	%of Variance	Cumulative %	Total	%of Variance	Cumulative %
1	1.763	25.186	25.186	1.763	25.186	25.186
2	1.438	20.540	45.726	1.438	20.540	45.726
3	1.094	15.629	61.355	1.094	15.629	61.355
4	.977	13.960	75.315			
5	.818	11.691	87.005			
6	.598	8.541	95.547			
7	.312	4.453	100.000			

The screen plot helps you to determine the optimal number of components. The Eigen value of each component in the initial solution is plotted.

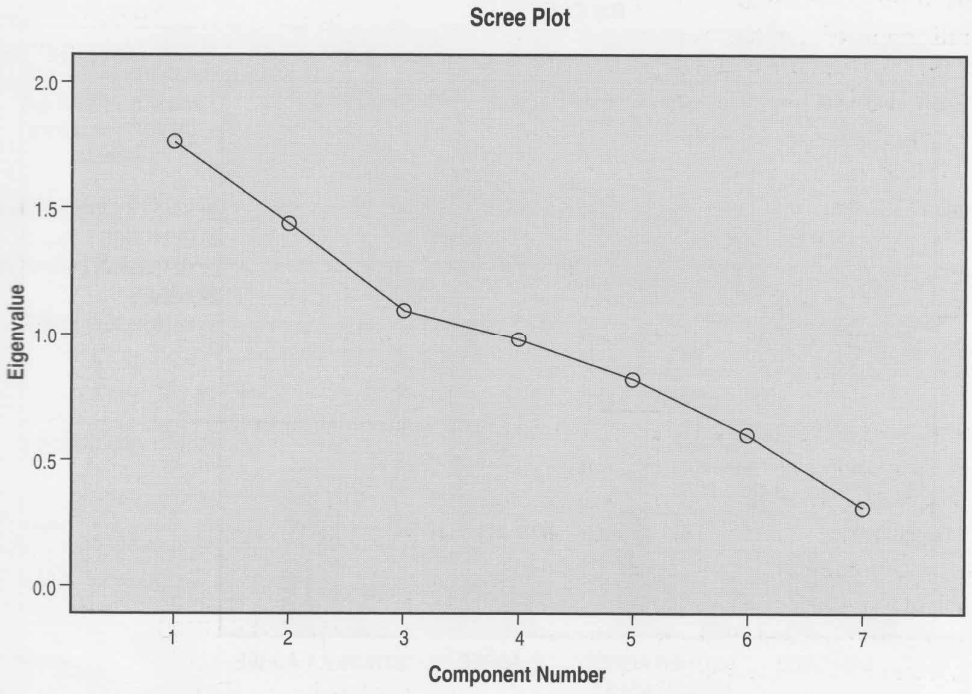


Figure 1- Scree Plot Showing The Number Of Components And The Eigen Value

Table 2- Extraction Method: Principal Component Analysis.

Component Matrix[a]	Component		
	1	2	3
hospital location	-.116	-.368	.753
established in	.371	.478	.113
consultation fees	.845	.325	.047
visiting hours	.370	.406	.560
Facilities	-.345	.714	-.189
doctors specifications	-.683	.309	.402
24 hour service	-.420	.445	-.020

