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THE COMBINED EFFECT OF SOFTWARE QUALITY AND SERVICE QUALITY ON THE USAGE OF HOSPITAL MANAGEMENT INFORMATION SYSTEM (HMIS); MEDIATING ROLE OF USER SATISFACTION IN PAKISTAN

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ABSTRACT

Purpose/Objective/Aim: The aim of our study is to see the combined effect of Software Quality and Service Quality on the Usage of Hospital Management Information System (HMIS) with the mediating role of User Satisfaction (US) in Pakistan.

Design/Methodology/Approach: The study design is cross-sectional and data was collected by convenient sampling technique. A sample of 218 was collected from a single fully implemented HMIS hospital. The target population was healthcare workers of the hospital using HMIS. Regression and correlation analysis were done to test the hypothesis.

Results/Findings: User Satisfaction was found to have positive effect on the Software Quality and Usage of HMIS relationship. Similarly, User Satisfaction was also found to mediate the relationship between Service Quality and Usage of HMIS positively.

Practical Implications/Limitations: The results of the study can be used to improve the overall quality of HMIS thus improving the overall healthcare quality in hospitals. The limitation was to have a small sample size and was taken only from a single fully implemented HMIS hospital.

Originality/Value: This type of quantitative study on the usage HMIS has not ever carried out in Pakistan according to previous literature. Moreover, User Satisfaction has not been taken as mediator in previous literature according to the knowledge of researcher.

Keywords: Service Quality, User Satisfaction, HMIS, Software Quality

1. Introduction

The domain of healthcare is important for any country and the quality of services provided by this sector should also evolve and improve in terms of technology to provide advanced quality care to the citizens of its country. According to Ismail et al (2015), for continuous improvements in the healthcare sector, the healthcare management plays an important and leading role. Innovations, especially in terms of technology are very essential for any hospital or healthcare setup when considering health facilities and also for their organizational development. In today's world, Information Technology or IT is contributing excessively in promotion of new technologies in almost all fields around the world. Healthcare being a growing and progressive domain is not lacking behind and is also adopting new innovations every day. The use and adoption of IT in hospitals and healthcare centers is an increasing demand for providing updated and innovative quality care to its patients. The recognition for the importance of IT in healthcare is also made by WHO (Von Lubitz and Wickramasinghe, 2014) and the role of IT in supporting healthcare in enhancing quality has also been established as one of the important factor in the healthcare setup and is a major tool in the provision of better quality standards (Leaning, 2015).

Hospital Management Information System (HMIS) is defined similarly yet ingeniously by many authors in the previous literature. As stated by Haux et al. (2014), "HMIS is defined as the socio-technical subsystem of a hospital, comprising all information processing systems as well as the associated human or technical actors in their respective information-processing roles". For Chen and Hsiao (2012), HMIS is a system which is integrated and plays a supporting role in managing hospital affairs by technology. According to Handayani et al. (2016), the architecture of HMIS includes all the basic processes starting from administration to end payment process which can either include OPDs, IPDs, emergency or any other department. Aniza et al. (2018), Nor Bizura (2010) and Nik Azliza et al. (2009) have described HMIS as a system which is electronically integrated, and collects information, stores data, retrieves the backups, saves data and displays all related information of patients which might include diagnostic reports from laboratories or radiology, patients history, and billing summary from different departments of hospital.

The use and adoption of Hospital Management Information System (HMIS) is acknowledged and admired in numerous ways, such as, facilitation of quality services, provision of better standards in patient care and overall management of the hospital data and processes. As stated by Najem (2016), HMIS is considered a dominantly important component of any healthcare setup especially big organizations of healthcare. HMIS plays a very important part in hospitals because of its capabilities in managing huge amounts of patients' information and related organizational data (Khalifa, 2014) in a very organized and easily approachable manner for its users. With new innovations in supply chains and challenges in information technologies faced by the healthcare organizations, the need of HMIS to handle the growing complexity is highly recommended and is required for handling diversities in managerial processes. (Ahmedi et al., 2014). HMIS, being an integrated system, manages all clinical information and patient related data, ancillary data and all data related to financial management. It also assists the organization in administrating and handling comprehensive data (Yusof, 2008) which can be very difficult to organize manually in absence of such capable software. To provide the quality healthcare to the patients by their hospital, HMIS quality is very meaningful. (Tan J.k., 2001).

Gade (2013) defined Software quality as "How well the software complies with or conforms to a given standard or requirements, based on functional requirements or specifications". IEEE Standard Glossary of Software Engineering Terminology as stated by Gade (2013) defines Software Quality as, "The degree to which a system, a component, or process meets specified requirements". Wikipedia defines the Software Quality in the context of software engineering, the measure of how well software is designed or the quality of design, and how well the software conforms to that design or the quality of conformance. For improving user acceptance and satisfaction, the evaluation of software quality is essentially desired and required. This evaluation also helps in reducing cost of its future developments and maintenance and increases the profit outcome for the organization, proving to be one of the key

points in success of any organization and thus the thirst of continuous evaluation and improvements in software quality rises (Gade, 2013). HMIS being software, Software Quality is taken as one of the independent variables in this study.

