IMPLEMENTATION DIFFICULTIES OF HOSPITAL INFORMATION SYSTEMS: A CASE STUDY IN A PRIVATE HOSPITAL IN TURKEY

by

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Title: Implementation Difficulties of Hospital Information Systems: A Case Study in a Private Hospital in Turkey

This thesis looks for potential sources of implementation difficulties of hospital information system in a private hospital in Turkey and provides recommendations to avoid these difficulties. Increasing cost of patient care delivery and the difficulties faced during the improvement studies of data quality and data access have increased the pressure for the use of information systems in healthcare organizations. However, due to complex workflows of hospitals, usage of information systems in healthcare brought some problems along with it. In this study, in order to find out the possible implementation difficulties, a survey was conducted in a private hospital in Turkey which was just in the stage of implementing a hospital information system. Techniques of interview, observation and questionnaire were applied for data collection. Data was analyzed by using descriptive, factor and ANOVA analyses. The results of these analyses showed that the potential sources of hospital information system implementation difficulties were related to organizational issues, end user profile, integration of different systems, inconsistency among different workflows of different departments and training issues whereas there was no major implementation problem related to software, hardware, planning, support, security and solution provider. Under the guidance of literature survey and the findings of the study, recommendations for achieving a successful, sufficient and efficient hospital information system implementation phase are given in terms of end user

contribution, business process reengineering, hardware planning, integration of information systems, training and support.

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Başlık: Hastane Bilgi Sistemi Uygulama Zorlukları: Türkiye'de Özel bir Hastanede Örnek Olay İncelemesi

Bu tez Türkiye'de özel bir hastanedeki hastane bilgi sistemi uygulama zorluklarının potansiyel kaynaklarını tetkik etmekte ve uygulama sırasındaki zorlukları önlemek için öneriler sağlamaktadır. Hasta bakımı vermenin artan maliyeti ve veri kalitesinin ve veriye ulaşmanın geliştirme çalışmalarında karşılaşılan zorluklar sağlık organizasyonlarında bilgi sistemleri kullanımı için baskıyı artırmaktadır. Ancak, hastanelerin karmaşık iş akışlarından dolayı, sağlıkta bilgi sistemleri kullanımı beraberinde bazı problemleri de getirdi. Bu çalışmada, potansiyel uygulama zorluklarını ortaya çıkarabilmek için, Hastane Bilgi Sistemi'nin henüz uygulama aşamasında olan Türkiye'deki özel bir hastanede bir araştırma yapıldı. Veri toplamak için mülakat, gözlem ve anket teknikleri uygulandı. Veri, tanımlayıcı, faktör ve ANOVA analizleri kullanılarak analiz edildi. Bu analizlerin sonuçları; Hastane Bilgi Sistemi uygulama zorluklarının potansiyel kaynaklarının organizasyonel konular, son kullanıcı profili, farklı sistemlerin entegre olması, farklı bölümlerin farklı iş akışları arasındaki tutarsızlıklar ve eğitim konuları ile ilgili olduğunu gösterdi, diğer tarafta ise yazılım, donanım, planlama, destek, güvenlik ve hizmet sağlayıcı ile ilgili konularda ana bir problem yoktu. Literatür araştırması ve bu çalışmanın sonuçlarının öncülüğünde, başarılı, yeterli ve verimli bir Hastane Bilgi Sistemi uygulama fazına ulaşabilmek için son kullanıcı katılımı, iş süreçlerinin yeniden yapılanması, donanım planlama, bilgi sistemlerinin entegrasyonu ve destek bazında öneriler verildi.

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PREFACE

What is the usage of information systems in healthcare? In recent years, information systems have been started to be used in healthcare due to increasing cost of high quality patient care, patient awareness in healthcare services and also competition in healthcare organizations. Increasing usage of information systems in healthcare fetched some difficulties along with its benefits. This thesis aims to expose potential difficulties of Hospital Information System (HIS) implementation in a private hospital in Turkey and provide some recommendations to decrease potential difficulties.

Articles, which are about the medical informatics, information systems, HIS, implementation of information system applications in hospitals and in other industries, internet sources, which mostly comprise HIS implementation case studies, interviews with hospital management, observations in hospital environment and the questionnaire applied to end users constituted the resources of this thesis.

The survey, conducted in a private hospital in Turkey, where all phases of HIS implementation were applied, forms the basis of this thesis. After specification of the hospital, interviews were done with the hospital management and observations were done in the hospital. A questionnaire was prepared for applying to end users by using obtained information from literature survey, interviews and observations. Questionnaires were delivered to end users and collected data was interpreted by using statistical tools. Chapter 1 gives an overview for the study. Chapter 2 reviews the literature on information technology era and applications in healthcare, HIS, benefits and advantages, problems and disadvantages of HIS, implementation difficulties of HIS and recommendations to minimize HIS implementation difficulties. Chapter 3 describes the methodology of the study: choice of

organization, preparation and administration of the questionnaire and data analysis approach. In Chapter 4, the results of descriptive statistics, factor and ANOVA analyses and their interpretations are given. Finally in Chapter 5, conclusions of the study and related recommendations are discussed.

Information technology usage in healthcare will increase in coming years as a result of technology improvements and other costing and operational issues. In such an environment that medical informatics challenge to traditional forms of providing healthcare, for achieving a successful, sufficient and efficient HIS implementation phase, identification of the potential difficulties of HIS implementation and consideration of the recommendations stated for the avoidance of these difficulties have become crucial.

CHAPTER 1

INTRODUCTION

In recent years, cost of providing high quality services and patient satisfaction in hospitals has increased tremendously. Using information systems in healthcare has become one of the best solutions for hospital management to decrease cost, to increase patient satisfaction, to improve hospital processes and to provide high quality services. As a result, usage of Hospital Information System (HIS) has become a widely used approach.

HIS is defined as a computer system designed to ease the management of all the hospital's medical and administrative information and to improve the quality of healthcare by Degoulet and Fieschi (1997). Another definition of HIS is given as "the applications that support the healthcare processes by allowing healthcare professionals or patients direct access to order entry systems, medical record systems, patient information systems, and so on" (Ash et al. 2004).

However, implementation of HIS projects is very costly due to investments on HIS software and hardware, long implementation duration, complex hospital processes and possible difficulties during implementation.

According to the studies about HIS implementation, implementation difficulties are related to infrastructure, application and organization of the implementation processes (Littlejohns et al. 2003), integration of hospital workflows and independent physician groups, data toxicity (Memel et al. 2001) and trainings (Ash et al. 2004).

The above mentioned HIS implementation difficulties, as stated, appear due to various reasons. If those reasons cannot be identified and/or cannot be avoided, most of the projects may fail. The purpose of this study was to determine the possible implementation difficulties of a HIS project in a private hospital in Turkey together with their sources and then give some recommendations to overcome these difficulties to guide other hospitals and HIS solution provider companies.

For this purpose, a literature survey was conducted by an extensive review of books, journals, Internet resources and dissertations. Then, interviews and observations were made with end users from various departments in the hospital. Finally, a questionnaire was prepared and delivered to HIS users of this hospital for determining sources of HIS. Descriptive statistics, factor and ANOVA analyses were used for evaluation of the collected data.

The thesis is organized as follows:

Chapter 1 gives an overview for the study. Chapter 2 reviews the literature on information technology era and applications in healthcare, HIS, benefits and advantages, problems and disadvantages of HIS, implementation difficulties of HIS and recommendations to minimize HIS implementation difficulties. Chapter 3 describes the methodology of the study: choice of organization, preparation and administration of the questionnaire and data analysis approach. In Chapter 4, the results of descriptive statistics, factor and ANOVA analyses and their interpretations are given. Finally in Chapter 5, conclusions of the study and related recommendations are discussed.

CHAPTER 2

LITERATURE SURVEY

Information Technology Era in Healthcare

Use of information technologies in healthcare business has caused the concept of medical informatics to emerge. Medical informatics is the field concerned with management and use of information in health and biomedicine (Hersh, 2002). Although medical informatics seems as a service, it is considered as a science that specifies the best usage of information technologies to improve healthcare services.

Increasing cost of patient care delivery and the difficulties faced during the improvement studies of data quality and data access have increased the pressure for the use of technologies in healthcare organizations. Apart from these, payment systems and provisions from insurance companies have also encouraged the use of information systems in healthcare. Due to the huge and complex structure of healthcare organizations, there is a high need for integrated healthcare information systems to meet their needs.

Hospital information systems, electronic patient records, decision support systems, telemedicine, radiology information systems and other systems based on information technology affect the healthcare workflows and healthcare services. These systems also decrease the cost of providing good quality services to patients and the accessibility time to patient records. Relational database systems, network communications, distributed processing architectures, optical disk storage and other information technology components also support these applications.

Healthcare delivery system has some features that discourage widespread usage of information technologies. Clinical staff performs some tasks including hands-on care, inductive and diagnostic thinking, detailed record keeping, patient education, and communication with colleagues. However, computers are not yet as useful, ubiquitous and handy as the stethoscope and other medical technologies. In addition, medical workflows are complex and subject to change. Adaptation of these workflows to information systems applications is a problem. Information technologies facilitate alliances between geographically separate parties. Most of the hospitals want to utilize from benefits of systems. However, since medical licensing and malpractice laws require paper based record keeping, information systems also challenges legacy systems.

The reviewed studies show that usage of information technologies in healthcare increases day to day. New applications are identified and used to improve the healthcare services.

Information Technology Applications in Healthcare

Information technology applications used in healthcare have different kinds of purposes. In one approach, the type of information used is important. Patient specific information, which is used for patient care, and knowledge-based information, which comprises the scientific basis of healthcare are two types of information used in clinical informatics. Electronic Medical Record (EMR) is the core application that uses patient specific information. EMR keeps all patient information such as laboratory results, medications and clinical reports, in electronic environment. Although paper-based medical records are handier for physicians, they are incomplete, difficult to access in more than one place, difficult to read and insecure from unauthorized users and usage (Hersh, 2002). EMR overcomes most of these

problems and provides complete, easy to access and secure patient information to physicians. Knowledge-based information supports clinical decision making, continuing education of staff, administrative planning and management, performance assessment and improvement, patient and family education, and research.

In another approach, Electronic Data Interchange (EDI), which is defined as the application to application exchange of business documents, is the main purpose. EDI is used to carry out medical payments and other administrative transactions between healthcare providers and insurance payers. These systems achieve to exchange information and complete transactions without human intervention and decrease the operational costs since the number of telephone calls and personnel costs are reduced and some of the jobs in both hospitals and insurance companies are eliminated.

In addition to these, there are also some popular applications that have been developed to overcome some problems in healthcare business and also provide high quality services to patients. These applications are briefly explained below:

Hospital Information Systems (HIS): HIS can provide computerized patient records, centralized patient data, and enhanced intra-organizational communication and data sharing. HIS provides the platform to handle all of the hospital operations through a computerized system. HIS works integrated with other systems including medical departmental systems and non medical systems such as financial, human resources, accounting and third party software.

Decision Support Systems (DSS): A DSS in healthcare crosses the patient specific and knowledge based information. This system is revealed from artificial intelligence and expert system researches that attempted to model clinical diagnostician. However, systems resulted from this study were too time consuming for clinical use. Consequently these applications are emerged in the form of decision

support systems, which are embedded in EMR and aim to detect critical situations and errors in care and then notify the clinician, provide appropriate information accordingly, or both (Hersh, 2002). Research studies show that DSS applications are very efficient in EMR. They detect medical prescribing errors and decreases costs.

Telemedicine: Telemedicine can be defined as the use of information technologies for providing medical services and information from one location to another. Telemedicine with its lower cost and better quality is beneficial for people who live in remote or underserved areas. Although their region does not have some healthcare services, they can easily utilize from healthcare services via telemedicine. Patients do not need to go to central medical centers, which are more expensive than a local hospital. If telemedicine is provided at patient's home, traveling cost to hospital will be eliminated for patient. The overall cost reduction appears when patients are seen in early stages of their illnesses as an outcome of using telemedicine. As a result, this early diagnosis will prevent high costs of illnesses, which are in advanced stage, and decrease pressure to hospitals and emergency departments.

Expert Systems: Expert systems are computer programs that are derived from a branch of computer science research called Artificial Intelligence (AI). AI is concerned with the concepts and methods of symbolic inference, or reasoning, by a computer, and how the knowledge used to make those inferences will be represented inside the machine. Computer scientists often define an expert system, as one that contains some known facts, general rules and a logical engine that can check the validity of a new proposition against what is already known. Medical Expert Systems are active knowledge systems which use two or more items of patient data to generate case-specific advice.

Basics of Hospital Information Systems

Since there are a lot of aspects and facilities of HIS, various HIS definitions have been formulated by different parties. In the following sections, different definitions of HIS and basic components of HIS are given.

According to Sneider (1987), HIS is "a hospital wide system or network of systems designed to support the flow of information between departments". This definition emphasizes that HIS should take entire hospital workflows under its control regardless of medical functionalities of departments; HIS should influence flows of every department.

According to Degoulet and Fieschi (1997), HIS is "a computer system designed to ease the management of all the hospital's medical and administrative information, and to improve the quality of healthcare". They emphasize the importance of HIS, which is the way of managing all departments of hospital including medical and administrative, to improve the quality of hospital. As a result of HIS usage in hospital, inputs including medical patient data, financial and performance information are collected from end users and these data is used in further analysis. HIS helps to assess critical quality indicators and also evaluates these indicators via its reporting facility.

Prokosch and Dedeck (1995) pointed out that a variety of names have been used to describe HIS, such as hospital communication systems, electronic medical records, medical information systems, etc. but on the other hand, HIS also has been applied to describe very different forms of computer applications in hospital environments. They argued that the way of defining HIS is to define its components, which are hospital communication systems, and some information processing or knowledge processing functionality.

Tan (1995) realized the difficulties of defining hospital information systems and from an integrated perspective, he has treated HIS as a health management information system (HMIS) by defining it as "the application of a total systems perspective in linking relevant theoretical principles with practical methodologies for the effective administration (i.e. planning and management) of information technologies and their applications to improving health service delivery within the context of current and future healthcare environments".

Another definition states that: "Hospital Information Systems are the applications that support the healthcare processes by allowing healthcare professionals or patients, direct access to order entry systems, medical record systems, patient information systems, and so on" (Ash et al. 2004).

National Library of Medicine define HIS as an integrated, computer-assisted systems designed to store, manipulate, and retrieve information concerned with the administration and clinical aspects of providing medical services within hospital (MedPAC 2001).

The key features of HIS are quick response time, ease of access, clarity of use, ease of use, understandable user interfaces and return on investment. Also, hardware and software have to be designed according to different needs; it should support mobile devices, and integration with other systems (Hammond, 2001).

Ma (2003) defined the objective of HIS as providing the right information for making a particular set of right decisions.

According to Degoulet (1997), traditional components of HIS include:

- The administration sub system
- The healthcare unit sub system
- The biological information subsystem

The "administration subsystem", which includes general and cost accounting, purchasing, inventory and human resources sub systems, is complementary of a HIS as a supporter of healthcare unit sub system. Figure 1 explains the Hospital Administrative Subsystem with its components (Ma, 2003).

Hospital Administrative Subsystem
Medical-administrative patient management
Identification
Preadmission, admission, discharge, and transfers
Invoicing, links with insurance companies
Financial management
General and cost accounting
Administrative controls
Inventory management
Purchasing
Planning
Hospital activities management
Material management
Resource management (beds, appointment)
Activity/statistical reports (range of cases)
Resource planning and optimization
Personnel management

Figure 1. Hospital administrative subsystem

Second component of HIS which is "healthcare unit subsystem" includes patient care related functionalities such as service, drug and blood ordering, clinical documents, electronic patient record. Figure 2 shows content of Hospital Healthcare Units Subsystem (Ma, 2003).

Hospital Health Care Units Subsystem
Managing patient data
Observations, interviews, examinations, diagnostic and prognostic decisions, etc.
Procedure management (prescriptions and procedures)
Reporting (reports, file summaries, charts)
Health care management
Logistics
Administration and accounting
Statistics on activities
Communications
Internal and external health care units
Organizations outside the hospital
Training and research
Access to knowledge, protocols
Querying data banks

Figure 2. Hospital healthcare units subsystem

The "biological information subsystem" includes biology laboratories, imaging services, printing and distributing results and laboratory management as give in Figure 3 (Ma, 2003).

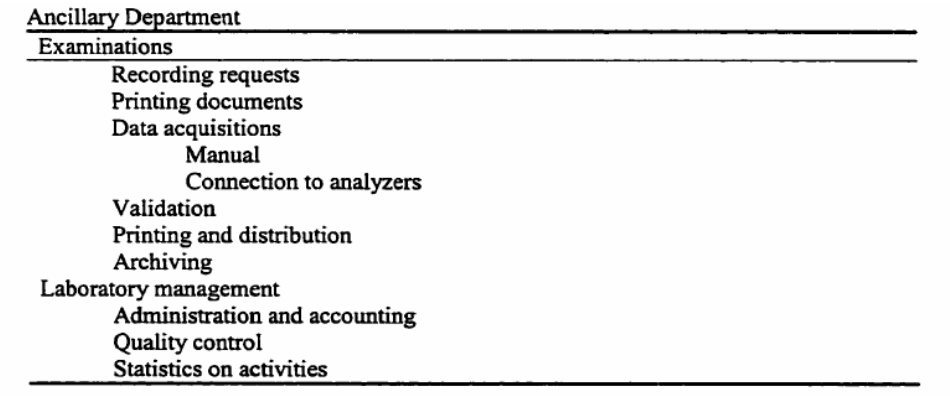

Figure 3. Biological information subsystem

Evolution of Hospital Information Systems

Improvement of information technology has affected the healthcare sector like other industries, but it is not the unique reason of HIS evolution. New technology (hardware and software) is the most significant factor (Hammond, 1987). Computer technology evolved from mainframes, which were difficult to manage and learn, to new technology computers, which are fast, easy to manage, user friendly and more functional. This evolution increased the demand of using computers in both work and daily life. Other factors influencing evolution of HIS were the developers and the users involved, economic factors, the amount of data generated and the demand for information, and the external factors such as governmental regulations and third party payment requirements (Ma, 2003).

After introduction of HIS into hospitals, improvement in patient care as well as hospital management, collection and retrieval of accurate and complete medical information, lower operational costs and treatments costs, lower time to reach patient

medical data, interpretation of clinical data and warning for exceptional medical cases such as drug to drug interaction warnings were expected from HIS. However, most of the first generation HIS did not succeed to make these expectations actual. To meet the expectations of patients and to solve problems of hospital managers and healthcare professionals, healthcare providers realized the benefit of working as integrated with each other. However, the integration between these parties required an integrated hospital information system. This situation has increased the value of HIS and resulted in improvements in HIS.

El Camino Hospital in California started to use the first HIS, "Technician", in 1972. This system only offered order entry and result reporting facilities but did not offer emergency or ambulatory services. The second system was "Computer Stored Ambulatory Record (COSTAR)", which was developed at Harvard.

According to studies, in 2001, only 16% of the hospitals had a clinical patient order entry (CPOE) system and 67% planned to have a CPOE system in the next few years (Ball, 2003). The benefit of CPOE is largely dependent to other integrated systems such as radiology, laboratory and pharmacy information systems. Physician acceptance varies for different systems. Successful CPOE provides a non-monetary return on investment such as decrease in length of stay, reaching patient medical data in a shorter time, seeing integrated medical data etc.

Today, USA hospitals focus on healthcare systems including HIS that are based on technology. According to Gartner's survey in 2001, half of the hospital executives indicated that they have planned to add clinical decision support system and almost 60% planned to have physician order entry system. In another study, it is stated that the increase for the overall hospital spending on IT was going to increase 6-7% per

year through 2004, while clinical spending would grow 13-15% annually (Ball, 2003).

The first generation of HIS occurred in early 1960s and lasted until 1970s. During that time, computers evolved from single tasking, difficult to manage mainframes to multi-tasking, user-friendly computers. This evolvement and other factors such as economical developments, increasing importance of data manipulation resulted in the development of HIS. In that time, many well-known technology companies such as IBM, NCR, Honeywell, Control Data, and Burroughs started to offer HIS products into market. In addition to these companies, some industries that had experienced working with computers to manage complex systems have also developed HIS. For example, Lockheed supported the early development of the Technicon Hospital Information System (Bekey and Schwartz, 1972). HIS that was developed in that time usually included some patient care functionalities and the main focus was to automate medical records of patients. At that time, due to expensive costs of HIS, only large hospitals tended to implement HIS. Most of the HIS projects failed as a result of lack of knowledge about HIS, its complexity, missing contribution of hospital management and inadequate technology.

The second generation of HIS started in the middle of 1970s and ended at the end of 1970s. At that time hospitals started to focus on financial issues and to use financial systems. Most of the HIS have served financial systems and their main purpose was to transmit information from end users to financial systems. HIS did not save any information about patient during patient visit. They are used to retrieve and transfer information. The technology of second generation HIS was better and also cheaper than the first generation.

Third generation of HIS started in the late 1970s. This generation was influenced by database technology, which was introduced in early 1980s and focused on patient care planning and departmental solutions such as laboratory and pharmacy.

The fourth generation of HIS started in the early 1980s and has come to present. The main feature of the fourth generation HIS is being an integrated system with other third party systems including financial or other departmental services. One of the main concepts of this generation is providing all of the needs from a single vendor. Therefore, the cost of the systems is lower and hospital management works with a single company. However, this has also some disadvantages. Sometimes a single vendor cannot meet all of the needs of a hospital with the same quality and technology.

Integration of Hospital Information Systems with other Medical Systems

In recent years, medical data demand of insurance companies, private and public purchaser and payers, government and organizations that accredit license and certify hospitals increased very much. Providing the appropriate data that requires this demand has pointed out the importance of integration of HIS.

Penetration of managed care, which is a general term used to describe a system of health care delivery that attempts to oversee all aspects of an enrollee's care, has also influenced HIS integrity. Personal and national health expenditures have increased in recent years. This increase resulted in implementation of new systems such as prospective payment system, contract pricing for specific procedures, and enrollment of recipients in managed care plans (Ma, 2003). As fee-for-service concept was replaced by managed care, hospitals started to find ways to cut costs. An integrated HIS solution was one of the ways of cutting costs since it decreases labor

and operational costs (e.g. usage of less paper and telephone). In addition to this, managed care requires documented delivery of care, and measurable and demonstrable quality of care, which can be achieved by a HIS working integrated with other systems such as electronic medical records, financial and reporting tools, departmental information systems and even with other hospitals.

Information system is also a key factor in the development of an integrated delivery system. Improving information systems helps system integration and more system integration needs development of new information systems. For that reason information system is the key player to achieve hospital integrity.

Improvements in technology encouraged hospital managers and healthcare professionals to find solutions to their problems with new technology. Some problems that they have faced were, creating integrity in patient medical data, improving quality of care and reducing cost in their organizations. This situation caused cooperation of healthcare providers which, in turn, result in efficient usage of clinical resources, medical data integrity and quality improvement.

According to Merriam-Webster (1998), integrity is “an unimpaired condition: soundness” or “the quality or state of being complete or undivided: completeness”.

Integration of HIS with other systems is the critical factor for HIS integrity. The purpose of HIS integration can be explained as follows:

- Realization of digital hospital information system through the connection of HIS, RIS and PACS, which can achieve the system function, information processing and communication on a complete platform
- Optimization of workflows, sharing medical resources, improving work efficiency, economization of funds and increasing revenue

- Realization of telemedicine which will provide benefit of sharing information among physicians who are in distant places
- Providing individualized services to patients with the help of huge database of HIS which can support medical research and telemedicine services

HIS integrity could be measured by three components of the system. One is the ability of the system that automates organizational tasks, second is the ability of the system to facilitate communication and coordination among organizational elements and the third is the ability of the system that retrieves, manipulates and displays information from a database for making some organizational decisions. The main purpose of HIS is to automate clinical related data. This requires connectivity of various data from different systems. For that reason, HIS should be connected to other systems through a network and collect data from other clinical systems such as radiology information systems, laboratory information systems or other financial systems. Another facility of HIS should be manipulation of collected information.

The previous studies suggested the following steps for the integration of HIS (Tan and Hann, 1994; Prince and Sullivan, 2000):

1. All existing systems in the hospital should be connected through a network and physicians should be able to reach HIS and other clinical and financial systems from their offices.
2. The evolution to an "open system" platform and the adoption of software standards.
3. Hospital should establish an overall plan to interconnect and reconcile the evolving perspectives of general management, the information systems department, and user groups.

4. Electronic medical records of HIS should be integrated with all application modules and all medical devices.
5. HIS should have decision support systems.
6. There should be enterprise wide scheduling.
7. System should have a common identifier, which is unique and common in all other integrated systems.
8. HIS should have an order management.
9. There should be high-speed data, voice and image transmissions.

In the study where information technology use among Health Management Organizations (HMOs) was examined by using a national survey in 1995 (Wholey et al., 2000), the integration of information systems among HMOs was analyzed by using four categories:

1. Information technology functions
2. Staffing and cost
3. Services provided
4. Advanced technologies

Integration of clinical and financial systems is an important determinant of HIS integrity. Cost of one patient or patient groups, cost of one procedure, profitability of hospital can be calculated easily through integration of financial and clinical systems.

