



Evaluation of Implementing Electronic Health Record and Its Relationship with Health Services Quality in Healthcare Centers

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ABSTRACT

Electronic health record contains individuals' health information from before birth till after death, the present study aims to evaluate implementing electronic health record and its relation with health services quality in healthcare centers administering Gachsaran city family physician. For assessing cares quality, one of the most important groups receiving health services i.e. children was selected and the procedure of providing cares to this group was compared three months before implementing electronic record and three months after that. Data were collected using standard checklist of ministry of health and data analysis was done using T-test. After comparing services before and after electronic health records, in processes of evaluating and categorizing children's problem ($p=0.0001$), recommendations and measurements ($p= 0.0002$) and service provider performance in information recording ($p=0.0001$), a significant relation was observed between before and after implementing electronic health record. The study results show that electronic health record in healthcare could reduce inevitable errors in paper form and causes health services quality. Also, there are many capacities in electronic record structure such as its integration and sharing capability which could help easier access and providing higher quality services.

INTRODUCTION

Success of Primary Health Care program (PHC) in the form of healthcare network systems of the country caused utilization of four basic principle of the country healthcare network system i.e. establishing social justice, intra-sectorial cooperation, public participation and using suitable technology in all stages of administering rural family physician plan.

In family physician plan and reference system, general physician and his team undertake full responsibility of the people and families under their care domain and after the individual reference to specialized levels, they assume the responsibility of pursuing the performed measurements too. Then, one of the most important duties of family physician is to provide primary health cares and services that without providing these services, using the term of family physician just for providing treatment services, is a malapropos act. Also, all health services are provided actively in family physician plan for the covered population.

The key administrative tool is evaluating and pursuing family physician goals of family health record which is now completing and implementing in all administrative centers in paper form (Iranian Ministry of Health, 2015)

Electronic health record includes a series of information relating to citizens health from before birth (including germinal period information and before that – like information relating to laboratory fertilization) till after death

(like information obtained from autopsy, burial place and so on) which is stored continuously and over time in electronic form and if necessary, regardless of special time or space, all or part of it will be in access of authorized people (Khazra , 2006). In other words, it is electronic collection of the individual life length information which is shared by providers of registered or confirmed cares in various places (Khezri, 1385). Also, in another definition by international organization of electronic health record standardization includes a digital reservoir from all information of the patient which contains retrospective, present and provident information and its main aim is continuous, effective and integrated support of health care.

Electronic record provides a single and coherent, integrated and complete source of patients' health information. Issues such as treatment, prescription, tests results, information relating to the environment and healthcare information are included in it. The organizations think about health services quality gradation for improving and providing their activities and this is only possible through access to high quality information (Management AHI & Association , 2005)

Among the most important advantages of electronic health record we can point to the following cases:

- Efficiency: one of promises of electronic health is increasing the efficiency of healthcare services and then costs reduction. One of possible ways to reduce costs is to avoid repeated or unnecessary diagnosis or treatment interventions through advanced communication facilities between healthcare services institutions and through the patient involvement or participation. Internet, naturally serves as a means for reaching this aim of electronic health.

2- Care quality: a service receiver who has higher training (as a result of electronic health information aspects) could establish a more effective relation with service provider which in turn leads to better understanding and care quality improvement.

3- Based on evidences: electronic health interventions should be based on evidences, in this sense that their effectiveness and efficiency should be proved through exact scientific evaluation and regarding the case background. Electronic record facilitates the possibility of access to such evidences and then creates the possibility of required support for diagnosis or decision making about treatment.

3- Enabling services receivers and patients

Electronic health creates new ways for patient –oriented medicine and the ability to train the patient by creating medical knowledge bases and personal electronic files accessible for service receivers through internet.

And then causes increasing of awareness and more satisfaction of the patient (Wickramasinghe & E, 2005).

In this respect, paper record due its shortages is not able to establish suitable relation between health service providers and required data may not be provided for people on time (Mindy, 2008).

Electronic record has some priorities over paper record, among them we can point to the following cases:

The patient data are accessible (Hadianfar, 2003), HER documents are usually more readable and organized better, also being fully computerized increase documents quality through automatic control of entering data validity. Electronic health record through the capability of reusing data increases the efficiency of providers work circulation. Also, reusing data increases data quality (Hadianfar, 2003).