The availability of the system support, the responsiveness of the providers and the trainings of the new employs or HMIS users is defined as Service Quality by Delone and Mclean (2003).The provision of Service Quality by the providers or the management of hospital to its users is a very important aspect in increasing satisfaction and acceptance for the system, consequently, better results from the system usage. The clinical implementation or the success of any already adopted Information System (IS) lies in the user support (Gruber et al, 2019). High user support or Service Quality decreases user resistance for its system (He.J 2014). A study by Holden et al. (2012) found Service Quality to be one of the most important dimensions of any system success whether in early or in late implementations. In literature, Service Quality is also referred as similar terms like "User Support" or "management support". Service Quality, one of the major considerations evident in the previous literature, is also taken as independent variable along with Software Quality in this study.

User satisfaction defined by Davis et al. (1989) stated in Gade (2013) is "the degree to which a person believes that using a particular system would enhance his or her job performance". The measurement of User Satisfaction is very essential for the organization because it provides the feedback for further improvisations and alteration in accordance with the needs of its users. The responses or the feedback helps in introducing new developments in the software or the system thus proving to be advantageous way for improving customer rating and long-run of the system (Gade, 2013). In literature, User Satisfaction is also referred by similar term like End-User Computer Satisfaction (EUCS). User Satisfaction is taken as a mediating variable for this study.

Failures in the system or insufficient quality of HMIS whether, in its adoption or in already implemented HMIS, can be due to number of factors. According to Kijsanayotin et al. (2009) and Gagnon (2012), socio-economic factors are insufficiently understood, primarily those which include the study related to adoption of users and organizations. The potential success of any HMIS lies in the ability of users and organization to fit in the system (Yusof, 2008). The study of these factors can lead to better running of HMIS, better identification of faults or unidentified difficulties and errors, and improvements in user acceptance (P. W. Handayani, 2017). In a research carried out by Lærum, H., Karlsen, T. H., & Faxvaag, A. (2004), the use of HMIS made the work of medical secretaries, physicians and nurses much more simplified. However, the variation in their results was due to less emphasis on multidisciplinary approach of HMIS. The challenges associated with HMIS are related to result accuracy, cost-friendly maintenance, and quality in operational managements in hospital (P. W. Handayani et al., 2017). The hospital cannot retain patients' trust if inappropriate management of the patients' data and information exchange is exiting in the organization (Kluge 2007).

Previous literature has provided us chunks of information on the HMIS implementation, but very few surveys have been conducted on the already implemented systems. Therefore, the emphasis of this research is on the hospital where HMIS is already implemented to find the pros and cons of the implemented and running system and to observe where the system lacks in its integration and working. The primary objective of our study is to find the combined effect of Software Quality (SQ) and Service Quality on the Usage of Hospital Management Information System (HMIS) with the mediating role of User Satisfaction in Pakistan. The study would also investigate to find the deficiencies in the running system which can be addressed by other organizations where HMIS is already running and organizations which will be implementing HMIS in future. In a developing country like Pakistan, very few hospitals have fully implemented HMIS which leads the researcher to investigate this study. Even in current era, many hospitals and their professionals still prefer to arrange the patient's data and records manually not knowing that how HMIS can ease their work and can assist them in much more accurate and simplified manner. Up to date, secure and quick data

retrieval can also be made using HMIS. Innovations in IT of healthcare are not very appreciated which lead the researcher to provide grounds for future researchers and policy makers to know its importance in betterment of healthcare quality. Moreover, no previous literature, according to our knowledge has worked on this combination and relationship of variables, especially taking User Satisfaction as a mediating role. Our study will also help to improve the quality of HMIS thus contributing to improve the overall healthcare quality.

2. Literature Review:

2.1 HMIS and Software Quality:

The evaluation of any software is necessary to find whether the expected quality is being provided or not. An integrated software implemented in such a critical area like hospital, needs to provide quality results because any errors or inability in the system can result into serious consequences. Assessing the software quality gives us knowledge about the overall quality of the system. As far as previous literature is studied, the usage of HMIS by evaluating the Software Quality has not been studied by any scholar. This research undertakes this variable into consideration because HMIS is also a software in its true sense. There have past researchers, conducted on the variable System quality which is a similar term for Software Quality. As stated in Gable (2008), System quality is also user's experience of the system or a software; it's technical, design and operational perspectives and is reflected in a user's evaluation of system attributes such as ease of use, reliability and response time. Considering the past literature, the researcher formulated Hypothesis 1 as:

H1: Software Quality has a significant (positive) effect of the Usage of HMIS

2.2 HMIS and Service Quality:

For any implemented system or a software, the support provided by the management is always considered when assessing its overall quality. As HMIS is entirely hospital based, support provided by the hospital management is essential for the long term running of the system. High Service Quality is always recommendable for better usage of that system or software because the continuous requirement for fixing the bugs and reducing any errors is always needed. Moreover, quick responses by the user support are also necessary for user to have a reliable assistance. For improving the working practices and experiences, the management should provide adequate support and service to its users for maintaining a productive environment (Mohamadali & Garibaldi, 2010) and to flourish organizational objective and goals (P. W. Handayani, 2017).