HIS should also work with executive information systems (EIS). EIS is used for reporting purposes and has ability to generate multidimensional reports showing hospital, clinical staff performance, clinical statistics, and any report that will be generated using collected data. HIS feeds EIS and makes it possible to generate many multidimensional reports for hospital management and medical directory.

Ma (2003) made a study to examine the relationships of environmental and organizational factors to hospital integrity and hospital performance. He developed six hypothesis for this study which were related to the relationships among organizational factors, HIS integrity and hospital performance. He proposed relationship between HIS integrity and health management organization penetration, market competition, bed size, integrated delivery system affiliation, complexity and also a relationship between HIS integrity and hospital inefficiency. The Figure 4 shows the results of hypothesis testing.

The Results of Hypotheses Testing

Hypotheses		Expected	Results
H1: HMO penetration	→ HIS integrity	+	+
H2: Market competition	→ HIS integrity	+	NS
H3: Bed size	→ HIS integrity	+	+
H4: IDS affiliation	→ HIS integrity	+	+
H5: Complexity	→ HIS integrity	+	+
H6: HIS integrity	→ Hospital inefficiency	-	-

Note:
+ Positive relationship and significant at 0.05 level;
- Negative relationship and significant at 0.05 level;
NS not significant at 0.05 level.

Figure 4. Results of hypothesis testing

Explanations for these findings are stated by (Ma, 2003) as follows:

- HIS with high integrity allows the hospital to collect and retrieve all the information rapidly and accurately
- HIS with high integrity can lower costs, by reducing paper documents and patient medical records
- HIS with high integrity provides physicians with all the information to make clinical decisions
- Advanced HIS supports the hospital executive team in strategic planning

To summarize, HIS's structural functionality, connectivity and decision support functionality are the appropriate measures of HIS integrity (Ma, 2003).

As a result, some previous studies show that HIS integrity directly affects the hospital performance. A high level integrated HIS will result in shorter average length of stay and lower costs. The number of studies conducted for HIS integrity and hospital performance is very limited. Some of the studies have suggested that HIS have improved hospital performance in terms of cost efficiency (Bernard, 1995), productivity (Shukla, 1990) and financial performance (Norrie and Blackwell, 2000; Smith et al. 2000; Prince and Sullivan, 2000). On the other hand, some of the studies have found no relationship between hospital performance and HIS integrity (Lin and Wan, 1999).

Success Factors for Hospital Information Systems

HIS projects in hospitals start with the purchasing decision of HIS, continue with implementation and post go live support, and end with decision of success or failure.

Deciding whether HIS is successful or not is not dependent to only technical issues, it is socially negotiated. Some hospitals might decide to solve problems of HIS and increase their resources and continue to support end users and use; other hospitals might abort HIS usage and accept their losses. Berg (2001) identifies a well functioning system as a match between the functionalities of the system and the needs and working patterns of the organization.

Success has many dimensions: effectiveness, efficiency, organizational attitudes and commitment, employee satisfaction and patient satisfaction (Berg, 2001). The main issue is agreeing on which dimension(s) hospital should determine

as the success criteria of HIS and which dimension is mostly relevant with HIS success.

Success of HIS implies careful attention to, what success parameters are used, agreement of different groups on these parameters and managing inevitable evolution of success criteria in hospital. It is difficult to list success or failure factors of HIS. Since number of users who are influenced by HIS and its use is large, their reactions to system and technology cannot be foreseen. In addition, a successful HIS in one hospital may not be successful in other hospital. Strategic plan, priority, size, user profile, financial and management structure, and leadership styles of each hospital might be different.

According to studies, there are some slogans such as the importance of leadership or user involvement for the success of HIS. It is sure that leadership is important but how a specific leadership style works for different situations is also important. User involvement is essential but it does not work for all cases. The proper leadership style for a specific implementation or optimal way of involving users can be discovered during process itself (Berg, 2001).

HIS should be managed by a project group, which consists of not only members of IT department but also end users of system and hospital top managers. Therefore, end users will own system, give quick feedback about problems of system to IT department and top management. Top managers will accelerate decision-making process and critical decision will be finalized in short time. Contribution of hospital top managers and end users to management of HIS will minimize problem solving time of IT team, designed workflows will be applicable and system functionalities will be closer to expectations of end user and management, which in turn increase the success of HIS.

Although HIS always has a risk of failure after successful implementation, successful implementation is an important determinant of HIS success. For that reason, one of the aims of hospital management should be to organize implementation period with minimum problems. According to studies, to achieve this, rapid implementation of HIS demonstrates the need for a team concept strategy for successful development and installation of a clinical system (Russ, 1991). All clinicians, nurses, information technology staff of hospital, service provider company consultants, administrative staff of hospital, in other words, people who contribute to implementation, should cooperate to design a system with integrated workflows of different parties.

Bell (1997) has done a study, which investigates the relationship between a hospital's information systems and its success. In this study, he has examined two questions. One is whether hospitals believe that their success depends on their information systems or not and the other one is related to HIS usage. The result also shows that there has been an increase in the usage of HIS, but the main issue is the interpretation of HIS with other medical systems.

Cost effectiveness and cost benefit analysis can also be used to assess the cost and health effects of using medical technologies including HIS. Cost-effectiveness analysis (CEA) is the comparison of two or more healthcare interventions. The main purpose of this analysis is to show relationship between used resources (cost) and outcome benefits (effects) for given information technologies or programs. If the ratio is similarly measured for different technologies or programs, the cost per effect can be compared.

Building a new HIS should improve the existing hospital processes and decrease the duration that patient spends in hospital for a routine examination,

surgery or check up. HIS users and hospital staff, whose work is affected by HIS, should assess the difference of using in HIS. They should assess new system in terms of different factors such as time saving, efficient working, ease of use, security, privacy, etc. After this assessment, hospital could determine whether HIS is successful or not in this hospital with contribution of feedback from patients. Of course hospital management should carefully distinguish feedbacks from patients and find feedbacks affected by HIS.

The proper HIS should perform mutual transformation of primary work processes, which are directly linked to patient care such as tasks of physicians and nurses and secondary work processes which support and complement primary care processes such as billing, laundry, resource management, maintenance of medical equipment. HIS should bring primary and secondary work processes to new levels of quality, efficiency and work satisfaction- whether that means an enlarged span of control for administrative personnel, and improved grip on the patient's trajectory for the healthcare professional, or a novel sense of autonomy for the patient (Berg, 2001).

Benefits and Advantages of Hospital Information Systems

Since HIS has been introduced, it has been thought that HIS will provide many benefits to hospitals for both management of hospital and patient care. It was expected to provide data integrity, completeness, and real time information as well as increase in quality of patient care and cost reduction. As a result of electronic data usage provided by HIS, paper usage, telephone costs, number of personnel for operations will decrease in hospitals. This will result in reducing the cost of delivering healthcare in long term. HIS will also decrease the cost of administrative processes such as transmitting and processing claims, utilization review, purchasing

supplies and tracking inventory, paying bills, negotiating contracts, controlling quality and performance, creating reports to measure performance of hospital, optimizing workflows in hospital.

HIS usage in hospitals facilitates management of resources and patients, and clinician behavior. For example, as a result of up-to-date electronic patient records in HIS, number of duplicate tests will be reduced.

Accessible and integrated electronic patient records supplies up-to-date medical data of patients and reduces the decision-making faults that result from lack of data. Additionally, computerized order entry system and automated remainders reduce the errors by eliminating illegible orders, improving type of communication and tracking orders and their results and checking inappropriate orders (Ash et al. 2004).

Since HIS can be integrated with other clinical and financial system and even other HIS in other hospitals, it prevents manual data collection and storage, redundant data entry, nonstandard data and invalid data. Prevention of manual data collection and storage minimizes amount of incorrect clinical data and misunderstandings. Keeping medical data in electronic environment makes it possible to reach data from multiple places and to use this data efficiently. So, most of the time, clinical staff does not need to enter same or similar data for multiple times. Since every clinical staff enters data in same way, standardization of medical data is obtained as a result of HIS usage.

Some HIS has clinical decision support system functionality. Clinical decision support systems assist physicians in diagnosing and patient treatment. Finally, HIS minimizes the number of medical treatment mistakes and also reduce the time for diagnosing time for physicians.

Some HIS functions in integration with medical imaging systems. This provides physicians to view radiology reports from HIS and to reach medical images directly, which in turn will reduce surgery time, patient pain and also cost.

HIS also provides benefits for hospital management. With the help of HIS, hospital management can generate reports by using information provided by HIS. These reports will help to hospital management in strategic planning, quality improvement and evaluation of services.

Hebert (1998) made a research in five hospitals to assess the impact of HIS in hospitals. The participants of this study were selected from four different groups, which were laboratory technicians, nurses, pharmacists and physicians. The data was collected through interviews with participants, written archival data and observations of HIS use. The result of the study showed that HIS increased the cost efficiency and productivity.

Another benefit of information systems on healthcare is admission monitoring and scheduling system that is designed to reduce fluctuation of workload in nursing units. The effects of the system on work-load distribution, full time equivalents, labor cost, and employees were assessed in a 235 bed hospital (Shukla, 1990). The result of the study showed that the system had provided more stable workloads by improving the productivity by about 3 percent and reducing the number of days that nurses were forced to take leave off without any payment during low-census periods by 40 percent.

In another study by Ma (2003), the benefits of Clinical Information System (CIS) were summarized as:

- Data is easily retrieved for resource allocation and resource utilization.
- Quality of healthcare is increased

- The usage of paper and paperwork has been reduced.
- The CIS has also monitored the time spent on documentation, physician and nursing satisfaction, and average length of stay of patients.

Norrie and Blackwell (2000) made on the computerized patient data management system (PDMS) that can save nursing time and requires fewer nurses, the PDMS implementation has resulted in time savings especially in nursing staff. Finally, the result of the study showed that in 8 years period, this system provided profit to hospital.

Smith, Bullers, and Piland (2000) conducted a three-year study for the assessment of relationship between IT and medical group financial performance. The results showed that with development of more capable information systems, medical managers could control cost, and reduce the expenses of daily operations.

Bernard et al. (1995) performed a 2.5 years study to control the use of clinical information system to direct and monitor physician and hospital practice in general medicine services. The average length of stay (LOS) decreased, the intervention services had fewer deaths, but there were no difference in quality, readmission and mortality rates, and patient satisfaction.

Problems and Disadvantages of Hospital Information Systems

In addition to various benefits and advantages of HIS, there are some problems and disadvantages of HIS like other information systems. HIS could have more problems compared to other information systems since hospital processes are more complicated and difficult to define and clinical staff is not familiar to computers and information system.

After hospitals start to use HIS, they transform their records to electronic environment. All clinical staff communicates through HIS, since they can find

results, clinical notes, orders and every kind of medical data in system. As a result of this new communication type, oral communication decreases and social relations between individuals and groups are affected. Wetzel (2001) claims that "Past experience suggests that efforts to introduce clinical information systems into practice settings will result in failures and unanticipated consequences if their technical aspects are emphasized and their social and organizational factors are overlooked".

According to Ball (2003), there are two main problems that occur at the interface of the information system and work practice: errors in the process of entering and retrieving information in or from the system and errors in the communication and coordination processes that the HIS is supposed to support like:

- One choice is close to another choice on the screen and users too easily click the wrong choice.
- Users might lose overview as a result of need to switch between different screens. For example, to fill an intensive care unit template for a patient, user should refer to other screens to get necessary inputs.

The following problems are result of errors in the communication and coordination processes:

- Duplicate drug administration by nurse as a result of skipping on time order entry.
- Users ignore warning messages and skip important warnings from system.

Communication among hospital staff reduces as a result of HIS usage and sometimes hospital operations are disturbed. For example, if a HIS does not have warning facility to physician when a new order is dropped to order list of physicians, when physician enters order for IP consultation from other specialty, since order is

entered through system, he does not call physician from whom he asked consultation. In this case, the patient should wait till the other physician checks his order list from the system.

Hebert (1998) made a study about impact of HIS on hospitals and has exposed some disadvantages of HIS. The result of the study showed that HIS has some negative effects including reduced job satisfaction and less time spent interacting with patients. Most of the clinical staff does not think that information systems make their jobs efficient and they do not like using HIS. As a result of this, job satisfaction of clinical staff is affected negatively with use of HIS. Another affect is on interaction with patient. Most of the physicians complain from losing eye contact with patient at the time of examination since they write some notes on computer.

Implementation Difficulties of Hospital Information Systems

HIS implementation and adaptation in hospitals is more complicated and problematic compared to other information systems implementations in different business areas. System infrastructure design, requirement specification, master data collection and definition, integration with other systems, localization, training, and final system test are the main activities of implementation phase. Hospital processes, which are dynamic and difficult to define, are to be applied in the system. Some departments of hospital such as radiology, nuclear medicine, radiotherapy, laboratory and oncology require specific information systems as a result of non-standardized workflows. These sub systems should be integrated with HIS and also with each other for a comprehensive patient medical record. Since the implementation phase includes many critical activities for having successful system in hospital, it is inevitable to come out with some problems during this time.

One of the main implementation problems arises while determining the actual requirements of hospital, which are subject to change for different workflows and different departments. Missing needs and missing workflow definitions result in big gap between hospital needs and actual HIS functionalities and facilities. Consequently, parties, hospital management and system provider should somehow compensate. Either system provider will meet these new requirements by additional development effort which is not planned at the beginning of the project or hospital management will modify some workflows or skip some requirements of hospital which will result in problems in future. Both options affect successful implementation and are the main problems of this process. The greater the gap between hospitals needs and designed HIS, the greater the risk of failure of HIS.

Addressing each hospital requirement results in system manageability problems. Different end users have different needs and sometimes these needs conflict with each other. For example, some of the physicians want to make some modifications on clinical notes such as service reports that they have filled and saved as signed in system, but some physicians think that signed clinical notes should not be modified as other physician starts medication according to this service report. Also different departments have different needs. If every need of each department is implemented in system, system will back out of standardization. The trajectory of end user led design processes tends to loose direction and momentum due to multitude of different voices pushing the process into different directions to nowhere at all (Berg, 2001).

In running hospital, clinical staff has very limited time for contribution to HIS implementation or in a new constructing hospital, hospital management does not want to recruit clinical staff before hospital starts because of cost issues, therefore

end user contribution is lower during HIS implementation. As a result of insufficient contribution of end users to design process, some parts of the system does not meet end user expectations, such as user interface design of the system, sequence of actions in a flow, format and content of clinical forms etc. However, end users involvement to implementation is much more than negotiating with IT team, talking system needs, making implementation plans and achieving socio-technical fit. Users generally do not know what specific configuration they need, what will be the best flow in actual work and expressing their needs in a proper way. In addition, speaking same language with clinical staff takes time for IT team. They always want to see their needs in system regardless of thinking efficient way of every need. According to one investigation in a hospital, physicians and nurses have been involved in HIS project for designing screens and forms. HIS is only implemented in few wards of hospital. After some time, number of screens and forms were out of control and screens were linked to each other in different ways. (Berg, 2001).

According to studies, to figure out how to be an integrated delivery system and how to integrate independent physician groups (Memel et al. 2001) is an organization challenge during implementation. Most of the organizations have some difficulties to design expected integrated system for hospital, define complete needs of this integrated system, match medical groups with the components of system and also organize necessary medical groups which are independent from each other for working together for the same aim. For instance, a hospital desires to have an integrated system including a HIS to follow up all medical data of patient and an ERP system to handle necessary cost and profit analysis and material management of hospital and another information system for dosage based drug management. All of the systems should be integrated for completing whole cycle of the hospital. The

problem is, to set expectations from each system and decide at which level these systems should be integrated and what are the operations that medical staff will do and which system they should use. For integrity of a hospital workflow, independent medical groups should complete their parts and provide inputs to others to complete remaining parts. Consequently, if organization cannot figure out the integrated system in detail, some problems about HIS will come out during implementation.

Integration of financial systems and external systems to HIS is another implementation problem (Memel et al. 2001). Each party should provide necessary inputs to HIS and to each other, in desired format for a complete integration. For example, some medical systems do not support standardized types of messages for integration such as HL7. In that case, workflows should be defined clearly, each scenario should be thought not to miss some flows and necessary development should be done accordingly to integrate these systems. This might cause some problems such as missing input data and unplanned effort. Another problem of integration is interruption in workflows as a result of problem in one system. In that case, one side cannot generate necessary inputs and feed subsequent system and finally flow of hospital is not completed.

Struggling with the balance between focusing on the bottom line and the focusing on the processes and people that allow us to deliver our services to the community (Memel et al. 2001) is one of the challenges of HIS implementation for hospital management. Hospital management should think every detailed requirement of hospital; define hospital processes and workflows that will be applied in HIS and get expectations and requirements from end users. Every activity is complementary of each other and hospital management should attach importance to each activity at same level.

Another problem is data toxicity (an overload of redundant, inaccurate, uninformative or confusing “facts” leading to incorrect conclusions) (Memel et al. 2001). During implementation, hospital provides master data that will be used for hospital operations such as service names, service centers, service points and appointment slots of services for each staff. Sometimes, this master data is not organized, unnecessary or conflicting. Both removing some definitions and defining new ones in system, or modification of existing ones without removing them from system correct this master data. Both options require additional effort and also correction of master data relevant parts.

Standardization of data definitions, representation, and vocabulary, which is complicated by multiple disparate data sources, is another challenge in implementation (Memel et al. 2001). Since a complete system requires inputs from multiple resources, this data should be standardized for complete understanding. Users of system is not only medical staff but also accounting staff and department secretaries who do not have medical knowledge as much as medical staff of hospital. In that case, same definitions might have different understanding according to different user groups. This situation results in misunderstanding between groups and generates problems during implementation.

Since hospital is an organization, which has different specialties with different processes and different requirements, HIS implementation level is not same within organization for different specialties. One department applies all of its requirements and workflows in HIS, as the other department has still some missing needs in system or integration points with other systems. As a result of this, bringing information systems to same level of implementation across the organization is a problem (Memel et al. 2001) during HIS implementation.

Technical requirements of the system should be planned in implementation stage according to future workload of hospital. According to studies, supporting web-based delivery and the associated growing demands on and network bandwidth (Memel et al. 2001) is a challenge in HIS implementation. It is difficult to foresee the systems and equipments that will be need of hospital in future and demand for hospital from the beginning. For example, a hospital thinks to use only HIS in main hospital and satellite clinic of this hospital during implementation, network bandwidth and equipments are planned accordingly. After some time, hospital purchases PACS (Picture Archive and Communication System) licenses for satellite clinic also which will result in considerable allocation in network bandwidth between hospital and satellite clinic and slowness in hospital operations.

Privacy of patient medical information, security of system and confidentiality of medical records are considerable items during implementation. Security infrastructure of system should be defined clearly, hospital management should set privileges of end users, and HIS should be compatible with standards for patient privacy and medical records confidentiality. If medical record access privilege is assigned to non-medical end users, such as department secretaries, all of the medical record of patient including lab results, clinical notes and reports, medical treatment and such kind of private medical information will be open to department secretaries who do not provide any medical treatment. For instance, psychiatric notes should not be accessible by medical staff except patient's psychiatrist. For that reason, HIS should have medical record access privilege which is privilege based. Otherwise, this will be problem for hospital staff and management.

Security is an inevitable must for a hospital that uses computer systems for its operations. Protecting system from external attacks and keeping privacy of patient

medical information by controlling access to system are some precautions of hospital for security. However, security should be balanced with easy access to system. Otherwise, users will have difficulties to reach patient information, and finally to use system. For example, using firewall might cause slowness in HIS or multiple checks before seeing patient medical record increases the time of retrieving data.

Physicians have critical role in HIS implementation, since they are supposed to provide input to system and mostly they need outputs from system to perform daily operations in hospital. However, physicians refuse to seek information in the computer system "because that is not his task" (Ash et al. 2004). Physician resistance to system increase the HIS learning time of physicians and this result in wrong or missing data in system and finally problems in hospital operations during implementation. For example, hence physician does not enter laboratory orders of patient into system after patient admission, nurse cannot collect sample for patient, because, she is supposed to see order, generate barcode for sample from system and stick barcode on collected sample. If she collects sample and send to laboratory without barcode, the remaining part of the flow will be disturbed. Another observation about physician resistance to system is that physicians are very protective of their time. Anything that takes more time and is not viewed as efficient will not only be resisted but avoided entirely in future. For example, Emergency Department (ED) physicians in University of Virginia Health Sciences center, agreed to use an automated system for department's grease board, since they have realized time saving (Hard, 1992). Hard (1992) also explains one opinion about physician resistance as, "there are exceptions, but younger physicians tend to be more computer and technologically oriented and tend to be more demanding on the computer staff".

Training methodology for physicians is another reason for resistance. Physicians prefer individual trainings in live environment to group trainings of system in a simulated test environment. They know the patients, diagnoses and apply actual scenario to system, which will bring more benefit to physicians.

One of the main problem areas of HIS implementation is related to end user training issues. Hospital organization and HIS implementation project managers should plan duration, content and methodology of end user training according to end user profiles. Sometimes, healthcare delivery organization cuts training programs for a new HIS for budgetary reasons (Ash et al. 2004). Practice sessions of training is not handled, system functionalities are explained briefly, end users could not apply hospital workflows to system and ask questions about system during training as a result of training cut off by organization. This means that end users will learn some facilities and functionalities after hospital starts to use system, and problems during implementation will be inevitable.

Hermann Hospital has also experienced problems in identifying training plan for different groups (Tonnesen et al. 1999) during their HIS implementation. System end users had different computer skills. They did not achieve to define current computer skills of end users. For that reason, some of the users needed basic computer skills training. Additionally, different end user groups use different modules of system. Hospital management had to plan responsibilities and privileges of end users and trainings accordingly. Another problem in Hermann Hospital was finding time in a business for training. Since, hospital operations were going on during implementations, system end users could not find time for trainings. So they needed ongoing training after initial deployment and training.

According to studies, the failure of healthcare to realize the full potential of IT, highlighted by the Institute of Medicine (IOM) in its recent reports on healthcare safety and quality can be attributed in part to failure in user education (Ball, 2003). User training should not only explain the system facilities and functionalities but also aim of HIS usage, gains provided by integrated systems, ease of use in hospital workflows, efficiency in hospital operations should be explained to end users during training. End users should understand that HIS usage is not a job assigned by hospital management; it is an actual need of every hospital.

Hermann Hospital is one of the examples of HIS implemented hospitals. They have implemented a clinical information system for an integrated medical care delivery system. During implementation, they have encountered some problems. According to Hermann implementation team, problems are grouped into different categories: (Tonnesen et al. 1999)

1. Shifting administrative priorities: The distant locations and number of offices resulted in large amounts of rework.
2. Software Immaturity: Hospital could not find some needs in system during implementation and product documentation was inadequate to operate independently from vendor.
3. Software-hardware mismatches (response time): As a result of unorganized database architecture, retrieving data from database took too much time.
4. Resource deployment: Some of the activities delayed as a result of difficulty of recruiting qualified people in market and system end users could not contribute to project when they were needed.
5. Physician order entry: The order entry system was not physician centric.

6. Client server related problems: It was difficult to install a new release or patch to end users' machines. Some machines could be skipped during installation.
7. Help desk and support issues: As a result of weaknesses in training, need of help desk increased after end users started to use the system.
8. Security: Users and administrators were universally concerned about data loss.

Mostly, hospitals do not analyze HIS implementation phases of other hospitals and read articles and case studies related to implementation, before they start to implement their systems. They are not aware of potential problems and for that reason there is no chance for them to take necessary precautions for minimizing difficulties in implementation. Meanwhile, referring to other implementation projects and case studies would also minimize problems after starting implementation for elimination of some existing problems. But again, most of the hospitals ignore this kind of solutions and try to find solutions within their organization.

HIS implementation requires a good cooperation between process owners of hospital and service providers. Every activity of implementation should be planned very carefully, risk assessment and alternative plans should be considered, workflows should be defined very clearly, master data should be prepared very carefully to avoid mass data, resources should be planned in detail, and milestones of the implementation should be set. Otherwise, implementation time increases which results in high costs, end user problems, and interruption of hospital operations. However, foreseeing implementation plan and making necessary timings and arrangements are not so easy and most of the time delay in completing HIS implementation is not inevitable.

Implementation of an information system in an organization involves the mutual transformation of the organization by the technology and of the system by the organization (Berg, 2001). Information systems projects in healthcare change social interactions, communication among process owners, cooperation and decision-making. For that reason HIS implementation project will influence organizational structure, defined processes of hospital, communication and cooperation among end users and also assigned tasks to clinical staff. For example, electronic patient records change the recording practices of physicians and privileges of accessing medical record will come out. Another example, some groups will access to other group's information resources, such as seeing orders and appointments of other departments, or some tasks will be handled automatically by system and staff needed for this task will disappear and finally decreasing need of personnel will result in changes in organization hierarchy of hospital. As a result of these essential changes, hospital management, who decides to have HIS and is the owner of HIS project, might have difficulties to deal with reactions from clinical and administrative staff, modifications in workflows and defining procedures of hospital. Most of the time, process owners will resist using new system; have difficulties to adapt to new workflows, processes, work definitions and new responsibilities. Such organizational processes also affect system itself. In some cases, new facilities and functionalities are added to HIS which in turn will take too much time. For example, in HIS implementation of Netherlands mental health hospital, discussion of patient rights resulted in definition of 25 new authorization levels.

