Journal of Theoretical and Applied Information Technology
15th July 2020. Vol.98. No 13

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

EMR FOR OBSTETRIC EMERGENCY DEPARTMENT AND LABOUR WARD IN JORDAN UNIVERSITY HOSPITAL

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ABSTRACT

The use of computer technology of all forms is spreading quickly and widely across all medical specialties, including its use in medical record keeping in the form of Electronic Medical Records (EMR), for it has been realized that this provides several benefits over traditional paper based record systems. Tablet based applications are particularly useful in this area as they offer portability, and support the needs of dynamic medical environments. This paper describes the development of a purpose designed novel tablet based EMR for the Obstetric Emergency Department (OED) and Labour Ward (LW) of a hospital where electronic medical records are only partially implemented at present. The pre-design stage in the form of a thorough investigation of the currently used system, its shortfalls, and determination of the users' requirements for the proposed new system was followed by defining a set of aims that the new system should realise. This was taken to be the basis for designing and developing the tablet based EMR. After development, the tablet-based EMR was then evaluated by its potential user groups, showing that it has the potential to improve record keeping in the obstetric department by overcoming several shortfalls of the traditional paper record system, and adding benefits such as portability, more efficient data entry and retrieval, and streamlining the patient journey through the department.

Keywords: *Electronic Medical Records, Obstetrics, Tablet, Emergency Department, Labour Ward*

1. INTRODUCTION

The use of information technology in health care has many forms and applications. Health Information Technology (HIT) has an expanding role in improving health care quality and reduces cost [3, 4]. One of the main roles of information technology in healthcare is the transformation of the record keeping process and management of clinical data. An IT application that has led to major changes in the data management process within health care is the EMR.

The use of EMR provides a number of beneficial functions for its user, such as viewing of patient related information, documentation and care management, ordering of investigations and prescriptions, messaging, analysis and reporting, patient-directed functionalities, and billing [6]. From these functions stem the purposes most commonly recognized for creating and maintaining electronic patient records, namely patient care, communication, legal documentation, billing and reimbursement, research and quality management, and informing public health policies [5].

The use of electronic medical records in the medical field and specifically in obstetrics has been

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

gaining importance recently. This is due to the identified benefits that implementation of an electronic system for keeping and managing patient information would add from a clinical, organizational and societal aspect, as demonstrated by several studies conducted in this field [1, 2].

To date, the department of obstetrics in Jordan University Hospital (JUH) is using electronic medical records in a very limited fashion and there are several steps in the patient journey through the department where documentation is paper based. Furthermore, electronic linking between different steps in patient care is lacking.

Implementation of a comprehensive electronic medical record system that has the added benefit of being portable in the form of a tablet based application has the potential to transform the record keeping process within obstetric care, making it more efficient both from a patient care point of view, as well as improving the process of data storage, management and retrieval.

In order to successfully implement new HIT several factors have to be taken into consideration. The project should have a clear objective from the start, each step in the design process should include strong involvement of end users, the project supervisor should have relevant experience, each participant should have clear responsibilities, the product should be as faultless as possible, and implementation should be gradual [20].

In this article, it is demonstrated how the implementation of a novel tablet based EMR system could be put into use in the obstetric emergency department and labour ward environment. First, the design process was based on department staff recommendations and identification of certain shortfalls within the current system. Second, the system was tested by the different user groups, and finally, their responses were analyzed to test how the system could potentially have a positive impact on the record keeping process as well as clinical care.

2. BACKGROUND

EMRs were first called for in the 1990s as a result of the numerous shortfalls of paper records, and the recognition that novel methods have to be introduced to decrease the likelihood of human errors in healthcare [5].

Introduction of technology that supports decision-making and improves linkage and integration of different systems has a number of benefits such as improving patient safety [7]. Information technology in medicine has the potential to improve safety in a number of ways: prevention of adverse outcome, quicker response to adverse events, and reviewing clinical events to identify areas for improvement [8]. The use of EMRs in health care positively affects quality of care as it increases the likelihood that caregivers will follow guidelines and management protocols through decision support, which in turn improves clinical monitoring, and has the potential to reduce medical errors [9, 10]. Further advantages for the use of EMR have been identified including: improving communication, providing easier access to information, retrieving information, assisting with calculations, monitoring, decision support, rapid response and tracking of adverse events, and medication safety [10]. Information technology also positively affects efficiency through decreasing rates of health service utilization, however effects on provider time are variable, with some studies showing and increase in time whereas others demonstrate a reduction [9].

