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Exploring the effectiveness of obstetrics and gynecology information systems in hospitals of a developing country: A qualitative content analysis

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ABSTRACT

Obstetrics and gynecology information systems are designed to replace paper charts, interact with other clinical wards of hospital, and to better care for patients. This qualitative study was performed to explore the perception of midwives about the effectiveness of information systems. In this qualitative study, data were collected through semi-structured and in-depth interviews and analyzed by content analysis and constant comparison method. Participants were 15 midwives from obstetrics and gynecology units of affiliated hospitals of Semnan University of Medical Sciences, Iran. Purposeful sampling method was used and continued until data saturation. The several themes that emerged from the interviews were divided into strength and weak points. Strength points included the facilitating the recording of information, reduction of costs and time, and the weakness points were repetition of tasks, low computer literacy of the staff, system restrictions on recording and editing, the unavailability of system and reduced the role of midwives in patient care. Midwives were faced with challenges in the use of information systems indicating the lack of quality of the information system. It seems that reinforcing strength points and resolving hardware and software problems can increase obstetrics and gynecology staff's acceptance of this information system and reduce their cultural resistance toward it.

Keywords: Effectiveness, Obstetrics and Gynecology information systems, Qualitative research, Content analysis

INTRODUCTION

Health information systems refer to any system that captures, stores, manages or transmits information related to the health of individuals or the activities of organizations that work within the health sector [1]. Hospital Information System [HIS] is comprehensive, integrated information software designed to manage all the aspects of a hospital's operation, such as medical, administrative, financial, and legal issues and the corresponding processing of services [2]. It enables the hospitals to immediately access the information in any place or time in order to make the right decisions, i.e. to take an action based on real facts. Managers' decisions based on real facts lead to a better efficiency and improved performance and ultimately to higher administrative efficiency in the hospital [3]. Using health information systems facilitates fast and easy access to the patients and nurses' health information [4]. The lack of comprehensiveness or coherence in health care systems may cause miscommunication, repeated tests, increased costs and most disconcertingly, errors in patient care [5].

The subsystem of obstetrics and gynecology is part of the broader health information system which provides useful information including mother and child care during pregnancy, delivery, postpartum [postnatal period] and the female reproductive system [6]. Nowadays, the prenatal information system in health centers is concerned with collecting the data related to the pregnant women and new born babies in order to provide health monitoring and evaluation of mother and child health programs as well as analyzing prenatal mortality[7]. Some of the problems in the current information systems include: the incoherence of the recorded information, too much information, lack of immediate accessibility of the essential information, poor documentation and redundant data [7].

One of the priorities of health programs is women's health. Despite this, a large number of women die each year because of pregnancy and prenatal causes, the side effects even being much more worrying [8]. Since mothers and their babies are among the vulnerable groups of a society, it is doubly important to maintain and improve their health and care conditions. It is obvious that improvements in the efficiency and quality of health services during pregnancy and postpartum greatly depend on sufficient and correct health information [9].

The evaluation of health information systems can be used as a method for increasing the reliability of the efficiency of these systems and can also pave the way for improving the quality of healthcare and services. The aim of evaluating the systems is to determine their assets and drawbacks and suggest corrective action to improve the performance of the systems [1].

In a study about implementation of the Zambia electronic prenatal record system for comprehensive prenatal and delivery care, Benjamin *et al*. [2010] have found out that using a comprehensive electronic health record has improved clinical care [10]. The results of a study by Shaw *etal*. [2007] about web-based access to personal health record of pregnant women before delivery [a randomized controlled trial] showed that the pregnant women are prone to use web-based health record more than others [11]. Similarly, Tundia *et al*. [2013] have shown that the use of an electronic medical record has a positive effect on preventive care for women's health and accordingly the gynecologists should try more in promoting health information systems [12].