Electronic health records (EHRs) includes the patients clinical information. Therefore, it constitutes the vital part of a healthcare system. A system (HER) makes possible the patients information electronic storage and transfer. Many modern hospitals have computerized records, but these systems are usually private and are often employed by a special ward of the hospital. Hospitals could have tens of individual systems which don't have the capability of operating with each other. A patient health information description could be broadcasted throughout some individual systems which makes difficult to acquire the patient full clinical history for clinical specialists.

Among advantages of electronic record, we can point to access to the patient full information in improving clinical cares and reducing medical mistakes. Electronic health record is a concentrated long term series of an individual healthcare information which are usable for all services providers in each center and at every time and is considered as the main part of an integrated health information system. Those systems which have electronic health records have this capability that while causes the patient health level improvement, save hundreds of hours and reduce care costs too. An electronic health record causes better decision making in treatment course and development of treatment results and collects better data for general health and research, but it just occurs when a standard method is selected for creating and developing it.

Since information in healthcare section are stored and retrieved in paper form for years and its significant has been emphasized in family physician program too, in this form that the first measurement of family physician after recognizing their covered population and their registration, is forming health record for each member of the family and performing the first visit which is done freely for all the covered population and the respective forms which are provided by the city coordination staff and delivered to health team, are completed and recorded in the record. Any treatment measurement which is done by the family physician for covered people should be recorded in the family health record. Once a year, periodical visit for all covered people and target groups should be performed according to service packages and recorded in health record (Iranian Ministry of Health, 2015). But, yet health record in most service provider centers of the country is in paper form and or if a city or university has independently measured for making records electronic, usually a part of healthcare course is turned from paper to electronic form and practically it doesn't include required integration which is the most important advantage of electronic file and or in case of making total file electronic, sharing information between all provider units is not possible, since this movement is also performing in Yasuj Medical sciences University and yet electronic file is experimentally triggered in some centers of service providers, this study tries to besides evaluating this trend implementation and the effect that electronic file has on health service, examine challenges and weaknesses to compare services quality between centers with electronic health records and centers which use paper record and be able to create a dynamic electronic system with all capacities of electronic record which leads to promoting health services and not like other disappointed efforts in past years in the field of electronic health records, this plan fails at the beginning and just to be a change from paper to computer form.

EXPERIMENTAL SECTION

For assessing the impact of electronic health record regarding the multiplicity of provided cares and based on age groups in the society health centers implementing electronic health record, one of the most important groups receiving care i.e. children under 1 years old was selected, the statistical population included all children below 1 years old in Gachsaran city that the sample was selected by cluster sampling method. In this way that first health centers and bases implementing electronic health record were specified and then for determining the research clusters by simple random method 3 health bases were selected. The research population in selected bases was 850 persons that for determining the sample content using Cochran formula the number of research samples was obtained 264. Criteria of selecting sample people were children below 1 year old in both male and female sexes who had referred to health base at the time of research and health record was formed for them. Health records of research samples were compared in two time sections and three months before implementing electronic health record and three months after that. The comparison was performed in this way that the plan of children merged cares in three months before and three months after implementing electronic record were examined by standard checklists. This checklist was completed for examining the process of providing children health program service in health center by observation, interview and examining documents relating to the processes. Scoring method for each question is zero and one and in each question, if all discussed cases were complete the score was 1 and if even one case was incomplete or wrong, the score will be zero and if there is no other case, a dark line will be put. Checklist includes 5 parts; each has its relating questions. Checklist parts includes organization, service provider performance, awareness of service provider and service provider performance in information registration.

Validity and reliability of checklist was confirmed using correlation method between evaluators. In this way that forms were completed in 10 observations simultaneously by the researcher and his research colleague separately, then the obtained data were assessed one by one by the researcher and his colleague and were confirmed by determining correlation coefficient above 70%. After collecting, data were analyzed using statistical software (SPSS version 22) and dual T- test and with certainty level of 95%. P level was considered significant less than 0.05.