The aforementioned benefits can be classified into three types: clinical outcomes (e.g., improved quality, reduced medical errors), organizational outcomes (e.g., financial and operational benefits), and societal outcomes (e.g., improved ability to conduct research, improved population health, reduced costs) [10].

Despite the many benefits of implementing HIT, some disadvantages have also been identified. New types of error related to the use of EMRs in health care have been identified, specifically errors related to data entry and retrieval, and errors in data communication and coordination. These errors can be minimized through training and education of users, revision and improvement of design, getting users on board during system implementation, and qualitative research to re-evaluate and optimize [11].

Some studies have highlighted other drawbacks associated with EMR. For instance, the productivity of the end-users will initially drop during the adaptation phase to the new system, which may lead to temporary losses in revenue during this phase [6]. This, however, should be a temporary issue as the productivity subsequently returns to its original levels within three months [10]. The introduction of a new EMR also tends to

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decrease the speed of workflow initially, but this seems to be temporary as some users actually report a faster workflow after the initial slowdown [12].

Another issue related to EMRs is the strong concern of public and patients about privacy and security [13]. These concerns arise in relation to data access and storage, data mining, and regarding the regulatory frameworks that govern the handling of clinical data [14], with the main security threats arising from within the institutions providing patient care, as well as those that have access to the data for secondary purposes [15]. Three ethical priorities should therefore govern the use of EMRs, namely privacy and confidentiality, security, and integrity and availability, whilst maintaining a fine balance between them [16, 17].

Moreover, the implementation of EMRs can be faced by a multitude of barriers that may hinder the implementation of such technology in an effective manner. These barriers fall into a number of categories, including financial, technical, time-related, psychological, social, legal, organizational, and related to the process of change itself [18]. The attitudes of end users towards the introduction of new technology into their practice can have a significant effect on the degree acceptance and efficiency of use of such technology [19] these attitudes may be affected by a number of factors such as high initial cost and uncertain benefit, high initial physician time costs, usability of new technology, difficult complementary changes and inadequate support, inadequate electronic data exchange, lack of incentives, and physicians attitudes [6].

It has been suggested that the Plan-do-study-act (PDSA) quality improvement model can facilitate the EMR implementation process [21]. PDSA cycles offer a support mechanism for development and improvement of complex healthcare systems [22]. The actual results of a certain action are compared with the original aim or target of that action [23].

Strategies that seem to be associated with success in ambulatory EMR system implementation also include applying evidence from published literature, focusing on workflow, and incorporating critical management factors [21].

Data from automated EHR should be validated for research purposes as their reliability at present is variable [24].

Certain requirements have to be considered in designing a medical record system for use in obstetrics. Obstetricians have a specialty specific way of recording patient data and find that some more general systems are of limited usefulness as they lack specialty specific features and requirements [25]. The ability to view most routine obstetric information from a single screen is not an available feature in the majority of existing systems, and most existing electronic records focus on one part of the patient's journey through obstetric care, where only certain aspects are recorded electronically while other parts are still using paper notes, as linking between office and inpatient records is severely lacking [25]. The long-term storage of information in a secure and reliable fashion is especially important in this specialty do to medicolegal implications [25].

It has been demonstrated that obstetricians and gynaecologists are less likely than other physicians to use EMRs in their practice, and systems available to them have less functionalities to prevent errors and less basic functions [26]. However, the implementation of obstetric EHR has been shown to enhance documentation as it is less likely that users will miss key information and improves accuracy, without compromising direct patient care [27, 28]. User acceptance of the system was improved when obstetric health care providers directly supervised system development [28].

One reason hindering the introduction of EMRs in hospital settings is that users do not prefer to return to fixed computer terminal every time there is a need for documentation, especially in dynamic environments. Portable devices can overcome this obstacle [29, 30].

