

## Examination of the User Expectations from Hospital Information System

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**Abstract**—Understanding user expectations is an important issue in Hospital Information Systems. The expectations of the users must be well understood and taken into consideration in Hospital Information System design to catch the success and user support. 17 potential end-user expectations from Hospital Information Systems are rank ordered according to the perceived importance of users and the least five expectations appeared to be Privacy, Help Manuals, Security, Research Facilities and Decision Support respectively from the least ranked. These expectations are supposed to be higher ranked. The user assets that may affect this unexpected result are examined. It is seen that perceived importance may change according to the user assets, and these assets have influence on the unexpected result.

**Keywords**—*Expectation Failure; Expectation Ranking; Hospital Information System; Rank Ordering; User Expectations.*

### I. INTRODUCTION

Information System (IS) success and failure reasons are largely discussed in the literature. Technical issues, organizational issues, management issues are the main topics for the failure [1-3]. “Expectation Failure” is one of the reasons for the failure, which can be defined as the gap between the users’ expectations from the IS and its real performance [4]. IS Success (ISS) reasons are also of great interest to the literature as well as failure reasons.

#### A. Background

The ratings of the perceived importance usually change from one person to another, because everyone has a different measurement standard and personal approach [5]. Elimination of such individual relativity is possible by means of the rank ordering process [5].

Relative importance and rank ordering of ISS factors directly related to the user expectations are examined in the literature [5-9]. “Realization of user requirements” in Pearson’s work [7], “users’ confidence in the systems” in Montazemi’s work [8] and Eldon’s work [5], “user expectations” in Conrath and Mignen’s work [9] appear to be in the top five ranked important factors.

In IS context, understanding user expectations is a challenging task [10, 11]. According to the contrast theory, the difference between the expectation and reality is

exaggerated, when expectations are not met [12, 13]. The degree of harm increases exponentially. That is, the frustration fuels itself by the word of mouth conversations between users within the organization.

Although the importance of user expectations is known by literature and researchers show great interest to this topic, there is no study about the expectations from Hospital Information System (HIS).

In the previous work, perceived importance of the user expectations from HIS was examined [14]. In this study, it was stated that the expectations of users must be well understood and discreetly worked out to design and implement a successful, acceptable and useful IS [14]. The expectations and priorities of these expectations must be well understood. In healthcare, huge investments are made in IS and failure rate is 60-70% [15]. User acceptance is important to catch the success. It can be provided with high expectation meeting ratios. That may lead higher usage ratios, resulting in successful IS implementations.

#### B. Motivation

There were surprising results in the previous work [14]. Decision Support, Research Facilities, Security, Help Manuals and Privacy expectations were the least five ranks. Except Help Manuals, the other four are expected to mean more importance to the users according to the literature.

Patient’s health data are the most sensitive data about humans [16]. Electronic Patient Records and Information systems give opportunity to easy and unauthorized access to the private and very sensitive data about the patients, when compared to manual archives. For this reason, the security and privacy of the patient data in HIS are questioned.

Decision Support functions are crucial for end-user acceptance [17]. In literature, there are studies proving Hospital Information Systems (HIS) with Decision Support functions be more successful [18-21]. It supports the clinical diagnosis, enlightens the physician in treatment by reminding him the right trials and also provides him with the background information of the patient.

Clinical research is another indispensable virtue of the HIS [22]. Medicine improves by way of the researches. Consider making the research without the facilities of the HIS in medicine. Examining the handwritings in the manual

archive, within the unstructured data and hard to read handwriting would be long time consuming and difficult process. Additionally, this way of research is prone to mistakes and misleading results.

The literature tells us these expectation variables are/should be indispensable and crucial virtues of the HIS. It would be hard to work in complex healthcare environment for the healthcare professionals without these facilities. The motivation of this work is the low ranks of these important aspects of the HIS, which do not comply with the literature.

The aim of this study is to examine further the unexpected least five ranked expectations. The objective is to get an answer to the question “What personal features of the HIS users (named as ‘assets’ in this study) may be effective in this unexpected result”.