According to a study by Wetzel (2001), if HIS usage is not primarily directed by administrative purposes, HIS development will result in the selection and integration of variety of specialized systems supporting distinct medical disciplines.

For instance, if hospital management does not plan to use HIS for improving hospital quality and patient pleasure, generating some reports to control hospital productivity, profitability, medical staff and quality of medications, HIS will not realize its actual aims and work in a productive way. For that reason, when hospital management decides to have HIS, they should not skip administrative needs of hospital and should include them in the scope of new system.

Inadequate design of HIS including performance problems, useless user interface, and problems in technology, increase the difficulties of HIS implementation. For example, if physicians do some of their activities from various menus, which do not have link to each other, this will cause problems for physicians. They will be confused of using system; resist to use system and system usage will decrease.

HIS brings technology to hospitals. This sometimes becomes problematic since; some of the hospitals see HIS as a technological improvement, instead of seeing HIS as an organizational development resulted from technology and end user contribution. In this case, end user resistance starts and organization cannot realize the actual benefits of HIS. Physicians perceive HIS as a magic stick, which makes everything easier and faster without their input. They expect system to sense what they think and warn them accordingly. For example, a private hospital started to implement a physician order entry system. In this system, if patient will be admitted, physician is supposed to place admission request for patient and in admission request they should order surgery. However, most of the physicians got used to place surgery orders for outpatients directly, instead of giving admission request for surgery orders. Since they see HIS as a technology, which is capable of doing everything that they cannot imagine, they expected system to understand whether patient will be admitted

or not. If patient will be admitted, system should force physician to place admission request. Mostly, end users cannot find what they expect from system in actual usage of HIS because of different perception of HIS.

To prevent implementation difficulties of HIS, recommendations stated in previous studies are as follows:

- Needs and expectations of stakeholders should be understood and planning should be started accordingly (Memel et al. 2001).
- Experiences in other HIS implementation projects should be utilized. Their methodology, pain areas, achievement or failure reasons of project, needs, workflow should be always kept in mind. Interdepartmental cooperation needs standardization. Common needs of different departments should be standardized to keep integrity of the system. (Memel et al. 2001).
- There should be always a balance between organizational targets and regional needs. Some of the organizational targets do not match regional and governmental needs. (Memel et al. 2001).
- IT education of end users is essential for a successful HIS implementation. This should include continuing education of physicians, nurses and department secretaries. Training should link information systems to actual clinical scenario. (Ash et al. 2004)
- Physicians' resistance should be overcome by following the below techniques (Hard, 1992):
    - Do not mandate physicians to use system. This will increase the level of resistance to system
    - Encourage physicians to use system for inquiring result reporting, and patient information instead of order entry.

- Provide personal computer lounge of physician.
- Devote one person for one by one training of physicians.
- Loan a personal computer dedicated for accessing HIS to any physician wanting access.
- Provide access to medical databases for physicians.
- Provide print outs of list of inpatients with their locations or other lists from system that will be useful to physicians.

- Involving users in the implementation process and providing features of benefit to them, such as time saving measures like specialty specific order sets, widespread implementation across the organization, and engaging the clinical leadership, are the most important keys to success (Hersh, 2002). Hospital organization should focus on creating a collective willingness to change along participation of end users.
- Some simple issues such as how computers and mobile devices will be employed, integration of these devices with surgical systems, how teams will share computers, place of computers in hospital, type of monitors should also be planned effectively during HIS implementation. (Memel et al. 2001).

CHAPTER 3

RESEARCH METHODOLOGY

As indicated in literature survey, many problems may be faced during implementation of HIS projects due to various reasons and if those reasons can not be identified and/or cannot be avoided, most of the projects may fail. The objective of this study was to determine the possible implementation difficulties of HIS projects together with their reasons and then give some recommendations to overcome these difficulties to guide other hospitals and HIS solution provider companies.

Choice of Organization

The survey was conducted in a private hospital in Turkey that was established in 2005 with the aim of providing highly qualified health services. This private hospital belongs to a foundation, which was established 25 years ago and has completed over 40 projects such as hospitals, health offices, schools, dormitory buildings, and sports complexes. The reason for choosing this hospital was that it has passed through the all necessary steps for implementing a HIS.

In mid 2003, hospital management started to search for a HIS which would meet the complete hospital requirements including clinical and back office procedures. They prepared Request for Proposal (RFP) to define their needs. Candidate HIS provider companies responded to this RFP and gave their offers to hospital management. Hospital management made an assessment for HIS provider companies using the functionality, company profile, hardware, deployment and

training, price and general cost criteria. Each company was scored as low, medium and high for each criterion. After this assessment, hospital management selected one HIS solution provider which is an international company providing both medical and other industrial solutions.

The project started with the Kick-off meeting. HIS project team consisted of six clinical information systems specialists (three members from HIS solution provider company and three of them were from hospital information systems team) and two project managers (one is from HIS solution provider company and one from hospital).

The first step of the project was requirement analysis part. There were two teams involved in this step: hospital team and HIS solution provider company team. Hospital team consisted of the nursing director, chief operational officer, hospital project manager and clinical information systems specialists. HIS solution provider company team consisted of clinical information systems specialists, project manager and also consultants from foreign countries in which the system was being developed. When hospital team and solution provider company team went over the RFP document, it was seen that there were a lot of new requirements to be included in RFP document such as new functions, new facilities, and localization issues. After the update of the RFP document according to the new requirements, a new scope document was prepared which lead to some updates on HIS software. After the update of the software with new functionalities and localized functions, testing was done to verify the presence of new requirements in system and also for reporting the bugs in system. After these activities the system was ready to use.

During implementation, the project team also worked together with the end users to collect the master data from hospital management. After collecting master

data from end users, project team checked the validity of the master data and uploaded them to live database.

Project team also took place in the study of integration of HIS to other departmental information systems such as Enterprise Resource Planning System (SAP), Radiology Information System (RIS), Picture Archiving and Communication Systems (PACS), Radio Therapy Information System, Dosage Based Drug Management System (PYXIS), Smart Cards, EPBX.

Training was one of the important issues of the implementation. Trainings were planned both for core team, consisting of nurses, physicians and department secretaries, and also for the other end users. First, hospital core team was trained, the aim of this activity was to get their help in end user trainings, decide on scenario that would be applied in training sessions and also get first impression about the software. Each training session was five half days. The first three days of the training sessions were theoretical training and the last two days of the training were hand out sessions in which end users applied actual clinical workflows in system. The other end users also had similar training after education of core team. Hospital master data was used in trainings to make end users familiar with the hospital master data. The training sessions did not cover to train all of the current end users since they had not been recruited at that time.

After one year from the start of the implementation, hospital was opened to service and system was started to be used. Project team provided two months support for the system. Each member was assigned to one location in hospital and helped to end users in their responsible location.

Preparation and Administration of the Questionnaire

In order to be able to prepare a functional questionnaire for the survey, interviews were made with Chief Executive Officer (CEO), Chief Information Officer (CIO), Chief Operational Officer (COO) and manager of patient relations. The aim of these interviews were to collect information about history of the hospital and the project, to find out the observed HIS implementation difficulties observed by hospital managers and the precautions they applied to prevent perceived difficulties together with their previous experiences.

The technique of observation was also used as data collection for the preparation of the questionnaire. The aim was to understand the end users' resistance and/or acceptance of the installed HIS.

Under the guidelines of literature survey, interviews and observations, an initial questionnaire was developed. This questionnaire was applied as a pilot study to 2 nurses, 2 physicians and 1 department secretary. The final questionnaire (Appendix A), which was prepared by modifying the initial one, included 71 questions of which 6 were open ended. The first 5 questions of the questionnaire were related to demographic properties of the respondents. 56 of the questions were prepared following the below group headings as potential causes of HIS implementation difficulties but ordered in different sequence in the questionnaire to avoid halo effect and there were different number of questions under each group heading as given below:

- Organization (7 questions): Aims to find out the difficulties arising from organizational issues such as communication with management and attitudes of hospital management.

- Software (8 questions): Aims to find out the difficulties arising from software related issues such as software flexibility and software usability.
- Hardware (3 questions): Aims to find out the difficulties arising from hardware related issues such as the location and speed of computers.
- End user profile (10 questions): Aims to find out the difficulties arising from profile of end users such as the computer skills and clinical system usage experience of end users. There are two sub groups under end user profile heading: end user profile general computer skills and end user profile clinical system experience.
- Integration (4 questions): Aims to find out the difficulties arising from integration related issues such as conceptual design of integration and performance problems resulted from integration.
- Security (2 questions): Aims to find out the difficulties arising from security issues such as data loss in software.
- Planning (4 questions): Aims to find out the difficulties arising from planning issues such as planning project organization and master data collection.
- Workflow (5 questions): Aims to find out the difficulties arising from workflow issues such as different workflows in different hospital departments.
- Support (3 questions): Aims to find out the difficulties arising from support issues such as methodology and sufficiency of end user support
- Training (5 questions): Aims to find out the difficulties arising from training issues such as methodology and duration of training.

- Solution Provider (5 questions): Aims to find out the difficulties arising from solution provider such as organization of solution provider company and sufficiency of solution provider consultants.

All of the above questions except end user profile group were 5-point Likert scale (5: Strongly agree, 1: Strongly disagree). End user profile group questions were Yes or No questions. Rest of the questions, of which 2 were open ended and 8 were ordinal scale, were general questions related to computer usage and HIS implementation.

The survey was conducted in spring of 2005 by means of applying the final questionnaire to the end users of the hospital. The questionnaire was delivered to all of the HIS users with a population of 206 manually in closed envelopes. 112 questionnaires were returned, indicating a response rate of 54%. The composition of the population according to their occupations is presented the Table 1.

Table 1. Occupations of the Population (N=206)

Occupation	Given Frequency
Physician	73
Nurse	79
Department Secretary	40
Technician	7
Management Staff	3
Pharmacist	4
Not Specified	-

Data Analysis Approach

After collecting the questionnaires from end users, collected data was entered to SPSS for further statistical analysis. The following analyses were applied to the data groups;

- Descriptive Statistics for demographic characteristics of the respondents
- Factor Analysis for set of questions under each group, and the descriptive statistics for redefined variables of each group.

- ANOVA Analysis for redefined variables of each group versus demographic characteristics of the respondents.

CHAPTER 4

RESULTS

Statistical Results

Demographic Characteristics

Demographic information about the 112 respondents is given in Table 2.

Table 2. Demographic Characteristics of the Respondents (n=112)

Property	Frequency
Occupation	
Physician	36
Nurse	40
Department Secretary	19
Technician	7
Management Staff	2
Pharmacists	0
Not Specified	8
Gender	
Female	76
Male	34
Not Specified	2
Age Group	
Less than 25	15
25-34	61
35-44	16
More than 44	11
Not Specified	9
Education Level	
High School Graduate	16
Associate Degree	18
Bachelor's Degree	42
Master's Degree (MS, MA, MD-Residency)	29
PhD Degree	5
Not Specified	2

As illustrated in Table 2, most of the end users who replied the questionnaire were nurses and physicians. Related to gender split, the 67% of end users were females,

and 30% were males. In terms of age, there were a considerably higher percentage of younger people, with 67.9% lower than 35 years old. The level of education was high. Out of 112 respondents, 94 of them (83.9%) were university graduates.

Table 3 shows the gender of respondents according to each occupation. As illustrated in Table 3, 63% of physicians were males and 84% of department secretaries were females.

Table 3. End Users' Occupation versus Gender

Occupation	Female	Male
Physician	13	23
Nurse	40	0
Department Secretary	16	3
Technician	2	5
Management Staff	0	2

Table 4 shows the age group of end users for each occupation. 80% of nurses were within the age group of 25 to 35 whereas all department secretaries were below 35.

Table 4. End Users' Occupation versus Age Group

Occupation	Less than 25	25-34	35-44	More than 44	Not Specified
Physician	0	11	15	10	0
Nurse	5	32	0	0	3
Department Secretary	9	10	0	0	0
Technician	1	4	1	1	0
Management Staff	0	2	0	0	0

Table 5 shows the education level of respondents for each occupation. The results show that most of the nurses had bachelor's degree where most of the physicians had residency.

Table 5. End Users' Occupation versus Education Level

Occupation	High School Graduate	Associate Degree	Bachelor's Degree	Master's Degree	PhD Degree	Not Specified
Physician	0	0	11	20	5	0
Nurse	7	8	21	4	0	0
Department Secretary	7	7	4	0	0	1
Technician	1	2	3	1	0	0
Management Staff	0	0	0	2	0	0

Factor Analyses

Factor analysis was applied to each of the groups in the questionnaire besides demographic characteristics. As a result, variables of each group were redefined dropping the total number of variables under these groups from 56 to 22.

Related to Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO value), if KMO value is greater than 0.5 and significance is 0.00 then the results of a factor analysis can be accepted as valid.

KMO values and total variance explained for each group, given in Table 6, indicate that the factor analyses are valid for all of them. The rotated component matrix values of the analyses are given in Appendix B.

Table 6. KMO Values and Total Variance Explained for Questionnaire Groups

Group	KMO Value	Total Variance Explained (%)
Organization	0.595	72.8
Software Features	0.862	68.5
Hardware	0.604	59.5
End User Profile		
Clinical System Experience	0.657	66.1
General Computer Skills	0.733	59.8
Integration	0.561	85.1
Security	0.500	64.3
Planning	0.661	76.6
Workflow	0.554	66.3
Support	0.500	50.6
Training	0.558	65.6
Solution Provider	0.731	51.8

Factor Analysis for Organization

For the group of 7 questions that measure whether organization impacted HIS implementation or not, the items listed below show the redefined variables and their related questions.

1. Communication between management and HIS end users was sufficient
    a. Management orients end users correctly,
    b. Management informs end users about decisions and hospital workflows

c. Hospital management takes end users into consideration about implementation difficulties

d. Hospital workflows and HIS workflows are harmonious

2. Contribution of end users to HIS implementation project was sufficient

    a. Hospital management took end users' opinion on selection of HIS

    b. Users participated requirement analysis studies

3. Being a new hospital had no unconstructive effect on implementation.

    a. Being a new hospital had no unconstructive effect on implementation.

Factor Analysis for Software Features

For the group of 8 questions that measure whether software features impacted HIS implementation or not, the items listed below show the redefined variables and their related questions.

1. Usability issues in software did not cause any difficulty

    a. Menu of HIS is explanatory and leading.

    b. Language of HIS is simple and understandable.

    c. The usage of HIS is very easy.

    d. I am happy with HIS

2. Manipulation of medical data and workflows in software was sufficient

    a. HIS provides fast and on time information.

    b. The data in HIS is accurate

    c. HIS provides data integrity.

    d. HIS meets workflow needs.

Factor Analysis for Hardware

For the group of 3 questions that measure whether hardware impacted HIS implementation or not, the only redefined variable and its related questions are given below.

1. Hardware related issues in HIS implementation did not cause any difficulty
    a. The layout of the computers is appropriate for HIS usage
    b. The number of computers is sufficient for HIS usage
    c. The speed of computers is sufficient for HIS usage

Factor Analysis for End User Profile

There comes out totally 13 items to measure whether end user profile impacted HIS implementation or not. 10 of them are the items asked directly in the questionnaire and 3 of them are the items derived from the "Other" item.

However, some of the questions are directly related to clinical system usage experience of end users whereas the other set is directly related to general computer usage of end users. For that reason, factor analysis was applied to two different question sets.

For the first factor analysis which was applied to clinical system usage related questions, the items listed below show the redefined variables and their related questions.

1. Primary computer usage for patient activities
    a. Entering Patient Data
    b. Patient data/result viewing
    c. Ordering (service, drug, blood, diet)
2. Advanced computer usage for patient activities
    a. Patient result reporting

b. HIS

For the second factor analysis which was applied to general computer usage experience related questions, the items listed below show the redefined variables and their related questions.

1. General computer usage experience
    a. Writing
    b. Mailing
    c. Internet Usage
2. Computer usage for presentation purpose
    a. Presentation preparation
3. Computer usage tendency
    a. Do you have your own computer?
    b. Have you ever gone to computer course?
    c. Office usage

Factor Analysis for Integration

For the group of 4 questions that measure whether integration impacted HIS implementation or not, the items listed below show the redefined variables and their related questions.

1. Integrated systems reduced time of work
    a. Working with integrated systems reduces work time.
    b. Using different systems as integrated make works faster.
2. Using different systems together did not cause difficulties
    a. Different terminologies used in different systems caused no difficulty
    b. No difficulty is faced due to complexity of different workflows of different systems

Factor Analysis for Security

For the group of 2 questions that measure whether security related issues impacted HIS implementation or not, the only redefined variable and its related questions are given below.

1. Security related issues in HIS implementation did not cause difficulties
    a. There are no data loss problems in HIS
    b. Every document is kept in HIS

Factor Analysis for Planning

For the group of 4 questions that measure whether planning issues impacted HIS implementation or not, the items listed below show the redefined variables and their related questions.

1. HIS master data, workflow and support were planned sufficiently.
    a. Hospital master data met hospital needs
    b. End user support has been planned well.
    c. Hospital workflows have been planned well in HIS.
2. Starting to use HIS just after the hospital opening did not cause difficulties.
    a. Starting to use HIS just after the hospital opening did not cause difficulties

Factor Analysis for Workflow

For the group of 5 questions that measure whether workflow issues impacted HIS implementation or not, the items listed below show the redefined variables and their related questions.

1. HIS was sufficient on workflows
    a. HIS workflows make hospital workflows simple.

b. System has flexible workflows.

c. Legal workflows are compatible with HIS workflows.

2. Undefined hospital workflows and inconsistency among different department workflows had no unconstructive effect on implementation.

    a. Applying different workflows of different departments was not difficult.

    b. Undefined hospital workflows had no unconstructive effect on implementation

Factor Analysis for Support

For the group of 3 questions that measure whether support issues impacted HIS implementation or not, the only redefined variable and its related questions are given below.

1. End user support was sufficient

    a. Getting support for HIS usage decreased working time.

    b. Knowing availability of a support person decreased the time of learning.

    c. The end user support was sufficient

Factor Analysis for Training

For the group of 5 questions that measure whether training issues impacted HIS implementation or not, the items listed below show the redefined variables and their related questions

1. Content, methodology and scheduling of training were sufficient

    a. The methodology and content of training were sufficient.

b. Long time between training and hospital go-live decreased the implementation problems.

2. End user participation and duration of training were sufficient
    a. The contribution of end users to trainings was sufficient.
    b. End users preferred to learn HIS in training instead of live system
    c. The duration of trainings was sufficient.

Factor Analysis for Solution Provider

For the group of 5 questions that measure whether solution provider impacted HIS implementation or not, the only redefined variable and its related questions are given below.

1. HIS Solution Provider was sufficient in HIS application.
    a. Consultants could produce on time solutions
    b. The solution provider company is well organized
    c. The lack of medical knowledge of consultants did not result in any difficulties to explain requirements
    d. Consultants have knowledge of HIS
    e. Presence of foreign consultant did not increase the number of difficulties.

Descriptive Statistics

Tables 7 and 8 show the descriptive values of resulting variables of each group items. Names of the redefined variables, mean, maximum and minimum values of each group and its variables, calculated on the basis of their corresponding original variables, are illustrated in the tables. Mean values, less than 3 in Table 7 show

unsatisfied responses and are evaluated as implementation difficulties in this HIS project. As given in Table 8, end user profile group has two different maximum

Table 7. Descriptive Statistics

	5:Strongly agree, 1:Strongly disagree		
	Mean	Minimum	Maximum
ORGANIZATION	2.41	1.42	4.33
Communication between management and HIS end users was sufficient	3.47	1.00	5.00
Contribution of end users to HIS implementation project was sufficient	1.65	1.00	4.00
Being a new hospital had no unconstructive effect on implementation.	2.10	1.00	5.00
WORKFLOW	2.71	1.42	4.17
HIS was sufficient on workflows	3.03	1.00	4.67
Undefined hospital workflows and inconsistency among different department workflows had no unconstructive effect on implementation	2.39	1.00	4.00
TRAINING	2.84	1.33	4.17
Content, methodology and scheduling of training were sufficient	2.60	1.00	4.50
End user participation and duration of training were sufficient	3.08	1.33	5.00
INTEGRATION	2.85	1.00	5.00
Integrated systems reduced time of work	3.08	1.00	5.00
Using different systems together did not cause difficulties	2.61	1.00	4.50
SECURITY	3.02	1.00	5.00
Security related issues in HIS implementation did not cause difficulties	3.02	1.00	5.00
PLANNING	3.14	1.50	5.00
HIS master data, workflow and support were planned sufficiently	3.17	1.00	5.00
Starting to use HIS just after the hospital opening did not cause difficulties.	3.11	1.00	5.00
SOFTWARE	3.19	1.13	5.00
Usability issues in software did not cause any difficulty	3.00	1.00	5.00
Manipulation of medical data and workflows in software was sufficient	3.35	1.25	5.00
SOLUTION PROVIDER	3.37	1.20	4.80
HIS Solution Provider was sufficient in HIS application.	3.37	1.20	4.80
SUPPORT	3.49	2.00	5.00
End user support was sufficient	3.49	2.00	5.00
HARDWARE	3.80	1.33	5.00
Hardware related issues in HIS implementation did not cause any difficulty	3.80	1.33	5.00

Table 8. Descriptive Statistics for End User Profile

END USER PROFILE	Mean	Minimum	Maximum
End User Profile General Computer Skills	0.45	0.00	0.89
General computer usage experience	0.84	0.00	1.00
Computer usage for presentation purpose	0.46	0.00	1.00
Computer usage tendency	0.06	0.00	1.00
End User Profile Clinical System Experience	0.82	0.00	2.00
Primary computer usage for patient activities	1.08	0.00	2.00
Advanced computer usage for patient activities	0.56	0.00	2.00

values for different sets; 1 is maximum value and indicates satisfied responses for general computer skills set whereas 2 is maximum value and indicates satisfied responses for clinical system experience of end users set. Zero is minimum value and indicates unsatisfied responses for both groups.

Descriptive statistics show that issues related to five groups have caused the main difficulties in this HIS project. Those groups are;

- Organization
- Workflow
- Training
- Integration
- End User Profile

A focus on the results of descriptive analysis introduces the following outcomes:

- The mean value of "Organization" group, which is 2.412, indicates that organizational issues are some of the main reasons of difficulties in this HIS implementation. The mean values of the group variables indicate that users disagree the sufficiency of end user contribution to HIS implementation (μ= 1.652) and a new hospital is another problem in this HIS implementation (μ= 2.107) but there is an acceptable satisfaction of end users with the level of communication with management (μ=3.478).

- The mean value of "Workflow" group, which is 2.713, indicates that workflow related issues have caused difficulties in this implementation. The mean values of the group variables indicate that HIS is almost sufficient on workflows (μ=3.031) but different workflows in different departments have made standardization difficult and caused difficulties (μ=2.395).
- The mean value of "Training" group, which is 2.847, means that training issues are reasons of difficulties in this implementation. The mean values of the group variables indicate that content, methodology and scheduling of training have not been sufficient (μ=2.609) but according to end users, the contribution of the end users to trainings and duration of trainings have been sufficient and end users wanted to learn during trainings instead of learning after go live (μ=3.085).
- The mean value of "Integration" group, which is 2.85, indicates that integration issues have caused difficulties in this study. The mean values of the group variables indicate that end users believe that working with integrated systems reduce working time and enables to do jobs in a faster way (μ=3.083) and end users have had difficulties on using different systems as integrated due to learning different systems and terminology (μ=2.610).
- The mean value of "Security" group, which is 3.023, indicates that end users are comfortable with security issues of system. The analysis shows that they do not have problems such as data loss or inaccurate data in system and they agree that there is no need to keep some documents both in system and out of system since the system is sufficient to keep data secure and without any loss.
- The mean value of "Planning" group, which is 3.141, indicates that planning issues did not cause any difficulties in this HIS project. The mean values of

the group variables show that end users agree that hospital processes are well defined in HIS and end user support has been planned well (μ=3.179) and they agree that starting to use HIS just after hospital caused no difficulties (μ=3.111).