To facilitate the delivery of care at bedside the used device should have features to support its function such as long battery life, powerful processor, intuitive operating systems and adequate screen size [29].

This enables physicians to use low cost, familiar devices, to achieve streamlined data management with minimal disruption to the work routine, and minimal need for training [31].

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

3. METHODS

3.1 Step1: Study Site and Population

This study was carried out at Jordan University Hospital, Obstetrics and Gynaecology Department, in particular the Obstetrics Emergency Department (OED) and the Labour Ward (LW).

The obstetrics department at Jordan University Hospital has a dedicated emergency department for dealing with cases presenting with acute issues related to this specialty. It is independent of the main emergency department, but there is an existing system for communication and referrals between the two sites that depends on verbal phone communication.

Cases presenting to the department are assessed, triaged, and follow one of the following paths: treat and discharge, admit to labour ward, admit to other hospital departments (figure 1).

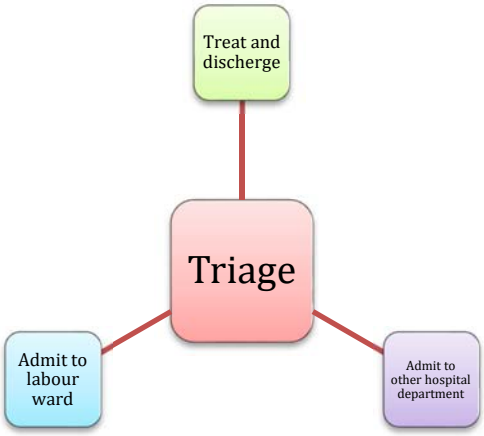

Figure 1: Possible Outcomes Of Triage Process In OED

The department has a doctors' and nurses' station, an ultrasound assessment room, an emergency delivery room, bays with 9 examination cubicles, and an assessment room for neonates. It is located on the Ground floor of the Obstetrics and neonates building of the hospital.

Labour ward is located on the first floor of the same building and consists of a doctors' and nurses station, nine delivery rooms, three dedicated obstetric theatres, and a recovery area.

At any particular time, two separate teams cover services at the two department and cases are handed over accordingly by a verbal process.

The staff in the obstetrics department include: 9 consultants, 30 residents, 30 interns, and 38 nurses. Participants were staff involved in the record keeping of patients presenting to these two departments namely consultant Obstetricians (4), residents (15), interns (5) and nurses (6).

Jordan University Hospital currently has an electronic record system that partially covers the clinical services provided there. Most specialties' outpatient departments now use a computerized record system for outpatient visits, prescriptions, and ordering and reviewing investigations.

Inpatient services also benefit from certain computerized functionalities, although less extensive, and most inpatient records are still only held in paper form, apart from a brief discharge summary that can be retrieved from the system to obtain some basic information about the patient's stay.

Obstetrics, one of the major specialties provided by JUH, is part of the aforementioned record system in that it benefits from the electronic medical record facilities in the antenatal clinic setting. Paper notes are hardly ever used in the outpatient department and are not routinely requested from the records department during the visit. If the patient, on the other hand, is admitted to labour ward, the notes are kept in traditional paper form.

As part of the admission process, a substantial proportion of patients passes through the OED, where some parts of the patient record are computerized, whereas other parts are recorded on paper notes. There is at present no linking between the patient's notes in OED and LW.

3.2 Step2: Assessing Currently Used Record System

The team members assessed the current situation by on-site visits, semi-structured interviews, and observational process. Members of staff in OED and LW were interviewed about the different parts of the patient's journey through the department about a number of points depending on their type of involvement in the patient's journey and the keeping of their records. In addition to that, the steps in record keeping process were directly observed and randomly selected patients files were

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

examined after anonymization and hiding of private information.

Patients currently present to the emergency department for a variety of obstetric and gynaecological complaints, a large proportion of these being related to labour. The patient's details are registered at the reception. If the patient is known to JUH she will already have an existing file number, otherwise a new record and file number will be created.

The patient is then admitted to the department and assessed by the nurses and medical staff. Entries into the patient's records will be documented partially electronically, and partially on a form designed for this purpose, which eventually be kept in the patient's paper medical record. According to the patient's condition, she will follow one of the aforementioned paths (figure 1) after going through the triaging process by the emergency department staff.