P.W. Handayani (2017) has also stated that the appropriate Service and training by the management can result into more efficient usage of HMS. Moreover, support facilities can also encourage the physicians to be benefited by using HMIS. Keeping in view the related previous literature, Hypothesis 2 is generated as:

H2: Service Quality has a significant (positive) effect on the Usage of HMIS

2.3 Software Quality and User Satisfaction:

The User Satisfaction decreases when the system is unable to perform the assigned task with accuracy. When the software reside a lot of bugs which hinder the tasks being performed, it also contributes to it (P. W. Handayani, 2017). Better quality software or application increases the User Satisfaction and raises the acceptance for the system, and likewise when the software does not meet the needs the of the users, it raises dissatisfaction in employees, stated in P.W. Handayani (2017). Improving the system also aids the physicians in providing effective clinical
treatment on the basis of their electronic records (Chen & Hsiao, 2012). Based on above literature, following has been hypothesized:

H3: Software Quality has a (positive) impact on User Satisfaction (US)

2.4 Service Quality and User Satisfaction:

The level of User Satisfaction is related to the quality of Service provided by the management to its employees. High Service Quality increases the User satisfaction as it aids the HMIS users to work

progressively and complete the given tasks efficiently (Ismail et al., 2015). According to P. W. Handayani (2017), Management support has significant influence on the satisfaction of the employees using HMIS. The management can only achieve this satisfaction from the users, particularly physicians, when sufficient service quality is provided to satisfy their clinical requirements (Chen & Hsiao, 2012). Considering the previous literature, following hypothesis has been formulated:

H4: Service Quality has significant (positive) impact of User Satisfaction (US)

2.5 HMIS and User Satisfaction:

For any software, the User Satisfaction is very important because the success of any system lies within the satisfaction of its users. The response of the users will provide the basis for the organization to judge the efficiency or the capability of the implemented system. According to Delone and McLean (2003), the evaluation of HMIS is very valuable to improve its quality and to increase the satisfaction and acceptance of its users. HMIS being an integrated system, needs to be highly user efficient and the usage of HMIS should also be beneficial for healthcare professionals using it. It has been found by Chen and Hsiao (2012) that increased User Satisfaction leads to more Usage of HMIS by the employees, specifically due to its ease of use. When the employees feel benefited from HMIS, it enhances their User Satisfaction and ultimately more Usage of the system by them (P.W. Handayani 2017). Taking into consideration the previous studies done by previous scholars, following has been hypothesized:

H5: User satisfaction has a (positive) impact on Usage of HMIS

2.6 Mediating role of User Satisfaction:

Software Quality and Service Quality affects the User Satisfaction and User Satisfaction in turn affects the usage of the system. Hospital management does not realize that non-technical factors like human and organizational characteristics influence user acceptance for the system. (P.W. Handayani 2017). According to the knowledge of the researcher, no past researcher has taken these variables in this relationship, especially taking User Satisfaction as a mediating role. Based on researches made by past scholars on the variables mentioned above, the researcher, therefore, tend to find the whether the relationship is mediated through User Satisfaction or not.

H6: User Satisfaction mediates (positive) relationship of Software Quality and Usage of HMIS H7: User Satisfaction mediates the (positive) relationship of Service Quality and Usage of HMIS

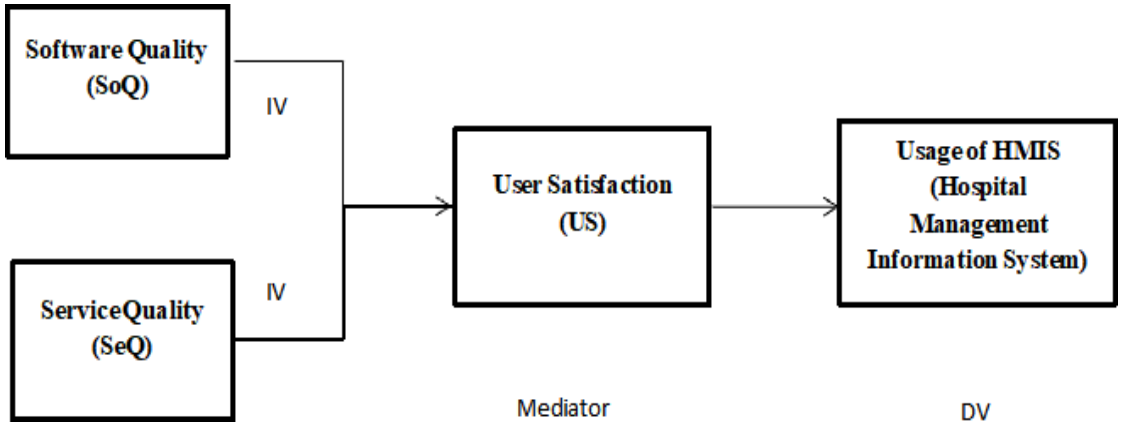


Figure 1: Theoretical framework/Research Model:

3. Methodology:

3.1 Participants:

Respondents included in the study were mid-level hospital managers, doctors, nurses, technologist and technicians, pharmacists and administrative staff like receptionists; working in different hospital departments i.e. Radiology, Laboratory Outpatient and Inpatient department,
Pharmacy, Emergency etc. This study was cross sectional and used non- probability convenient sampling. Sample size was 218 and only a single hospital, an internationally accredited tertiary hospital was selected because it was the only hospital in the locality having a fully implemented HMIS. The questionnaires were distributed and respondents were asked to complete it voluntarily, and anonymity and confidentiality were guaranteed. Out 250 distributed questionnaires, 230 were returned; from which 12 were not usable making the response rate 87.2%. The analysis of the results was done using SPSS (Statistical Packaging for Social Sciences) version 21.
The male population (55%) was more as compared to female population (45%) in the study. The average age in the sample was 20-30 years (78.9%) and majority of them were full-time workers (87.2%). Most population had a graduation qualification (47.7%) and majorities were nurses (43.1%). Most of the majority population (38.5%) had 2 years of experience and 3-5 years of experience (36.7%).

3.2 Scales/Measures used:

There are 55 scale items in the questionnaire, and 6 additional items related to demographics of the respondents. The 1-5 Likert scale is used to measure each of the scale items. Least number on the scale i.e. 1 indicates highest level of disagreement with statement and largest number i.e. 5 represents the highest level of agreement with the given statement. The other three words (2, 3 and 4) stand for Disagree, Neutral/ Neither disagree or agree, and Agree, respectively.

3.2.1 Usage of HMIS:

The usage of HMIS was measured on 10 items scale which was developed by Brooke, J. (1996). One sample item was included, “I think that I would like to use HMIS frequently”. The scale was determined using Cronbach alpha to be 0.68.

3.2.2 Software Quality (SQ):

The scale developed by Gade (2013) was used for the measurement of Software Quality and there were 25 items included in the scale. One of the items in the sample was “All the functionality of HMIS works as expected”. The Cronbach alpha of the scale was 0.90.

3.2.3 Service Quality (SeQ):

The items developed by Najem, F. M. were used to measure Service Quality, which was measured on a scale. (2016). One example that was added to the questionnaire was: “Support given to users of HMIS has been adequate”. The Cronbach alpha of the scale was 0.85.

3.2.4 User Satisfaction (US):

User Satisfaction was measured on the scale developed by Armstrong et al (2005) and the scale included 13 items. Sample item was “Information I get from HMIS is clear”. The Cronbach alpha calculated by reliability analysis for the scale was 0.92.

3.3 Control Variables:

One-way ANOVA was performed to control the variation in variables i.e. Usage of HMIS (Dependent Variable) and User Satisfaction (Mediator), on the basis of demographics included in the study. Table 1 mentions the results of the analysis obtained. The result of One-way ANOVA revealed that there was a significant difference in terms of Gender (F=8.89, p=0.003), Work-status (F=2.89, p=0.05), Qualification (F=4.43, p=0.001) and Position (F=11.20, p=0.000) with respect to Usage of HMIS, whereas no significant difference was found in terms of Age and Experience. The difference in User Satisfaction was significant between Position (F=15.86, p=0.000) and there was no significance observed for other demographics i.e. Gender, Age, Work-status, Qualification and Experience.

TABLE 1: One-way ANOVA

	Usage of HMIS		User Satisfaction	
Source of Variation	**F statistics**	**P-value**	**F statistics**	**P-value**
Gender	8.89	0.003	3.91	0.49
Age	0.90	0.40	0.70	0.49
Work-Status	2.89	0.05	0.27	0.76
Qualification	4.43	0.001	0.97	0.43
Position	11.20	0.000	15.86	0.000
Experience	0.64	0.63	2.13	0.07

4. Results:

In Table 2 the calculated descriptive i.e. means and standard deviations and the results of correlation analysis are presented.

TABLE 2: Descriptive and Correlations

		Mean	**SD**	**SoQ**	**SeQ**	**US**	**Usage of HMIS**
1	Software Quality	3.64	0.50	1			
2	Service Quality	3.87	0.69	0.60*	1		
3	User Satisfaction	3.86	0.66	0.72*	0.77*	1	
4	Usage of HMIS	3.35	0.56	0.38*	0.31*	0.47*	1

N=218, *p<0.05, SoQ= Service Quality, SoQ= Software Quality, US= User Satisfaction

As the table indicates, Software Quality (SoQ) had significant positive correlation with the Usage of HMIS (0.38, p=0.000) which gives initial support to the study Hypothesis 1. Service Quality (SeQ) also had significant positive correlation with the Usage of HMIS (0.31, p=0.000) which favors the previously formulated Hypothesis 2. There was a significant positive correlation between Software Quality and User Satisfaction (0.72, p=0.000) and also the significant positive correlation was observed between Service Quality and User Satisfaction (0.77, p=0.000) which supports the Hypothesis 3 and Hypothesis 4 respectively. User satisfaction and Usage of HMIS were also found to have significant positive correlation (0.47, p=0.000) which favors the formulated Hypothesis 5.