- The mean value of "Software" group is 3.190 meaning that software issues are not the sources of difficulties in this implementation. The mean values of the group variables indicate that users are happy with the usability issues of the system such as menu design of system, language of system, and ease of use (μ=3.007) and end users agree that HIS provides accurate, fast and on time information as well as data integrity and meets workflow needs of hospital (μ=3.355).
- The mean value of "Solution Provider" group is 3.371 meaning that end users are happy with the solution provider in this HIS project. The results show that HIS consultants had sufficient clinical knowledge to discuss with clinical staff and to understand requirements of clinical end users and also they knew HIS very well, explained each detail and provided on time solutions for problems.
- The mean value of "Support" group, which is 3.492, indicates that support of end users is organized well and it has no disturbance effect on end users' activities.
- The mean value of "Hardware" group is 3.809. This indicates that end users are happy with the hardware related issues such as layout of and number of computers in hospital for HIS usage, and sufficient speed of computers which do not interrupt HIS activities according to end users.

- The mean value of "End user profile general computer skills" (μ=0.455), which is less than 0.50, indicates that general computer skills of end users is one of the main reasons of difficulties in this HIS implementation. The mean values of the group variables indicate that end users have experience on mailing, writing and internet usage (μ=0.844), most of the end users do not use computer with the aim of presentation preparation (μ=0.467) and finally end users do not have computer usage tendency (μ=0.063). The mean value of "End user profile clinical system experience" (μ=0.820), which is less than 1, indicates that lack of clinical system experience of end users have caused difficulties. The mean values of the group variables indicate that end users have used computers, but not the systems, for patient activities such as saving patient data and scheduling (μ=1.087) but end users are not familiar using HIS and do not use computers for reporting purposes (μ=0.563).

For 7 of the 8 non-grouped questions descriptive statistics are given in Table 9.

Table 9. Descriptive Statistics for Non-grouped Questions

	Never: 5, Everyday: 1		
Non-group Questions	Mean	Minimum	Maximum
How often did you have problems in HIS?	2.46	1.00	4.00
How often did you have problems in issues which are not related to HIS?	3.04	1.00	5.00
How often do you use computers?	1.54	1.00	5.00
How often did you have problems as a result of working with integrated systems?	3.03	1.00	5.00
How often did you have problems in transmitting data between integrated systems?	3.14	1.00	5.00
How often HIS provides wrong data?	3.66	1.00	5.00
How often did you need support for HIS?	2.46	1.00	5.00

From Table 9, it can be concluded that:

- End users had problems with the system a few times in a week and they needed to get support from implementation team (μ=2.460).

- End users had other kinds of problems such as printer, network problems a few times in a month. This did not cause any problem since the frequency of this kind of problems is normal for every implementation (μ=3.040).
- End users were using computers a few times in a week which indicates the familiarity of end users to computers (μ=1.54).
- End users had integration relevant problems a few times in a month (μ=3.030).
- End users had data transmission problems a few times in a month (μ=3.140).
- Retrieving inaccurate data from HIS was very rare and HIS was capable of keeping data accurately (μ=3.660).
- End users needed support for HIS a few times in a week (μ=2.460).

Apart from the above statistics, the result of the last general question shows that the level of end users' computer usage skills was sufficient.

End users also asserted their opinions about the system in open ended questions during the study. They pointed out the difficulties and their satisfactions in these open ended questions. These comments show that 27 of 112 (24%) end users had usability problems with the system. However, this cannot be accepted as a main difficulty in implementation, because questions related to "Software" did not support that as can be seen in Table 7. From 11 end users, 8 of them (7%) agree that system was slow, 3 of 112 (2%) end users agree that the duration of the training was insufficient and lack of system functionality caused difficulties. 4 of 112 (3.5%) end users emphasized that they were happy with the HIS and 6 of 112 (5%) end users also emphasized that they were very happy with the support.

ANOVA Analyses

ANOVA analysis is applied to all of the variables for each group to find out if there are any differences according to demographic characteristics of the end users. In ANOVA analysis the significance level is set as 10% (0. 1). If the lower significance level is less than 0.1 it is accepted that there is a significant difference for that variable according to that demographic characteristic.

In the following sections, only the significant results are discussed for each demographic characteristic.

ANOVA Analysis for Age

Table 10. ANOVA Analysis for Age Group

		MEAN			
	Significance	Less than 25	25-34	35-44	More than 44
Contribution of end users to HIS implementation project was sufficient	0.056	1.63	1.77	1.75	1.09
Usability issues in software did not cause any difficulty	0.014	3.05	3.17	2.71	2.31
Manipulation of medical data and workflows in software was sufficient	0.059	3.3	3.48	3.31	2.86
Computer Usage for presentation purpose	0.000	0.01	0.01	0.06	0.36
Computer usage tendency	0.015	0.31	0.45	0.60	0.51
Advanced computer usage for patient activities	0.016	0.66	0.67	0.18	0.45
Integrated systems reduced time of work	0.007	3.03	3.27	3.06	2.20
HIS master data, workflow and support were planned sufficiently	0.066	3.53	3.23	3.04	2.75
HIS was sufficient on workflows	0.041	3.11	3.18	2.68	2.69
Content, methodology and scheduling of training were sufficient	0.053	2.83	2.38	2.78	3.04
HIS Solution Provider was sufficient in HIS application	0.055	3.57	3.44	3.35	2.87
How often did you have problems in HIS?	0.013	2.07	2.79	2.25	2.00

From Table 10, where results of ANOVA analysis applied for 4 different age groups are given, it can be observed that:

- End users, who were elder than 44, were on the extreme agreement level compared to other groups for the following issues;

    - They were the most dissatisfied group with the contribution of end users to HIS implementation, usability of software, manipulation of medical data and workflows, the time reduction of integrated systems, the planning of HIS master data, workflow and support, and the HIS solution provider.
    - They had problems in HIS most frequently.
    - They had the highest experience on usage of computers for presentation purpose.
    - They were the most satisfied group with the training issues.
- End users who were younger than 25 had the least computer usage tendency, but were the most satisfied group with the planning of HIS master data, workflow and support.
- End users who were within the age group of 35 to 44 had the least experience on advanced computer usage for patient activities but they had the most computer usage tendency.
- End users who were elder than 34 did not agree that HIS was sufficient on workflows.
- End users who were younger than 35 had the least experience on computer usage for presentation purposes, but had the most experience on advanced computer usage for patient activities.
- End users who were within the age group of 25 to 34 were on the extreme agreement level compared to other groups for the following issues;
    - They were the most satisfied group with the contribution of end users to HIS implementation, usability of software, manipulation of medical

data and workflows, time reduction of integrated systems, workflows on HIS, and solution provider.

- They were the most dissatisfied group with the training issues.

ANOVA Analysis for Gender

Table 11. ANOVA Analysis for Gender

		MEAN	
	Significance	**FEMALE**	**MALE**
Usability issues in software did not cause any difficulty	0.003	3.19	2.64
Hardware related issues in HIS implementation did not cause any difficulty	0.008	3.68	4.09
Integrated systems reduced time of work	0.015	3.25	2.78
HIS was sufficient on workflows	0.050	3.13	2.82
Content, methodology and scheduling of training were sufficient	0.002	2.42	3.00
How often did you have problems in issues which are not related to HIS?	0.085	2.910	3.340
How often do you use computers?	0.099	1.660	1.300

From Table 11, where results of ANOVA analysis applied for gender are given, it can be observed that males were less satisfied with the usability of software, time reduction of integrated systems, and HIS sufficiency on workflows whereas females were less satisfied with the training issues and had more problems in HIS when compared with each other. Also males were the most satisfied group with hardware related issues and used computers more frequently.

ANOVA Analysis for Education

Table 12. ANOVA Analysis for Education

		Mean				
	Significance	High School Graduate	Associate Degree	Bachelor's Degree	Master's Degree	PhD Degree
Communication between management and HIS end users was sufficient	0.080	3.813	3.903	3.393	3.302	3.050
Usability issues in software did not cause	0.046	3.217	3.417	3.030	2.638	2.900

any difficulty						
General computer usage experience	0.006	0.583	0.870	0.881	0.905	1.000
Computer usage tendency	0.030	0.354	0.370	0.452	0.586	0.667
Primary computer usage for patient activities	0.098	0.833	1.444	1.111	0.905	1.333
Security related issues in HIS implementation did not cause difficulties	0.011	3.031	3.294	2.833	3.276	2.200
HIS Solution Provider was sufficient in HIS application.	0.024	3.427	3.776	3.381	3.193	2.800
How often did you have problems in HIS?	0.084	2.929	2.867	2.341	2.179	2.800
How often do you use computers?	0.005	2.267	1.294	1.714	1.179	1.000

From Table 12, where results of ANOVA analysis applied for 5 education levels are given, it can be observed that:

- End users who had PhD degree were the most dissatisfied group with the communication of end users with hospital management, security issues in HIS and HIS solution provider, but had the most general computer usage experience and tendency and also used computers very frequently.
- End users who had Master's degree were the most dissatisfied group with the usability of the software and had problems in HIS most frequently.
- End users who had Associate degree were the most satisfied group with the communication of end users with hospital management, usability of software, security issues in HIS and solution provider and also had the most experience in primary computer usage in patient activities.
- End users who graduated from high school had the least computer usage experience and tendency, but had the least problems in HIS.

ANOVA Analysis for Occupation

Table 13. ANOVA Analysis for Occupation

	Significance	Physicians	Nurse	Depart. Secretary	Technician	Management Staff
Usability issues in software did not cause any difficulty	0.030	2.688	3.346	3.039	2.893	2.875
Computer usage tendency	0.000	0.620	0.450	0.298	0.238	0.500
Primary computer usage for patient activities	0.037	1.111	1.009	1.474	0.857	0.000
Advanced computer usage for patient activities	0.000	0.278	0.850	0.526	0.571	1.000
Content, methodology and scheduling of training were sufficient	0.000	2.833	2.090	3.056	2.714	3.500
HIS Solution Provider was sufficient in HIS application.	0.079	3.150	3.497	3.644	3.429	3.800
How often did you have problems in HIS	0.070	2.194	2.722	2.438	3.000	3.500
How often do you use computers?	0.001	1.167	1.897	1.235	2.571	1.000
How often did you need support for HIS?	0.016	2.514	2.833	1.750	2.857	1.500

From Table 13, where results of ANOVA analysis applied for 5 different occupations are given, it can be observed that:

- Physicians were on the extreme agreement level compared to other occupations for all of the following issues;
    - They were the most dissatisfied group with the usability of software, and HIS solution provider.
    - They had the least experience on advanced computer usage for patient activities.
    - They had problems in HIS most frequently.
    - They had the most computer usage tendency.

- Nurses were the most satisfied group with the usability issues in software, but were the most dissatisfied group with the training issues.
- Department Secretaries had the most experience on primary computer usage for patient activities.
- Technicians had the least computer usage tendency and the least usage of computers, but required the least support for HIS.
- Management staff were on the extreme agreement level compared to other occupations for all of the following issues;
    - They had the least experience on primary computer usage for patient activities.
    - They required the most support for HIS.
    - They had the most experience on advanced computer usage for patient activities and used computers most frequently.
    - They had the least problems in HIS.
    - They were the most satisfied group with the training issues and the solution provider.

Interpretation of the Results

The results of the analyses given in the previous section can be interpreted as follows under the light of the interviews done with hospital management and the observations made in hospital during this study:

- During the interviews, it was understood that recruitment of most of the end users was done after specification of requirements, preparation of hospital RFP, and even selection of HIS, and specifically the most of the physicians were recruited later, just before of after the hospital opening due to their high salaries. This explains why:

    - End users were not satisfied with their contribution to HIS implementation since it was impossible for the solution provider to have their opinions during the requirement analysis phase.
    - End users who are elder than 44 were the most dissatisfied group with their contribution to HIS implementation, since 90% (11 of 10) of this group were physicians who were recruited latest.
- Since standard operating procedures for the departments were not well defined due to being a new hospital, end users were not satisfied with the sufficiency of the workflows.
- Since the physicians' major concern was to care for patients but not the HIS, they would have preferred a HIS in which they would have spent less time for data entry. This explains why physicians, who were mostly males (67%), elder than 44 (90%) and with master's degree (74%), were the least satisfied group with the usability of the software.
- Physicians had the most computer usage tendency since due to their position they needed Internet environment for their researches.
- For the computer usage for patient activities, management staff did not have any experience on primary issues but had the highest experience on advanced issues since they mostly used clinical systems for reporting.
- End users younger than 35 had more experience on clinical systems since healthcare information system is a new trend and have started to be taught in medical schools in recent years.
- Almost all of the end users were not happy with using different systems as integrated, since they were required to learn different screens, terminologies and different menus.

- All of the end users had difficulties with the workflows, since though standard operating procedures for each department are different within a hospital; they are forced to use a HIS with a unique standardized operating procedure for all of the departments.
- Most of the end users were not satisfied with the content, methodology and scheduling of training, due to the long duration between trainings and hospital opening and also the train the trainee approach. However, end users elder than 44 were the most satisfied group with the HIS training, since individual trainings were provided for them to prevent their resistance.
- The frequencies of having problems in HIS and of requesting support for HIS of the end user were high due to lack of clinical and general computer usage experience of end users, insufficient end user training for the late recruited end users, and long duration between the hospital opening and the trainings of the early recruited end users.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

This study aimed to find out implementation difficulties of HIS by using results of the study conducted in a private hospital in Turkey and to give recommendation for decreasing the possible problems in HIS implementation.

The results of this study showed out that the potential sources of HIS implementation difficulties were related to organizational issues, end user profile, integration of different systems, inconsistency among different workflows of different departments and training issues whereas there was no major implementation problem related to software, hardware, planning, support, security and solution provider.

Organizational issues that caused HIS implementation difficulties can be itemized as being a new hospital and the mismanagement of the hospital administration for the contribution of end users to HIS implementation

End users profile was another reason for the implementation difficulties since general computer skills, clinical system experience and computer usage tendency of end users were not sufficient.

In the hospital that was studied, HIS was required to integrate with seven different systems and this caused another implementation difficulty due to complexity of learning different user interfaces, terminologies and workflows of different systems. This is in agreement with the previous study based on the integration of external systems to HIS (Memel et al. 2001).

According to previous studies, bringing information systems to same level of implementation across the organization is a problem (Memel et al. 2001). Findings of this study also supported this finding; since there were different workflows for different departments in the hospital though there was a unique workflow definition in the HIS implemented.

The previous studies show that sometimes, health care delivery organization cuts training programs for a new HIS for budgetary reasons (Ash et al. 2004) which result in problems in HIS implementation. Content, methodology and scheduling of HIS training was also one of the difficulties in this study, since due to budgetary reason most of the end users were recruited late and also train the trainee approach was used for the same reason. Another reason for the training related difficulties was the long duration between training sessions and hospital opening leading the users to forget what they have learnt.

Besides the above major sources of implementation difficulties, though software related issues were not found to be one of the main sources, since the physicians' major concern was to care for patients but not the HIS, usability of the HIS became a problem due to its time consuming usage.

Taking the literature survey and the findings of this study into consideration, the followings can be recommended for achieving a successful, sufficient and efficient HIS implementation phase.

- Request for proposal (RFP), which is a base document for HIS implementation, should be prepared by a team including a variety of analysts, end users and executives.

- Hospital management, at the beginning, should accept that there might be modifications in hospital processes and workflows, leading to a business process reengineering (BPR) study.
- Since for most of the end users, the user interface is everything that they come into contact with, while using the system physically, conceptually and perceptually, consideration of the user interface should be one of the main issues in HIS selection as well as its usability, flexibility, configurability and technology. For that reason, to increase the satisfaction of the end users with the HIS, hospital management should care for the end users' opinion in this phase.
- In order to increase the contribution of end users during system implementation, joint application design (JAD) approach, which is penalizing interviews conducted with analysts, users and executives to reach requirement analysis jointly, can be used. This approach will also help hospital management to share their decisions and strategies related to HIS with the end users.
- Related to hardware issues, the ergonomics of computer desks in physicians' offices should be designed in such a way that physicians' efficiency in HIS usage and the care they show to patients can be optimized. Also the capacity of the network and the speed of the computers should be planned sufficient enough to prevent waiting times of the end users.
- Related to end user profile, hospital management should provide the necessary trainings to bring all of the end users to a specific level for computer usage in order to avoid possible related implementation difficulties.

Another suggestion for avoidance can be to consider clinical system usage experience of candidates during recruitment period.

- In order to avoid integration related problems, hospital management should prepare detailed conceptual design of integrations, master data definitions that will be transmitted among systems and the compatibility study of different technologies being used.
- Master data, such as service definitions, drug names, reasons of visits, diagnose codes, which are the main essentials of HIS implementation should be prepared together with the users of related specialty.
- Standard operating procedures (SOP) should be prepared for each department so that end users can use them as reference for daily patient activities they performed manually and then can easily adapt to HIS.
- For the continuity of HIS usage, the hospital management should provide location based end user support, continuous training and frequently asked questions derived from calls of the end users.
- Training strategies should be determined considering the end users' opinions in terms of content, methodology, location, scheduling and duration. It can be highly recommended that trainings should be given by project team instead of train the trainee approach and the duration between the trainings and HIS go live should not be too long not to cause to forget HIS usage.

In order to generalize the HIS implementation difficulties and the recommendations for the solutions, similar studies can be done in university and public hospitals in terms of various levels of HIS implementations such as beginning, migration and upgrade as well as other private hospitals.

APPENDIX A

QUESTIONNAIRE

This questionnaire is prepared to collect data for master thesis study called "Implementation Difficulties of Hospital Information Systems" in Boğaziçi University Management Information Systems Graduate Program.
Please put X for the choice that's appropriate for you.

HIS: Hospital Information Systems

Occupation:
Department:
Age:
Gender: Female …. Male ….
Education Level:
Primary …. High School …. Associate …. Bachelor's …. Master's.... Other …….
School Degree Graduate Degree Degree

		Strongly Agree	Somewhat Agree	Neutral	Somewhat Disagree	Strongly Disagree
1.	Management informs end users about decisions and hospital workflows	◯	◯	◯	◯	◯
2.	Management orients end users correctly	◯	◯	◯	◯	◯
3.	Hospital management took end users' opinion on selection of HIS	◯	◯	◯	◯	◯
4.	Users participated requirement analysis studies	◯	◯	◯	◯	◯
5.	Being a new hospital had no unconstructive effect on implementation.	◯	◯	◯	◯	◯
6.	Hospital workflows and HIS workflows are harmonious	◯	◯	◯	◯	◯
7.	Hospital management takes end users into consideration about implementation difficulties	◯	◯	◯	◯	◯
8.	HIS meets workflow needs.	◯	◯	◯	◯	◯
9.	Menu of HIS is explanatory and leading	◯	◯	◯	◯	◯
10.	Language of HIS is simple and understandable	◯	◯	◯	◯	◯

11.	HIS provides data integrity	◯	◯	◯	◯	◯
12.	The data in HIS is accurate	◯	◯	◯	◯	◯
13.	The usage of HIS is very easy	◯	◯	◯	◯	◯
14.	HIS provides fast and on time information.	◯	◯	◯	◯	◯
15.	I am happy with HIS	◯	◯	◯	◯	◯
16.	The number of computers is sufficient for HIS usage.	◯	◯	◯	◯	◯
17.	The layout of the computers is appropriate for HIS usage	◯	◯	◯	◯	◯
18.	The speed of computers is sufficient for HIS usage	◯	◯	◯	◯	◯
19.	Working with integrated systems reduces work time	◯	◯	◯	◯	◯
20.	Using different systems as integrated make works faster	◯	◯	◯	◯	◯
21.	No difficulty is faced due to complexity of different workflows of different systems	◯	◯	◯	◯	◯
22.	Different terminologies used in different systems caused no difficulty	◯	◯	◯	◯	◯
23.	Every document is kept in HIS	◯	◯	◯	◯	◯
24.	The lack of medical knowledge of consultants did not result in any difficulties to explain requirements	◯	◯	◯	◯	◯
25.	Presence of foreign consultant did not increase the number of difficulties	◯	◯	◯	◯	◯
26.	Consultants have knowledge of HIS.	◯	◯	◯	◯	◯
27.	Consultants could produce on time solutions	◯	◯	◯	◯	◯
28.	The solution provider company is well organized.	◯	◯	◯	◯	◯
29.	Hospital workflows have been planned well in HIS.	◯	◯	◯	◯	◯
30.	Hospital master data met hospital needs	◯	◯	◯	◯	◯
31.	Starting to use HIS just after the hospital	◯	◯	◯	◯	◯

	opening did not cause difficulties.					
32.	End user support has been planned well.	◯	◯	◯	◯	◯
33.	Undefined hospital workflows had no unconstructive effect on implementation	◯	◯	◯	◯	◯
34.	Legal workflows are compatible with HIS workflows.	◯	◯	◯	◯	◯
35.	HIS workflows make hospital workflows simple.	◯	◯	◯	◯	◯
36.	System has flexible workflows	◯	◯	◯	◯	◯
37.	Applying different workflows of different departments was not difficult	◯	◯	◯	◯	◯
38.	The end user support was sufficient	◯	◯	◯	◯	◯
39.	Knowing availability of a support person decreased the time of learning.	◯	◯	◯	◯	◯
40.	Getting support for HIS usage decreased working time	◯	◯	◯	◯	◯
41.	The duration of trainings was sufficient	◯	◯	◯	◯	◯
42.	The methodology and content of training were sufficient	◯	◯	◯	◯	◯
43.	Long time between training and hospital go-live decreased the implementation problems	◯	◯	◯	◯	◯
44.	The contribution of end users to trainings was sufficient	◯	◯	◯	◯	◯
45.	End users preferred to learn HIS in training instead of live system.	◯	◯	◯	◯	◯
46.	There are no data loss problems in HIS	◯	◯	◯	◯	◯
		Never	Rarely	A Few Times in a Month	A Few Times in a Week	Everyday
46.	How often did you have problems in HIS?	◯	◯	◯	◯	◯
47.	How often did you have problems in issues which are not related to HIS?	◯	◯	◯	◯	◯
48.	How often do you use computers?	◯	◯	◯	◯	◯

49.	How often did you have problems as a result of working with integrated systems?	◯	◯	◯	◯	◯
50.	How often did you have problems in transmitting data between integrated systems?	◯	◯	◯	◯	◯
51.	How often HIS provides wrong data?	◯	◯	◯	◯	◯
52.	How often did you need support for HIS?	◯	◯	◯	◯	◯
		Yes	No			
53.	Do you have your own computer?	◯	◯			
54.	Have you ever gone to computer course?	◯	◯			
55.	Please check the appropriate choice to indicate your previous aim(s) of using computers					
	a.	Entering Patient Data				
	b.	Patient data/result viewing				
	c.	Patient result reporting				
	d.	Ordering (service, drug, blood, diet)				
	e.	Writing				
	f.	Mailing				
	g.	Internet Usage				
	h.	Other				
		Very Low	Low	Normal	Good	Very Good
56.	What is the level of your computer skills?	◯	◯	◯	◯	◯

57. Please write the difficulties that you had during implementation.

.....

.....

.....

58. Other comments:

.....

.....

Thank You

APPENDIX B

FACTOR ANALYSES

Factor Analysis for Organization

Table 14. KMO and Bartlett's Test for Organization

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.595
Bartlett's Test of Sphericity	Approx. Chi-Square	229.989
	df	21
	Sig.	.000

Table 15. Total Variance Explained for Organization

Component	Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.531	36.154	36.154	2.164	30.910	30.910
2	1.521	21.725	57.879	1.841	26.302	57.211
3	1.042	14.881	72.760	1.088	15.548	72.760

Extraction Method: Principal Component Analysis.

Table 16. Rotated Component Matrix for Organization

	Component		
	1	2	3
Management orients end users correctly.	.881		
Management informs end users about decisions and hospital workflows.	.872		
Hospital management takes end users into consideration about implementation difficulties.	.623		.344
Hospital workflows and HIS workflows are harmonious.	.471		.304
Hospital management took end users' opinion on selection of HIS		.925	
Users participated requirement analysis studies		.923	
Being a new hospital had no unconstructive effect on implementation			.925

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a Rotation converged in 5 iterations.

Factor Analysis for Software Features

Table 17. KMO and Bartlett's Test for Software Features

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.862
Bartlett's Test of Sphericity	Approx. Chi-Square	430.068
	df	28
	Sig.	.000

Table 18. Total Variance Explained for Software Features

Component	Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.356	54.447	54.447	2.930	36.624	36.624
2	1.119	13.991	68.438	2.545	31.814	68.438

Extraction Method: Principal Component Analysis.

Table 19. Rotated Component Matrix for Software Features

	Component	
	1	2
Menu of HIS is explanatory and leading.	.886	
Language of HIS is simple and understandable.	.873	
The usage of HIS is very easy.	.808	.302
I am happy with HIS	.628	.566
HIS provides fast and on time information.		.857
The data in HIS is accurate		.705
HIS provides data integrity.	.429	.664
HIS meets workflow needs.	.349	.630

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a Rotation converged in 3 iterations.

Factor Analysis for Hardware

Table 20. KMO and Bartlett's Test for Hardware

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.604
Bartlett's Test of Sphericity	Approx. Chi-Square	51.646
	df	3
	Sig.	.000

Table 21. Total Variance Explained for Hardware

Component	Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %
1	1.784	59.477	59.477

Extraction Method: Principal Component Analysis.

