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# Reactions and Perceptions of Healthcare Professional Towards Wireless Devices in Healthcare Environment in the Developing World: a Case of Pakistan

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## Abstract

*This study explored reactions and perceptions of medical professionals in the use of wireless technology in the Pakistani healthcare setting. 300 professionals were surveyed with 97 survey forms returned. The regression analysis indicates that clinical performance and better quality of services would be the determinants in using wireless technology in Pakistani healthcare. These medical professionals felt that in order to continuously use the technology, training and technical supports are essential. They also felt that the introduction of such a technology would result in the attraction of more practitioners, save time, save effort and provide high quality information. Collectively, these factors, in the opinion of these professionals will reduce inaccuracies in data.*

### Keywords

Wireless technology, user perceptions

## Introduction

Pakistan's ministry for healthcare has predicted that Pakistan is realising significant advantages from the emerging information economy. This is reflected in the recent infrastructure investment and other technological developments. Despite this development, it appears that Pakistan is lagging behind in healthcare service provision.

The slow adoption of technological development in the developing countries like India and Pakistan can be due to lack of management support (Gururajan et al., 2005b, Lu et al., 2005, Gururajan et al., 2005a) the perceived complexity and cost (Lu et al., 2005, Houston et al., 2003, Lu et al., 2003); sensitive nature of information and logistics involved in a healthcare facility (Eastes, 2001, Li et al., 2005); nature and type of risk involved (Davenport, 2005, Lu et al., 2003)pressure for high quality of care, high litigation cost and lack of infrastructure, the extent of integration with existing health systems(Li et al., 2005) and the necessity for other resources to support technology infrastructure (Davenport, 2005, Lu et al., 2003). While the use of technology is rising there is limited empirical research available into the perceptions of healthcare professionals using or adopting wireless technologies. Previous studies that have used existing models to predict behaviour determinants of adoption of technologies in healthcare have demonstrated their inadequacy. Further, the uptake of wireless and handheld devices is either on an individual level or on a very small scale but not at organisational levels in Pakistan. There is limited research available on determinants and factors that are critical to understanding user perceptions of technologies specific to healthcare on a larger scale. Therefore, any knowledge of these factors of adoption of wireless technology will help the healthcare administrators to develop appropriate policies in order to address the ever-increasing demands of heath services. This is more valid in the case of Pakistan because of the demands placed on the healthcare services and rising interest in wireless technologies in the health domain. This has given impetus to this study.

The main research question asked in this study, thus, is "How do users perceive Wireless Technology in the Pakistani Healthcare Environment?".

The culture of Pakistani environment has always encouraged the use of technology. This is high on the agenda at state and federal level government. The healthcare sector in Pakistan is operating in an environment of intense regulatory framework, cost reduction, high competition, expectation of high quality of services, high demand on the healthcare sector, limited resources, and the demand for providing high quality of care - anytime anywhere. This research in particular does not study the process involved in the uptake of the technological development, rather it assumes that a decision has been made at some stage to use the wireless technology. While the decision to use is a preliminary phase only, the actual use may happen over a period of time. During this phase it is anticipated that factors such as familiarity, infrastructure, cost, clinical process, quality of care, management support, policies and procedures, security, availability of appropriate wireless application, trust and knowledge of the technology will facilitate the adoption and hence the use of wireless handheld devices in Pakistani healthcare environment. The scope of this study is restricted to these aspects.

We have already indicated that studies that have used some of the existing prediction models of user perceptions of technology are found to be inadequate in a healthcare context. Chismar and Wiley-Patton (2006) empirically established that only perceived usefulness is significant and ease of use was not significant while predicting Internet use by applying the Extended Technology Acceptance Model (TAM) to the Healthcare Environment. Lapointe et al. (2006) established that TAM as devised by (Davies et al., 1989) is not adequate for health systems while studying the dynamics of IT adoption in a major change process in health delivery. They reasoned that adoption/resistance factors may be group related as opposed to the fundamental basis of TAM which is individualistic, influence of intra and inter organisational factors, linkages to cultures, environmental factors as well as the complexity of the environment. Suomi (2006) found that relative advantage, strong network externalities available, rich availability of information through different communication channels are key factors for innovation and adoption while introducing electronic patient records to hospitals. It should be noted that these are not discussed in the TAM models. Spil and Schuring (2006), following an examination of six studies in the healthcare domain established that perceived usefulness is a predictor of technology acceptance in healthcare. Ease of use was not found to be significant. In terms of technology diffusion, Horan et al. (2006) found that in order to diffuse technology in an organisation, it is important to ascertain physicians' behaviour, their workflow practices and their perceptions regarding the value of specific information systems. The study was conducted to understand physicians' use of online systems and empirically assessed an electronic disability evaluation system.