4.1 Regression Analysis:

The regression analysis was done using Process v 3.3 by Andrew F. Hayes. The results of the analysis are shown in Table 3(a) and Table 3(b).

Table 3(a): Mediated Regression Analysis.

Direct effect of X on Y:						
Coeff		**Se**	**T**	**P**	**LLCI**	**ULCI**
SoQ on US	0.949	0.062	15.241	0.000	0.826	1.072

SoQ on HMIS	0.101	0.095	1.062	0.289	-0.086	0.289
US on HMIS	0.339	0.072	4.691	0.000	0.197	0.482
Indirect Effect of X on Y:						
	Effect	**BootSE**		**BootLL CI**	**BootULCI**	
US	0.322	0.085		0.164	0.497	

SoQ= Software Quality, US= User Satisfaction

The results of non-significant relationships were found between Software Quality and Usage of HMIS as shown in Table 3 (a), Hypothesis 1 was not supported. But there was significant relationship between Software Quality and User Satisfaction (LLCI= 0.826, ULCI= 1.072) and between User Satisfaction and Usage of HMIS (LLCI= 0.197, ULCI= 0.497). Hence, Hypothesis 3 and 5 are accepted. Table 3(a) shows that the results of tests indicate that Software Quality was found to be mediating the relationship between User Satisfaction and Usage of HMIS (LLCI=0.164, ULCI= 0.497).

Table 3(b): Mediated Regression Analysis.

Direct effect of X on Y:						
	Coeff	**Se**	**T**	**p**	**LLCI**	**ULCI**
SeQ on US	0.747	0.415	18.023	0.000	0.665	0.829
SeQ on HMIS	-0.105	0.076	-1.377	0.169	-0.256	0.045
US on HMIS	0.48	0.079	6.043	0.000	0.323	0.636
Indirect Effect of X on Y:						
	Effect	**BootSE**		**BootLLCI**	**BootULCI**	
US	0.358	0.050		0.261	0.461	

SeQ= Service Quality, US= User Satisfaction

The results shown in Table 3 (b) showed that there is no notable relationship between Service Quality and the Usage of HMIS (LLCI= -0.256 and ULCI= 0.045), which means that Hypothesis 2 is not accepted. Between Service Quality and User Satisfaction (LLCI= 0.665, ULCI= 0.829) however there is significant relationship between User Satisfaction and Usage of HMIS (LLCI= 0.544, ULCI= 0.762),(LLCI=0.323, ULCI= 0.636) and hence, Hypothesis 4 and 5 are accepted. Above mentioned results revealed that Service Quality and Usage of HMIS (LLCI=0.261, ULCI= 0.461) had been mediated by User Satisfaction.

5. Discussion:

The study has accepted most of the study hypotheses through empirical analysis. Our hypotheses in the study were tested using regression analysis. Our formulated hypothesis got confirmed from the results as it was observed that Software Quality had a positive role on User Satisfaction. In previous literature, it was also found that they form positive relationship in between them and high quality of Software ultimately increases the User satisfaction of the employees using HMIS. Similarly, Service Quality and User Satisfaction were also found to have a positive relationship between them which

validates our Hypothesis 4. Our study results were similar to past studies that were conducted on these variables. In the case of High Service Quality, it will improve User satisfaction because it helps the HMIS users to work progressively and efficiently complete the given tasks (Ismail et al., 2015). The results as stated above by P. W. Handayani (2017) show that management support was a factor that influenced the satisfaction of the employees using HMIS. According to our result, Usage of HMIS and User satisfaction also has significant relationship with each other and the same as the previous study. Chen and Hsiao (2012) also found out that increased User Satisfaction leads to more Usage of HMIS by the employees, specifically due to its ease of use. As mentioned above P.W. Handayani (2017) also said that if the employees feel the benefit from HMIS, it will improve their User Satisfaction and in the end, it will increase their Usage of the system.

The relationship between independent variables (i.e. Software Quality and Service Quality) and dependent variable (i.e. Usage of HMIS) was confirmed by regression analysis which supports our study hypotheses 6 and No past research has used this combination of variables as mediator in the User Satisfaction. To our knowledge this is the first study of its kind and our study seems to have contributed into the literature with the results of this new form of relationship.