Many studies have been done on information systems in Iran in which most commonly the use and efficiency of information systems among clinical personnel, including the nurses, have been examined [13-17]. However, no prior study has been done to determine in a comprehensive manner the efficiency of information systems in the field of obstetrics and gynecology from the perspective of the users. This is highly necessary because understanding the users' view is the key in using information systems and their cooperation and comments creates the required motivation for the implementation of such systems. The users' consensus on the usefulness and efficiency of the systems and their satisfaction guarantees the use of information systems [13]. Moreover, an investigation of the advantages of obstetrics and gynecology information systems including prenatal and postpartum information, information during pregnancy and delivery, information about infertility, laboratory and sonography, referential problems, test warnings and obstetrics and gynecology record can promote the use of these systems and identify their weaknesses and drawbacks.

It seems that the present study can be used for determining the appropriate criteria for evaluating obstetrics and gynecology information systems in the cultural and social context of hospitals in a developing country and thus be used for improving the implementation of obstetrics and gynecology systems. Accordingly, the aim of the present study is to identify and explain the efficiency of obstetrics and gynecology information systems in the hospitals of Semnan University of Medical Sciences.

MATERIALS AND METHODS

This study has used the conventional content analysis method. Conventional content analysis is an appropriate method for obtaining valid and reliable results from textual data to create knowledge, new insights, report facts and suggest ways for practical solutions [18]. Some of the questions that this qualitative method can answer include: what the users know about the efficiency of the obstetrics and gynecology information system and what is their view about it, the current complexities with regard to the system and what kind of effects to expect from it, which function of the information system could be more important for the users and what factors affect the efficiency of the obstetrics and gynecology information system. Accordingly, the present study is a qualitative one because it addresses the issue of the nature and effect of information systems and inquires about the efficiency and different aspects of information systems.

The case study includes the obstetrics and gynecology ward in Semnan's Amiralmomenin Hospital. The research sample included the administrative and personnel in the obstetrics and gynecology ward. Therefore, the users who were willing to cooperate and share their experiences with regard to obstetrics and gynecology information systems were interviewed.

The inclusion criteria were the willingness of the participants and having at least three months of work experience. The participants were chosen by purposeful sampling from the people who had the sufficient experience about the topic and willingness to participate in the study. In light of the principle of maximum variation in sampling, the participants were chosen from the users with different age and work experience. The personal information of the participants, including, age, gender, education and experience was recorded. Sampling continued until data and category saturation [19].

15 people from the obstetrics and gynecology ward participated in this study. Having obtained the approval and written consent of the participants, the sample people were interviewed individually in a detailed manner. A structured interview, field notes and manuscripts were used for data collection. The core question in the interview concerned the efficiency of obstetrics and gynecology information system. The interviews began with an open question, namely, "What is your definition of obstetrics and gynecology information system?" The follow-up questions were asked based on the responses of the participants to further investigate the topic, including: what uses does the obstetrics and gynecology system have for you in a single shift? How helpful is the system in carrying out your duties? Is the system in your ward efficient enough? Why or why not? What criteria do you have for the efficiency or inefficiency of the system? What could increase the efficiency of the system in your ward? What are some of the advantages of using the system? Some exploratory questions such as, "Could you explain more?" or "Please, make an example" were used to encourage the participants and get more accurate data. Each interview lasted between 30 to 45 minutes. The interviews were done in the obstetrics and gynecology ward of the hospital. The interview conditions, such as location, temperature, light and air conditioning were appropriate. The data collection and analysis were done simultaneously. The data analysis was done by using the conventional content analysis method and was based on the responses of the personnel.

The Lincoln and Guba criteria were used to determine the rigor of the data. Prolonged engagement of the researchers, sufficient participation, appropriate interaction with the participants, integration of the data and member check increased the credibility of the data. On time transcription, external check and rereading the whole data ensured the dependability of the data. Time triangulation and sample variety increased the credibility and confirmability of the data. The determining-confirming of the data was proven by the impartiality of the researchers and agreement on the codes and themes. Transferability and fittingness were observed by including direct quotations and examples and the consultation of experts in the field [20].