3 components extracted

1 component- awareness

2 component- ease of information

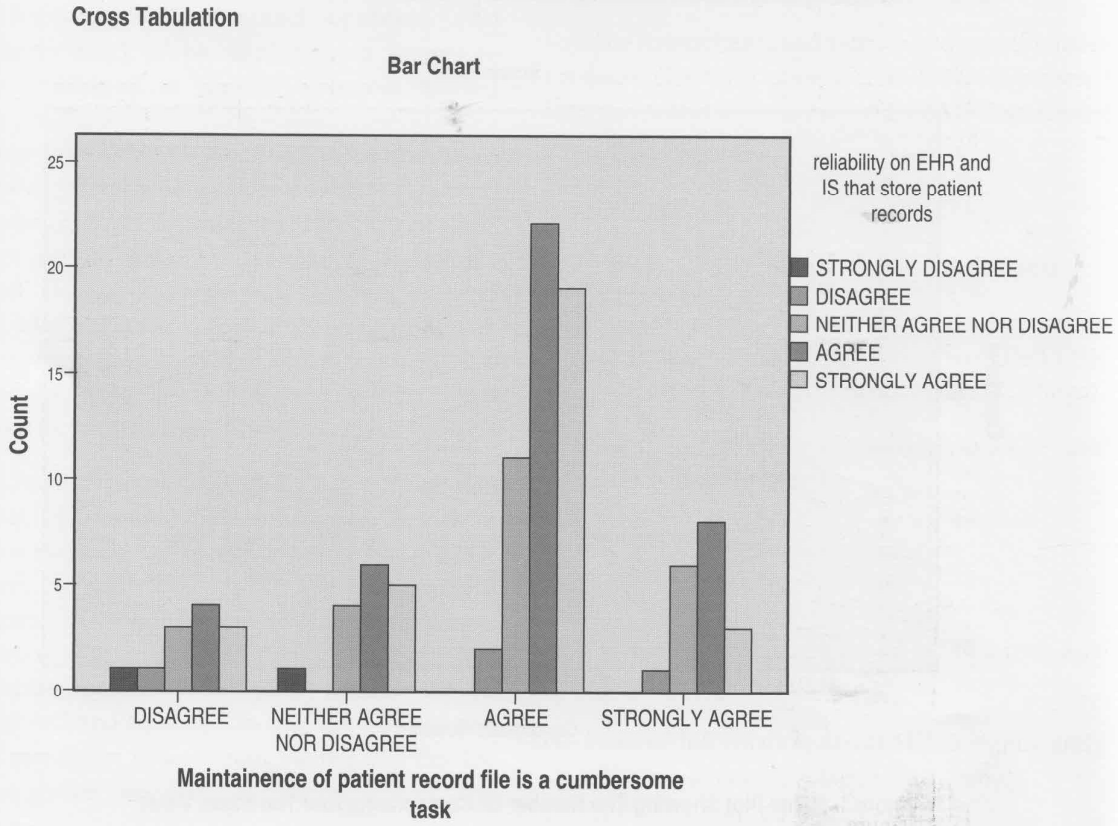
3 component- convenience

From the above graph between the reliability on electronic health records that patient records and the maintenance of patient record files it is clear that:

1. Maximum number of patients feels that the maintenance of patient record files is a cumbersome task.
2. Maximum number who agree on point 1. Also rely on EHR
3. The second highest number is for patients who strongly agree that maintenance of patient files is a cumbersome task.
4. The minimum number disagrees, this minimum number being almost negligible, who think that maintenance of patient files is not a cumbersome task.

Cross tabulation between awareness of HIMS, Ease of Information and result on confidence level on HIMS used in the hospitals you visit.

Figure 2- Cross Tabulation Between Reliability On E.H.R (Electronic Hospital Records) And Maintenance Of Patient Records



information about the availability of doctor, timings, fees etc is easily conveyed to you * are you confident of HIMS used in hospitals you visit? Crosstabulation

TABLE 3- Cross tabulation between awareness of HIMS, Ease of Information and result on confidence level on HIMS used in the hospitals you visit.

Count

		are you confident of HIMS used in hospitals you visit?				
		DISAGREE	NEITHER AGREE NOR DISAGREE	AGREE	STRONGLY AGREE	Total
information about the availability of doctor, timings, fees etc is easily conveyed to you	STRONGLY DISAGREE	0	1	4	0	5
	DISAGREE	4	12	20	0	36
	NEITHER AGREE NOR DISAGREE	0	4	8	1	13
	AGREE	3	10	17	3	33
	STRONGLY AGREE	2	4	6	1	13
Total		9	31	55	5	100

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Information about the availability of doctor, timings, fees etc is easily conveyed to you * are you confident of HIMS used in hospitals you visit?	100	75.8%	32	24.2%	132	100.0%
Are you aware of HIMS? * are you confident of HIMS used in hospitals you visit?	100	75.8%	32	24.2%	132	100.0%

Are you aware of HIMS? * are you confident of HIMS used in hospitals you visit? Cross tabulation

Count

		are you confident of HIMS used in hospitals you visit?				
		DISAGREE	NEITHER AGREE NOR DISAGREE	AGREE	STRONGLY AGREE	Total
are you aware of HIMS?	YES	3	10	17	1	31
	NO	6	21	38	4	69
Total		9	31	55	5	100