Healthcare workers typically have numerous issues with the use of HMIS. Addressing these concerns needs understanding of the system attributes especially which are most important to their satisfaction and system productivity. Interestingly, the result of two hypotheses were not what was expected. We found out that the direct relationship of the independent variables with the dependent variables could not be determined by regression analysis so that the hypotheses 1 and 2 of the study were rejected. Based on the result of our study, it did not appear to be similar to previous studies done by other researchers, however there was indicated a significant positive correlation between the variables for these hypotheses compared to the previous researchers. This analysis of reliability of the questionnaire has been performed before, but the results presented may be related to the respondent's inability to interpret the questions included in the questionnaire or may be related to the limitation of the questionnaire's questions. However, improvising the questionnaire open-ended in order to get suggestion from us may lead to different results. After weighing all facts, we have determined that we should serve the interests of our HMIS users not by providing them a service of what we think they want, but of what they want.

6. Practical implications:

Hospital Management Information Systems (HMIS) are incredibly crucial to any healthcare organization. The hospital managers, policy makers and the IT department of the hospital together should concentrate on the above-mentioned variables to improve the efficiency of the HMIS to achieve improvisation of HMIS. Policy makers and managers should also focus more on Service Quality and provide support to ensure better outcomes from its users. Software Quality can also be enhanced to increase the User Satisfaction which can improve the overall quality and productivity of HMIS. In hospitals where HMIS is partially implemented, the policy makers should work on its complete implementation as it increases the quality of care and also reputes the organization. In a country such as Pakistan, manual registers of a patient and patient transcript of records are still being used in many hospitals and healthcare organizations which are very difficult to handle, maintain, store and access compared to Computer Based System. This study also emphasizes the organizations like these to introduce the implementation of HMIS in their workplace to increase their productivity, human resources efficiency and overall patient care quality. The questionnaire used in this research can be modified and can also be used as a test of the usability of

Existing HMIS/evaluation in various hospital contexts and organizations. By improving the quality of HMIS (Hospital Management Information System), it can play a vital role when HIS (Health information system) in the locality or on provincial level.

7. Limitations:

A few shortcomings with our study should be pointed out. This study was conducted in a small sample size and only from one fully implemented HMIS hospital. The design was cross-sectional and non-

probability sampling used was convenient sampling. Data were gathered using questionnaires hence the researcher had to rely on the perception of the respondents as they were the ones who gave their views HMIS. Common method bias might have occurred due to self-report. All of the variables were measured at the same time and were measured from one source and from respondents other than employees (patients) which may have restricted the generalizability of findings. Moreover, there are no open ended questions that can ask about any improvement directions which can play a vital role in future.

8. Future research:

The future researchers are recommended to have wider sample size and be extended to have more hospitals, both government and private; have proper analysis and have results generated to predict improvisation in the outcomes of HMIS. The researcher also suggests that multiple sources of data should be gathered and patient's voice should be incorporated in future research to determine the impact of HMIS on quality of patient care in the eyes of patients. To avoid chances of biasness, data collection is suggested to be done by random sampling.Furthermore, to measure usability and productivity of HMIS, more study variables such as information quality, patient satisfaction, total quality care and workload are suggested for future research through HMIS. Also it is suggested to create gaps between the data collection of independent and dependent variables. The study questionnaire can be used to test same or similar systems evaluation in other settings in Pakistan or elsewhere with very few refinements and alterations.

References

1. Ariffin, N. A. N., Yunus, A. M., Embi, Z. C., & Alam, K. P. P. S. (2008). Improving electronic medical records (emrs) practices through a clinical microsystem in the malaysian government hospitals. Communications of the IBIMA, 5(2), 50-64.
2. Armstrong, B., Fogarty, G. J., Dingsdag, D., & Dimbleby, J. (2005). Validation of a computer user satisfaction questionnaire to measure IS success in small business. Journal of Research and Practice in Information Technology, 37(1), 27-42.
3. Brooke, J. (1996). SUS-A quick and dirty usability scale. Usability evaluation in industry, 189(194), 4-7.
4. Delone, W. H., & McLean, E. R. (2003). The DeLone and McLean model of information systems success: a ten-year update. Journal of management information systems, 19(4), 9-30.
5. Chen, R. F., & Hsiao, J. L. (2012). An investigation on physicians' acceptance of hospital information systems: a case study. International journal of medical informatics, 81(12), 810-820.
6. Gable, G. G., Sedera, D., & Chan, T. (2008). Re-conceptualizing information system success: The IS-impact measurement model. Journal of the association for information systems, 9(7), 18. Gade, D. (2013). The evaluation of software quality.
7. Gagnon, M. P., Desmartis, M., Labrecque, M., Car, J., Pagliari, C., Pluye, P., ... & Légaré, F. (2012). Systematic review of factors influencing the adoption of information and communication technologies by healthcare professionals. Journal of medical systems, 36(1), 241-277.
8. Gruber, D., Cummings, G. G., Leblanc, L., & Smith, D. L. (2009). Factors influencing outcomes of clinical information systems implementation: a systematic review. CIN: Computers, Informatics, Nursing, 27(3), 151-163.
9. Handayani, P. W., Sandhyaduhita, P. I., Hidayanto, A. N., Pinem, A. A., Fajrina, H. R., Junus, K. M., ... & Ayuningtyas, D. (2016). Integrated hospital information system architecture design in Indonesia. In Maximizing Healthcare Delivery and Management through Technology Integration (pp. 207-236). IGI Global.
10. Haux, R., Ammenwerth, E., Winter, A., & Brigl, B. (2004). Strategic information management in hospitals: an introduction to hospital information systems. Springer Science & Business Media.