Rotated Component Matrix(a) for Hardware: a Only one component was extracted. The solution cannot be rotated

Factor Analysis for End User Profile

Factor Analysis for Clinical System Usage Experience

Table 22. KMO and Bartlett's Test for Clinical System Experience

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.657
Bartlett's Test of Sphericity	Approx. Chi-Square	103.219
	df	10
	Sig.	.000

Table 23. Total Variance Explained for Clinical System Experience

Component	Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.175	43.503	43.503	2.160	43.206	43.206
2	1.132	22.639	66.142	1.147	22.936	66.142

Extraction Method: Principal Component Analysis.

Table 24. Rotated Component Matrix for Clinical System Experience

	Component	
	1	2
Entering Patient Data	.820	
Patient data/result viewing	.831	
Patient result reporting	.471	-.639
Ordering (service, drug, blood, diet)	.728	
HIS		.843

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a Rotation converged in 3 iterations.

Factor Analysis for General Computer Usage

Table 25. KMO and Bartlett's Test for General Computer Usage

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.733
Bartlett's Test of Sphericity	Approx. Chi-Square	170.756
	df	28
	Sig.	.000

Table 26. Total Variance Explained for General Computer Usage

Component	Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.624	32.803	32.803	2.461	30.764	30.764
2	1.141	14.259	47.062	1.226	15.324	46.087
3	1.020	12.755	59.818	1.098	13.730	59.818

Extraction Method: Principal Component Analysis.

Table 27. Rotated Component Matrix for General Computer Usage

	Component		
	1	2	3
Do you have your own computer?	.428	.467	
Have you ever gone to computer course?		-.812	
Writing	.889		
Mailing	.840		
Internet Usage	.845		
Office usage		.571	
Presentation preparation			.879
Accounting Programs			

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a Rotation converged in 4 iterations.

Factor Analysis for Integration

Table 28. KMO and Bartlett's Test for Integration

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.561
Bartlett's Test of Sphericity	Approx. Chi-Square	155.985
	df	6
	Sig.	.000

Table 29. Total Variance Explained for Integration

Component	Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.222	55.561	55.561	1.708	42.703	42.703
2	2.222	29.597	85.158	1.698	42.455	85.158

Extraction Method: Principal Component Analysis.

Table 30. Rotated Component Matrix for Integration

	Component	
	1	2
Working with integrated systems reduces work time.	.928	
Using different systems as integrated make works faster.	.880	
Different terminologies used in different systems caused no difficulty		.925
No difficulty is faced due to complexity of different workflows of different systems		.877

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a Rotation converged in 3 iterations.

Factor Analysis for Security

Table 31. KMO and Bartlett's Test for Security

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.500
Bartlett's Test of Sphericity	Approx. Chi-Square	9.101
	df	1
	Sig.	.003

Table 32. Total Variance Explained for Security

Component	Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %
1	1.287	64.374	64.374

Extraction Method: Principal Component Analysis.

Rotated Component Matrix(a): a Only one component was extracted. The solution cannot be rotated.

Factor Analysis for Planning

Table 33. KMO and Bartlett's Test for Planning

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.661
Bartlett's Test of Sphericity	Approx. Chi-Square	84.999
	df	6
	Sig.	.000

Table 34. Total Variance Explained for Planning

Component	Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.051	51.286	51.286	1.985	49.628	49.628
2	1.012	25.304	76.591	1.079	26.963	76.591

Extraction Method: Principal Component Analysis.

Table 35. Rotated Component Matrix for Planning

	Component	
	1	2
Hospital master data met hospital needs.	.846	
End user support has been planned well.	.804	
Hospital workflows have been planned well in HIS.	.786	-.306
Starting to use HIS just after the hospital opening did not cause difficulties		.965

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a Rotation converged in 3 iterations.

Factor Analysis for Workflow

Table 36. KMO and Bartlett's Test for Workflow

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.554
Bartlett's Test of Sphericity	Approx. Chi-Square	104.241
	df	10
	Sig.	.000

Table 37. Total Variance Explained for Workflow

Component	Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.004	40.085	40.085	2.004	40.079	40.079
2	1.313	26.251	66.337	1.313	26.257	66.337

Extraction Method: Principal Component Analysis.

Table 38. Rotated Component Matrix for Workflow

	Component	
	1	2
HIS workflows make hospital workflows simple.	.891	
System has flexible workflows.	.797	
Legal workflows are compatible with HIS workflows.	.738	
Applying different workflows of different departments was not difficult.		.813
Undefined hospital workflows had no unconstructive effect on implementation		.740

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a Rotation converged in 3 iterations.

Factor Analysis for Support

Table 39. KMO and Bartlett's Test for Support

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.500
Bartlett's Test of Sphericity	Approx. Chi-Square	32.347
	df	3
	Sig.	.000

Table 40. Total Variance Explained for Support

Component	Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %
1	1.517	50.570	50.570

Extraction Method: Principal Component Analysis.

Rotated Component Matrix(a): a Only one component was extracted. The solution cannot be rotated.

Factor Analysis for Training

Table 41. KMO and Bartlett's Test for Training

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.558
Bartlett's Test of Sphericity	Approx. Chi-Square	95.300
	df	10
	Sig.	.000

Table 42. Total Variance Explained for Training

Component	Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.984	39.671	39.671	1.746	34.917	34.917
2	1.301	26.012	65.683	1.538	30.766	65.683

Extraction Method: Principal Component Analysis.

Table 43. Rotated Component Matrix for Training

	Component	
	1	2
The methodology and content of training were sufficient	.868	
Long time between training and hospital go-live decreased the implementation problems.	.787	
The contribution of end users to trainings was sufficient.		.816
End users preferred to learn HIS training instead of live system		.679
The duration of trainings was sufficient.	.608	.621

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a Rotation converged in 3 iterations.

Factor Analysis for Solution Provider

Table 44. KMO and Bartlett's Test for Solution Provider

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.731
Bartlett's Test of Sphericity	Approx. Chi-Square	147.556
	df	10
	Sig.	.000

Table 45. Total Variance Explained for Solution Provider

Component	Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %
1	2.590	51.791	51.791

Extraction Method: Principal Component Analysis.

Rotated Component Matrix(a): a Only one component was extracted. The solution cannot be rotated.

APPENDIX C

DESCRIPTIVE STATISTICS

Table 46. Descriptive Statistics for Organization

	N	Minimum	Maximum	Mean	Std. Deviation
Communication between management and HIS end users was sufficient	112	1.00	5.00	3.47	.74
Contribution of end users to HIS implementation project was sufficient	112	1.00	4.00	1.65	.75
Being a new hospital had no unconstructive effect on implementation.	112	1.00	5.00	2.10	1.13
Valid N (Listwise)	112				

Table 47. Descriptive Statistics for Software

	N	Minimum	Maximum	Mean	Std. Deviation
Usability issues in software did not cause any difficulty	111	1.00	5.00	3.00	.89
Manipulation of medical data and workflows in software was sufficient	112	1.25	5.00	3.35	.72
Valid N (listwise)	111				

Table 48. Descriptive Statistics for Hardware

	N	Minimum	Maximum	Mean	Std. Deviation
Hardware related issues in HIS implementation did not cause any difficulty	110	1.33	5.00	3.80	.73
Valid N (listwise)	110				

Table 49. Descriptive Statistics for End User Profile General Computer Skills

	N	Minimum	Maximum	Mean	Std. Deviation
General computer usage experience	111	.00	1.00	.84	.31
Computer Usage for presentation purpose	112	.00	1.00	.46	.25
Computer usage tendency	112	.00	1.00	.062	.24
Valid N (listwise)	111				

Table 50. Descriptive Statistics for End User Profile Clinical System Experience

	N	Minimum	Maximum	Mean	Std. Deviation
Primary computer usage for patient activities	111	.00	2.00	1.08	.76
Advanced computer usage for patient activities	112	.00	2.00	.56	.58
Valid N (listwise)	111				

Table 51. Descriptive Statistics for Integration

	N	Minimum	Maximum	Mean	Std. Deviation
Integrated systems reduced time of work	109	1.00	5.00	3.08	.94
Using different systems together did not cause difficulties	109	1.00	4.50	2.61	.81
Valid N (listwise)	108				

Table 52. Descriptive Statistics for Security

	N	Minimum	Maximum	Mean	Std. Deviation
Security related issues in HIS implementation did not cause difficulties	111	1.00	5.00	3.02	.79
Valid N (listwise)	111				

Table 53. Descriptive Statistics for Planning

	N	Minimum	Maximum	Mean	Std. Deviation
HIS master data. workflow and support were planned sufficiently	110	1.00	5.00	3.17	.78
Starting to use HIS just after the hospital opening did not cause difficulties.	108	1.00	5.00	3.11	1.05
Valid N (listwise)	108				

Table 54. Descriptive Statistics for Workflow

	N	Minimum	Maximum	Mean	Std. Deviation
HIS was sufficient on workflows	109	1.00	4.67	3.03	.74
Undefined hospital workflows and inconsistency among different department workflows had no unconstructive effect on implementation	109	1.00	4.00	2.39	.74
Valid N (listwise)	109				

Table 55. Descriptive Statistics for Support

	N	Minimum	Maximum	Mean	Std. Deviation
End user support was sufficient	108	2.00	5.00	3.49	.66
Valid N (listwise)	108				

Table 56. Descriptive Statistics for Training

	N	Minimum	Maximum	Mean	Std. Deviation
Content. methodology and scheduling of training were sufficient	110	1.00	4.50	2.60	.93
End user participation and duration of training were sufficient	110	1.33	5.00	3.08	.80
Valid N (listwise)	110				

Table 57. Descriptive Statistics for Solution Provider

	N	Minimum	Maximum	Mean	Std. Deviation
HIS Solution Provider was sufficient in HIS application.	110	1.20	4.80	3.37	.69
Valid N (listwise)	110				

Table 58. Descriptive Statistics for Non-group Questions

	N	Minimum	Maximum	Mean	Std. Deviation
How often did you have problems in HIS?	105	1	4	2.46	1.04
How often did you have problems in issues which are not related to HIS?	103	1	5	3.04	1.16
How often do you use computers?	109	1	5	1.54	1.03

How often did you have problems as a result of working with integrated systems?	102	1	5	3.03	1.10
How often did you have problems in transmitting data between integrated systems?	97	1	5	3.14	1.13
How often HIS provides wrong data?	104	1	5	3.66	1.03
How often did you need support for HIS?	104	1	5	2.46	1.15
What is the level of your computer skills?	106	1	5	3.46	.77

APPENDIX D

ANOVA ANALYSES

ANOVA Analysis for Age Group

ANOVA Analysis for Organization and Age Group

Table 59. Descriptive of ANOVA Analysis for Organization and Age Group

Communication between management and HIS end users was sufficient								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Less than 25	15	3.61	.73	.19	3.20	4.02	2.50	5.00
25-34	61	3.56	.64	.08	3.39	3.72	1.75	4.75
35-44	16	3.35	.89	.22	2.88	3.83	1.50	4.75
More than 44	11	3.27	.83	.25	2.71	3.83	1.00	4.25
Total	103	3.50	.71	.07	3.36	3.64	1.00	5.00
Contribution of end users to HIS implementation project was sufficient								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Less than 25	15	1.63	.74	.19	1.22	2.04	1.00	3.00
25-34	61	1.77	.78	.10	1.56	1.97	1.00	4.00
35-44	16	1.75	.83	.20	1.30	2.19	1.00	3.50
More than 44	11	1.09	.20	.06	.95	1.22	1.00	1.50
Total	103	1.67	.76	.07	1.52	1.82	1.00	4.00
Being a new hospital had no unconstructive effect on implementation.								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Less than 25	15	2.26	1.09	.28	1.65	2.87	1.00	5.00
25-34	61	2.13	1.10	.14	1.84	2.41	1.00	5.00
35-44	16	2.18	1.37	.34	1.45	2.92	1.00	5.00
More than 44	11	2.00	1.18	.35	1.20	2.79	1.00	4.00
Total	103	2.14	1.14	.11	1.92	2.36	1.00	5.00

Table 60. ANOVA Analysis for Organization and Age Group

		Sum of Squares	df	Mean Square	F	Sig.
Communication between management and HIS end users was sufficient	Between Groups	1.31	3	.43	.84	.47
	Within Groups	51.36	99	.51		
	Total	52.68	102			
Contribution of end users to HIS implementation project was sufficient	Between Groups	4.42	3	1.47	2.61	.056
	Within Groups	55.92	99	.565		
	Total	60.35	102			
Being a new hospital had no unconstructive effect on implementation.	Between Groups	.494	3	.16	.12	.94
	Within Groups	132.32	99	1.33		
	Total	132.81	102			

ANOVA Analysis for Software and Age Group

Table 61. Descriptive of ANOVA Analysis for Software and Age Group

Usability issues in software did not cause any difficulty								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Less than 25	15	3.05	.85	.21	2.57	3.52	1.50	4.00
25-34	60	3.17	.81	.10	2.96	3.38	1.00	5.00
35-44	16	2.71	1.03	.25	2.16	3.26	1.00	4.50
More than 44	11	2.31	.79	.24	1.78	2.85	1.00	3.50
Total	102	2.99	.88	.08	2.81	3.16	1.00	5.00
Manipulation of medical data and workflows in software was sufficient								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Less than 25	15	3.30	.61	.15	2.96	3.63	2.00	4.00
25-34	61	3.48	.67	.08	3.30	3.65	1.75	5.00
35-44	16	3.31	.73	.18	2.92	3.70	2.00	4.50
More than 44	11	2.86	.83	.25	2.29	3.42	1.25	4.00
Total	103	3.36	.71	.07	3.22	3.50	1.25	5.00

Table 62. ANOVA Analysis for Software and Age Group

		Sum of Squares	df	Mean Square	F	Sig.
Usability issues in software did not cause any difficulty	Between Groups	8.15	3	2.71	3.71	.014
	Within Groups	71.83	98	.73		
	Total	79.99	101			
Manipulation of	Between Groups	3.73	3	1.24	2.55	.059

medical data and workflows in software was sufficient	Within Groups	48.11	99	.486		
	Total	51.84	102			

ANOVA Analysis for Hardware and Age Group

Table 63. Descriptive of ANOVA Analysis for Hardware and Age Group

Hardware related issues in HIS implementation did not cause any difficulty								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Less than 25	15	3.64	.62	.16	3.29	3.98	2.33	4.67
25-34	59	3.80	.78	.10	3.59	4.00	1.33	5.00
35-44	16	3.97	.75	.18	3.57	4.38	2.00	5.00
More than 44	11	4.06	.51	.15	3.71	4.40	3.67	5.00
Total	101	3.83	.73	.07	3.69	3.97	1.33	5.00

Table 64. ANOVA Analysis for Hardware and Age Group

		Sum of Squares	df	Mean Square	F	Sig.
Hardware related issues in HIS implementation did not cause any difficulty	Between Groups	1.50	3	.50	.92	.43
	Within Groups	52.19	97	.53		
	Total	53.69	100			

ANOVA Analysis for End User Profile and Age Group

ANOVA Analysis for General Computer Skills and Age Group

Table 65. Descriptive of ANOVA Analysis for End User Profile General Computer Usage and Age Group

General computer usage experience								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Less than 25	15	.84	.30	.07	.67	1.01	.00	1.00
25-34	61	.81	.34	.04	.72	.90	.00	1.00
35-44	16	.91	.19	.04	.81	1.01	.33	1.00
More than 44	11	.78	.40	.12	.51	1.05	.00	1.00
Total	103	.83	.32	.03	.76	.89	.00	1.00
Computer Usage for presentation purpose								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum

					Lower Bound	Upper Bound		
Less than 25	15	.00	.00	.00	.00	.00	.00	.00
25-34	61	.01	.12	.01	-.01	.04	.00	1.00
35-44	16	.06	.25	.06	-.07	.19	.00	1.00
More than 44	11	.36	.50	.15	.02	.70	.00	1.00
Total	103	.05	.23	.02	.01	.10	.00	1.00
Computer usage tendency								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Less than 25	15	.31	.29	.07	.14	.47	.00	.67
25-34	61	.45	.27	.03	.38	.52	.00	1.00
35-44	16	.60	.13	.03	.53	.67	.33	.67
More than 44	11	.51	.17	.05	.39	.63	.33	.67
Total	103	.46	.26	.02	.41	.51	.00	1.00

Table 66. ANOVA Analysis for End User Profile General Computer Usage and Age Group

		Sum of Squares	df	Mean Square	F	Sig.
General computer usage experience	Between Groups	.158	3	.05	.48	.69
	Within Groups	10.70	99	.10		
	Total	10.86	102			
Computer Usage for presentation purpose	Between Groups	1.18	3	.39	8.74	.000
	Within Groups	4.46	99	.045		
	Total	5.65	102			
Computer usage tendency	Between Groups	.69	3	.23	3.65	.01
	Within Groups	6.27	99	.06		
	Total	6.96	102			

ANOVA Analysis for Clinical System Experience and Age Group

Table 67. Descriptive of ANOVA Analysis for End User Profile Clinical System Experience and Age Group

Primary computer usage for patient activities								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Less than 25	15	1.06	.86557	.22349	.5873	1.5460	.00	2.00
25-34	61	1.10	.73922	.09465	.9145	1.2931	.00	2.00
35-44	16	1.16	.62063	.15516	.8360	1.4974	.00	2.00
More	11	.84	.99290	.29937	.1814	1.5155	.00	2.00

than 44								
Total	103	1.0809	.76478	.07536	.9314	1.2304	.00	2.00
Advanced computer usage for patient activities								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Less than 25	15	.6667	.61721	.15936	.3249	1.0085	.00	2.00
25-34	61	.6721	.56925	.07288	.5263	.8179	.00	2.00
35-44	16	.1875	.40311	.10078	-.0273	.4023	.00	1.00
More than 44	11	.4545	.52223	.15746	.1037	.8054	.00	1.00
Total	103	.5728	.57055	.05622	.4613	.6843	.00	2.00

Table 68. ANOVA Analysis for End User Profile Clinical System Experience and Age Group

		Sum of Squares	df	Mean Square	F	Sig.
Primary computer usage for patient activities	Between Groups	.747	3	.249	.418	.740
	Within Groups	58.912	99	.595		
	Total	59.659	102			
Advanced computer usage for patient activities	Between Groups	3.263	3	1.088	3.597	.016
	Within Groups	29.941	99	.302		
	Total	33.204	102			

ANOVA Analysis for Integration and Age Group

Table 69. Descriptive of ANOVA Analysis for Integration and Age Group

Integrated systems reduced time of work								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Less than 25	14	3.0357	.69238	.18505	2.6359	3.4355	2.00	4.00
25-34	59	3.2797	.88703	.11548	3.0485	3.5108	1.00	5.00
35-44	16	3.0625	.89209	.22302	2.5871	3.5379	1.00	4.00
More than 44	11	2.2273	1.12614	.33954	1.4707	2.9838	1.00	4.00
Total	100	3.0950	.93661	.09366	2.9092	3.2808	1.00	5.00
Using different systems together did not cause difficulties								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Less than 25	15	2.5000	.68139	.17593	2.1227	2.8773	1.00	4.00
25-34	58	2.7328	.87467	.11485	2.5028	2.9627	1.00	4.50

35-44	16	2.5938	.66380	.16595	2.2400	2.9475	2.00	4.00
More than 44	11	2.1364	.45227	.13636	1.8325	2.4402	1.50	3.00
Total	100	2.6100	.79322	.07932	2.4526	2.7674	1.00	4.50

Table 70. ANOVA Analysis for Integration and Age Group

		Sum of Squares	df	Mean Square	F	Sig.
Integrated systems reduced time of work	Between Groups	10.360	3	3.453	4.335	.007
	Within Groups	76.487	96	.797		
	Total	86.848	99			
Using different systems together did not cause difficulties	Between Groups	3.527	3	1.176	1.921	.131
	Within Groups	58.763	96	.612		
	Total	62.290	99			

ANOVA Analysis for Security and Age Group

Table 71. Descriptive of ANOVA Analysis for Security and Age Group

Security related issues in HIS implementation did not cause difficulties								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Less than 25	15	3.1000	.54116	.13973	2.8003	3.3997	2.50	4.50
25-34	60	3.0083	.89486	.11553	2.7772	3.2395	1.00	4.50
35-44	16	2.9063	.68845	.17211	2.5394	3.2731	1.50	4.00
More than 44	11	3.1818	.68091	.20530	2.7244	3.6393	2.50	5.00
Total	102	3.0245	.79409	.07863	2.8685	3.1805	1.00	5.00

Table 72. ANOVA Analysis for Security and Age Group

		Sum of Squares	df	Mean Square	F	Sig.
Security related issues in HIS implementation did not cause difficulties	Between Groups	.597	3	.199	.309	.819
	Within Groups	63.092	98	.644		
	Total	63.689	101			

ANOVA Analysis for Planning and Age Group

Table 73. Descriptive of ANOVA Analysis for Planning and Age Group

HIS master data. workflow and support were planned sufficiently								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Less than 25	15	3.5333	.50079	.12930	3.2560	3.8107	2.67	4.33

25-34	59	3.2373	.76827	.10002	3.0371	3.4375	1.00	5.00
35-44	16	3.0417	.69788	.17447	2.6698	3.4135	2.00	4.00
More than 44	11	2.7576	1.05505	.31811	2.0488	3.4664	1.00	4.67
Total	101	3.1980	.77771	.07739	3.0445	3.3516	1.00	5.00
Starting to use HIS just after the hospital opening did not cause difficulties.								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Less than 25	14	3.0000	.78446	.20966	2.5471	3.4529	2.00	4.00
25-34	58	2.9483	1.08292	.14219	2.6635	3.2330	1.00	5.00
35-44	16	3.3125	1.19548	.29887	2.6755	3.9495	1.00	5.00
More than 44	11	3.7273	.90453	.27273	3.1196	4.3349	2.00	5.00
Total	99	3.1010	1.06421	.10696	2.8888	3.3133	1.00	5.00

Table 74. ANOVA Analysis for Planning and Age Group

		Sum of Squares	df	Mean Square	F	Sig.
HIS master data. workflow and support were planned sufficiently	Between Groups	4.303	3	1.434	2.476	.066
	Within Groups	56.182	97	.579		
	Total	60.484	100			
Starting to use HIS just after the hospital opening did not cause difficulties.	Between Groups	6.526	3	2.175	1.978	.122
	Within Groups	104.464	95	1.100		
	Total	110.990	98			

ANOVA Analysis for Workflow and Age Group

Table 75. Descriptive of ANOVA Analysis for Workflow and Age Group

HIS was sufficient on workflows								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Less than 25	14	3.1190	.62165	.16614	2.7601	3.4780	2.00	4.00
25-34	59	3.1808	.71203	.09270	2.9952	3.3663	1.00	4.33
35-44	16	2.6875	.70415	.17604	2.3123	3.0627	1.33	4.00
More than 44	11	2.6970	.94815	.28588	2.0600	3.3339	1.67	4.67
Total	100	3.0400	.74803	.07480	2.8916	3.1884	1.00	4.67
Undefined hospital workflows and inconsistency among different department workflows had no unconstructive effect on implementation								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		

Less than 25	14	2.7143	.61125	.16336	2.3614	3.0672	1.50	3.50
25-34	59	2.3898	.81509	.10612	2.1774	2.6022	1.00	4.00
35-44	16	2.1563	.56917	.14229	1.8530	2.4595	1.00	3.00
More than 44	11	2.5909	.70065	.21125	2.1202	3.0616	1.50	4.00
Total	100	2.4200	.75116	.07512	2.2710	2.5690	1.00	4.00

Table 76. ANOVA Analysis for Workflow and Age Group

		Sum of Squares	df	Mean Square	F	Sig.
HIS was sufficient on workflows	Between Groups	4.539	3	1.513	2.856	.041
	Within Groups	50.856	96	.530		
	Total	55.396	99			
Undefined hospital workflows and inconsistency among different department workflows had no unconstructive effect on implementation	Between Groups	2.700	3	.900	1.626	.189
	Within Groups	53.160	96	.554		
	Total	55.860	99			

ANOVA Analysis for Support and Age Group

Table 77. Descriptive of ANOVA Analysis for Support and Age Group

End user support was sufficient								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Less than 25	14	3.5238	.71270	.19048	3.1123	3.9353	2.33	4.67
25-34	59	3.4294	.54685	.07119	3.2869	3.5719	2.00	4.33
35-44	16	3.7708	.79553	.19888	3.3469	4.1947	2.00	5.00
More than 44	11	3.5303	.99671	.30052	2.8607	4.1999	2.33	5.00
Total	100	3.5083	.67311	.06731	3.3748	3.6419	2.00	5.00

Table 78. ANOVA Analysis for Support and Age Group

		Sum of Squares	df	Mean Square	F	Sig.
End user support was sufficient	Between Groups	1.479	3	.493	1.091	.357
	Within Groups	43.375	96	.452		
	Total	44.854	99			

