original article

E-health: effect on health system efficiency of Pakistan

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BACKGROUND AND OBJECTIVES: The health system in Pakistan is spraining because of increasing cost and demand gravities. The shortage of skilled health care workers is one of the main factors of health issues. There is a need to move away from the dependency of tools such as pen, paper, and human memory to a milieu where patients and health care providers can reliably access and share health information in real time across geographic and health sector boundaries.

DESIGN AND SETTINGS: The purpose of this research is to observe the effect of e-health on the physician–patient relationship and to analyze the capacity of health professionals by noting information and communication technologies usage as indicators.

METHODS: Structured questionnaire was used to gather data from physicians to judge the success and effect of existing e-health policy. Both categorical and Likert scale variables were used. The analysis of data was performed using chi-square test and binary logistic regression.

RESULTS: Specialist doctors comprised the major proportion of health care professionals in both male and female categories with good knowledge about Internet usage. E-health–based communication does not seem to be gender specific. Logistic regression revealed that busy doctors whose patients are more than 100 per week believe that e-health would significantly strengthen their communication with patients (OR=3.06; 95% CI=1.05–8.87). Among other significant impacts of e-health include reduced consultation period and time of diagnosis.

CONCLUSION: E-health technology can play a crucial role in controlling many epidemic diseases through effective surveillance. E-health implementation will result in improving the efficiency, better access of general public to the health care system, and eradication of diseases in Pakistan.

E-health is commonly considered as the Internet and medicine, but actually it recounts everything related to health care with computers and, broadly, it refers to the use of information technology.[1] This term "e-health" is misinterpreted with e-commerce and e-business. It is a new account pertaining to the Internet expanding and improving health care activities. Computers and Internet always create opportunities as well as challenges, so e-health is an information technology term referring from medical information intersection to health care services provision to patients.

Information technology is also bringing remarkable innovations in health care sectors such as artificial intelligence, biotechnology, nanotechnology, and nomadic information systems. There is a need of relational capital and competencies for the promotion of e-health. But there are some social elements that affect the e-health evolution. E-health provides a network through which information is transmuted in different sectors; however, its provision varies from culture to culture.[2] For medically compromised populations, it is effective to use Web-based designs.[3]

E-health is an easy-to-use, exciting, and entertaining technology. It promises to increase efficiency not only by reducing cost, but also by providing good quality health care services. It educates physicians and exhibits a new type of patient–health professional relationship. E-health involves a high degree of distribution of information, mobility, and information access. It has a wide area for monitoring environment. This can have a radi-

cal impact on health care systems. It can provide long-term health monitoring to patients without intrusion in their activities, and the use of medical resources can be achieved at the optimal level. Improvements in patient care can be brought with immediate transit while communicating with reliable information gained in the e-health system. Besides this, efficiency in the health system can be enhanced by exchanging readily available information from permanent data that is collected only once, and, therefore, very less time is spent on the medical history of any patient. E-health diminishes the documentation that saves not only time but also resources such as paper, stationery, and extra labor. It reduces errors in medical and clinical reports. E-health supports to review immense data in patient monitoring. It not only helps gather medical information relevant to patients, but also warns physicians regarding any unhealthy trends and enables physicians to respond promptly to patients' medical information. It facilitates by providing innovative ways to health care practitioners to collect, filter, and examine relevant information for a patient. The main features of the e-health system are as follows: (1) sophisticated diagnostic engine and (2) security and privacy.[4]

E-health may have contradictory effects on the patient–health professional relationship in health care. It can replace face-to-face consultations.[5] The purpose of e-health is to improve community's quality of life and to facilitate health professionals. Such system also helps in strengthening social networks and desire to keep learning new activities.[6] Health professionals can build a patient-driven web-based personal health record to maximize evaluation of their patients. E-health has a social stigma associated with some specific diseases and psychological costs or risks following private information disclosure.[7]