RESULTS

According the determined hypotheses in the study, health services quality provided for children was assessed in 5 parts. The first studied part was service provider performance. Service provider performance in integrated cares of healthy child includes 3 sub-processes which are: evaluation- categorizing, recommendations and consulting with mother. For examining the effect of electronic health record, the scores of these sections before and after implementing electronic record were compared that a significant relation was observed between the score of providers' performance before and after implementing electronic health record. The table of provider performance descriptive statistics is as follows:

Service provider performance

average standard error	standard deviation	number	average	
1.06255	17.26442	264	78.4735	service provider performance before implementing electronic health record
0.64839	10.53511	264	94.7614	service provider performance after implementing electronic health record

For comparing the service provider performance before and after implementing electronic health record, each sub-process score was compared using dual T-test with before implementing electronic health record that there was a significant difference in all three sub-processes of evaluating- categorizing ($p=0.0001$), recommendations ($p=0.002$) and consulting with mother ($p=0.001$). One of the most important reasons which could be enumerated in this field is that in the context of service providers' performance and evaluating categorizing process before and after implementing electronic health record, there were many mistakes in categorizing children problems. Categorizing means that children should be evaluated in respect various status which includes: risk symptoms, general status, icterus status, nutrition status, weight status, length, head around, eyesight status, evolution status, vaccination status and medicinal complements and based on statuses evaluation and existence of illness symptoms stand in a special category and according to special category the child stands, measurements and recommendations are performed by health care providers.

For example, in a study which had examined children cares evaluation, the correct rate of evaluation and categorizing children problems were obtained 63.9 (Tajaldini, 2015). But, after performing electronic health record, since this case was done smartly and regarding the information given to software, error percent in the field of evaluating children problems categorization reached zero and all evaluations of children status after implementing electronic health record were calculated correctly. In the recommendations section, required recommendations should be provided for the child according to the performed categorization that for example these recommendations could include urgent or non-urgent reference to physician, health recommendations or follow-up in different times regarding the child problem that in case of health observant mistake in problem categorizing, recommendations encounter difficulty. In this sub-process, regarding that electronic health record is categorized intelligently and required recommendations are provided, a significant difference was observed with before implementing electronic health record.

Other important part which was assessed in the field of caring children before and after implementing electronic health record, about service provider awareness, no significant difference was observed with paper file in this ground ($p=0.707$) and service receiver information before and after implementing electronic record was in similar status.

In the field of service provider performance in information registration, a significant difference was observed between electronic health record and paper form ($p=0.001$). in paper form, record form, book and statistical forms should match each other and cases like timely reference of child if needed, complete record of cares, correct record of growth diagrams should be registered completely and correctly that in paper form due to many statistical forms and need to record information in the record and statistical forms separately, there were many mistakes in paper state but in electronic state due to lack of information repetition necessity in separate forms and producing automatic reports by electronic record software, this problem was resolved.

Information record

average standard error	standard deviation	number	average	
0.85789	13.93908	264	67.3295	pair 1 record in performance of service provider file before implementing electronic information
0.66663	10.83145	264	93.7803	record in performance of service provider file before implementing electronic information

In organizing part which contains sub-processes of instruction and training materials, drug and complement estimation and equipment, all sub-processes are compared at the time of implementing electronic record and before it that a significant difference was observed about instructions and training materials with paper state ($p=0.003$). and among its reasons we can point to this case that in electronic state in electronic health record, instructions and training materials exist in electronic form and beside each care, so that service provider individual could access it easily and besides study provides required trainings. But, in the ground of drugs and complements estimation, no significant difference was observed with paper state.

For assessing awareness evaluation and service receiver, two sub-processes of awareness and satisfaction were evaluated. In this part, knowledge and behavior of service receiver was examined through recommendations provided for him. Mothers are interviewed after cares and during exit from the center, if accurate answer is given, score 1 is given and otherwise score zero. That in this ground no significant difference was observed with paper record ($p=0.650$). In the field of satisfaction, besides questions existing in checklist, the rate of service receivers satisfaction from services quality and time duration of care provision was assessed. That there was no significant difference with paper state.

DISCUSSION AND CONCLUSION

The present study was conducted for examining the impact of electronic health record on health services quality that for assessing this impact, one of the most important service receivers groups in health section was selected i.e. children and it was tried that service provision processes to be compared in paper and electronic state. In the study performed by Milani *et al* about the quality of providing child growth monitoring services, 58.9 % of personnel had good performance and 41.1% had weak performance (Milani, 2005). In another study which was performed under the title of evaluating integrated care plans of healthy child in healthcare centers. Important cases in providing healthcare for children such as evaluating child problem categorization, recommendation and measurements and consulting with mother, though has had improvements towards previous year but the obtained score has not been satisfactory in each part and it indicates that we could extend services to a higher quality level by more effective interventions (Tajaldini, 2015). For example, the score of problem evaluating and categorizing has been 63.9%. while in the present study and by full implementing of electronic health records, the average of this score in studied centers was obtained 94.7 which indicates the optimal impact of implementing electronic health record in this part, but there is some problems in full implementation of electronic health record and we could point to required infrastructures for administrating, integrating and also training and human force resistance.