In essence, these recent studies appear to be indicating that the current models of technology acceptance or its derivatives are not suitable to predict the user perceptions of wireless technology in healthcare environment. Strong support can also be derived from three specific studies that have tested TAM models in healthcare. The first study conducted by Jayasuriya (1998) established that ease of use was not significant in a clinical domain. The second study by Chau and Hu (2002) echoed similar sentiments. The third study by Hu et al. (1999) also found similar findings. Further, recent studies conducted by Howard et al. (2006) also established that ease of use was not significant while determining factors of adoption in a clinical domain in regard to wireless technology. Further, Ivers and Gururajan (2006) also found that there are other factors beyond the TAM models influencing the acceptance of technology.

Interviews conducted with 30 Queensland nursing staff members by Gururajan et al. (2005c) revealed that clinical usefulness of wireless technology is far more significant than ease of use factor as established in TAM. Another focus group discussion with the Western Australian senior health managers by Gururajan et al. (2005d) also indicated that aspects of clinical usefulness such as integration of clinical data may be a significant factor than the ease of use factor. Howard et al. (2006) also identified clinical usefulness is far more influencing than the ease of use factor while determining factors of adoption of wireless technology in the Indian healthcare domain. This variation requires further empirical investigation in order to explain the reason behind this variation specific to healthcare. Therefore, there is a need to identify attributes that assist in the understanding of the user perceptions and their reactions to using a technology in a given healthcare context.

Therefore, there appears to be a basis to identify factors that contribute to the perceptions of using a technology or intentions to using a technology in healthcare settings. Given that wireless technologies have started making in-roads in healthcare, the overarching purpose of the research is to identify these factors in the Pakistani healthcare system. The rationale of the purpose is justified by the fact that Pakistan is a strong player in software technologies, especially medical applications. Further, Pakistan facilitates 'health tourism' for the middle-east people, due to the advancement in medical technology and reduction in cost in offering high quality health services—as highlighted by various print media. However, our initial review of available literature indicated that this area is under-researched. Collectively, these aspects formed the basis for this study.

## Methodology[1]

An examination of IS studies indicated that there is a necessity for a suitable research method, as has indeed been confirmed by Straub (1989) who called for new efforts to validate the instruments that IS researchers were using. In Boudreau and his team in 2001, (Boudreau et al., 2001), after a review of MIS Quarterly, Communications of the ACM and Information & Management over the period 1997 and 1999, published in MIS Quarterly (vol. 25, p1) the statement that "findings suggest that the field (of IS) has advanced in many areas, but, overall, it appears that a majority of published studies are still not sufficiently validating their instruments". Therefore, we felt that if technology issues were to be studied with respect to a specific domain, then user involvement with the technology issues forms a major part in establishing the factors influencing such a study. This was actually endorsed by Rowlands (2005) in the statement that '… knowledge is gained, or at least filtered, through social construction such as language, consciousness, and shared meanings (p.81)'.

The research question posited in this study dictates the need to have quantitative research methods, while the behavioural component of the same investigation dictates qualitative research methods. In essence, to answer our research question, we require both methods. Qualitative methods will help us to understand the domain and the context in a practical sense. Quantitative methods will assist us to generalise our findings. The rationale for this approach is based on the notion that behavioural components require a thorough understanding of how users apply wireless technology in a given organisational setting in order to understand the behavioural issues. This is best extracted or accomplished by a qualitative approach, as we need to extract a number of 'tacit' aspects. A quantitative instrument then can be developed (from the qualitative data) to extract the quantitative aspects such as the opinion scores.

Considering the above, the suitability of one research method over the other had to be carefully weighed. Based on these, this study identified the exploratory approach to be suitable as an initial investigation. This approach is particularly favourable in confirming the direction of the study and the variables chosen for the study, as well as helping to refine the literature. The exploratory approach allows the researcher to eliminate irrelevant variables as they are identified and to include new relevant variables as they emerge.

