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# Evaluation of a Greek National Hospital Information System: A Prospective Study

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**Abstract:** Hospital Information Systems (HIS) focus on developing effective patient's care through the high-qualified medical, nursing and administrative services. However, user's opinion and satisfaction is fundamental for the successful information system adoption and acceptance. Evaluation of a Greek national hospital information system and assessment of the user satisfaction using the System Usability Scale (SUS) is the purpose of the study. The study sample consisted of 64 volunteers subdivided into two main groups (Health professionals = 21, administrative employees = 43). The evaluation of the individual satisfaction performed using SPSS 12 and more precisely by descriptive statistics and correlations. The findings confirm the ability and willingness of the national health care personnel to use information systems but the low percentage of users should be emphasized. At the beginning of the 21st century a new strategic plan is essential for the essential training of the personnel. In the light of the existing evidence, the use of information systems is cost effective and time saving procedure with many advantages. Ideally, this application could be a part of the regular personnel training under the supervision of the Greek Medical Council or other Governmental health authorities.

**Key words:** Information system, users satisfaction, evaluation, descriptivre statistics

## INTRODUCTION

Hospital Information Systems (HIS) focus on developing effective patient's care through the high-qualified medical, nursing and administrative services (Jaspers *et al*., 2004; Haux, 2006; Reichertz, 2006). The introduction of methods in order to promote liability in decision support functions and information processing is vital (Kalogeropoulos *et al*., 2003). The successfully adopted HIS eliminates heterogeneity in the hospital and supports its strategic information management (Winter *et al*., 2003). However, the increasing adoption of Information Technology (IT) in patient care necessitates the establishment of reliable evaluation of information systems (Lee, 2004).

Furthermore, the identification of user's and system's requirements is essential for the successful adoption of HIS (Staccini *et al*., 2005; Reichertz, 2006). Therefore, user's opinion and satisfaction is fundamental for the successful IS adoption and acceptance (Despont-Gros *et al*., 2005; Wu *et al*., 2007).

The purpose of the study, was to evaluate the adoption of an innovative HIS in a Greek hospital, stated in Kavala city, as far as concerns user satisfaction. Currently, the existing HIS in the specific hospital is in early stages. This effort concentrated to users' opinion for the existing information system, examining several aspects via the SUS questionnaire, which has not ever been used for the evaluation of user satisfaction in a hospital environment.

## MATERIALS AND METHODS

The departments of the hospital are stated in Table 1. In these departments, hospital information system is applied except the Psychiatric department.

For the purpose of this study, 241 persons working in the hospital were asked whether they used the HIS or not. Sixty-three of them were occupied at the administrative department of the hospital and the rest 178 were health professionals.

The overall of the users participated to the study was in total 64. Forty-three of them were administrative employees (administrative group) and twenty-one health professionals respectively (health care group).

To the degree of the percentages of the non-users, 31.7% of the administrative employees and 88.2% of the health care professionals were non-users of the HIS.

During this study, the System Usability Scale (SUS) questionnaire was used. Subjects were asked to complete

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Table 1: The departments of the hospital

| Health care departments | | |
|---|---|---|
| Pathological section | Surgical section | Administrative departments |
| A' Pathology | A' Surgery | Personnel department |
| B' Pathology | B' Surgery | Secretarian |
| A' Pulmonary | Dental Surgery | Admission Office |
| B' Pulmonary | Thoracic Surgery | Financial Management |
| Cardiology | Orthopaedic | Department of computer science |
| Urology | Urology | Nutritional |
| Neurology | ENT | Warehouse department |
| Reumatology | Opthalmology | |
| Dermatology | Anaesthesiology | |
| Pediatric | Midwifery and Obstetrics | |
| | Neurosurgery | |
| Others | | |
| Haematology | Psychiatric section | |
| Radiology | Psychiatry | |
| Pharmacology | | |
| Biochemistry | | |
| Microbiology | | |
| Nuclear medicine | | |
| Pathological anatomy | | |

a paper-based form of SUS given to them hand-to-hand, translated to the Greek language and attached with the consent form.

When using and scoring the SUS questionnaire the following criteria should be taken into account:

- Respondents should not think for a long time what to check. The immediate response is valuable.
- All items should be checked.
- If respondents are not sure what to response to a particular item, they should mark the centre point of the scale.
- Each item's score contribution will range from 0 to 4.
- For items 1, 3, 5, 7 and 9 the score contribution is the scale position minus 1. For items 2, 4, 6, 8 and 10, the contribution is 5 minus the scale position.
- The score contributions from each item are summed.
- The above sum is multiplied by 2.5. The result from this multiplication is the overall value of SUS.
- SUS scores have a range of 0 to 100.
- Scores of each item separately are pointless on their own.

This research gained ethics approval from the local health authorities. According to Helsinki's declaration, an information sheet and a consent form were given to all subjects. The above were written in the Greek language for the convenience of the respondents. The participants were firstly informed about the purpose of the study both orally and reading the information sheet. The participation was limited to that specified in the information sheet. All the subjects (n = 64) agreed signing the consent form to participate in the filling of the questionnaire.