ANOVA Analysis for Training and Age Group

Table 79. Descriptive of ANOVA Analysis for Training and Age Group

Content. methodology and scheduling of training were sufficient								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Less than 25	15	2.8333	.97590	.25198	2.2929	3.3738	1.00	4.00
25-34	60	2.3833	.88952	.11484	2.1535	2.6131	1.00	4.50
35-44	16	2.7813	.65749	.16437	2.4309	3.1316	1.50	4.00
More than 44	11	3.0455	1.05959	.31948	2.3336	3.7573	1.50	4.50
Total	102	2.5833	.91219	.09032	2.4042	2.7625	1.00	4.50
End user participation and duration of training were sufficient								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Less than 25	15	3.2222	.86984	.22459	2.7405	3.7039	1.67	4.67
25-34	60	3.1444	.73931	.09544	2.9535	3.3354	1.67	5.00
35-44	16	2.8750	.89339	.22335	2.3989	3.3511	1.67	4.67
More than 44	11	3.0000	.76012	.22918	2.4893	3.5107	1.67	4.00
Total	102	3.0980	.78256	.07749	2.9443	3.2517	1.67	5.00

Table 80. ANOVA Analysis for Training and Age Group

		Sum of Squares	df	Mean Square	F	Sig.
Content. methodology and scheduling of training were sufficient	Between Groups	6.313	3	2.104	2.653	.053
	Within Groups	77.728	98	.793		
	Total	84.042	101			
End user participation and duration of training were sufficient	Between Groups	1.262	3	.421	.680	.566
	Within Groups	60.591	98	.618		
	Total	61.853	101			

ANOVA Analysis for Solution Provider and Age Group

Table 81. Descriptive of ANOVA Analysis for Solution Provider and Age Group

HIS Solution Provider was sufficient in HIS application.								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Less than 25	15	3.5733	.53381	.13783	3.2777	3.8689	2.40	4.20
25-34	59	3.4407	.67750	.08820	3.2641	3.6172	2.00	4.80
35-44	16	3.3500	.73212	.18303	2.9599	3.7401	2.20	4.40

More than 44	11	2.8727	.77083	.23241	2.3549	3.3906	1.20	4.00
Total	101	3.3842	.69437	.06909	3.2471	3.5212	1.20	4.80

Table 82. ANOVA Analysis for Solution Provider and Age Group

		Sum of Squares	df	Mean Square	F	Sig.
HIS Solution Provider was sufficient in HIS application.	Between Groups	3.621	3	1.207	2.626	.055
	Within Groups	44.594	97	.460		
	Total	48.215	100			

ANOVA Analysis for Non-group Questions and Age Group

Table 83. Descriptive of ANOVA Analysis for Non-group Questions and Age Group

How often did you have problems in HIS?								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Less than 25	14	2.07	.616	.165	1.72	2.43	1	3
25-34	14	2.79	1.074	.144	2.50	3.07	1	4
35-44	16	2.25	.775	.194	1.84	2.66	1	4
More than 44	11	2.00	1.095	.330	1.26	2.74	1	4
Total	97	2.51	1.022	.104	2.30	2.71	1	4
How often did you have problems in issues which are not related to HIS?								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Less than 25	15	2.93	1.163	.300	2.29	3.58	1	4
25-34	55	3.07	1.200	.162	2.75	3.40	1	5
35-44	16	3.13	1.258	.315	2.45	3.80	1	5
More than 44	10	3.20	1.135	.359	2.39	4.01	2	5
Total	96	3.07	1.181	.121	2.83	3.31	1	5
How often do you use computers?								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Less than 25	15	1.47	.834	.215	4.07	5.00	2	5
25-34	59	1.71	1.175	.153	3.98	4.59	1	5
35-44	16	1.25	.775	.194	4.34	5.16	2	5
More	11	1.27	.647	.195	4.29	5.16	3	5

than 44								
Total	101	1.55	1.034	.103	4.24	4.65	1	5
How often did you have problems as a result of working with integrated systems?								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Less than 25	14	3.07	.997	.267	2.50	3.65	2	5
25-34	55	2.93	1.120	.151	2.62	3.23	1	5
35-44	15	3.60	1.056	.273	3.02	4.18	2	5
More than 44	10	2.70	1.059	.335	1.94	3.46	1	4
Total	94	3.03	1.102	.114	2.81	3.26	1	5
How often did you have problems in transmitting data between integrated systems?								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Less than 25	13	2.92	.954	.265	2.35	3.50	2	4
25-34	53	3.23	1.120	.154	2.92	3.54	1	5
35-44	14	3.43	1.342	.359	2.65	4.20	1	5
More than 44	10	2.70	1.059	.335	1.94	3.46	1	4
Total	90	3.16	1.131	.119	2.92	3.39	1	5
How often HIS provides wrong data?								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Less than 25	14	3.64	1.082	.289	3.02	4.27	2	5
25-34	56	3.77	.953	.127	3.51	4.02	1	5
35-44	16	3.69	1.138	.285	3.08	4.29	1	5
More than 44	11	3.27	1.104	.333	2.53	4.01	1	5
Total	97	3.68	1.016	.103	3.48	3.89	1	5
How often did you need support for HIS?								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Less than 25	14	2.21	1.188	.318	1.53	2.90	1	5
25-34	55	2.62	1.240	.167	2.28	2.95	1	5
35-44	16	2.63	.957	.239	2.11	3.14	1	4
More than 44	11	2.18	.982	.296	1.52	2.84	1	4
Total	96	2.51	1.161	.118	2.28	2.75	1	5
What is the level of your computer skills?								

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Less than 25	14	3.71	.726	.194	3.29	4.13	3	5
25-34	59	3.39	.743	.097	3.20	3.58	1	5
35-44	15	3.47	.834	.215	3.00	3.93	2	5
More than 44	10	3.30	.949	.300	2.62	3.98	2	5
Total	98	3.44	.774	.078	3.28	3.59	1	5

Table 84. ANOVA Analysis for Non-group Questions and Age Group

		Sum of Squares	df	Mean Square	F	Sig.
How often did you have problems in HIS?	Between Groups	10.890	3	3.630	3.778	.013
	Within Groups	89.357	93	.961		
	Total	100.247	96			
How often did you have problems in issues which are not related to HIS?	Between Groups	.497	3	.166	.116	.951
	Within Groups	131.992	92	1.435		
	Total	132.490	95			
How often do you use computers?	Between Groups	3.934	3	1.311	1.235	.301
	Within Groups	103.017	97	1.062		
	Total	106.950	100			
How often did you have problems as a result of working with integrated systems?	Between Groups	6.567	3	2.189	1.853	.143
	Within Groups	106.338	90	1.182		
	Total	112.904	93			
How often did you have problems in transmitting data between integrated systems?	Between Groups	4.088	3	1.363	1.068	.367
	Within Groups	109.735	86	1.276		
	Total	113.822	89			
How often HIS provides wrong data?	Between Groups	2.277	3	.759	.729	.537
	Within Groups	96.816	93	1.041		
	Total	99.093	96			
How often did you need support for HIS?	Between Groups	3.264	3	1.088	.803	.496
	Within Groups	124.725	92	1.356		
	Total	127.990	95			
What is the level of your computer skills?	Between Groups	1.408	3	.469	.778	.509
	Within Groups	56.724	94	.603		
	Total	58.133	97			

ANOVA Analysis for Gender

ANOVA Analysis for Organization and Gender

Table 85. Descriptive of ANOVA Analysis for Organization and Gender

Communication between management and HIS end users was sufficient								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Female	76	3.5559	.70545	.08092	3.3947	3.7171	1.75	5.00
Male	34	3.3750	.78153	.13403	3.1023	3.6477	1.00	4.75
Total	110	3.5000	.73103	.06970	3.3619	3.6381	1.00	5.00
Contribution of end users to HIS implementation project was sufficient								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Female	76	1.7039	.73111	.08386	1.5369	1.8710	1.00	4.00
Male	34	1.5294	.80661	.13833	1.2480	1.8109	1.00	4.00
Total	110	1.6500	.75586	.07207	1.5072	1.7928	1.00	4.00
Being a new hospital had no unconstructive effect on implementation.								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Female	76	2.0658	1.08733	.12472	1.8173	2.3143	1.00	5.00
Male	34	2.2353	1.25671	.21552	1.7968	2.6738	1.00	5.00
Total	110	2.1182	1.13922	.10862	1.9029	2.3335	1.00	5.00

Table 86. ANOVA Analysis for Organization and Gender

		Sum of Squares	df	Mean Square	F	Sig.
Communication between management and HIS end users was sufficient	Between Groups	.769	1	.769	1.445	.232
	Within Groups	57.481	108	.532		
	Total	58.250	109			
Contribution of end users to HIS implementation project was sufficient	Between Groups	.716	1	.716	1.255	.265
	Within Groups	61.559	108	.570		
	Total	62.275	109			
Being a new hospital had no unconstructive effect on implementation.	Between Groups	.675	1	.675	.518	.473
	Within Groups	140.789	108	1.304		
	Total	141.464	109			

ANOVA Analysis for Software and Gender

Table 87. Descriptive of ANOVA Analysis for Software and Gender

Usability issues in software did not cause any difficulty								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Female	75	3.1933	.88204	.10185	2.9904	3.3963	1.00	5.00
Male	34	2.6471	.83284	.14283	2.3565	2.9377	1.00	4.00
Total	109	3.0229	.89981	.08619	2.8521	3.1938	1.00	5.00
Manipulation of medical data and workflows in software was sufficient								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Female	76	3.3980	.71784	.08234	3.2340	3.5621	1.75	5.00
Male	34	3.2868	.76161	.13061	3.0210	3.5525	1.25	4.50
Total	110	3.3636	.72996	.06960	3.2257	3.5016	1.25	5.00

Table 88. ANOVA Analysis for Software and Gender

		Sum of Squares	df	Mean Square	F	Sig.
Usability issues in software did not cause any difficulty	Between Groups	6.981	1	6.981	9.284	.003
	Within Groups	80.461	107	.752		
	Total	87.443	108			
Manipulation of medical data and workflows in software was sufficient	Between Groups	.291	1	.291	.543	.463
	Within Groups	57.789	108	.535		
	Total	58.080	109			

ANOVA Analysis for Hardware and Gender

Table 89. Descriptive of ANOVA Analysis for Hardware and Gender

Hardware related issues in HIS implementation did not cause any difficulty								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Female	75	3.6844	.74312	.08581	3.5135	3.8554	1.33	5.00
Male	33	4.0909	.64157	.11168	3.8634	4.3184	2.00	5.00
Total	108	3.8086	.73512	.07074	3.6684	3.9489	1.33	5.00

Table 90. ANOVA Analysis for Hardware and Gender

		Sum of Squares	df	Mean Square	F	Sig.
Hardware related issues in HIS implementation did not cause any difficulty	Between Groups	3.786	1	3.786	7.427	.008
	Within Groups	54.037	106	.510		
	Total	57.823	107			

ANOVA Analysis for End User Profile and Gender

ANOVA Analysis for General Computer Skills and Gender

Table 91. Descriptive of ANOVA Analysis for End User Profile General Computer Usage and Gender

General computer usage experience								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Female	75	.8356	.32128	.03710	.7616	.9095	.00	1.00
Male	34	.8529	.31984	.05485	.7413	.9645	.00	1.00
Total	109	.8410	.31945	.03060	.7803	.9016	.00	1.00
Computer Usage for presentation purpose								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Female	76	.0395	.19601	.02248	-.0053	.0843	.00	1.00
Male	34	.0882	.28790	.04937	-.0122	.1887	.00	1.00
Total	110	.0545	.22813	.02175	.0114	.0977	.00	1.00
Computer usage tendency								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Female	76	.4518	.27055	.03103	.3899	.5136	.00	1.00
Male	34	.5000	.23570	.04042	.4178	.5822	.00	.67
Total	110	.4667	.26017	.02481	.4175	.5158	.00	1.00

Table 92. ANOVA Analysis for End User Profile General Computer Usage and Gender

		Sum of Squares	df	Mean Square	F	Sig.
General computer usage experience	Between Groups	.007	1	.007	.069	.794
	Within Groups	11.014	107	.103		
	Total	11.021	108			
Computer Usage for presentation purpose	Between Groups	.056	1	.056	1.074	.302
	Within Groups	5.617	108	.052		
	Total	5.673	109			
Computer usage tendency	Between Groups	.055	1	.055	.806	.371
	Within Groups	7.323	108	.068		
	Total	7.378	109			

ANOVA Analysis for Clinical System Experience and Gender

Table 93. Descriptive of ANOVA Analysis for End User Profile Clinical System Experience and Gender

Primary computer usage for patient activities								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Female	75	1.0578	.74409	.08592	.8866	1.2290	.00	2.00
Male	34	1.1373	.82925	.14222	.8479	1.4266	.00	2.00
Total	109	1.0826	.76867	.07363	.9366	1.2285	.00	2.00
Advanced computer usage for patient activities								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Female	76	.6184	.56491	.06480	.4893	.7475	.00	2.00
Male	34	.4706	.61473	.10543	.2561	.6851	.00	2.00
Total	110	.5727	.58198	.05549	.4627	.6827	.00	2.00

Table 94. ANOVA Analysis for End User Profile Clinical System Experience and Gender

		Sum of Squares	df	Mean Square	F	Sig.
Primary computer usage for patient activities	Between Groups	.148	1	.148	.248	.619
	Within Groups	63.665	107	.595		
	Total	63.812	108			
Advanced computer usage for patient activities	Between Groups	.513	1	.513	1.523	.220
	Within Groups	36.405	108	.337		
	Total	36.918	109			

ANOVA Analysis for Integration and Gender

Table 95. Descriptive of ANOVA Analysis for Gender and Age Group

Integrated systems reduced time of work								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Female	74	3.2568	.89229	.10373	3.0500	3.4635	1.00	5.00
Male	33	2.7879	.94398	.16433	2.4532	3.1226	1.00	4.00
Total	107	3.1121	.92987	.08989	2.9339	3.2904	1.00	5.00
Using different systems together did not cause difficulties								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Female	74	2.6486	.85900	.09986	2.4496	2.8477	1.00	4.50
Male	33	2.5606	.71543	.12454	2.3069	2.8143	1.50	4.00
Total	107	2.6215	.81507	.07880	2.4653	2.7777	1.00	4.50

Table 96. ANOVA Analysis for Integration and Gender

		Sum of Squares	df	Mean Square	F	Sig.
Integrated systems reduced time of work	Between Groups	5.017	1	5.017	6.081	.015
	Within Groups	86.637	105	.825		
	Total	91.654	106			
Using different systems together did not cause difficulties	Between Groups	.177	1	.177	.264	.608
	Within Groups	70.244	105	.669		
	Total	70.421	106			

ANOVA Analysis for Security and Gender

Table 97. Descriptive of ANOVA Analysis for Security and Gender

Security related issues in HIS implementation did not cause difficulties								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Female	76	2.9539	.81313	.09327	2.7681	3.1398	1.00	4.50
Male	33	3.1515	.75503	.13143	2.8838	3.4192	2.00	5.00
Total	109	3.0138	.79774	.07641	2.8623	3.1652	1.00	5.00

Table 98. ANOVA Analysis for Security and Gender

		Sum of Squares	df	Mean Square	F	Sig.
Security related issues in HIS implementation did not cause difficulties	Between Groups	.898	1	.898	1.417	.237
	Within Groups	67.831	107	.634		
	Total	68.729	108			

ANOVA Analysis for Planning and Gender

Table 99. Descriptive of ANOVA Analysis for Planning and Gender

HIS master data. workflow and support were planned sufficiently								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Female	75	3.2444	.75602	.08730	3.0705	3.4184	1.00	5.00
Male	33	3.0808	.81663	.14216	2.7912	3.3704	1.00	4.67
Total	108	3.1944	.77490	.07456	3.0466	3.3423	1.00	5.00
Starting to use HIS just after the hospital opening did not cause difficulties.								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Female	73	3.0822	.99657	.11664	2.8497	3.3147	1.00	5.00
Male	33	3.2121	1.19262	.20761	2.7892	3.6350	1.00	5.00

Total	106	3.1226	1.05743	.10271	2.9190	3.3263	1.00	5.00

Table 100. ANOVA Analysis for Planning and Gender

		Sum of Squares	df	Mean Square	F	Sig.
HIS master data. workflow and support were planned sufficiently	Between Groups	.614	1	.614	1.022	.314
	Within Groups	63.636	106	.600		
	Total	64.250	107			
Starting to use HIS just after the hospital opening did not cause difficulties.	Between Groups	.384	1	.384	.341	.561
	Within Groups	117.022	104	1.125		
	Total	117.406	105			

ANOVA Analysis for Workflow and Gender

Table 101. Descriptive of ANOVA Analysis for Workflow and Gender

HIS was sufficient on workflows								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Female	74	3.1351	.66419	.07721	2.9813	3.2890	1.00	4.00
Male	33	2.8283	.88632	.15429	2.5140	3.1426	1.33	4.67
Total	107	3.0405	.74916	.07242	2.8969	3.1841	1.00	4.67
Undefined hospital workflows and inconsistency among different department workflows had no unconstructive effect on implementation								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Female	74	2.3919	.74609	.08673	2.2190	2.5647	1.00	4.00
Male	33	2.4394	.76809	.13371	2.1670	2.7117	1.00	4.00
Total	107	2.4065	.74963	.07247	2.2629	2.5502	1.00	4.00

Table 102. ANOVA Analysis for Workflow and Gender

		Sum of Squares	df	Mean Square	F	Sig.
HIS was sufficient on workflows	Between Groups	2.149	1	2.149	3.935	.050
	Within Groups	57.342	105	.546		
	Total	59.491	106			
Undefined hospital workflows and inconsistency among different department workflows had no unconstructive effect on implementation	Between Groups	.051	1	.051	.091	.764
	Within Groups	59.514	105	.567		
	Total	59.565	106			

ANOVA Analysis for Support and Gender

Table 103. Descriptive of ANOVA Analysis for Support and Gender

End user support was sufficient								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Female	73	3.4566	.58927	.06897	3.3191	3.5941	2.00	4.67
Male	33	3.6313	.79030	.13757	3.3511	3.9115	2.00	5.00
Total	106	3.5110	.65959	.06407	3.3840	3.6380	2.00	5.00

Table 104. ANOVA Analysis for Support and Gender

		Sum of Squares	df	Mean Square	F	Sig.
End user support was sufficient	Between Groups	.694	1	.694	1.603	.208
	Within Groups	44.988	104	.433		
	Total	45.682	105			

ANOVA Analysis for Training and Gender

Table 105. Descriptive of ANOVA Analysis for Training and Gender

Content. methodology and scheduling of training were sufficient								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Female	75	2.4200	.92649	.10698	2.2068	2.6332	1.00	4.00
Male	33	3.0000	.79057	.13762	2.7197	3.2803	1.50	4.50
Total	108	2.5972	.92337	.08885	2.4211	2.7734	1.00	4.50
End user participation and duration of training were sufficient								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Female	75	3.1333	.82519	.09528	2.9435	3.3232	1.67	5.00
Male	33	3.0202	.71170	.12389	2.7678	3.2726	1.67	4.33
Total	108	3.0988	.79066	.07608	2.9479	3.2496	1.67	5.00

Table 106. ANOVA Analysis for Training and Gender

		Sum of Squares	df	Mean Square	F	Sig.
Content. methodology and scheduling of training were sufficient	Between Groups	7.709	1	7.709	9.784	.002
	Within Groups	83.520	106	.788		
	Total	91.229	107			
End user participation and duration of training were sufficient	Between Groups	.293	1	.293	.467	.496
	Within Groups	66.598	106	.628		
	Total	66.891	107			

ANOVA Analysis for Solution Provider and Gender

Table 107. Descriptive of ANOVA Analysis for Solution Provider and Gender

HIS Solution Provider was sufficient in HIS application.								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Female	75	3.4133	.69074	.07976	3.2544	3.5723	2.00	4.80
Male	33	3.2909	.72300	.12586	3.0345	3.5473	1.20	4.40
Total	108	3.3759	.69965	.06732	3.2425	3.5094	1.20	4.80

Table 108. ANOVA Analysis for Solution Provider and Gender

		Sum of Squares	df	Mean Square	F	Sig.
HIS Solution Provider was sufficient in HIS application.	Between Groups	.343	1	.343	.700	.405
	Within Groups	52.034	106	.491		
	Total	52.377	107			

ANOVA Analysis for Non-group Questions and Gender

Table 109. Descriptive of ANOVA Analysis for Non-group Questions and Gender

How often did you have problems in HIS?								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Female	70	2.49	1.073	.128	2.23	2.74	1	4
Male	33	2.48	.972	.169	2.14	2.83	1	4
Total	103	2.49	1.037	.102	2.28	2.69	1	4
How often did you have problems in issues which are not related to HIS?								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Female	69	2.91	1.172	.141	2.63	3.19	1	5
Male	32	3.34	1.125	.199	2.94	3.75	1	5
Total	101	3.05	1.169	.116	2.82	3.28	1	5
How often do you use computers?								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Female	74	1.66	1.138	.132	4.07	4.60	1	5
Male	33	1.30	.728	.127	4.44	4.96	2	5
Total	107	1.55	1.039	.100	4.25	4.65	1	5
How often did you have problems as a result of working with integrated systems?								

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Female	69	3.01	1.169	.141	2.73	3.30	1	5
Male	31	3.13	.957	.172	2.78	3.48	1	5
Total	100	3.05	1.104	.110	2.83	3.27	1	5
How often did you have problems in transmitting data between integrated systems?								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Female	65	3.11	1.161	.144	2.82	3.40	1	5
Male	30	3.30	1.088	.199	2.89	3.71	1	5
Total	95	3.17	1.136	.117	2.94	3.40	1	5
How often HIS provides wrong data?								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Female	69	3.61	1.074	.129	3.35	3.87	1	5
Male	33	3.82	.950	.165	3.48	4.16	1	5
Total	102	3.68	1.036	.103	3.47	3.88	1	5
How often did you need support for HIS?								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Female	69	2.46	1.220	.147	2.17	2.76	1	5
Male	33	2.48	1.064	.185	2.11	2.86	1	4
Total	102	2.47	1.166	.115	2.24	2.70	1	5
What is the level of your computer skills?								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Female	72	3.46	.670	.079	3.30	3.62	2	5
Male	32	3.47	.983	.174	3.11	3.82	1	5
Total	104	3.46	.775	.076	3.31	3.61	1	5

Table 110. ANOVA Analysis for Non-group Questions and Gender

		Sum of Squares	df	Mean Square	F	Sig.
How often did you have problems in HIS?	Between Groups	.000	1	.000	.000	.997
	Within Groups	109.728	101	1.086		
	Total	109.728	102			
How often did you have problems in issues	Between Groups	4.055	1	4.055	3.026	.085
	Within Groups	132.697	99	1.340		

which are not related to HIS?	Total	136.752	100			
How often do you use computers?	Between Groups	2.944	1	2.944	2.771	.099
	Within Groups	111.524	105	1.062		
	Total	114.467	106			
How often did you have problems as a result of working with integrated systems?	Between Groups	.281	1	.281	.228	.634
	Within Groups	120.469	98	1.229		
	Total	120.750	99			
How often did you have problems in transmitting data between integrated systems?	Between Groups	.759	1	.759	.586	.446
	Within Groups	120.546	93	1.296		
	Total	121.305	94			
How often HIS provides wrong data?	Between Groups	.980	1	.980	.913	.342
	Within Groups	107.344	100	1.073		
	Total	108.324	101			
How often did you need support for HIS?	Between Groups	.010	1	.010	.007	.932
	Within Groups	137.402	100	1.374		
	Total	137.412	101			
What is the level of your computer skills?	Between Groups	.002	1	.002	.004	.950
	Within Groups	61.844	102	.606		
	Total	61.846	103			

ANOVA Analysis for Education Level

ANOVA Analysis for Organization and Education Level

Table 111. Descriptive of ANOVA Analysis for Organization and Education Level

Communication between management and HIS end users was sufficient								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
High School Graduate	16	3.8125	.56642	.14161	3.5107	4.1143	2.50	5.00
Associate Degree	18	3.9028	.46288	.10910	3.6726	4.1330	3.25	4.75
Bachelor' s Degree	42	3.3929	.72864	.11243	3.1658	3.6199	1.75	4.75
Master's Degree	29	3.3017	.79445	.14753	2.9995	3.6039	1.00	4.75
PhD Degree	5	3.0500	.97468	.43589	1.8398	4.2602	1.50	4.00
Total	110	3.4977	.73455	.07004	3.3589	3.6365	1.00	5.00
Contribution of end users to HIS implementation project was sufficient								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
High School Graduate	16	1.9688	.61830	.15457	1.6393	2.2982	1.00	3.00

Associate Degree	18	1.6944	.82496	.19444	1.2842	2.1047	1.00	4.00
Bachelor's Degree	42	1.6071	.70309	.10849	1.3880	1.8262	1.00	4.00
Master's Degree	29	1.5862	.84588	.15708	1.2645	1.9080	1.00	4.00
PhD Degree	5	1.5000	.86603	.38730	.4247	2.5753	1.00	3.00
Total	110	1.6636	.75756	.07223	1.5205	1.8068	1.00	4.00
Being a new hospital had no unconstructive effect on implementation.								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
High School Graduate	16	2.5000	1.09545	0.27386	1.9163	3.0837	1.00	5.00
Associate Degree	18	2.2778	1.27443	0.30039	1.6440	2.9115	1.00	5.00
Bachelor's Degree	42	1.8571	0.81365	0.12555	1.6036	2.1107	1.00	4.00
Master's Degree	29	2.2414	1.40548	0.26099	1.7068	2.7760	1.00	5.00
PhD Degree	5	2.0000	1.22474	0.54772	0.4793	3.5207	1.00	4.00
Total	110	2.1273	1.13420	0.10814	1.9129	2.3416	1.00	5.00