Thus the principles of each method were applied to this study. Due to the similarities in cultural, social, political, and demographics of Pakistani and Indian healthcare environment, the initial exploratory phase was borrowed from earlier research by one of the authors of this paper in the Indian healthcare environment. The research was conducted using a qualitative approach to establish the direction for the study based on the Indian healthcare environment. Indian and Pakistani healthcare environments are also very similar in the context of technology uptake and ICT infrastructure. This was then followed up with a main study using the quantitative approach. The uniqueness of this approach is the development of the instrument from the qualitative interviews, using the statements provided by interview participants. This has provided relevance and reliability to our quantitative instrument.

## Data Collection & Results

As argued above, the qualitative approach (individual interviews) was used to collect initial sets of themes for the adoption of wireless technology by the physicians. The qualitative data were collected originally from India and this data were used to develop an instrument.

The main reason for this approach was that previously tested instruments were found to be inadequate in healthcare settings for Pakistan as previous instrument omitted the context in which the technology was used. The data from the interviews were used to develop a specific range of questions to gather more detailed view from the wider population. This survey instrument was pilot tested to capture the information reflecting the perceptions and practices of those adopting wireless technology in the Indian healthcare system. It was particularly focussed on what internal and external environmental factors would shape the adoption of wireless technology and the extent of their influence. The survey consisted of questionnaire items on perceived implementation of wireless technology in order to attract medical practitioners, their comfort in using this technology, their opinion on cost and time savings, their opinion on the available technical support within their organisation and the influence of handheld technology in delivering high quality information to the medical professionals. The respondents were given with a five-point Likert scale ranging from Strongly agree to strongly disagree.

This survey was then distributed to over 300 physicians in Pakistan. The samples were randomly chosen through local health departments. The respondents included doctors from both private and public hospitals. They ranged

1 *Methodology portion of this paper has been reproduced from an earlier publication by two authors of this paper and appropriate permission has been taken from third author*

from emergency department to oncology unit. We did not make any distinction on the range of medical practice as this was not the main objective of this study. A cover letter explained the objectives and goals of the research. A total of 97 completed surveys were received. The survey responses were then transcribed into a spreadsheet file. A Visual Basic interface was written to generate numerical codes for various elements of the survey for data analysis using SPSS. The coded spreadsheet file was then copied into a SPSS file format for further data analysis

Regression analysis was conducted with the dependent variable of "Do you believe the use of wireless handheld device would enhance your clinical performance?" This was done against the technically enabling independent variables of

1. Do you believe more training is required to be comfortable in using wireless handheld devices?
2. Do you believe technical support is important in the handling of wireless handheld devices?

Output from this regression is shown in Table 1.

Table 1: Regression analysis on factors that practitioners consider will enhance clinical performance

| R Squared | Level of Significance | F statistic | Regression Sum of Squares | Residual sum of squares | Coefficient (Constant) | Coefficient (1) | Coefficient (2) |
|---|---|---|---|---|---|---|---|
| 0.607 | 0.000 | 71.8 | 562.32 | 364.18 | 0.012 (se=0.318) | 0.264 (se=0.116) | 0.574 (se=0.100) |

The regression was highly significant ($p<0.01$) indicating that practitioners considered that the implementation of wireless technology would enhance clinical performance provided adequate training and technical support was provided.

Further regression analysis was done with the same dependent variable, namely "Do you believe the use of wireless handheld device would enhance your clinical performance?" This was done against the managerially significant independent variables of

1. Do you believe the implementation of wireless technology will attract more practitioners?
2. Do you believe the use of wireless handheld device would help save time?
3. Do you believe the use of wireless handheld device would help save effort?
4. Do you believe the use of wireless handheld device will help delivery of high quality information?

Output from this model is shown in Table 2 below.

Table 2: Additional regression analysis on factors that practitioners consider will enhance clinical performance

| Parameter | Value |
|---|---|
| **R-squared** | 0.812 |
| **Level of Significance** | 0.000 |
| **F statistic** | 98.317 |
| **Regression Sum of Squares** | 752.4 |
| **Residual sum of squares** | 174.1 |
| **Constant (standard error)** | .423 (0.347) |
| **Coefficient (1)** | .568 (0.093) |
| **Coefficient (2)** | .158 (0.086) |
| **Coefficient (3)** | .286 (0.089) |
| **Coefficient (4)** | -.187 (0.094) |

The regression was highly significant ($p<0.01$) indicating that practitioners considered that the implementation of wireless technology would enhance clinical performance and that it would save time, effort and would attract more practitioners. Practitioners also believed that wireless hand held devices would also help with the delivery of high quality information.