In the research of Babalhavaeji *et al* which was performed about designing electronic health records for diabetic patients, it was specified that in designing electronic record, information like age, name and surname, mass body index, the first blood pressure, glucose profile background, insulin, Antihypertensive drug, Corticosteroids, smoking, blood cholesterol, blood pressure, treatment and diabetic foot clinic should be placed in the first degree of importance (Alhavanji, 2015)

SimaAjami *et al* in a study under the title of electronic health record specified that the organization indisposition is one of administrative obstacles of electronic health record and also among other reasons of electronic health records failure; we can point to resources shortage, lack of information technological support and stakeholders' unawareness about electronic records implementation (Ajami, 2011).

In the study of FarahnazSodooghi *et al* about creating individual electronic record which evaluated standards of data collection for creating electronic record showed, they showed that regarding the range of data diversity, need assessment of stakeholders, obtaining experts view for determining data collection is significant. This researcher's findings showed that data collection of individual health record could include more details like mental health information (Sodooghi, 2014)

In a study which was conducted about factors effective on electronic health record, it was concluded that the role of age and working background in promoting treatment services providers custodians for patients towards electronic health records is very significant since by increasing of age and working background gradually the awareness rate has raised and people by acquiring experience and making relation with issues relating to electronic health record reach this aim. Therefore, acquiring experience and training and then their awareness promotion could have a significant role in people point of view in people point of view to electronic health records, so that in higher age classes and more working background, people view towards electronic health record promotes too (Hafezi, 2015).

In the research of Mirani *et al* which administrative obstacles of electronic health record was evaluated, it was specified that using experienced and expert people in technical, financial and organizational grounds and providing required trainings and technical plating for implementing electronic health record along with designating required resources paves the way for utilizing this system. In this study, in which the importance of electronic records implementation obstacles was assessed through interview with experts, the following results were obtained:

The significant degree of technical obstacles in creating and using electronic health files was more than other obstacles (average = 71). Financial and moral obstacles respectively with averages of 70.05 and 68.16 were in second and third degree and individual and organizational obstacles were respectively in ranks three and four with averages of 64.84 and 62.67 (Milani, 2005).in the present study, since one of important examined cases was

existence of instructions relating to service provision for children and act according to them, since these instructions was in electronic form and existed in each section that service was provided electronically, then health observers had more tendency to provide service through electronic record system.

Another study finding about learning methods and stages of medical electronic records standardization specified that the process of medical electronic records standardization includes some stages. The first stage is existence of demand for standard. The second stage is creating standard based on required features which have been specified in the first stage. After confirmation of standardization institute, standard turns to a primary sample and is examined. Finally and in case of acquiring positive results, the considered standard is broadcasted (Sodooghi, 2014).

Since in health section, yet electronic record has not designed fully and coherently and due to multiplicity of used software in this section, there was not the necessary integration in this domain, then need to designing an integrated system which could both be service providers guide and a tool for reporting health records was felt more than before. And the present study confirms this issue that in case of providing healthcare by electronic health record system, we could improve healthcare and take steps to more quality of cares.

In the study of AmyMadore under the title of electronic health record implementation, it was specified that implementing electronic health record is a complex issue and besides hardware, software and human force requires accurate planning, changing management skills and its acceptance by the personnel, also this system requires continuous evaluation and updating for responding when necessary (Madore, 2011).

In a study which was performed in the field of electronic health record, it was specified that by better and more efficient designing of electronic record, users training and also providing training protocols, we can prevent from many medical errors (Rapso, 2005).

It should be mentioned that after implementation of electronic health record, yet in the country no research has closely evaluated its impact on health services quality and previous studies in most cases have been about standards and infrastructures. One of the most important results of the present study was to prove this matter that electronic health record could cause prevention and reduction of errors occurred in provided healthcare in health centers, so that in examining children cares and processes of evaluating, categorizing, matching report forms and providing recommendations, a significant relation was observed between before and after electronic health record implementation. The present study confirms that existence of electronic processes in providing healthcare could reduce inevitable errors in paper form.

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