As was stated to the consent form, the subjects were free:

- To ask questions concerned of the study and the given information sheet and
- To withdraw at any time, without giving any reason and without their legal rights being affected, as their participation was voluntary.

Additionally, as far as concerning the consent form, the subjects had the opportunity either to agree or disagree to take part to the study and allow any responsible person, relevant to the specific research, to look any of the information that the subject would transfer.

All the data collected for the study kept in a safe place locked. As it was specified in the protocol the results may be published in a Greek or an international journal or conference by all means, without transgressing the anonymity of subjects. The anonymity was secured by using index numbers.

The statistical package used was SPSS 12.0. The statistical methods used were descriptive statistics, bivariate correlations and non-parametric tests.

## RESULTS

The statistical evaluation of the data revealed that health professionals (n = 21) would strongly prefer to use the system frequently in the 67% of the cases. These results are significant ($p<0.01$). Nevertheless, it is interesting that 81% of the health care users would prefer to use the system frequently. The latter results are also significant ($p<0.01$), using the Chi-squared test (95%CI on proportion = (0.795,0.824)).

Similar results are observed also for the administrative users (n = 43); over the half of them would strongly desire to use the system regularly. The administrative group in

a percentage equal to 72% agreed to frequent use. These results were also significant ($p<0.01$) as resulted from the use of the Chi-square statistical test (95%CI on proportion = (0.712,0.730)).

Concerning the complexity of the system, the 43% of the health care professionals totally disagreed and an additional proportion equal to 24% disagreed that the system was complex. A small part of this group also characterised the system complex (14%). Moreover, a significant percentage (19%) had no specific opinion. These results are not significant when performing test statistics.

Likewise, approximately half of the administrative employees totally disagreed and in addition the 16% of the entire group disagreed that the system was complex. Only the 9% of the administrative users consider the system as complex. It is also worth-mentioning that approximately the 28% of them neither found it complex nor simple. These results are significant ($p<0.05$), but the 95%CI on the proportion is (0.617,0.639).

Nevertheless, it is interesting that the 66.7% of the health care professionals and the 62.8% of the administrative group in total disagreed that the system is complex.

Using Pearson's Correlation, significant correlations were established at the 0.05 or 0.01 levels in both health care and administrative groups.

In the health care group, confidence and functional integrity have a significant correlation at the 0.01 level where $r = 0.668$. Functional integrity is also significantly negatively correlated to inconsistency at the 0.05 level where $r = -0.543$. Frequency of use and integrity are correlated with $r = 0.517$ and $p<0.05$. The frequency of use is also correlated to confidence where $r = 0.660$ and $p<0.01$. Another interesting feature is the correlation of cumbersome to use to technician's support ($r = 0.689$ and $p<0.01$) and to inconsistency ($r = 0.470$ and $p<0.05$). The complexity is significantly correlated to inconsistency ($r = 0.812$ and $p<0.01$), integrity ($r = -0.490$ and $p<0.05$), cumbersome to use ($r = 0.484$ and $p<0.05$) and technician's support ($r = 0.546$ and $p<0.05$).

In the administrative group, significant correlations are also demonstrated. Frequency of use is significantly correlated to confidence ($r = 0.529$ and $p<0.01$), as well as to need to learn before the use of the system ($r = 0.483$ and $p<0.01$) and integrity ($r = 0.356$ and $p<0.05$). Frequency of use is also significantly negatively correlated to complexity ($r = -0.321$ and $p<0.05$). Inconsistency and easy to use correlation is significant at the 0.01 level with $r = 0.406$. Inconsistency and technician's support correlation is also significant with $r = 0.473$ and $p<0.01$. A significant negative correlation is demonstrated among cumbersome to use and integrity ($r = -0.384$ and $p<0.05$). Integrity is also significantly correlated to confidence ($r = 0.469$ and $p<0.01$). The negative correlations among complexity and confidence ($r = -0.410$ and $p<0.01$) and also among complexity and integrity ($r = -0.371$ and $p<0.05$) are significant. Complexity is also significantly correlated to cumbersome to use ($r = 0.478$ and $p<0.01$) and inconsistency ($r = 0.330$ and $p<0.05$). Finally, the integrity is negatively correlated to cumbersome to use ($r = -0.384$ and $p<0.05$).

## DISCUSSION

Kavala Hospital information system is function-limited and is applied by a small percentage of health care professionals. At the administrative departments of the hospital, the system was applied by the majority of the employees. As a result, the percentage of the non-users administrative employees was high and the percentage of the non-users health care professionals was extremely high.

The SUS seemed to be a successful questionnaire for the evaluation of user satisfaction in hospitals, not only because of its flexibility, but also because of the wide range of aspects that covers. The SUS was designed by Brooke in order to measure the usability of a system; it is a ten-item high-levelled scale assessing a variety of aspects of system usability subjectively and is freely available for usability assessment in a variety of research projects and industrial evaluations (Finstad, 2006). The main reasons that SUS questionnaire has been selected is that this tool is simple, flexible and focused in the evaluation of user satisfaction. As far as we know, this questionnaire has not been used for evaluation of hospital information systems.