Materials used in the study will be given in the Materials section. In Methods section, the methods used to get the study results will be described. In Results section, the result of the study will be given without any comment, and these results will be discussed in the Discussion section. The findings of the study and the proposed future work will be in the Conclusion and Future Work part.

II. MATERIALS

A. User Expectations

HIS specifications, computer support centers’ experiences and interviews with HIS end-users are used to constitute the possible user expectations from a HIS. These possible expectations are grouped to make them more comprehensible. The expectation groups constitute Expectation Dimensions of the study, which are Usage Expectations, System and Data Expectations, Improvement Expectations and Managerial Expectations. Table I lists what an end user may expect from a HIS. These expectations are constituted and presented to the literature to measure the expectation meeting ratios of HIS by a newly proposed evaluation framework for HIS [23].

TABLE I. POSSIBLE USER EXPECTATIONS FROM HIS

Usage Expectations	System and Data Expectations	Improvement Expectations	Managerial Expectations
Ease-of-use	Consistency	Improving Service Quality	Reporting Facilities
Need For Training	Privacy	Decreasing Work Load	Decision Support
Help Manuals	Security	Bringing Positive Change	Function Sufficiency
Speed	Availability	Research Facilities	
User Support	Interoperability		

TABLE II. USER ASSET VARIABLES, TYPES AND VALUES

User Asset Variables	Values	Types
Education	Primary, High School, University graduate	Ordinal
Sex	Male, Female	Nominal
IS Experience	Inadequate, Average, Good and Advanced.	Ordinal
Business Title	Physician, Nurse, Laboratory Technician, Office workers, Others	Nominal
Working Unit	Administrative Unit, Basic Medicine, Internal Medicine, Surgical Medicine	Nominal

B. User Assets

In this study, five user assets, that may affect the least ranked expectations, are examined, *Business title, Education, Sex, IS experience, Working Unit*. User asset variables, their values and types of variables are given in Table II.

C. Data

Expectation Questionnaire is applied in a big hospital for data collection having 1700 (900-1000 online) HIS users.

Volunteered HIS end-users in the hospital have participated in the study.

III. METHODS

A. Expectation Questionnaire

Data are collected using the questionnaire method. The questionnaire, named as “Expectation Questionnaire”, is formed and used for collecting medical users’ perceived importance. For each expectation variable, a question is asked to capture the importance of that variable. Users are asked to express their importance weights using 5-point Likert scale (very important, important, average important, not so important, not important), ranging from 5 (very important) to 1 (not important).

B. Analysis:

The internal consistencies of the answers to the Expectation Questionnaire are measured by Cronbach’s Alpha coefficient, which is commonly used as a measure of the internal consistency or reliability [24]. Statistical Package for Social Sciences 19.0 (SPSS, SPSS Inc, Chicago, Illinois, USA) is used to compute Cronbach Alpha coefficient. Cronbach’s Alpha greater than 0.70 is considered reliable.

Expectations are rank ordered in variable base for all users in the previous work; the results are given in Table III [14]. In this study, they are rank ordered for user assets under examination and the results are given in Table IV-VIII.

In expectation based ranking, the final rating RF of the expectation variable  $j$  is computed by

$$RF_j = \sum_{i=1}^k W_i R_i / n \quad (1)$$

where  $k$  is the number of Likert scales used (5 for this study),  $W$  is the weight (1 to 5) of the Likert scale  $i$ ,  $R$  is the number of answers given as that Likert scale and  $n$  is the total number of answers.

IV. RESULTS

660 questionnaires are passed out and 504 are returned by the users (response rate is 76.4%); 428 of them are completely filled without any missing importance rating.

Cronbach’s Alpha coefficient, measuring the reliabilities (internal consistencies), is 0.871. It is apparently high and greater than 0.7, meaning the answers to the questions are internally consistent.