E-health can improve the health care delivery system by introducing positive changes in the physician–patient relationship such as improved clinical decision making, strengthening communication between physician and patients, and increased efficiency. Three important elements of e-health are as follows: (1) convenience to health professionals and patients, (2) control of health records, and (3) patients' choice for services. E-health incorporates disease management, clinical decision support, physician–patients communication, and administrative efficiencies.[8] E-health can resolve many problems and crisis being faced in the existing health system. Information technology can help in improving the general health system of the community by providing better management for health services.[9] Some laws, regulations, and professional security cultures are involved for e-health. To make e-health secure, national standardization of professional education and protocols is required.[10]

In Pakistan, the health care system is facing a number of challenges. Health care sector is needed to be restructured to bring improvements. Although the government understands the importance of benefits provided by information technology solutions, but it seems imperative to focus on e-health policy for its implementation. The purpose of this research work is to analyze the effect of e-health on the health care system in Pakistan by getting responses from health care providers. The scope of our study was limited to service providers because the study appeared to be the first analytical report of its kind on the e-health aspect; patients will be surveyed in the next phase of research in this context,. The reason is that in near future e-health will provide benefits to patients and health professionals, but ultimately it will be used by health professional to facilitate patients. So, feedback from health care providers is needed on how comfortable they will be in utilizing the said system. It can help government to analyze regarding e-health before providing funds for the communication infrastructure required for pervasive the health care system.

At present in Pakistan, World Health Organization (WHO) provides the reference guidelines for the health system, and the proposed e-health policy is another progressive step where WHO would be the main advisory body.11 Pakistan is determined to work in collaboration with international organizations including WHO for developing state-of-the art innovative technology to improve its health care and delivery system.12 The real issues in moving ahead in this direction are as follows: (1) whether the national health infrastructure is capable of absorbing this innovative system and (2) if it is implemented, to what extent human capacities will run the system. Both these aspects will directly affect the health system efficiency; however, if health professionals at the national level are well aware of the e-health system and its functionaries, this would definitely be the key driver in the health care success in Pakistan. Keeping in view these challenges, this study was conducted with an aim to examine the e-health impact on the physician–patient relationship and to document the opinion of health professionals regarding communication technologies in health care services, in general, and its role in the e-health system, in particular.

METHODS

To maximize an adequate e-health response, the selection of health facilities and identification of appropriate health professionals are prerequisite. The factors that

can influence the biasness should be taken into account before the onset of data acquisition. In this context, we aimed to develop a questionnaire that would minimize personal judgments and address evidence-based responses. Hence a detailed, close-ended, self-structured, and multi-item questionnaire was designed. It is worth mentioning that the scope of this study was limited to only doctors/service providers; hence, our utmost effort was to observe their responses considering that if the government introduces e-health policy in Pakistan, to what extent it will bring efficiency in the health system from doctors' perspective.

Survey design

The survey was conducted in Rawalpindi District during May–July 2012. Prior to distributing the sample, a brief introduction of e-health and the proposed policy to be implemented by the government was given to the respondent. Eighty health professionals were targeted in the first place; out of these, 73 agreed to participate and filled the questionnaire. After compiling the data, 7 entries were excluded because of missing values. Questionnaire was collected on the spot, and care was taken to obtain responses on the individual basis.

Description of variables

The categorical variables include "type of organization," "type of health facility," "years of practice in medical profession," "age group," and "number of patients per week." The binary variables include "gender" and "visit abroad." To document the impact of e-health, a 5-point Likert scale (ranging from "very often" to "never") was used, which involved 22 response items. Out of these, 8 questions were related to the frequency of Internet use by doctors to get updated information and their practice to recommend patients to browse health Web sites. However, the other 14 items were concerned with both the efficiency of professionals and the strengthening of communication with patients by utilizing e-health in the clinical case.