11. He, J. (2014). Technology Adoption in Hospitals–The Roles of System Integration and Technology Support.
12. Holden, R. J., Brown, R. L., Scanlon, M. C., & Karsh, B. T. (2012). Modeling nurses' acceptance of bar coded medication administration technology at a pediatric hospital. Journal of the American Medical Informatics Association, 19(6), 1050-1058.
13. Ismail, N. I., Abdullah, N. H., & Shamsuddin, A. (2015). Adoption of hospital information system (HIS) in Malaysian public hospitals. Procedia-Social and Behavioral Sciences, 172, 336-343.
14. Khalifa, M. (2014). Technical and human challenges of implementing hospital information systems in Saudi Arabia. Journal of Health Informatics in Developing Countries, 8(1).
15. Kijsanayotin, B., Pannarunothai, S., & Speedie, S. M. (2009). Factors influencing health information technology adoption in Thailand's community health centers: Applying the UTAUT model. International journal of medical informatics, 78(6), 404-416.
16. Lærum, H., Karlsen, T. H., & Faxvaag, A. (2004). Use of and attitudes to a hospital information system by medical secretaries, nurses and physicians deprived of the paper-based medical record: a case report. BMC medical informatics and decision making, 4(1), 18.
17. Leaning, M. (2006). The modal nature of ICT: challenging the historical interpretation of the social understanding and appropriation of ICT. The Journal of Community Informatics, 2(1).
18. Kluge, E. H. W. (2007). Secure e-health: managing risks to patient health data. International journal of medical informatics, 76(5-6), 402-406.
19. Mohamadali, N. A. K., & Garibaldi, J. M. (2010, June). A Novel Evaluation Model of user Acceptance of Software Technology in Healthcare Sector. In Healthinf (pp. 392-397).
20. Najem, F. M. (2016). the impact of hospital information system quality on the health care quality: a case study on european gaza hospital. the impact of hospital information system quality on the health care quality: a case study on european gaza hospital.
21. P. W. Handayani, A. N. Hidayanto, A. A. Pinem, P. I. Sandhyaduhita & I. Budi (2017). Hospital information system user acceptance factors: User group perspectives. Informatics for Health and Social Care, 43(1), 84-107.
22. Tan, J. K. (2001). Health management information systems. The Journal for Healthcare Quality (JHQ), 23(6), 44.
23. Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. MIS quarterly, 425-478.
24. Von Lubitz, D., & Wickramasinghe, N. (2006). Healthcare and technology: the doctrine of networkcentric healthcare. International Journal of Electronic Healthcare, 2(4), 322-344.
25. Yusof, M. M., Kuljis, J., Papazafeiropoulou, A., & Stergioulas, L. K. (2008). An evaluation framework for Health Information Systems: human, organization and technology-fit factors (HOT-fit). International journal of medical informatics, 77(6), 386-398.

Appendix: Questionnaire

Dear Respondent,

The following questionnaire is a part of research conduct entitled “The combined effect of System/Software Quality and User Satisfaction on the usage of Hospital Management Information System (HMIS); moderating role of Service Quality in Pakistan”. There is no right or wrong answers as long it is done honestly. The answers to the questionnaire and your identity both will remain completely confidential. The survey results will only be analyzed for academic purpose. You are requested to take few minutes out of your busy schedule to complete this questionnaire. Although you are not bound and can quit answering but it will be our privilege if you do that.

Thank you for your cooperation and for the time taken to fill the questionnaire. Your responses will contribute to the academic research.

Komal Abrar
Researcher

Scale: Responses to each item is measured on a five-point scale with the anchors labeled: (1) Strongly disagree, (2) Disagree, (3) Neither disagree or agree, (4) Agree, (5) Strongly Agree.

Section A

Usage of Hospital Management Information System (HMIS)

1.	I think that I would like to use HMIS frequently.	1	2	3	4	5
2.	I found HMIS unnecessarily complex.	1	2	3	4	5
3.	HMIS is easy to use.	1	2	3	4	5
4.	I think that I would need the support of a technical person to be able to use HMIS.	1	2	3	4	5
5.	I found the various functions in HMIS were well integrated.	1	2	3	4	5
6.	I thought there was too much inconsistency HMIS.	1	2	3	4	5
7.	I would imagine that most people would learn to use HMIS very quickly.	1	2	3	4	5
8.	I found HMIS very difficult to use.	1	2	3	4	5
9.	I felt very confident using HMIS.	1	2	3	4	5
10.	I needed to learn a lot of things before I could get going with HMIS.	1	2	3	4	5

Brooke, J. (1996). SUS-A quick and dirty usability scale. Usability evaluation in industry, 189(194), 4-7.