Ethical considerations

For this study, the approval of the committee of ethics of Semnan University of Medical Sciences (date: 6/30/2015; no.IR.SEMUMS.REC.1394.51) was obtained. The permission of the administrative was obtained prior to the start of the study. The participants were informed about the aim of the study and the way to answer to the questions. The confidentiality of the data and the right to exit from the study were explained to the participants.

RESULTS

The present study was conducted with the participation of 15 people from the personnel of obstetrics and gynecology ward. The age limitation for participation was 23-51 (mean: 37) and work experience 0/5-28 years (mean: 10/5). Having determined the initial concepts, 50 codes were extracted from the interviews at the beginning. After various reviews, these codes were summarized and categorized based on their similarities and differences. Further review and comparison of the categories enabled us to identify the meaning of the codes in terms of initial themes. Based on their nature, the initial themes were named conceptual and abstract. Accordingly, these themes showed the weaknesses and strengths (efficiency) of obstetrics and gynecology information systems. The themes and their formation are represented in Table (1) that confirmed by comments of the participants.

Table1. Themes and sub-themes

Themes	Sub-themes
Facilitating the reading of information	Fast data access and monitoring
	Work acceleration
	Speed
Saving time and costs	The effectiveness of the system
	Reduce costs
Low literacy level of the personnel	The low computer literacy
	Hard data entry and work with system
	Require trained personnel to operate the system
The limitation of the system in recording and editing the information	Unable to edit information
	Unable to record some information
Repetition of tasks	System as task overload
	Complete hand record
The unavailability of the system	Lack of access to information after discharge
	Lack of access to patient data in some wards
	Lack of access to monthly or yearly statistics in system
	Non-flexibility in adding information
	Unable to load the educational information in system
Decreasing the role of the personnel in taking care of the patients	Reducing the time for direct patient care
	The absence of a secretary to work with system

A) The weaknesses of using obstetrics and gynecology information systems

Low literacy level of the personnel: Most of the participants thought that the low computer literacy level of the nurses and the personnel is a major obstacle in the efficiency of the information systems and noted that a training course on how to use the system must be included in the training programs for the personnel. The three following quotations clearly show these points:

"Once there was a natural delivery and the woman did not allow episiotomy and she had to be sent to the surgery room for episiotomy and I didn't know the type of surgery and I didn't know what to inject and there was nothing about this type of surgery in the system. It was my night shift and I had to wait till morning for my colleague from the surgery ward and ask her about what was I supposed to inject the woman. Anyway, perhaps we don't have enough information about it."

"I had already studied ICDL. I could easily work with the system, but my colleagues told me that I need to take the pre-employment and OJT courses more seriously, be it brochures, booklets or films."

"Well, if I'm supposed to work with the system they must train us in advance, not in bits and pieces during work."

The limitations of the system in recording and editing the information: Most of the participants pointed to the limitations of the system in recording and editing some information as one of the main obstacles in efficiently using the obstetrics and gynecology information systems. For example, one of the midwives said:

"There is no editing option. Sometimes we need to enter information about electrocardiogram immediately, you know we have to do it quickly, so you may make a mistake, like you enter the wrong doctor's name and then the electrocardiogram is recorded and it is not possible to edit or when we want to enter information about birth certificate we can't edit it at all and if you like mistake the genders then it will have serious consequences. For example, I once entered one birth certificate twice! So, one baby was born twice! You may make a mistake and then immediately find out about it but then nothing can be done. Imagine you register the wrong patient's name for delivery! You can't delete it!"

Another midwife said something similar:
"I wish we could access the system to correct some of the errors which happen because we are too busy, not that advertently, no, we could edit them ourselves so it won't be necessary to report to the officials. For example, if you enter something about a medicine you can edit it later, but not for birth certificates."