Data analysis

All data were entered in Microsoft Excel®. Entries with greater than 5% missing values were excluded from the analysis. A descriptive analysis was performed to document the distribution of responses in terms of age, gender, and type of organization. Chi-square test was used to examine the relationship between 3 major categories of health professionals with gender, age groups, and type of organization. To predict the impact of e-health on strengthening of communication between doctors and patients, binary logistic regression analysis was performed. The dependent variable (strengthening communication with patients) was transformed as a binary (yes/no) item, and the responses "never" and "rarely" were recoded as "no" and the rest of Likert scale items (sometimes to very often) as "yes." Among independent variables, 1 binary (gender), 1 categorical, and 2 five-point Likert scale items were selected on the basis of their uniform response. Binary scores obtained for the categorical variable "number of patients per week" was binary coded as <100 patients and >100 patients per week for logistic regression. Binary scores were obtained by transforming Likert scale categories to have more distinctive differences in response items. Such types of changes in scores from "summative Likert" to "cumulative binary" were found more effective in comparing symptoms of general illnesses and depression.[13] The other 2 scale variables were transformed into binary in a similar way as described for the dependent variable. For the analysis of data, SPSS version 16 (SPSS Inc, Chicago, IL) for Windows was used.

RESULTS

Health professionals' distribution

To describe the results, a dataset of 66 subjects was finally included because this was most complete. Chi-square analysis showed that data pertaining to the level of health professional in our study had no significant difference with genderwise distribution (**Figure 1**). However, in both the categories, specialist doctors comprise the major proportion of health professionals. For age groups, our study showed a significant difference between different age categories and health professionals, where young doctors with age less than 30 years constituted a dominant proportion in the dataset (**Figure 2**). We further observed that most of the health professionals belonged to government hospitals in our study, with physicians significantly greater in number (**Figure 3**).

Logistic regression

Out of 4 predictors analyzed in the binary logistic regression analysis, 3 appeared significant in explaining the positive outcome of e-health on improving the communication of health professional with their patients. E-health–based communication seems not gender (female)-specific because it has no influence on the outcome variable. Regarding the number of patients, our regression results indicated an interesting relationship between dependent and independent variables. In this context, the transformation of variable describing the number of patients seen per week into a categorical

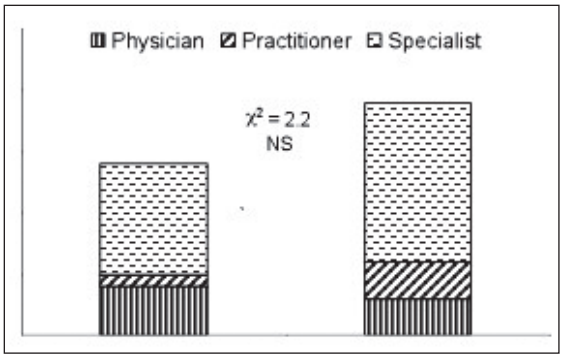

Figure 1. Chi-square test for examining the relationship between Gender and health professionals.

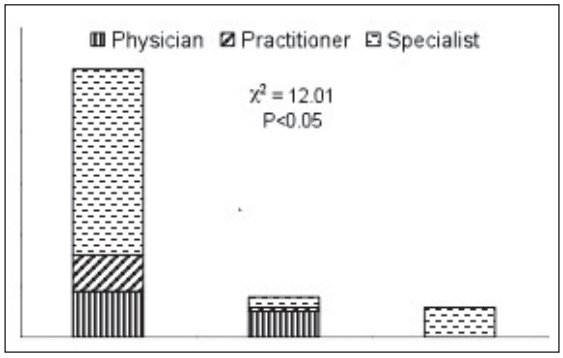

Figure 2. Chi-square test for examining the relationship between Age groups and health professionals.