The statistical evaluation of the data revealed that the majority of both administrative and health care users would like to use the system frequently. Furthermore, for the perceived ease to use, the opinions of both health care professionals and administrative employees were fluctuated presenting similarities among the two groups.

Health care users are seemed to believe that the system is easy to be learned. Therefore, there was no need to get extra knowledge before its use. They also considered that the system is well integrated and consistent providing them confidence and desire for frequent use.

On the other hand, administrative users disagreed that the system is cumbersome and complex. In contrast, they were appeared to believe that it is well integrated and consistent, providing them confidence for frequent use. It was also easy to learn it without requiring a lot of knowledge prior to use.

The findings of this study for the health care group suggested that a well-integrated system makes confident users. Therefore, they could handle it more frequently. The integrity affects significantly the inconsistency and vice versa. The same bilateral relation is applied to inconsistency, which is significantly affected by complexity. When an information system is not well integrated then becomes inconsistent and complex and furthermore cumbersome for the user. Due to complexity, which results to a confusing for the user system, support from the technician becomes essential. Therefore, a correlation pathway among significant aspects, affecting the successful adoption of the system may be hypothesised for user satisfaction consideration, in which all the above are represented (Fig. 1).

In the administrative group, interesting interrelations were also demonstrated. A well-integrated information system makes its user confident to handle the system frequently. But a non well-integrated system makes the user impatient and unwilling to use it regularly. The complex system was cumbersome to use. A well-integrated information system was also consistent and less complex. Thus, according to the findings of the study the negative and bilateral relationship among complexity and integrity was very strong. A complex system is not an integrated system and vice versa. Therefore, a complex system creates a field of insecurity to the users and therefore becomes cumbersome and inconsistent for them. The inconsistent system emphasizes the need for support from a technician as vital. The entire characteristics are demonstrated at the following scheme (Fig. 2).

User satisfaction depends on the way that the system facilitates the user (Dupuits and Hasman, 1995). Successful adoption of the system and the user satisfaction, are essential items, guiding the integration of the system. By this way, the users would be confident to use the system frequently. A non-well integrated system is complex and inconsistent. The triangles among Confidence- Integrity- Frequency to use (CIF triangle) and Integrity- Complexity- Inconsistency (ICI triangle) found to have significant value in both groups. Therefore, there is a strong indication for their adoption in evaluation studies.

The development of information system technology in a hospital environment is in early stages and still under consideration by the local authorities. If this milestone is overcome, a great emphasis should be given in the level of training of all health-related and administrative professionals. The fact that most of the health professionals are not users of this technology creates a

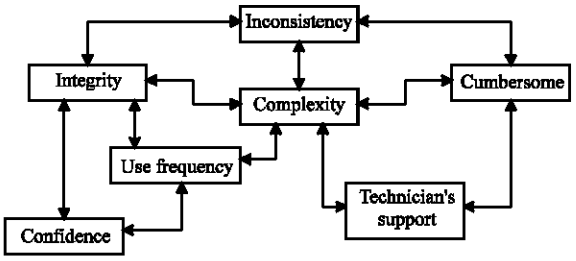


Fig. 1: A correlation pathway among significant aspects

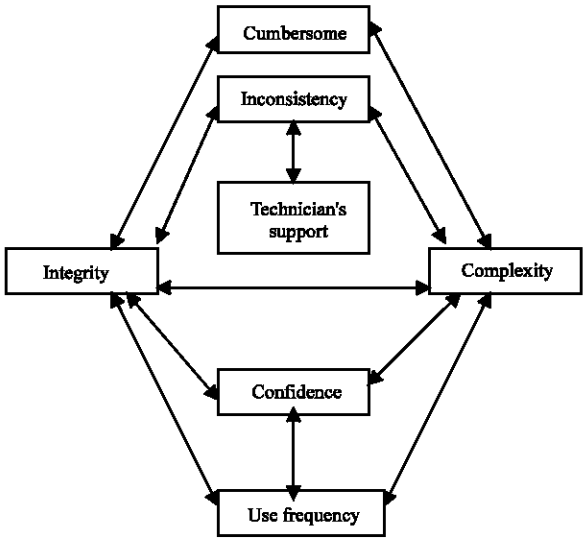


Fig. 2: The entire characteristics are demonstrated

field of confusion affecting mainly the persons seeking medical health care. For the successful adoption of an innovative HIS, evaluation studies should include tests for user satisfaction. The CIF and ICI triangles could be important concepts that may be used for the assessment of user satisfaction and therefore, of hospital information systems. Further research utilizing a larger selection of both health-related professionals and administrative employees would be recommended for future trials. The SUS questionnaire used in this study was proved very useful for this purpose. However, the need for a more holistic approach in terms of the hospital information systems sphere of evaluation is required.

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