With regard to the limitations in recording some information, the following two examples can be mentioned:

"A couple of things which may happen for a patient like weak heart beat that should be given position or oxygen can be recorded in the patient's profile but not in HIS because it requires further explanation. Sometimes there could be medical errors which can be recorded in the profile but there is not such a thing in the HIS. By medical error I mean something which was about to happen but didn't, or like when there is a medical error we don't record it in the system, for example, a patient falling off the bed."

"There is no such a thing as health report in the system, the way there is in paper reports. I wish there were such options in the system as weeks of pregnancy, age of pregnancy, initial examination, and generally all the procedures that we take for the patient. Not that these were left blank but rather filled by the information; rather than handwriting them in the profiles."

Repetition of tasks: Some of the participants mentioned that re-entering the information is one of the chief obstacles in the efficiency of the obstetrics and gynecology information systems which imposes additional work on the personnel. For example, on the participants said:

"Some of the information we enter into the system, like birth certificate, remains in handwritten forms as well. You'd better have either this or that, I mean either the profile or the system, not both. Although I personally think a handwritten profile is more complete."

Another participant confirmed the above comment by saying:

"The personnel is too few, especially in night shifts, everyone is supposed to do her own work, as if working with the system is an extra work which is hard to be done."

The unavailability of the system: More than 90% of the participants mentioned the following as some of the major obstacles in using the obstetrics and gynecology information systems: inaccessibility of the patient's information after discharge from the hospital, unavailability of some of the information, unavailability to monthly and annual statistics, the inflexibility of the system for additional information and the impossibility of uploading training courses on the system. In the following, some of the comments are included:

"The information is deleted after the patient's discharge; well it is certainly a problem. If some information is needed, for example, the name and address of the patient, it will be available only before discharge but when the patient is discharged it won't be available and the information is classified and we can't access the classified information with our usernames. And then I have to find the names or addresses from the patients' information notebooks which are kept by the receptionists and since we don't have a receptionist in our ward we don't have a notebook."

"I can't access ICU or all wards with my username. For example, if I want to know a patient's condition in the ICU I can't neither I can about one in NICU. I suppose there is a classified password for such wards."

"Currently, statistics regarding the number of births, natural/cesarean, weight of the baby, number of the babies/twins are recorded in binders by hands which show what's going on in the hospital, I wish the statistics were recorded monthly or annually in the system."

"I wish HIS was flexible enough and also someone could add additional training courses or edit them in the HIS."
"I wish we could access up-to-date scientific information on the system."

Decreasing the role of the personnel in taking care of the patients: One of the advantages of the system that was mentioned by the participants was the fact that using the system decreases the time for direct patient care because of the lack of enough personnel to work with the system. One of the participants said in this regard that:

"When the information used to be handwritten because we could stand beside the patient's bed we could interact with him/her and it felt better. A computer is far from the patient and we are unconsciously distanced from the patient."

Another participant referred to the higher risks and errors due to the lack of enough personnel to work with the system, noting:

"If there was someone for typing the information it could be much better, or at least someone just do the typing in the night shift, in that case we could concentrate on the patient, accuracy increases, error decreases."

B) The advantages of using obstetrics and gynecology information systems

Facilitating the recording of information: A couple of points were mentioned by the participants about the advantages of using obstetrics and gynecology information systems in improving the quality of health and medical services. Facilitating the process of recording the information was one the most important advantages about using obstetrics and gynecology information systems which was mentioned almost by all the participants. The following examples explain this category:

"The patient's information is available and it is not necessary anymore to find the profile from the archive. The information is accessed more quickly. The monitoring of the information is dome much easier."

"It greatly facilitates accessibility. We used to write on papers and had to give it to the crew to go to the pharmacy and bring us the medicine. Now, we just send the information to the pharmacy via the system and the crews bring us the medicine. Writing and all that time consuming is done away with and everything is officially recorded in the system."