Table 112. ANOVA Analysis for Organization and Education Level

		Sum of Squares	df	Mean Square	F	Sig.
Communication between management and HIS end users was sufficient	Between Groups	7.117	4	1.779	3.614	.008
	Within Groups	51.695	105	.492		
	Total	58.812	109			
Contribution of end users to HIS implementation project was sufficient	Between Groups	1.948	4	.487	.844	.500
	Within Groups	60.606	105	.577		
	Total	62.555	109			
Being a new hospital had no unconstructive effect on implementation.	Between Groups	6.154	4	1.538	1.205	0.313
	Within Groups	134.064	105	1.277		
	Total	140.218	109			

ANOVA Analysis for Software and Education Level

Table 113. Descriptive of ANOVA Analysis for Software and Education Level

Usability issues in software did not cause any difficulty								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
High School Graduate	15	3.2167	0.67392	0.17401	2.8435	3.5899	2.00	4.00

Associate Degree	18	3.4167	0.76216	0.17964	3.0377	3.7957	1.75	4.75
Bachelor's Degree	42	3.0298	0.94708	0.14614	2.7346	3.3249	1.00	5.00
Master's Degree	29	2.6379	0.85457	0.15869	2.3129	2.9630	1.00	4.25
PhD Degree	5	2.9000	1.32994	0.59477	1.2487	4.5513	1.00	4.50
Total	109	3.0092	0.90391	0.08658	2.8376	3.1808	1.00	5.00
Manipulation of medical data and workflows in software was sufficient								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
High School Graduate	16	3.4688	0.82095	0.20524	3.0313	3.9062	1.75	5.00
Associate Degree	18	3.5833	0.57522	0.13558	3.2973	3.8694	2.75	5.00
Bachelor's Degree	42	3.3690	0.77938	0.12026	3.1262	3.6119	1.75	5.00
Master's Degree	29	3.1810	0.70044	0.13007	2.9146	3.4475	1.25	4.00
PhD Degree	5	3.2000	0.69372	0.31024	2.3386	4.0614	2.00	3.75
Total	110	3.3614	0.73227	0.06982	3.2230	3.4997	1.25	5.00

Table 114. ANOVA Analysis for Software and Education Level

		Sum of Squares	df	Mean Square	F	Sig.
Usability issues in software did not cause any difficulty	Between Groups	7.709	4	1.927	2.489	0.048
	Within Groups	80.532	104	0.774		
	Total	88.241	108			
Manipulation of medical data and workflows in software was sufficient	Between Groups	2.147	4	0.537	1.001	0.411
	Within Groups	56.301	105	0.536		
	Total	58.448	109			

ANOVA Analysis for Hardware and Education Level

Table 115. Descriptive of ANOVA Analysis for Hardware and Education Level

Hardware related issues in HIS implementation did not cause any difficulty								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
High School Graduate	15	3.7556	0.49548	0.12793	3.4812	4.0299	2.67	4.67
Associate Degree	17	4.0588	0.55572	0.13478	3.7731	4.3445	2.67	5.00
Bachelor'	42	3.6984	0.76795	0.11850	3.4591	3.9377	1.33	5.00

s Degree								
Master's Degree	29	3.8506	0.84790	0.15745	3.5280	4.1731	2.00	5.00
PhD Degree	5	3.7333	0.98319	0.43970	2.5125	4.9541	2.00	4.33
Total	108	3.8056	0.73783	0.07100	3.6648	3.9463	1.33	5.00

Table 116. ANOVA Analysis for Hardware and Education Level

		Sum of Squares	df	Mean Square	F	Sig.
Hardware related issues in HIS implementation did not cause any difficulty	Between Groups	1.695	4	0.424	0.772	0.546
	Within Groups	56.555	103	0.549		
	Total	58.250	107			

ANOVA Analysis for End User Profile and Education Level

ANOVA Analysis for General Computer Skills and Education Level

Table 117. Descriptive of ANOVA Analysis for End User Profile General Computer Usage and Education Level

General computer usage experience								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
High School Graduate	16	0.5833	0.49441	0.12360	0.3199	0.8468	0.00	1.00
Associate Degree	18	0.8704	0.28328	0.06677	0.7295	1.0112	0.00	1.00
Bachelor's Degree	42	0.8810	0.25313	0.03906	0.8021	0.9598	0.00	1.00
Master's Degree	28	0.9048	0.25430	0.04806	0.8062	1.0034	0.00	1.00
PhD Degree	5	1.0000	0.00000	0.00000	1.0000	1.0000	1.00	1.00
Total	109	0.8471	0.31601	0.03027	0.7871	0.9071	0.00	1.00
Computer Usage for presentation purpose								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
High School Graduate	16	0.0000	0.00000	0.00000	0.0000	0.0000	0.00	0.00
Associate Degree	18	0.0000	0.00000	0.00000	0.0000	0.0000	0.00	0.00
Bachelor's Degree	42	0.0714	0.26066	0.04022	-0.0098	0.1527	0.00	1.00
Master's Degree	29	0.1379	0.35093	0.06517	0.0044	0.2714	0.00	1.00
PhD Degree	5	0.0000	0.00000	0.00000	0.0000	0.0000	0.00	0.00

Total	110	0.0636	0.24522	0.02338	0.0173	0.1100	0.00	1.00
Computer usage tendency								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
High School Graduate	16	0.3542	0.25730	0.06433	0.2171	0.4913	0.00	0.67
Associate Degree	18	0.3704	0.27745	0.06540	0.2324	0.5083	0.00	0.67
Bachelor's Degree	42	0.4524	0.26361	0.04068	0.3702	0.5345	0.00	1.00
Master's Degree	29	0.5862	0.19221	0.03569	0.5131	0.6593	0.00	1.00
PhD Degree	5	0.6667	0.00000	0.00000	0.6667	0.6667	0.67	0.67
Total	110	0.4697	0.25660	0.02447	0.4212	0.5182	0.00	1.00

Table 118. ANOVA Analysis for End User Profile General Computer Usage and Education Level

		Sum of Squares	df	Mean Square	F	Sig.
General computer usage experience	Between Groups	1.381	4	0.345	3.818	0.006
	Within Groups	9.404	104	0.090		
	Total	10.785	108			
Computer Usage for presentation purpose	Between Groups	0.321	4	0.080	1.350	0.257
	Within Groups	6.234	105	0.059		
	Total	6.555	109			
Computer usage tendency	Between Groups	0.991	4	0.248	4.207	0.003
	Within Groups	6.185	105	0.059		
	Total	7.177	109			

ANOVA Analysis for Clinical System Experience and Education Level

Table 119. Descriptive of ANOVA Analysis for End User Profile Clinical System Experience and Education Level

Primary computer usage for patient activities								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
High School Graduate	16	0.8333	0.78881	0.19720	0.4130	1.2537	0.00	2.00
Associate Degree	18	1.4444	0.69546	0.16392	1.0986	1.7903	0.00	2.00
Bachelor's Degree	42	1.1111	0.73129	0.11284	0.8832	1.3390	0.00	2.00
Master's Degree	28	0.9048	0.79534	0.15031	0.5964	1.2132	0.00	2.00
PhD Degree	5	1.3333	0.81650	0.36515	0.3195	2.3471	0.00	2.00
Total	109	1.0826	0.76867	0.07363	0.9366	1.2285	0.00	2.00

Advanced computer usage for patient activities								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
High School Graduate	16	0.5625	0.62915	0.15729	0.2272	0.8978	0.00	2.00
Associate Degree	18	0.7222	0.66911	0.15771	0.3895	1.0550	0.00	2.00
Bachelor's Degree	42	0.6667	0.57027	0.08799	0.4890	0.8444	0.00	2.00
Master's Degree	29	0.3793	0.49380	0.09170	0.1915	0.5671	0.00	1.00
PhD Degree	5	0.2000	0.44721	0.20000	-0.3553	0.7553	0.00	1.00
Total	110	0.5636	0.58305	0.05559	0.4535	0.6738	0.00	2.00

Table 120. ANOVA Analysis for End User Profile Clinical System Experience and Education Level

		Sum of Squares	df	Mean Square	F	Sig.
Primary computer usage for patient activities	Between Groups	4.585	4	1.146	2.013	0.098
	Within Groups	59.228	104	0.569		
	Total	63.812	108			
Advanced computer usage for patient activities	Between Groups	2.545	4	0.636	1.936	0.110
	Within Groups	34.510	105	0.329		
	Total	37.055	109			

ANOVA Analysis for Integration and Education Level

Table 121. Descriptive of ANOVA Analysis for Integration and Education Level

Integrated systems reduced time of work								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
High School Graduate	15	2.9667	1.02586	0.26487	2.3986	3.5348	1.00	4.50
Associate Degree	17	3.4706	0.51450	0.12478	3.2061	3.7351	2.50	4.00
Bachelor's Degree	41	3.0488	1.01738	0.15889	2.7277	3.3699	1.00	5.00
Master's Degree	29	2.9483	1.03807	0.19276	2.5534	3.3431	1.00	4.00
PhD Degree	5	3.3000	0.67082	0.30000	2.4671	4.1329	2.50	4.00
Total	107	3.0888	0.95120	0.09196	2.9065	3.2711	1.00	5.00
Using different systems together did not cause difficulties								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		

High School Graduate	15	2.6667	.64550	.16667	2.3092	3.0241	2.00	4.00
Associate Degree	16	2.8438	.97841	.24460	2.3224	3.3651	1.00	4.00
Bachelor's Degree	42	2.5714	.90103	.13903	2.2906	2.8522	1.00	4.50
Master's Degree	29	2.5000	.71962	.13363	2.2263	2.7737	1.00	4.00
PhD Degree	5	2.7000	.57009	.25495	1.9921	3.4079	2.00	3.50
Total	107	2.6121	.81642	.07893	2.4557	2.7686	1.00	4.50

Table 122. ANOVA Analysis for Integration and Education Level

		Sum of Squares	df	Mean Square	F	Sig.
Integrated systems reduced time of work	Between Groups	3.563	4	0.891	0.984	0.420
	Within Groups	92.343	102	0.905		
	Total	95.907	106			
Using different systems together did not cause difficulties	Between Groups	1.376	4	.344	.506	.731
	Within Groups	69.278	102	.679		
	Total	70.654	106			

ANOVA Analysis for Security and Education Level

Table 123. Descriptive of ANOVA Analysis for Security and Education Level

Security related issues in HIS implementation did not cause difficulties								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
High School Graduate	16	3.0313	.74092	.18523	2.6364	3.4261	2.00	4.50
Associate Degree	17	3.2941	.81123	.19675	2.8770	3.7112	1.50	4.50
Bachelor's Degree	42	2.8333	.75439	.11641	2.5982	3.0684	1.00	4.50
Master's Degree	29	3.2759	.78588	.14593	2.9769	3.5748	2.00	5.00
PhD Degree	5	2.2000	.57009	.25495	1.4921	2.9079	1.50	3.00
Total	109	3.0229	.79752	.07639	2.8715	3.1744	1.00	5.00

Table 124. ANOVA Analysis for Security and Education Level

		Sum of Squares	df	Mean Square	F	Sig.
Security related issues in HIS implementation did not cause difficulties	Between Groups	8.002	4	2.001	3.428	.011
	Within Groups	60.690	104	.584		
	Total	68.693	108			

ANOVA Analysis for Planning and Education Level

Table 125. Descriptive of ANOVA Analysis for Planning and Education Level

HIS master data. workflow and support were planned sufficiently								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
High School Graduate	15	3.4000	.44006	.11362	3.1563	3.6437	2.67	4.33
Associate Degree	17	3.5294	.57806	.14020	3.2322	3.8266	2.33	4.33
Bachelor' s Degree	42	3.1190	.89812	.13858	2.8392	3.3989	1.00	5.00
Master's Degree	29	2.9540	.84386	.15670	2.6330	3.2750	1.00	4.67
PhD Degree	5	3.2000	.50553	.22608	2.5723	3.8277	2.67	3.67
Total	108	3.1821	.78853	.07588	3.0317	3.3325	1.00	5.00
Starting to use HIS just after the hospital opening did not cause difficulties.								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
High School Graduate	15	3.2000	.94112	.24300	2.6788	3.7212	2.00	5.00
Associate Degree	17	2.9412	.96635	.23437	2.4443	3.4380	2.00	5.00
Bachelor' s Degree	41	3.0732	1.10432	.17247	2.7246	3.4217	1.00	5.00
Master's Degree	28	3.3571	1.16155	.21951	2.9067	3.8075	1.00	5.00
PhD Degree	5	2.8000	.44721	.20000	2.2447	3.3553	2.00	3.00
Total	106	3.1321	1.05176	.10216	2.9295	3.3346	1.00	5.00

Table 126. ANOVA Analysis for Planning and Education Level

		Sum of Squares	df	Mean Square	F	Sig.
HIS master data. workflow and support were planned sufficiently	Between Groups	4.440	4	1.110	1.841	.127
	Within Groups	62.090	103	.603		
	Total	66.530	107			
Starting to use HIS just after the hospital opening did not cause difficulties.	Between Groups	2.801	4	.700	.624	.647
	Within Groups	113.350	101	1.122		
	Total	116.151	105			

ANOVA Analysis for Workflow and Education Level

Table 127. Descriptive of ANOVA Analysis for Workflow and Education Level

HIS was sufficient on workflows								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
High School Graduate	15	3.1778	.60246	.15556	2.8441	3.5114	2.33	4.33
Associate Degree	17	3.2941	.78954	.19149	2.8882	3.7001	1.67	4.33
Bachelor's Degree	41	2.9919	.77991	.12180	2.7457	3.2380	1.00	4.00
Master's Degree	29	2.9195	.73816	.13707	2.6388	3.2003	1.67	4.67
PhD Degree	5	2.6667	.91287	.40825	1.5332	3.8001	1.33	3.67
Total	107	3.0312	.75588	.07307	2.8863	3.1760	1.00	4.67
Undefined hospital workflows and inconsistency among different department workflows had no unconstructive effect on implementation								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
High School Graduate	15	2.7667	.62297	.16085	2.4217	3.1117	2.00	4.00
Associate Degree	17	2.4706	.95966	.23275	1.9772	2.9640	1.50	4.00
Bachelor's Degree	41	2.3659	.78282	.12226	2.1188	2.6129	1.00	4.00
Master's Degree	29	2.2414	.60682	.11268	2.0106	2.4722	1.00	4.00
PhD Degree	5	2.2000	.57009	.25495	1.4921	2.9079	1.50	3.00
Total	107	2.3972	.74839	.07235	2.2538	2.5406	1.00	4.00

Table 128. ANOVA Analysis for Workflow and Education Level

		Sum of Squares	df	Mean Square	F	Sig.
HIS was sufficient on workflows	Between Groups	2.587	4	.647	1.138	.343
	Within Groups	57.976	102	.568		
	Total	60.563	106			
Undefined hospital workflows and inconsistency among different department workflows had no unconstructive effect on implementation	Between Groups	3.078	4	.769	1.394	.241
	Within Groups	56.291	102	.552		
	Total	59.369	106			

ANOVA Analysis for Support and Education Level

Table 129. Descriptive of ANOVA Analysis for Support and Education Level

End user support was sufficient								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
High School Graduate	15	3.4222	.62319	.16091	3.0771	3.7673	2.33	4.67
Associate Degree	17	3.8235	.50163	.12166	3.5656	4.0814	2.67	4.67
Bachelor's Degree	41	3.5041	.70759	.11051	3.2807	3.7274	2.00	5.00
Master's Degree	28	3.3155	.59202	.11188	3.0859	3.5450	2.33	4.67
PhD Degree	5	3.7333	1.03816	.46428	2.4443	5.0224	2.00	4.67
Total	106	3.5047	.66446	.06454	3.3767	3.6327	2.00	5.00

Table 130. ANOVA Analysis for Support and Education Level

		Sum of Squares	df	Mean Square	F	Sig.
End user support was sufficient	Between Groups	3.094	4	.774	1.806	.134
	Within Groups	43.265	101	.428		
	Total	46.359	105			

ANOVA Analysis for Training and Education Level

Table 131. Descriptive of ANOVA Analysis for Training and Education Level

Content. methodology and scheduling of training were sufficient								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
High School Graduate	16	2.6563	.83104	.20776	2.2134	3.0991	1.00	4.00
Associate Degree	17	2.6471	1.19589	.29005	2.0322	3.2619	1.00	4.00
Bachelor's Degree	42	2.4762	.91700	.14150	2.1904	2.7619	1.00	4.50
Master's Degree	28	2.6607	.83946	.15864	2.3352	2.9862	1.00	4.50
PhD Degree	5	2.7000	.97468	.43589	1.4898	3.9102	1.50	4.00
Total	108	2.5880	.92431	.08894	2.4116	2.7643	1.00	4.50
End user participation and duration of training were sufficient								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum

					Lower Bound	Upper Bound		
High School Graduate	16	3.3229	.81302	.20325	2.8897	3.7561	2.00	4.67
Associate Degree	17	3.4020	.77518	.18801	3.0034	3.8005	1.67	5.00
Bachelor's Degree	42	3.0317	.77847	.12012	2.7892	3.2743	1.67	4.67
Master's Degree	28	2.8810	.83747	.15827	2.5562	3.2057	1.33	4.33
PhD Degree	5	2.8667	.76739	.34319	1.9138	3.8195	1.67	3.67
Total	108	3.0864	.80770	.07772	2.9323	3.2405	1.33	5.00

Table 132. ANOVA Analysis for Training and Education Level

		Sum of Squares	df	Mean Square	F	Sig.
Content. methodology and scheduling of training were sufficient	Between Groups	.870	4	.217	.247	.911
	Within Groups	90.545	103	.879		
	Total	91.414	107			
End user participation and duration of training were sufficient	Between Groups	4.137	4	1.034	1.622	.174
	Within Groups	65.668	103	.638		
	Total	69.805	107			

ANOVA Analysis for Solution Provider and Education Level

Table 133. Descriptive of ANOVA Analysis for Solution Provider and Education Level

HIS Solution Provider was sufficient in HIS application.								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
High School Graduate	15	3.4267	.61350	.15840	3.0869	3.7664	2.40	4.40
Associate Degree	17	3.7765	.55174	.13382	3.4928	4.0601	2.80	4.80
Bachelor's Degree	42	3.3810	.71746	.11071	3.1574	3.6045	2.00	4.80
Master's Degree	29	3.1931	.75116	.13949	2.9074	3.4788	1.20	4.40
PhD Degree	5	2.8000	.24495	.10954	2.4959	3.1041	2.40	3.00
Total	108	3.3722	.70164	.06752	3.2384	3.5061	1.20	4.80

Table 134. ANOVA Analysis for Solution Provider and Education Level

		Sum of Squares	df	Mean Square	F	Sig.

HIS Solution Provider was sufficient in HIS application.	Between Groups	5.393	4	1.348	2.937	.024
	Within Groups	47.283	103	.459		
	Total	52.677	107			

ANOVA Analysis for Non-group Questions and Education Level

Table 135. Descriptive of ANOVA Analysis for Non-group Questions and Education Level

How often did you have problems in HIS?								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
High School Graduate	14	2.93	1.141	.305	2.27	3.59	1	4
Associate Degree	15	2.87	.915	.236	2.36	3.37	1	4
Bachelor's Degree	41	2.34	1.039	.162	2.01	2.67	1	4
Master's Degree	28	2.18	1.020	.193	1.78	2.57	1	4
PhD Degree	5	2.80	.837	.374	1.76	3.84	2	4
Total	103	2.48	1.046	.103	2.27	2.68	1	4
How often did you have problems in issues which are not related to HIS?								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
High School Graduate	13	3.77	.599	.166	3.41	4.13	3	5
Associate Degree	15	3.00	1.069	.276	2.41	3.59	1	4
Bachelor's Degree	41	2.88	1.166	.182	2.51	3.25	1	5
Master's Degree	27	2.89	1.281	.247	2.38	3.40	1	5
PhD Degree	5	3.40	1.517	.678	1.52	5.28	1	5
Total	101	3.04	1.166	.116	2.81	3.27	1	5
How often do you use computers?								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
High School Graduate	15	2.27	1.438	.371	2.94	4.53	1	5

Associate Degree	17	1.29	.849	.206	4.27	5.14	2	5
Bachelor's Degree	42	1.71	1.132	.175	3.93	4.64	1	5
Master's Degree	28	1.18	.476	.090	4.64	5.01	3	5
PhD Degree	5	1	.000	.000	5.00	5.00	5	5
Total	107	1.55	1.039	.100	4.25	4.65	1	5
How often did you have problems as a result of working with integrated systems?								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
High School Graduate	13	3.31	1.109	.308	2.64	3.98	2	5
Associate Degree	15	3.27	.961	.248	2.73	3.80	2	5
Bachelor's Degree	40	2.85	1.075	.170	2.51	3.19	1	4
Master's Degree	27	2.89	1.188	.229	2.42	3.36	1	5
PhD Degree	5	3.80	1.095	.490	2.44	5.16	2	5
Total	100	3.03	1.105	.111	2.81	3.25	1	5
How often did you have problems in transmitting data between integrated systems?								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
High School Graduate	12	3.33	1.155	.333	2.60	4.07	2	5
Associate Degree	14	3.50	1.019	.272	2.91	4.09	1	5
Bachelor's Degree	38	2.92	1.148	.186	2.54	3.30	1	5
Master's Degree	27	3.11	1.155	.222	2.65	3.57	1	5
PhD Degree	4	3.75	1.258	.629	1.75	5.75	2	5
Total	95	3.15	1.139	.117	2.92	3.38	1	5
How often HIS provides wrong data?								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
High School Graduate	14	3.57	1.016	.272	2.98	4.16	2	5
Associate Degree	15	4.27	.704	.182	3.88	4.66	3	5
Bachelor's	40	3.60	1.057	.167	3.26	3.94	1	5

Degree								
Master's Degree	28	3.46	1.105	.209	3.04	3.89	1	5
PhD Degree	5	3.60	.894	.400	2.49	4.71	2	4
Total	102	3.66	1.029	.102	3.45	3.86	1	5
How often did you need support for HIS?								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
High School Graduate	14	2.71	1.383	.370	1.92	3.51	1	5
Associate Degree	15	2.40	1.454	.375	1.59	3.21	1	5
Bachelor's Degree	40	2.55	1.085	.172	2.20	2.90	1	5
Master's Degree	28	2.18	.983	.186	1.80	2.56	1	4
PhD Degree	5	3.20	.837	.374	2.16	4.24	2	4
Total	102	2.48	1.158	.115	2.25	2.71	1	5
What is the level of your computer skills?								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
High School Graduate	13	3.31	1.182	.328	2.59	4.02	1	5
Associate Degree	18	3.67	.767	.181	3.29	4.05	3	5
Bachelor's Degree	40	3.30	.608	.096	3.11	3.49	2	4
Master's Degree	28	3.54	.744	.141	3.25	3.82	2	5
PhD Degree	5	4.00	.707	.316	3.12	4.88	3	5
Total	104	3.46	.775	.076	3.31	3.61	1	5

Table 136. ANOVA Analysis for Non-group Questions and Education Level

		Sum of Squares	df	Mean Square	F	Sig.
How often did you have problems in HIS?	Between Groups	8.901	4	2.225	2.122	.084
	Within Groups	102.789	98	1.049		
	Total	111.689	102			
How often did you have problems in issues which are not related to HIS?	Between Groups	9.277	4	2.319	1.759	.143
	Within Groups	126.565	96	1.318		
	Total	135.842	100			
How often do you use computers?	Between Groups	15.326	4	3.831	3.942	.005
	Within Groups	99.141	102	.972		
	Total	114.467	106			

How often did you have problems as a result of working with integrated systems?	Between Groups	6.641	4	1.660	1.380	.247
	Within Groups	114.269	95	1.203		
	Total	120.910	99			
How often did you have problems in transmitting data between integrated systems?	Between Groups	5.590	4	1.398	1.081	.371
	Within Groups	116.346	90	1.293		
	Total	121.937	94			
How often HIS provides wrong data?	Between Groups	6.864	4	1.716	1.662	.165
	Within Groups	100.126	97	1.032		
	Total	106.990	101			
How often did you need support for HIS?	Between Groups	6.196	4	1.549	1.162	.332
	Within Groups	129.264	97	1.333		
	Total	135.461	101			
What is the level of your computer skills?	Between Groups	3.713	4	.928	1.581	.185
	Within Groups	58.134	99	.587		
	Total	61.846	103			