The rank orders of the expectation variables are given in Table III. The top five ranked expectations are Availability, Speed, Bringing Positive Change, Ease of Use and User Support. The five least ranked expectations appeared to be Privacy, Help Manuals, Security, Research Facilities and Decision Support respectively from the least ranked.

Tables IV – VIII give the least ranked five expectations according to the user assets under examination in the format final rating/rank, where “/1” represents the least ranked and

TABLE III. EXPECTATION RANKING

Expectation	r <sup>a</sup>	RF <sup>b</sup>
Availability	1	4.792
Speed	2	4.790
Decreasing work load	3	4.706
Ease of Use	4	4.685
User Support	5	4.685
Need for Training	6	4.657
Improve service quality	7	4.633
Function Sufficiency	8	4.605
Consistency	9	4.537
Bringing Positive Change	10	4.477
Interoperability	11	4.472
Report Facilities	12	4.411
Decision Support	13	4.367
Research Facilities	14	4.288
Security	15	4.255
Help Manuals	16	4.245
Privacy	17	4.030

a. r = Rank.  
b. RF = Final Rating

TABLE IV. LEAST RANKED EXPECTATIONS (TITLES)

Expectation	Physician (n = 147)	Nurse (n = 140)	Laboratory Technician (n = 29)	Office Worker (n = 39)	Other (n = 37)
Privacy	3.680/1	4.293/4	4.241/2	4.000/3	4.324/3
Security	4.048/2		4.241/3	4.256/4	
Decision Support	4.483/3	4.286/3	4.310/5	4.385/5	4.378/4
Interoperability	4.517/4				
Consistency	4.544/5				
Report Facilities		4.221/2	4.276/4		
Research Facilities		4.108/1		3.923/2	4.270/2
Help Manuals		4.364/5	4.172/1	3.923/1	4.162/1

the others are in ascending order, where  $n$  is the number of users. The rank orders in these tables are computed by (1) just as in the table III.

In Table IV, *title* asset values, Privacy and Decision Support is in the five least ranked in all titles, Research Facilities and Security is in the least ranked in three out of the five titles. In Table V, *education* asset values, Privacy, Security, Help Manuals and Research Facilities are in the five least ranked in both graduate groups.

In Table VI, *sex* asset values, Privacy, Decision Support, Help Manuals and Research Facilities are in the five least ranked in both sexes. Security is in the five least only in Men.

In Table VII, *IS experience* asset values, Privacy and Help Manuals are in the five least ranked in all four groups, Security and Research Facilities are in the five least ranked in the three of the four groups. Decision Support is in the five least in two groups.

In Table VIII, *working unit* asset values, Privacy, Security, Research Facilities and Help Manuals are in the five least ranked in all four groups. Decision Support is in the five least in two groups.

TABLE V. LEAST RANKED EXPECTATIONS (EDUCATION)

Expectation	High School Graduates (n = 34)	University Graduates (n = 378)
Research Facilities	4.071/1	4.305/4
Help Manuals	4.143/2	4.257/2
Privacy	4.143/3	4.029/1
Security	4.286/4	4.262/3
Bringing Positive Change	4.286/5	
Decision Support		4.378/5

TABLE VI. LEAST RANKED EXPECTATIONS (SEX)

Expectation	Men (n = 183)	Women (n = 209)
Research Facilities	4.475/4	4.139/1
Privacy	3.825/1	4.215/2
Help Manuals	4.257/3	4.249/3
Reporting Facilities		4.273/4
Decision Support	4.492/5	4.283/5
Security	4.115 /2	

TABLE VII. LEAST RANKED EXPECTATIONS (IS EXPERIENCE)

Expectation	Inadequate (n =35)	Average ( n = 160)	Good ( n = 196)	Advanced ( n = 31)
Privacy	3.800/1	4.169/2	4.005/1	3.350 /1
Help Manuals	4.067/2	4.238/3	4.265/3	4.350/4
Security	4.133/3		4.255/2	3.650/2
Research Facilities	4.200/4	4.113/1	4.418/4	
Function Sufficiency	4.267/5			
Decision Support		4.281/4	4.439/5	
Report Facilities		4.319/5		
Bringing Positive Change				4.300/3
Consistency				4.350/5