Another regression analysis was done with the dependent variable of "Do you believe the use of wireless handheld device would provide better quality of service to the patient?" This was done against the data quality independent variables of

1. Do you believe the use of wireless handheld device will help delivery of high quality information? and

2. Do you believe the use of wireless handheld devices can effectively reduce documentation inaccuracy?

Output from this regression is shown in Table 3.

Table 3: Regression analysis on factors that practitioners consider will provide better quality service

| R Squared | Level of Significance | F statistic | Regression Sum of Squares | Residual sum of squares | Coefficient (Constant) | Coefficient (1) | Coefficient (2) |
|---|---|---|---|---|---|---|---|
| 0.309 | 0.000 | 20.84 | 333.91 | 745.05 | -0.352 (se=0.712) | 0.575 (se=0.206) | 0.519 (se=0.147) |

The regression was highly significant ($p<0.01$) indicating that practitioners considered that a quality service depended on the delivery of high quality information and a reduction of documentation inaccuracies.

## Discussion

This paper looks at the factors that influence the adoption of wireless handheld devices in healthcare environment in the Pakistani environment. The factors considered important by practitioners were analysed using regression and it is apparent that in general practitioners are in favour of adopting the technology provided there is adequate training and technical support. This aspect needs to be considered by management and it is imperative that sufficient resources are allocated to ensure that sufficient technical support is provided.

Practitioners consider wireless technology to be useful in terms of saving time and effort as well as attracting more practitioners to the hospital system. Another factor in favour of the technology is the perception by practitioners that higher quality, more accurate data will be produced.

In order to achieve clinical performance, the design of an effective human-computer interface, while challenging, constitutes a key factor for the acceptance of the technology and its routine use by healthcare workers (Chen et al. 2004). This is an important development consideration as the relevant information should be easy to navigate and read, and has to be presented in an organised fashion when required within the resource limitations (e.g. screen size and bandwidth) of a wireless handheld environment. Usability factors are not only likely to constitute an acceptance barrier, but can also be the cause of medical errors. Bates et al. (2001) argue, 'While it may be easy and common to blame operators for accidents [or errors], investigation often indicates that an operator "erred" because the system was poorly designed' (p. 301). Therefore, medical errors can also occur due to poor usability. Taken together, these factors would contribute to reduce medical errors. By implication, it is important to involve users in the design of the wireless applications, thereby maximising their clinical performance.

Simply acquiring and implementing wireless technology alone would be insufficient to accomplish clinical performance and, subsequently, drive adoption and diffusion. Wireless technology should be integrated with process improvement and organisational change. Process improvement requires the optimisation of clinical processes and should be supported by technology, rather than driven by it (Smith 2004). Ultimately, this is likely to generate significant patient outcomes and financial improvements with health organisations. This is implied by the respondents in terms of attracting more patients, saving time and saving effort.

As implied by the empirical evidence collected in this study, cost constitutes an important factor which will affect the integration and, subsequently, the success of wireless handheld devices in the healthcare setting (Sax et al. 2003). While the cost aspects were not directly explored, aspects such as saving effort, saving time, reduction in inaccuracies and high quality information are components of cost. While existing research in this area argues that wireless technology has the potential to decrease charting time and medical errors and enhance patient care quality, there is no evidence that comparisons of costs before and after the implementation of wireless technology have been made. This suggests that further research is required, but also, more importantly, shows that, indirectly, costs have the potential to affect clinical usefulness and threaten widespread adoption.

## Conclusion

This study explored medical practitioners' perceptions and their reactions towards introducing a wireless technology in a Pakistani healthcare context. The practitioners have asserted that clinical performance and quality of service are two main determinants to the acceptance of such a technology. The contributing factors towards clinical performance and quality of service are training required to use the technology in a clinical

setting and technical support required to maintain the technology. The advantages of using such a technology appear to be attracting more patients, saving time, saving effort and realising high quality information. These collectively lead to reduction in data inaccuracies.

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