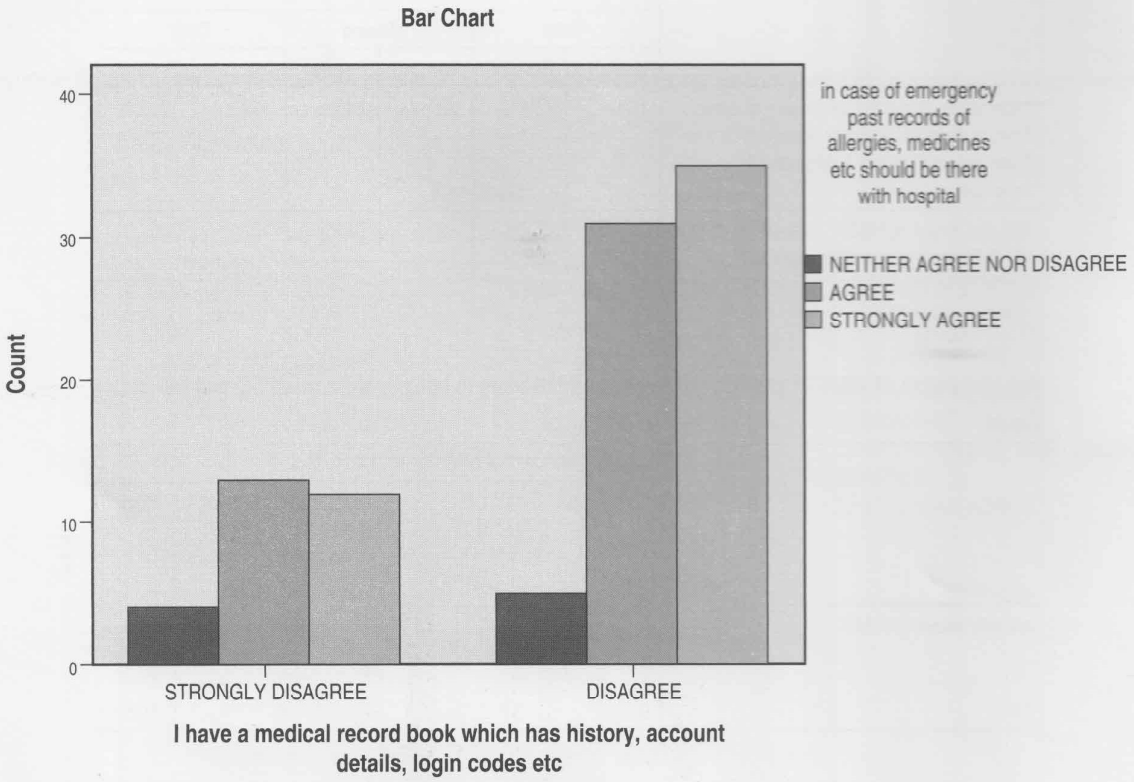
Information about the availability of doctor, timings, fees etc is easily conveyed to you * are you confident of HIMS used in hospitals you visit? Cross tabulation

Table 4- Cross Tabulation Between Confidence in Hims Used in Hospitals You Visit And Ease of Information

Count

		are you confident of HIMS used in hospitals you visit?				
		DISAGREE	NEITHER AGREE NOR DISAGREE	AGREE	STRONGLY AGREE	Total
information about the availability of doctor, timings, fees etc is easily conveyed to you	STRONGLY DISAGREE	0	1	4	0	5
	DISAGREE	4	12	20	0	36
	NEITHER AGREE NOR DISAGREE	0	4	8	1	13
	AGREE	3	10	17	3	33
	STRONGLY AGREE	2	4	6	1	13
Total		9	31	55	5	100

Figure 3- Cross Tabulation between Maintenance of A Medical Record Book and Emergency Information Record.



From the above graph between case of emergencies and keeping a medical record book it is clear that maximum number strongly agree and the next highest, they agree that in case of emergencies the past records of medical history and allergies etc should be stored with the hospital. The same patients did not have a medical record book where the information could have been stored.

Figure 4 - Cross Tabulation between Hims Catering to your Requirements and Updating of Patient Records Managed By Hospital.