Patients admitted to labour ward are usually in labour or suffer from significant acute pregnancy-related problems that require close observation and/or prompt treatment. At present there is no communication system between labour ward and the emergency department other than verbal communication via phone between staff of both departments. Once the patient reaches labour ward labour related entries into the patient's record are documented on another form and non labour related issues are documented in freestyle manner on continuation sheets.

Patients' records are usually kept at the station in both departments, and documentation occurs either there after assessing the patient or at bedside if the records are moved there. The user groups involved in patient record keeping throughout their journey through OED and LW are receptionists, medical staff (consultants, residents, interns), and nursing staff.

3.3 Step3: Defining System Requirements

A research team was formed to oversee the potential to improve medical record in obstetric emergency department and labour ward in Jordan University Hospital.

The team conducted in-depth semi-structured interviews with the users of the current medical record system applied in the obstetric emergency department and labour ward at JUH. This aimed towards identifying the current record keeping methods, the needs and requirements of the users, as well as the shortfalls of the current system, and potential areas for improvement. A number of open questions were used for this purpose. Separate groups of questions were designed for different user groups (table 1).

Table 1: The Main Closed Questions Of The Interviews With The System Users.

Receptionist interview questions	
No.	Question
1	What is the nature of the system you currently use to register patients in the emergency department
2	What are the information you require to register the patient
3	How do you communicate to the staff in OED that a patient requires attendance in the department
Medical and nursing staff interview questions	
No.	Question
1	What type of system are you currently using for obstetric patients' record keeping? How do you record obstetric patients' information?
2	Is any part of the record keeping system computerized at present?
3	Who are the staff that are involved in the note keeping process of obstetric patients?
4	What is the type of patient information you require?
5	What are the stages that the patient passes through from presentation to admission to labour ward.
6	How are notes recorded in each step?
7	Who records the notes in each step?
8	What specific part of patient information is required by each of the stakeholders?
9	How is patient information communicated between different groups of staff involved in each step of the admission process?
10	What are the shortfalls of the current system?
11	What improvement to the system would be valuable to the users?
12	What types of technological facilities are currently available at JUH?

Through these interviews the existing system was investigated with regard to its practicalities and shortfalls, and user needs and requirements were determined. Further details were specified, namely, detailed information about patient data, stakeholders, the patient registration process, and users' permissions and privileges. Shortfalls of the currently used record keeping system are detailed in table 2.

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

Table 2: Shortfalls Of The Current Record Keeping System.

No.	Issue
1	Paper notes take up considerable space
2	Information loss or errors due to retrospective documentation or loss of paper notes
3	Patient's privacy could be compromised as notes are left at the desk
4	Retrieval of data is difficult
5	OED notes are not linked to LW notes leading to delays in the patient's journey through the departments, and sometimes duplication of procedures and investigations
6	There is no section for the triage process in the current notes
7	Notes can only be accessed by one user at a time
8	Notes cannot be accessed remotely
9	Current notes don't support decision making
10	Current notes don't support risk management

Based on the aforementioned information provided by the targeted users (Receptionists, obstetric consultants, obstetric residents, interns, ER nurses, labour ward nurses, as well as the system administrator), functional / non-functional requirements were identified.

The identified needs and requirements are shown in Table 3.

Table 3: Identified Needs And Requirements Of Proposed System.

No.	Requirement
1	The EMR should be practical and easy to use
2	The EMR should include all information related to patient's condition during her stay in OED and LW
3	Use of the EMR should reduce space needed for data storage in OED and LW
4	Use of EMR should reduce data loss and errors
5	Patient privacy should be protected
6	Data retrieval should be easy
7	Notes from the emergency department should be linked to labour ward notes to save time and limit duplication
8	System should provide a function for triaging patients after assessment in the emergency department.
9	Carers should be able to access multiple patient records at the same time
10	Multiple users should be able to access an individual patients notes at a particular moment in time
11	Use of EMR should support and improve communication between members of staff
12	The record should be portable to facilitate record keeping at the point of care as well as enabling users to remotely access records for supervision and coordination purposes
13	Using EMR should support decision making
14	Presence of mandatory data fields is required to prompt the carer to enquire about important information to avoid missing pertinent data.
15	Labour ward outcomes should have a dedicated section within the record
16	Using EMR should support risk management

3.4 Step4: Study Design and Specific Aims

Based on the aforementioned the team redesigned the recording process of the patient's journey in the obstetric emergency department and labour ward.