Section B

Service Quality

1.	Support provided to users of HMIS has been sufficient.	1	2	3	4	5
2.	Training on the use of HMIS has been sufficient.	1	2	3	4	5
3.	There is always someone to turn to if we need help with it.	1	2	3	4	5
4.	HMIS has helped in improving the quality of services.	1	2	3	4	5
5.	HMIS has improved the accuracy of results and patient information.	1	2	3	4	5
6.	HMIS has made medical decisions more information based.	1	2	3	4	5
7.	Overall, HIS has increased satisfaction and quality of healthcare.	1	2	3	4	5

Reference: Najem, F. M. (2016). the impact of hospital information system quality on the health care quality: a case study on european gaza hospital. the impact of hospital information system quality on the health care quality: a case study on european gaza hospital.

Section C

User Satisfaction

Information Quality	1.	Information I get from HMIS is clear.	1	2	3	4	5	6	7
	2.	The system is accurate.	1	2	3	4	5	6	7
	3.	The system provides me with sufficient information.	1	2	3	4	5	6	7
	4.	HMIS provides me with up-to-date information.	1	2	3	4	5	6	7
	5.	HMIS provide reports that are exactly what I need.	1	2	3	4	5	6	7
System Usefulness	6.	Using the system increases productivity.	1	2	3	4	5	6	7
	7.	Using HMIS saves time.	1	2	3	4	5	6	7
	8.	Using the system improves job performance.	1	2	3	4	5	6	7
System Usage Characteristics	9.	The system is easy to use.	1	2	3	4	5	6	7
	10.	The system is easy to learn.	1	2	3	4	5	6	7
	11.	It is easy to get the system to do what I want it to do.	1	2	3	4	5	6	7
Overall satisfaction	12.	Do you feel HMIS meets the information processing needs of the business?	1	2	3	4	5	6	7
	13.	Overall, are you satisfied with HMIS?	1	2	3	4	5	6	7

Reference: Armstrong, B., Fogarty, G. J., Dingsdag, D., & Dimbleby, J. (2005). Validation of a computer user satisfaction questionnaire to measure IS success in small business. Journal of Research and Practice in Information Technology, 37(1), 27-42.

Section D

Software Quality

1.	All the functionality of HMIS works as expected.	1	2	3	4	5
2.	HMIS works without any additional hardware (Eg. graphic card, memory card, RAM)	1	2	3	4	5

3.	The software can exchange information with other software.	1	2	3	4	5
4.	The display screen is well organized and attractive.	1	2	3	4	5
5.	The software is well maintained and updated.	1	2	3	4	5
6.	The software is easy to operate.	1	2	3	4	5
7.	The software has very high overall quality.	1	2	3	4	5
8.	HMIS works in different computer environment as well.	1	2	3	4	5
9.	Whenever the same operations are performed at any time, this software produces the same results.	1	2	3	4	5
10.	The software and its results are reliable.	1	2	3	4	5
11.	HMIS keeps data secured and safeguards against unauthorized activities.	1	2	3	4	5
12.	HMIS works as expected under changes in operating conditions. (under heavy input)	1	2	3	4	5
13.	HMIS lets you access regardless of its disability or severity of impairment.	1	2	3	4	5
14.	Are the results as expected?	1	2	3	4	5
15.	Can the software be moved to other environments?	1	2	3	4	5
16.	Can faults be easily identified?	1	2	3	4	5
17.	HMIS continues to work when a significant component or set of component goes down.	1	2	3	4	5
18.	You can use the documents in both newer and old versions.	1	2	3	4	5
19.	HMIS produces same behavior every time.	1	2	3	4	5
20.	Resources are available to learn about HMIS.	1	2	3	4	5
21.	*Ability to respond (response time)and memory, disk utilization*	1	2	3	4	5
22.	Do you comprehend how to use HMIS easily?	1	2	3	4	5
23.	Using HMIS doesn't require any additional effort.	1	2	3	4	5
24.	The external look of HMIS components like color and size of components appear attractive.	1	2	3	4	5
25.	Will you recommend this software to others?	1	2	3	4	5

Reference: Gade, D. (2013). The evaluation of software quality.

DEMOGRAPHIC QUESTIONS

Please Circle the Appropriate Answer.

1. **Gender:**

A. Male B. Female

2. **Age:**

A. <20B. 20-30 C. 31-50 D. Over 50

3. **Work status:**

A. Full-Time B. Part-Time

4. **Qualification:**

A. Diploma B. Graduation C. Masters D. Resident Doctor

E. Specialist F. Doctor

5. **Position:**

A. Technician/Technologist B. Nurse C. Pharmacist D. Doctor

E. Administrative Staff

6. **Experience in current organization:**

A.2yrs B. 3-5yrs C. 6-9 yrs D. 10-15 yrs. E. <More

E. Administrative Staff

7. **Experience in current organization:**

B. 2yrs B. 3-5yrs C. 6-9 yrs D. 10-15 yrs. E. <More