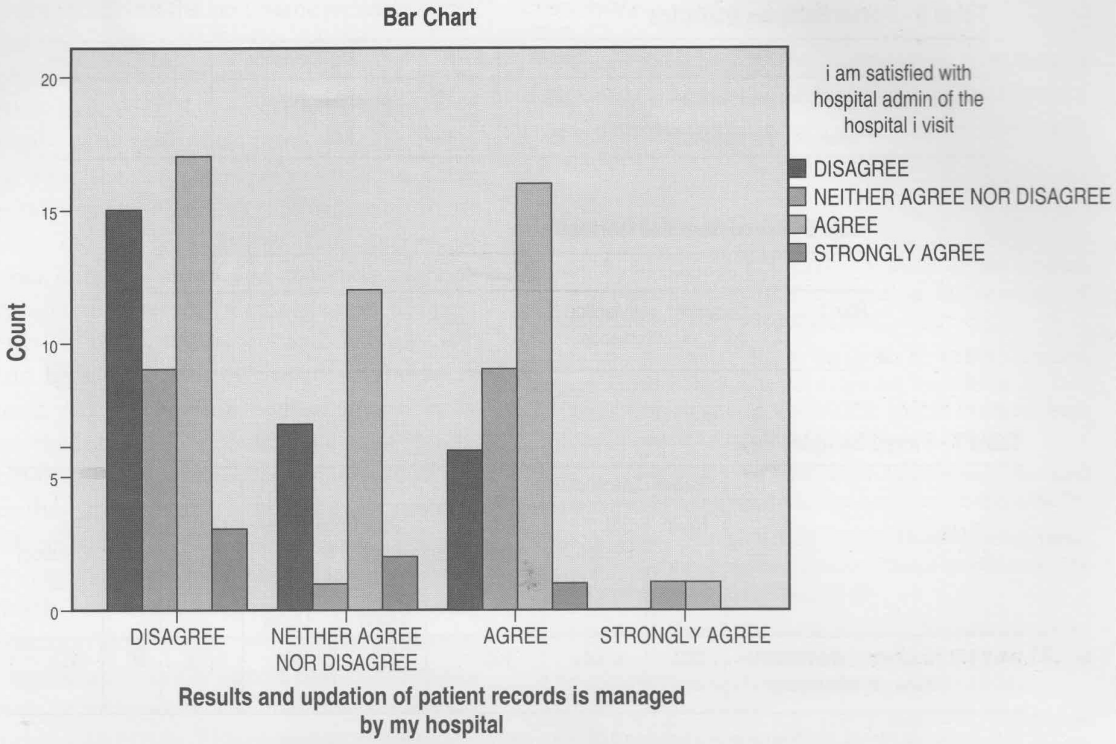
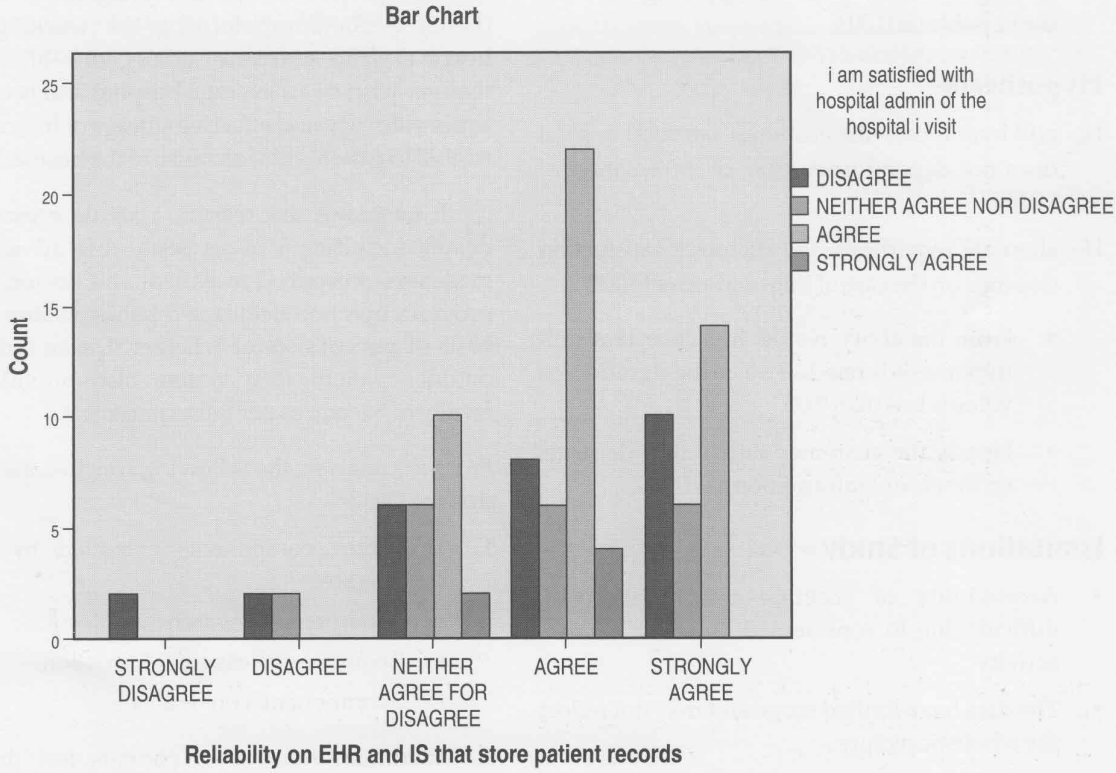