"In terms of speed, the computer is much faster than writing."

Saving time and costs: Another advantage of using the obstetrics and gynecology information systems is decreasing the costs of the ward. Two of the participants said the following with regard to the role of information systems in decreasing the costs of the ward:

"One of the advantages of the system is that it decreases the costs for buying paper and is beneficial for the hospital in terms of using less people and saving time."

"For financial reports, the computer enables to record everything together which is accessible in clear order. For example, if a patient has a complaint about something with regard to the costs we can report to him/her all the details that have been cost him/her the money. It is both good financially and for providing reports to the patients and officials."

DISCUSSION

This study aimed to enhance the personnel's information about the obstetrics and gynecology information systems. The study extracted many themes from the interviews which explained the advantages and disadvantages of using the obstetrics and gynecology information systems. The results show that most of the participants consider low literacy level of the personnel as the biggest obstacle in using the obstetrics and gynecology information systems. Previous studies have shown that almost one fourth of the personnel have the sufficient computer literacy in using the systems. It seems that one of the influential factors in this regard is the lack of enough personnel which leaves little time for training and using the new technology [21]. This makes the personnel believe that the clinical information system has changed their working conditions and has imposed extra work on them [22]. Therefore, the officials are required to monitor the needs of the personnel and take certain measures as to train them the skills for using the new technology [23].

The findings in the present study showed that the obstetrics and gynecology information systems face a certain limitation in terms of recording and editing the information, and sometimes the required information is not recordable in the computer. It appears that the lack of enough attention to the minimum information that the personnel need can affect their attitude toward the efficiency of the computer programs [24]. This is to say that if the recording and sharing of the information are not done conveniently, or presented in a format which does not develop the cooperation between two sections within an organization, the system will not be welcomed by most people [25]. In a study done by Goossen *et al*., which used the Delphi method, to determine international criteria for nursing information systems, two criteria were more important than others. The first criterion, "the minimum series of

information about the nurses should be extracted automatically from the information systems in order to be sued in decision-makings and planning clinical and research programs". This first criterion obtained 88/9% of the consensus. The other criterion, i.e. "the nursing information system should present standard concepts and a unified classification system should be used to describe care." This latter criterion obtained 88/3% of the consensus [26]. Gad *et al*. have found that given the expectations of the users and the real function of the information systems, this has become a real challenge in the process of management [27].

According to the results in the present study, the personnel mentioned the re-entering of the information as one of the problems. It seems that during the early stages of using the computer programs, it is not a problem of the personnel had to report both in handwritten profiles and on computers about some of the patients in each shift because it gives them the opportunity to learn about the system and make use of it in an efficient manner. Also, one of the other advantages of using this parallel strategy, is increasing the reliability and credibility of the new system and showing that the information system functions better than handwritten records. However, continuing this parallel strategy after the learning stage may impose extra work on the personnel [28].

The recording of information in both written and electronic forms in Iran may also be due to legal issues because electronic reports are not considered legal documents in the judicial system of Iran [29]. In a study about the readiness of the nurses to use hospital information systems, Lee has found out that the during the early stages of the implementation of the system in clinical wards, the nurses complained about the increased amount of work and the occasional re-entering of the information [30]. These findings highlight the fact that revising the judicial laws through negotiation and developing new rules in order to consider the electronic documents legally acceptable is highly necessary which can obviate the need for re-entering the information in clinical wards.

The results showed that the unavailability of the patients' information after discharge and the inaccessibility of the information in some sections make the systems inflexible for accepting new information. This is in fact one of the obstacles in the efficiency of the obstetrics and gynecology information systems. Ahmadi *et al*. have studied the adaptability of surgery information systems to the needs of the surgeons, and have found out that these systems have different information for the surgeons, neither of which has given sufficient and comprehensive information to them. Flexibility, programming and accessibility of the data in the information systems were important for the surgeons [31]. Studies have shown that the hospitals need to create communication channels between all the clinical and para-clinical sectors in order to share the information in the systems to ensure better services for the patients. Otherwise, a failed communication between the sectors may cause serious conflicts in the clinical services [32, 33].