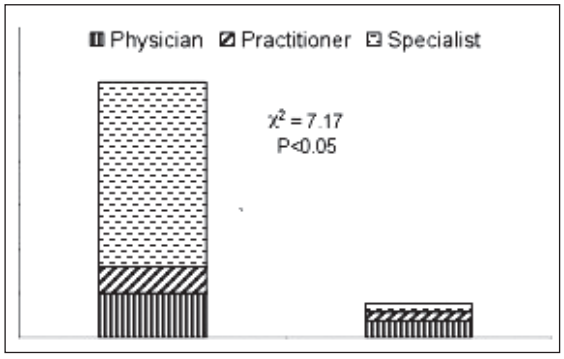

Figure 3. Chi-square test for examining the relationship between type of organization and health professional

variable has provided an alternate measure of primary outcome, i.e., strengthening communication. We found that for doctors who attended 100 patients or more per week, the odds of strengthening communication between the physician and patients significantly increased (OR=3.06: *P*<.05), which seems plausible, primarily because the e-health–based communication strength was perceived as a significant outcome of patients' number (**Table 1**). Similarly, the health professionals who believe that e-health would save time in patients diagnosis, as a result, will develop 4 times stronger communication with patients (OR=3.9; *P*=.009), provided the e-health system is introduced (**Table 1**).

DISCUSSION

The increasing population in Pakistan has created multifaceted problems related to health care and services.14 One such issue is the manual registry of diseases and patients' records in government hospitals, which are the prime health outlets where the general population seeks medical treatment. To overcome this challenging task, the e-health policy formulated by the federal government is partially launched.[15] The present health system in Pakistan is considered quite substandard mainly because it is the practice of nearly all governments to allocate less than 2% of gross national product on the country's annual health budget.[16] In this scenario, if e-health is implemented as a tertiary level, it will definitely produce positive outcomes—an important aspect that we highlighted in this study. However, this would require a substantial increase in budgetary allocation and financial support by the government to improve the existing health infrastructure and train health professionals to get the maximum benefit of the e-health system. Findings of this study have clearly indicated that among health professionals, specialists occupy the key position among doctors in both the gender and different age groups as revealed by the chi-square analysis. This could implicate two aspects. First, in the current perspective where rural–urban discrimination of health facilities is well documented in Pakistan,[17] the e-health system will definitely improve the access of patients of rural areas to specialists working in urban localities. Second, the poor people, who are the main sufferer, would strive for cheap consultation in less time with their choice of specialist doctor, either male or female, as the e-health system would enlist most updated records of health professionals at the national level.

The assessment of health professionals regarding their knowledge about information technology and Internet usage carried out in this study has revealed encouraging signs that Pakistan is ready to use e-health as a tool of future health care services. These important indicators can convince the international donors and planners to promote e-health applications because this fulfils the prerequisite for successful implementation of e-health program.[18] Hence, the efficiency of the health care system associated world over with the e-health can be expected in Pakistan, though we have a low literacy rate to immediately replace an old system.[19] In addition,

Table 1. Logistic regression on impact of e-health on strengthening communication with patients.

E-Health variables	*P* value	Odds ratio	95% CI
Save time in diagnosis (no)[a]	.009	3.90[b]	1.38–10.94
Gender (male)[a]	.525	1.38[c]	0.51–3.66
Over 100 patients per wk (all others)[a]	.039	3.06[b]	1.05–8.87
Reduce consultation period (no)[a]	.004	7.33[b]	1.82–29.42

[a]Binary predictor (reference category).

[b]Significant in univariate analysis.

[c]Non–significant.

young doctors and professionals, who intend to move abroad for career development[20] can be trained to build in e-health technologies as incentives to serve for this nation.

LIMITATIONS

We were confronted with 1 limitation in this research, which was the small group of sample size (number of physicians). For the conventional analysis, to present 2-tailed results, alpha is maximized; however, our study was based on 65% statistical power to achieve α=5%. Nevertheless, the SPSS used in the present study is widely applied to similar characteristics as logistic regression software tool with small sample size analogous to research work presented here.

In conclusion, our study justifies the capacity of health professionals to adopt the e-health approach and hence we conclude that transforming the existing health care delivery system into e-health–based framework would bring Pakistan's health system accessible and equitable to the general population. We believe that specialist doctors would cater to the need of the e-health system in a much efficient way by saving the time spent in diagnosis and increasing the number of patients in a cost-effective way.

Competing interests

The authors declare that they have no competing interests.

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