Figure 5 - Cross Tabulation Between Reliability on EHR and is (information Systems) That Store Patient Records And Hims Catering To Your Requirements



T test

Hypothesis between ease of information and customer satisfaction

Table 5 - Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Customer_satisfaction	3.65	100	.588	.059
	ease_of_information	3.35	100	.843	.084

Table 6- Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Customer_satisfaction & ease_of_information	100	.047	.640

Table 7 - Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Customer_satisfaction - ease_of_information	.305	1.005	.100	.106	.504	3.036	99	.003

95 % confidence interval, significance level is less than 0.05 hence alternate hypotheses are accepted.

Interpretation-

- The significance value after applying T-test on the variables is 0.003.

Hypothesis-

H_0- null hypothesis- the customer satisfaction level does not depend upon ease of information of HIMS.

H_1- alternate hypothesis- the customer satisfaction depends on the ease of information of HIMS.

- From the above results it is clear that null hypothesis is rejected, since the significance value is less than 0.05.
- Hence, the customer satisfaction depends on the ease of information of HIMS.

Limitations of Study

- Accessibility of accurate information was difficult due to confidential nature of patient activity.
- The data has a limited scope and may not reflect the wholistic picture.

Conclusions and Recommendations

The project Hospital Management System (HMS) is for computerizing the working of a hospital. The software takes care of all the requirements of an average hospital and is capable to provide easy and effective storage of information related to patients that come up to the hospital.

It generates test reports; provide prescription details including various tests, diet advice, and medicines prescribed to patient and doctor. It also provides injection details and billing facility on the basis of patient's status whether it is an indoor or outdoor patient. The system also provides the facility of backup as per the requirement.

From the analysis the following conclusions can be drawn:

1. The three components extracted by factor analysis are:
   - 1 component- awareness
   - 2 component- ease of information
   - 3 component- convenience
2. Maximum number of patients feel that the

maintenance of patient record files is a cumbersome task and prefer electronic health records. Maximum numbers of patients are not aware of HIMS but the very same patients agree to the fact that HIMS should be used in hospitals. Maximum number, about 85% agree that they have confidence on HIMS used in their hospitals. The maximum numbers of patients agree that the help reception desk in their hospital provides all relevant information about timings etc of the doctor. The maximum number strongly agree and the next highest, they agree that in case of emergencies the past records of medical history and allergies etc should be stored with the hospital. The same patients did not have a medical record book where the information could have been stored. The maximum number agrees that most of the times they are unaware of health packages and health insurance etc offered by their hospital. They highly rely (maximum- agree, second highest- strongly agree) on EHR and information systems that store patient records. The maximum number agrees that HIMS caters to their requirements and they have a strong confidence in HIMS. The customer satisfaction depends on the ease of information of HIMS.

Recommendations

Data Entry must be done through a user friendly and easy to use software. Data reports need to be presented in a understandable format.

The database used must have software to collate data from other formats. Knowledge management of the data generated can lead to drastic increase in efficiency.

There must be sufficient safeguards to maintain the secrecy and privacy of data. Security for the data is of utmost importance, after doing thorough validations.

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