The findings showed that using the obstetrics and gynecology information systems decreases the role of the personnel in the obstetrics and gynecology ward. The lack of enough personnel and spending too much time for working with the computers are some of the reasons for this problem. Lee *et al*. have reported that since the nurses had to spend a lot of time on the computers they complained about not having enough time for the patients [34]. Contrary to the findings of this study, there are many studies which show that using the information systems enables the nurses to spend more time with the patients [35-37]. The difference in such matters can be due the number of the personnel, the literacy level of the personnel and the number of the computers. Ammenwerth*et al*. confirm the latter point by showing that the nurses needed computer literacy and high skills to use them because they spend a lot of time on the computers so that little time remains for patient care [38]. Kahoue*iet al*. have found out that more than half of the nurses agreed that there was not enough computers in the ward and this problem had caused delays in recording the information and decrease in the time for patient care [39].

The results of the present study indicate that most of the personnel in the obstetrics and gynecology ward believe that the obstetrics and gynecology system facilitates the recording and monitoring of the information. Similarly, Kahouei *et al*. have shown that most of the nurses think that the nursing information system has made the nursing services faster. This finding may indicate that the personnel in the obstetrics and gynecology ward could record the information more easily by using a computer and the recorded information is more comprehensive and easier to read [17].

The results of the present study show that some of the personnel in the obstetrics and gynecology ward believe that the implementation of information systems in the obstetrics and gynecology ward can decrease the costs and save time in recording the information. The results indicate that the information systems can save time in many ways including fewer phone calls, lesser bureaucracy, fewer paper reports, prescriptions and preclinical services. Moradi*et*

al. have similarly referred to the advantages of hospital information systems including decreasing the time of hospitalization, saving time in recording and reporting the laboratory tests, decreasing the time for reception of the patients and decreasing the time for paying the costs and discharge [3].

Although the studies show that the implementation of obstetrics and gynecology information systems in hospitals improves the speed, security and quality of the recorded information, these systems are not still efficiently used because of their possible disadvantages. This may discourage the personnel to use the information systems and lead to an inefficient working procedure. Therefore, the quality and efficiency of the information systems can affect the attitude of the users. This is highly important because given the complexity of these systems and lack of clear rules; it is hard to access information on them. Also, the information systems in obstetrics and gynecology wards are not adaptable with the information of the users.

The findings of the present study should be interpreted with care. Since the method used in the study was qualitative, generalizing the findings to other wards of obstetrics and gynecology is not always possible. Moreover, because the obstetrics and gynecology information system is not completely implemented in the hospital considered in the study the exact efficiency of the system cannot be measured. These are some of the limitations of the present study so that further study on similar hospitals with higher efficiency of information systems is required.

CONCLUSION

The results show that there are certain challenges in using new technologies of patient care in hospitals. This is especially so given the growing the importance of the quality of medical services in obstetrics and gynecology, the use of information systems as a toll for increasing the care qualities and the obligation of the hospitals to use these systems and the lack of information of the personnel in using these systems.

According to the findings, it can be argued that the participants have not fully understood the advantages of using computer programs. The results show that even after some years of using the computer programs in obstetrics and gynecology wards, some personnel remain unwilling in using them in their daily work.

Given the fact that in such developing countries like Iran it is highly important to save financial resources, one could prevent possible failures in using the systems by identifying and presenting the problems. Therefore, it is required to encourage the personnel to use the information systems. If their attitude toward the systems is changed positively one can hope that the systems would be widely used in the future and would therefore improve the medical services. On the other hand, if the personnel remain unsatisfied, their negative attitude will cause many problems in using the information systems.

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