TABLE VIII. LEAST RANKED EXPECTATIONS ( WORKING UNIT)

Expectation	Administrative Unit (n =30)	Basic Medicine (n = 51)	Internal Medicine (n = 177)	Surgical Medicine (n = 134)
Privacy	3.967/1	4.294/2	3.927/1	4.090/1
Research Facilities	4.067/2	4.314/3	4.284/4	4.358/5
Help Manuals	4.100/3	4.118/1	4.249/3	4.343/4
Security	4.300/4	4.373/4	4.175/2	4.328/3
Interoperability	4.433/5			
Report Facilities		4.373/5		
Decision Support			4.429/5	4.299/2

## V. DISCUSSION

In the previous work, it was seen that end-users of HIS have the high priority for the Usage Expectations [14]. Four of the top six rated expectations were the Usage Expectations variables. This was commented as “a HIS must be easy to use, easy to learn, fast and well supported to get users’ support and appreciation”.

The surprising result was the least ranked five expectations, namely, Privacy, Security, Research Facilities and Decision Support. As stated in the introduction part, these are of great importance for HIS. In this study, user assets that may affect this surprising result are examined.

Examination of the user titles’ influence shows us Privacy and Decision Support is ranked as the least in all titles. All the users independent of the title think these two properties of the system as the least important. This result is completely opposite of the literature. Nurses, Office Workers and Other titles ranked Research Facilities in the least five. Considering the number of the users in the groups, Office Workers and Others are very small to influence the complete result, so they can be assumed negligible for this variable. As for the Nurses, being the second biggest group with 140 users, it can be said that it was effective for the complete result. Research facilities of a HIS comprise useful tools for nursing informatics. This result can be interpreted as most of the participant nurses are not interested in research.

Education asset does not give us any justification for the unexpected results. The great majority of the participants is university graduate (n = 378); so the least five of this group is identical with the general result.

When we examine the effect of sex, it is seen that Privacy, Decision Support and Research Facilities are in the least five for both. But, Men users have difference in Security. For Security expectation, this group has influence on the general result when considering the large number with n = 183.

In IS experience, Privacy, Security and Research Facilities are in the least five for all. Users defining themselves as having average and good IS experience have rated Decision Support as 4th and 5th least. That makes this expectation be in the least five in the general result.

Privacy, Security and Research Facilities are in the least five according to the working unit for all assets. Only in Internal medicine and Surgical Medicine users’ ranking, Decision Support is in the five least ranked expectations. This is another surprising result; Decision Support is a powerful virtue of the HIS for surgeons especially to decide operation.

## VI. CONCLUSION AND FUTURE WORK

In summary, in the study it is clear that:

- Nurse users have influence on Research Facilities
- Men users have influence on Security,

- Users with average and good IS Experience have influence on Decision Support ,
- Users working in Surgical Medicine and Internal medicine have influence on Decision Support to be the least ranked in general result.

Ironically, Privacy is in the least five in all of the examinations.

The users' assets, Title, Sex, IS Experience and Working unit have influence on the unexpected result. The study shows perceived importance may change according to user profiles. Although the literature says these four expectations under study is indispensable virtue of the HIS, the users may think just the opposite.

This study is one step forward for the investigation of these unexpected results opposite of the literature. But still we don't have justifying explanation. Let alone justifying, more surprising findings are faced such as the surgeons thinking Decision Support less important. The study should be deepened to analyze these results and get satisfying findings. These users groups under study may be further detailed and a hierarchical grouping can be made such as Nurses working in different units, users working in different units having different levels of IS experience etc.

Another reason of these least ranked expectations may be related to the quality of the HIS used. If it is unable to give the basic virtues such as working without outage (availability) and fast processing (speed), the top perceived importance may appear as being basic usage expectations. This issue may also be further studied.

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