ANOVA Analysis for Occupation

ANOVA Analysis for Organization and Occupation

Table 137. Descriptive of ANOVA Analysis for Organization and Occupation

Communication between management and HIS end users was sufficient								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Physician	36	3.3056	.81528	.13588	3.0297	3.5814	1.00	4.75
Nurse	40	3.6313	.66744	.10553	3.4178	3.8447	1.75	4.75
Department Secretary	19	3.6184	.71864	.16487	3.2720	3.9648	2.50	5.00
Technician	7	3.5714	.42608	.16104	3.1774	3.9655	3.00	4.25
Management Staff	2	4.0000	.00000	.00000	4.0000	4.0000	4.00	4.00
Total	104	3.5192	.72297	.07089	3.3786	3.6598	1.00	5.00
Contribution of end users to HIS implementation project was sufficient								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Physician	36	1.4583	.75000	.12500	1.2046	1.7121	1.00	4.00
Nurse	40	1.7125	.78354	.12389	1.4619	1.9631	1.00	4.00
Department Secretary	19	1.6842	.62828	.14414	1.3814	1.9870	1.00	3.00
Technician	7	1.9286	.93223	.35235	1.0664	2.7907	1.00	3.00
Management Staff	2	2.7500	.35355	.25000	-.4266	5.9266	2.50	3.00
Total	104	1.6538	.76665	.07518	1.5048	1.8029	1.00	4.00
Being a new hospital had no unconstructive effect on implementation.								
	N	Mean	Std.	Std. Error	95% Confidence		Minimum	Maximum

			Deviation		Interval for Mean			
					Lower Bound	Upper Bound		
Physician	36	2.2222	1.28976	.21496	1.7858	2.6586	1.00	5.00
Nurse	40	2.0750	1.11832	.17682	1.7173	2.4327	1.00	5.00
Department Secretary	19	2.2632	1.09758	.25180	1.7341	2.7922	1.00	5.00
Technician	7	2.1429	1.06904	.40406	1.1542	3.1316	1.00	4.00
Management Staff	2	1.5000	.70711	.50000	-4.8531	7.8531	1.00	2.00
Total	104	2.1538	1.15556	.11331	1.9291	2.3786	1.00	5.00

Table 138. ANOVA Analysis for Organization and Occupation

		Sum of Squares	df	Mean Square	F	Sig.
Communication between management and HIS end users was sufficient	Between Groups	2.814	4	.703	1.365	.252
	Within Groups	51.023	99	.515		
	Total	53.837	103			
Contribution of end users to HIS implementation project was sufficient	Between Groups	4.463	4	1.116	1.970	.105
	Within Groups	56.076	99	.566		
	Total	60.538	103			
Being a new hospital had no unconstructive effect on implementation.	Between Groups	1.500	4	.375	.273	.895
	Within Groups	136.039	99	1.374		
	Total	137.538	103			

ANOVA Analysis for Software and Occupation

Table 139. Descriptive of ANOVA Analysis for Software and Occupation

Usability issues in software did not cause any difficulty								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Physician	36	2.6875	1.01660	.16943	2.3435	3.0315	1.00	5.00
Nurse	39	3.3462	.73810	.11819	3.1069	3.5854	1.00	4.75
Department Secretary	19	3.0395	.79610	.18264	2.6558	3.4232	1.50	4.00
Technician	7	2.8929	.80178	.30305	2.1513	3.6344	1.75	3.75
Management Staff	2	2.8750	.53033	.37500	-1.8898	7.6398	2.50	3.25
Total	103	3.0194	.88954	.08765	2.8456	3.1933	1.00	5.00
Manipulation of medical data and workflows in software was sufficient								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Physician	36	3.2153	.74199	.12366	2.9642	3.4663	1.25	4.50
Nurse	40	3.5000	.71611	.11323	3.2710	3.7290	1.75	5.00
Department Secretary	19	3.3947	.61416	.14090	3.0987	3.6908	2.00	4.00

Technician	7	3.2143	.72785	.27510	2.5411	3.8874	2.25	4.25
Management Staff	2	3.8750	.17678	.12500	2.2867	5.4633	3.75	4.00
Total	104	3.3702	.70709	.06934	3.2327	3.5077	1.25	5.00

Table 140. ANOVA Analysis for Software and Occupation

		Sum of Squares	df	Mean Square	F	Sig.
Usability issues in software did not cause any difficulty	Between Groups	8.291	4	2.073	2.805	.030
	Within Groups	72.420	98	.739		
	Total	80.711	102			
Manipulation of medical data and workflows in software was sufficient	Between Groups	2.229	4	.557	1.120	.352
	Within Groups	49.268	99	.498		
	Total	51.498	103			

ANOVA Analysis for Hardware and Occupation

Table 141. Descriptive of ANOVA Analysis for Hardware and Occupation

Hardware related issues in HIS implementation did not cause any difficulty								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Physician	36	4.0556	.73247	.12208	3.8077	4.3034	2.00	5.00
Nurse	39	3.6239	.81355	.13027	3.3602	3.8877	1.33	5.00
Department Secretary	18	3.8704	.62767	.14794	3.5582	4.1825	2.33	5.00
Technician	7	3.7619	.49868	.18848	3.3007	4.2231	3.33	4.67
Management Staff	2	3.6667	.47140	.33333	-.5687	7.9021	3.33	4.00
Total	102	3.8301	.74424	.07369	3.6839	3.9762	1.33	5.00

Table 142. ANOVA Analysis for Hardware and Occupation

		Sum of Squares	df	Mean Square	F	Sig.
Hardware related issues in HIS implementation did not cause any difficulty	Between Groups	3.603	4	.901	1.669	.163
	Within Groups	52.341	97	.540		
	Total	55.943	101			

ANOVA Analysis for End User Profile and Occupation

ANOVA Analysis for General Computer Skills and Occupation

Table 143. Descriptive of ANOVA Analysis for End User Profile General Computer Usage and Occupation

General computer usage experience								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Physician	36	.9352	.20808	.03468	.8648	1.0056	.00	1.00
Nurse	39	.7949	.36367	.05823	.6770	.9128	.00	1.00
Department Secretary	19	.8246	.34009	.07802	.6606	.9885	.00	1.00
Technician	7	.6190	.44840	.16948	.2044	1.0337	.00	1.00
Management Staff	2	.6667	.47140	.33333	-3.5687	4.9021	.33	1.00
Total	103	.8350	.32631	.03215	.7712	.8987	.00	1.00
Computer Usage for presentation purpose								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Physician	36	.1389	.35074	.05846	.0202	.2576	.00	1.00
Nurse	40	.0250	.15811	.02500	-.0256	.0756	.00	1.00
Department Secretary	19	.0000	.00000	.00000	.0000	.0000	.00	.00
Technician	7	.0000	.00000	.00000	.0000	.0000	.00	.00
Management Staff	2	.0000	.00000	.00000	.0000	.0000	.00	.00
Total	104	.0577	.23429	.02297	.0121	.1033	.00	1.00
Computer usage tendency								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Physician	36	.6204	.16238	.02706	.5654	.6753	.33	1.00
Nurse	40	.4500	.25654	.04056	.3680	.5320	.00	1.00
Department Secretary	19	.2982	.29175	.06693	.1576	.4389	.00	.67
Technician	7	.2381	.16265	.06148	.0877	.3885	.00	.33
Management Staff	2	.5000	.23570	.16667	-1.6177	2.6177	.33	.67
Total	104	.4679	.26077	.02557	.4172	.5187	.00	1.00

Table 144. ANOVA Analysis for End User Profile General Computer Usage and Occupation

		Sum of Squares	df	Mean Square	F	Sig.
General computer usage	Between Groups	.809	4	.202	1.973	.105

experience	Within Groups	10.052	98	.103		
	Total	10.861	102			
Computer Usage for presentation purpose	Between Groups	.373	4	.093	1.750	.145
	Within Groups	5.281	99	.053		
	Total	5.654	103			
Computer usage tendency	Between Groups	1.768	4	.442	8.359	.000
	Within Groups	5.236	99	.053		
	Total	7.004	103			

ANOVA Analysis for Clinical System Experience and Occupation

Table 145. Descriptive of ANOVA Analysis for End User Profile Clinical System Experience and Occupation

Primary computer usage for patient activities								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Physician	36	1.1111	.78072	.13012	.8470	1.3753	.00	2.00
Nurse	39	1.0085	.68179	.10917	.7875	1.2296	.00	2.00
Department Secretary	19	1.4737	.78815	.18081	1.0938	1.8536	.00	2.00
Technician	7	.8571	.74180	.28037	.1711	1.5432	.00	2.00
Management Staff	2	.0000	.00000	.00000	.0000	.0000	.00	.00
Total	103	1.1003	.76246	.07513	.9513	1.2493	.00	2.00
Advanced computer usage for patient activities								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Physician	36	.2778	.45426	.07571	.1241	.4315	.00	1.00
Nurse	40	.8500	.53349	.08435	.6794	1.0206	.00	2.00
Department Secretary	19	.5263	.61178	.14035	.2314	.8212	.00	2.00
Technician	7	.5714	.78680	.29738	-.1562	1.2991	.00	2.00
Management Staff	2	1.0000	.00000	.00000	1.0000	1.0000	1.00	1.00
Total	104	.5769	.58612	.05747	.4629	.6909	.00	2.00

Table 146. ANOVA Analysis for End User Profile Clinical System Experience and Occupation

		Sum of Squares	df	Mean Square	F	Sig.
Primary computer usage for patient activities	Between Groups	5.817	4	1.454	2.665	.037
	Within Groups	53.480	98	.546		
	Total	59.297	102			
Advanced computer usage for patient activities	Between Groups	6.611	4	1.653	5.687	.000
	Within Groups	28.773	99	.291		
	Total	35.385	103			

ANOVA Analysis for Integration and Occupation

Table 147. Descriptive of ANOVA Analysis for Integration and Occupation

Integrated systems reduced time of work								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Physician	36	2.9028	1.01994	.16999	2.5577	3.2479	1.00	5.00
Nurse	39	3.3077	.93623	.14992	3.0042	3.6112	1.00	4.50
Department Secretary	17	3.0882	.73390	.17800	2.7109	3.4656	1.50	4.00
Technician	7	3.0714	.97590	.36886	2.1689	3.9740	1.00	4.00
Management Staff	2	3.5000	.70711	.50000	-2.8531	9.8531	3.00	4.00
Total	101	3.1139	.93777	.09331	2.9287	3.2990	1.00	5.00
Using different systems together did not cause difficulties								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Physician	36	2.3750	.65873	.10979	2.1521	2.5979	1.00	4.00
Nurse	38	2.8158	.94025	.15253	2.5067	3.1248	1.00	4.50
Department Secretary	18	2.7222	.64676	.15244	2.4006	3.0438	2.00	4.00
Technician	7	2.6429	.94491	.35714	1.7690	3.5168	2.00	4.00
Management Staff	2	3.0000	.70711	.50000	-3.3531	9.3531	2.50	3.50
Total	101	2.6337	.80589	.08019	2.4746	2.7928	1.00	4.50

Table 148. ANOVA Analysis for Integration and Occupation

		Sum of Squares	df	Mean Square	F	Sig.
Integrated systems reduced time of work	Between Groups	3.391	4	.848	.963	.432
	Within Groups	84.549	96	.881		
	Total	87.941	100			
Using different systems together did not cause difficulties	Between Groups	4.079	4	1.020	1.608	.178
	Within Groups	60.866	96	.634		
	Total	64.946	100			

ANOVA Analysis for Security and Occupation

Table 149. Descriptive of ANOVA Analysis for Security and Occupation

Security related issues in HIS implementation did not cause difficulties								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Physician	36	3.0556	.74429	.12405	2.8037	3.3074	1.50	5.00
Nurse	40	2.8625	.89147	.14095	2.5774	3.1476	1.00	4.50
Department Secretary	18	3.3056	.66728	.15728	2.9737	3.6374	2.50	4.50

Technician	7	3.1429	.85217	.32209	2.3547	3.9310	2.00	4.50
Management Staff	2	2.7500	1.06066	.75000	-6.7797	12.2797	2.00	3.50
Total	103	3.0243	.80555	.07937	2.8668	3.1817	1.00	5.00

Table 150. ANOVA Analysis for Security and Occupation

		Sum of Squares	df	Mean Square	F	Sig.
Security related issues in HIS implementation did not cause difficulties	Between Groups	2.755	4	.689	1.064	.379
	Within Groups	63.434	98	.647		
	Total	66.189	102			

ANOVA Analysis for Planning and Occupation

Table 151. Descriptive of ANOVA Analysis for Planning and Occupation

HIS master data. workflow and support were planned sufficiently								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Physician	36	2.9722	.84468	.14078	2.6864	3.2580	1.00	4.67
Nurse	39	3.3333	.78733	.12607	3.0781	3.5886	1.00	5.00
Department Secretary	18	3.3333	.48507	.11433	3.0921	3.5746	2.33	4.00
Technician	7	3.3810	.78004	.29483	2.6595	4.1024	2.33	4.33
Management Staff	2	3.8333	.23570	.16667	1.7156	5.9510	3.67	4.00
Total	102	3.2190	.77146	.07639	3.0674	3.3705	1.00	5.00
Starting to use HIS just after the hospital opening did not cause difficulties.								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Physician	36	3.2500	1.20416	.20069	2.8426	3.6574	1.00	5.00
Nurse	38	3.0263	1.02632	.16649	2.6890	3.3637	2.00	5.00
Department Secretary	17	3.0000	.86603	.21004	2.5547	3.4453	2.00	4.00
Technician	7	2.5714	.78680	.29738	1.8438	3.2991	2.00	4.00
Management Staff	2	4.5000	.70711	.50000	-1.8531	10.8531	4.00	5.00
Total	100	3.1000	1.06837	.10684	2.8880	3.3120	1.00	5.00

Table 152. ANOVA Analysis for Planning and Occupation

		Sum of Squares	df	Mean Square	F	Sig.
HIS master data. workflow and support were planned sufficiently	Between Groups	3.876	4	.969	1.671	.163
	Within Groups	56.234	97	.580		
	Total	60.110	101			
Starting to use HIS just	Between Groups	7.062	4	1.766	1.583	.185

after the hospital opening did not cause difficulties.	Within Groups	105.938	95	1.115		
	Total	113.000	99			

ANOVA Analysis for Workflow and Occupation

Table 153. Descriptive of ANOVA Analysis for Workflow and Occupation

HIS was sufficient on workflows								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Physician	36	2.7870	.73096	.12183	2.5397	3.0344	1.33	4.67
Nurse	39	3.2137	.67749	.10848	2.9941	3.4333	1.00	4.00
Department Secretary	17	3.1176	.58856	.14275	2.8150	3.4203	2.00	4.00
Technician	7	3.1429	1.06904	.40406	2.1542	4.1316	1.67	4.33
Management Staff	2	3.5000	1.17851	.83333	-7.0885	14.0885	2.67	4.33
Total	101	3.0462	.73489	.07312	2.9011	3.1913	1.00	4.67
Undefined hospital workflows and inconsistency among different department workflows had no unconstructive effect on implementation								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Physician	36	2.2778	.62615	.10436	2.0659	2.4896	1.00	4.00
Nurse	39	2.4231	.79089	.12664	2.1667	2.6795	1.00	4.00
Department Secretary	17	2.7941	.75122	.18220	2.4079	3.1804	1.50	4.00
Technician	7	2.0714	1.05785	.39983	1.0931	3.0498	1.00	4.00
Management Staff	2	2.5000	.70711	.50000	-3.8531	8.8531	2.00	3.00
Total	101	2.4109	.75959	.07558	2.2609	2.5608	1.00	4.00

Table 154. ANOVA Analysis for Workflow and Occupation

		Sum of Squares	df	Mean Square	F	Sig.
HIS was sufficient on workflows	Between Groups	4.076	4	1.019	1.959	.107
	Within Groups	49.931	96	.520		
	Total	54.007	100			
Undefined hospital workflows and inconsistency among different department workflows had no unconstructive effect on implementation	Between Groups	3.963	4	.991	1.770	.141
	Within Groups	53.735	96	.560		
	Total	57.698	100			

ANOVA Analysis for Support and Occupation

Table 155. Descriptive of ANOVA Analysis for Support and Occupation

End user support was sufficient								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Physician	36	3.5972	.80610	.13435	3.3245	3.8700	2.00	5.00
Nurse	38	3.3947	.54720	.08877	3.2149	3.5746	2.33	4.33
Department Secretary	17	3.6667	.68718	.16667	3.3133	4.0200	2.33	4.67
Technician	7	3.4762	.60422	.22837	2.9174	4.0350	2.67	4.00
Management Staff	2	3.1667	.23570	.16667	1.0490	5.2844	3.00	3.33
Total	100	3.5150	.67466	.06747	3.3811	3.6489	2.00	5.00

Table 156. ANOVA Analysis for Support and Occupation

		Sum of Squares	df	Mean Square	F	Sig.
End user support was sufficient	Between Groups	1.437	4	.359	.782	.539
	Within Groups	43.624	95	.459		
	Total	45.061	99			

ANOVA Analysis for Training and Occupation

Table 157. Descriptive of ANOVA Analysis for Training and Occupation

Content. methodology and scheduling of training were sufficient								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Physician	36	2.8333	.82808	.13801	2.5532	3.1135	1.00	4.50
Nurse	39	2.0897	.86505	.13852	1.8093	2.3702	1.00	4.00
Department Secretary	18	3.0556	.83822	.19757	2.6387	3.4724	1.00	4.00
Technician	7	2.7143	.75593	.28571	2.0152	3.4134	1.50	3.50
Management	2	3.5000	1.41421	1.00000	-9.2062	16.2062	2.50	4.50
Total	102	2.5931	.93005	.09209	2.4105	2.7758	1.00	4.50
End user participation and duration of training were sufficient								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Physician	36	2.8704	.73583	.12264	2.6214	3.1193	1.67	4.33
Nurse	39	3.2137	.76563	.12260	2.9655	3.4619	1.67	5.00
Department Secretary	18	3.1481	.85728	.20206	2.7218	3.5745	1.67	4.33
Technician	7	3.3810	.97046	.36680	2.4834	4.2785	2.33	4.67
Management Staff	2	2.6667	.47140	.33333	-1.5687	6.9021	2.33	3.00
Total	102	3.0817	.78935	.07816	2.9267	3.2367	1.67	5.00

Table 158. ANOVA Analysis for Training and Occupation

		Sum of Squares	df	Mean Square	F	Sig.
Content. methodology and scheduling of training were sufficient	Between Groups	17.556	4	4.389	6.099	.000
	Within Groups	69.809	97	.720		
	Total	87.365	101			
End user participation and duration of training were sufficient	Between Groups	3.338	4	.834	1.358	.254
	Within Groups	59.592	97	.614		
	Total	62.930	101			

ANOVA Analysis for Solution Provider and Occupation

Table 159. Descriptive of ANOVA Analysis for Solution Provider and Occupation

HIS Solution Provider was sufficient in HIS application.								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Physician	36	3.1500	.79048	.13175	2.8825	3.4175	1.20	4.80
Nurse	39	3.4974	.62723	.10044	3.2941	3.7008	2.00	4.80
Department Secretary	18	3.6444	.63822	.15043	3.3271	3.9618	2.40	4.80
Technician	7	3.4286	.46803	.17690	2.9957	3.8614	2.80	4.00
Management Staff	2	3.8000	.28284	.20000	1.2588	6.3412	3.60	4.00
Total	102	3.4020	.69766	.06908	3.2649	3.5390	1.20	4.80

Table 160. ANOVA Analysis for Solution Provider and Occupation

		Sum of Squares	df	Mean Square	F	Sig.
HIS Solution Provider was sufficient in HIS application.	Between Groups	4.021	4	1.005	2.160	.079
	Within Groups	45.138	97	.465		
	Total	49.160	101			

ANOVA Analysis for Non-group Questions and Occupation

Table 161. Descriptive of ANOVA Analysis for Non-group Questions and Occupation

How often did you have problems in HIS?								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Physician	36	2.19	.951	.158	1.87	2.52	1	4
Nurse	36	2.72	1.111	.185	2.35	3.10	1	4
Department Secretary	16	2.44	.892	.223	1.96	2.91	1	4

Technician	7	3.00	.816	.309	2.24	3.76	2	4
Management Staff	2	3.50	.707	.500	-2.85	9.85	3	4
Total	97	2.52	1.022	.104	2.31	2.72	1	4
How often did you have problems in issues which are not related to HIS?								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Physician	35	3.06	1.259	.213	2.62	3.49	1	5
Nurse	36	2.81	1.261	.210	2.38	3.23	1	5
Department Secretary	16	3.31	.793	.198	2.89	3.74	2	4
Technician	7	4.00	.577	.218	3.47	4.53	3	5
Management Staff	2	3.50	.707	.500	-2.85	9.85	3	4
Total	96	3.08	1.176	.120	2.85	3.32	1	5
How often do you use computers?								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Physician	36	1.17	.447	.075	4.68	4.98	3	5
Nurse	39	1.50	1.273	.204	3.69	4.52	1	5
Department Secretary	17	1.24	.562	.136	4.48	5.05	3	5
Technician	7	2.57	1.512	.571	2.03	4.83	2	5
Management Staff	2	1	.000	.000	5.00	5.00	5	5
Total	101	1.55	1.034	.103	4.24	4.65	1	5
How often did you have problems as a result of working with integrated systems?								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Physician	34	3.06	1.205	.207	2.64	3.48	1	5
Nurse	36	3.11	1.141	.190	2.73	3.50	1	5
Department Secretary	16	3.00	.966	.242	2.49	3.51	2	5
Technician	7	2.71	.756	.286	2.02	3.41	2	4
Management Staff	2	3.50	.707	.500	-2.85	9.85	3	4
Total	95	3.05	1.095	.112	2.83	3.28	1	5
How often did you have problems in transmitting data between integrated systems?								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for		Minimum	Maximum

					Mean			
					Lower Bound	Upper Bound		
Physician	33	3.21	1.193	.208	2.79	3.64	1	5
Nurse	32	3.16	1.167	.206	2.74	3.58	1	5
Department Secretary	16	3.19	1.047	.262	2.63	3.75	2	5
Technician	7	3.29	1.113	.421	2.26	4.31	2	5
Management Staff	2	2.50	.707	.500	-3.85	8.85	2	3
Total	90	3.18	1.128	.119	2.94	3.41	1	5
How often HIS provides wrong data?								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Physician	35	3.54	1.067	.180	3.18	3.91	1	5
Nurse	36	3.78	1.045	.174	3.42	4.13	1	5
Department Secretary	16	3.44	1.031	.258	2.89	3.99	2	5
Technician	7	4.43	.535	.202	3.93	4.92	4	5
Management Staff	2	4.00	.000	.000	4.00	4.00	4	4
Total	96	3.69	1.029	.105	3.48	3.90	1	5
How often did you need support for HIS?								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Physician	35	2.51	1.040	.176	2.16	2.87	1	4
Nurse	36	2.83	1.231	.205	2.42	3.25	1	5
Department Secretary	16	1.75	.931	.233	1.25	2.25	1	4
Technician	7	2.86	1.215	.459	1.73	3.98	1	4
Management Staff	2	1.50	.707	.500	-4.85	7.85	1	2
Total	96	2.51	1.161	.118	2.28	2.75	1	5
What is the level of your computer skills?								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Physician	34	3.32	.806	.138	3.04	3.60	2	5
Nurse	38	3.45	.645	.105	3.24	3.66	2	5
Department	17	3.71	.849	.206	3.27	4.14	3	5

Secretary								
Technician	7	3.14	1.069	.404	2.15	4.13	1	4
Management Staff	2	4.50	.707	.500	-1.85	10.85	4	5
Total	98	3.45	.788	.080	3.29	3.61	1	5

Table 162. ANOVA Analysis for Non-group Questions and Occupation

		Sum of Squares	df	Mean Square	F	Sig.
How often did you have problems in HIS?	Between Groups	8.928	4	2.232	2.249	.070
	Within Groups	91.299	92	.992		
	Total	100.227	96			
How often did you have problems in issues which are not related to HIS?	Between Groups	9.871	4	2.468	1.849	.126
	Within Groups	121.462	91	1.335		
	Total	131.333	95			
How often do you use computers?	Between Groups	19.588	4	4.897	5.381	.001
	Within Groups	87.363	96	.910		
	Total	106.950	100			
How often did you have problems as a result of working with integrated systems?	Between Groups	1.370	4	.343	.277	.892
	Within Groups	111.366	90	1.237		
	Total	112.737	94			
How often did you have problems in transmitting data between integrated systems?	Between Groups	1.056	4	.264	.200	.938
	Within Groups	112.100	85	1.319		
	Total	113.156	89			
How often HIS provides wrong data?	Between Groups	6.065	4	1.516	1.459	.221
	Within Groups	94.560	91	1.039		
	Total	100.625	95			
How often did you need support for HIS?	Between Groups	15.890	4	3.972	3.225	.016
	Within Groups	112.100	91	1.232		
	Total	127.990	95			
What is the level of your computer skills?	Between Groups	4.522	4	1.131	1.887	.119
	Within Groups	55.722	93	.599		
	Total	60.245	97			

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