The formulated research aims to fulfill these requirements are reflected in table 4 with associated hypotheses. First, this study aims to implement an EMR for obstetric emergency department and labour ward in the university of Jordan Hospital, which has usable interfaces, a secured database, and is provided with network services. The EMR was designed to standardize the process of patient care documentation, in terms of saving time and effort, to offer a more holistic overview of the patient's status, provide patient care management services, and offer a repository for research purposes since the Jordan University Hospital is an educational hospital, as well as facilitating the risk management process by enabling easy review of any clinical events.

Second, the study aims to streamline the patient journey in the obstetric emergency department and labour ward and facilitate seamless integration of the different steps in the triage and admission process, to reduce delay, improve communication between departments, any minimize data loss or duplication.

The third aim is to improve the efficiency of the note taking process by enabling staff to continuously record information in situations where the care provider has to remain at bedside, such as emergency cases, or patients in labour by using portable devices. Using tablets will enable staff members to record data without having to leave the patient's side or having to deal with multiple page paper notes that are cumbersome to use and could be lost or damaged if frequently moved or handled in

these situations. This is expected to improve the accuracy of the recorded data as it is documented at the point of contact with the patient, rather than retrospective documentations once returning to the base where the notes are kept, and once the clinical event in question has passed, therefore minimizing the risk of documentation errors and missed information.

Fourth, this study is concerned with enhancing the management and decision making process in obstetric emergency department and labour ward, therefore, special supporting decision-making tools that will prompt the care provider to enquire about specific information and alert to any deviation of any clinical parameter from the normal range will decrease the risk of missing important data that might influence the type of care provided.

3.5 Step 5: Development Of The New System

Features and functionalities in the EMR-obstetric emergency department and labour ward system in university of Jordan hospital were designed to offer the functional requirements specified by its potential users:

Functionalities

Login to system – different privileges

Since enhancing patients' privacy is one of the intended outcomes of this study, the user should login to the system by a predetermined username and password (figure 2). The users of the system were identified according to their authorities. Each user has the authority to access areas of the patient record that are pertinent to their work, i.e. receptionist can access patient demographics, but not medical notes.

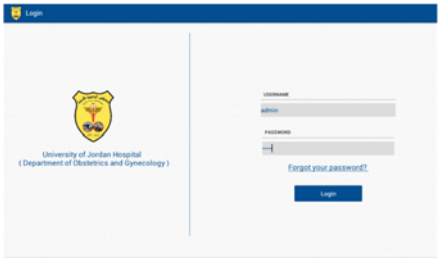

Figure 2: Login Screen

The users of the system are:

- Medical staff: head of obstetrics department, consultant obstetrician, residents, interns.
- Nursing staff: OED nurses, labour ward nurses.
- Clerical staff: receptionists
- Administrator/IT

An option exists to recover the password in case the user forgets

Patient profile

This part of the record is completed by the receptionist upon patient presentation to the emergency department, and includes information that identify the patient such as name, ID number, date of birth, phone number, etc (figure 3). Completing this part of the record adds the patient to the OED patient list, and the patient is now allocated a space within OED and is highlighted for the medical/nursing staff to alert them of her presence, and to start the evaluation process.

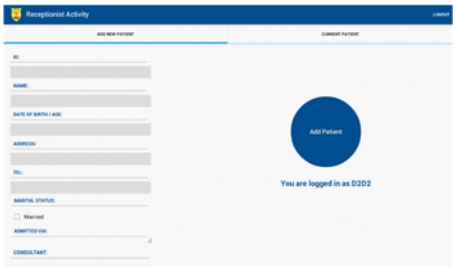

Figure 3: Patient Profile Interface

Patient information can be edited as required by the receptionist. Once admitted, the patient will appear in the current patient list. Entering ID in the search field can also search the patient information.

Admission note:

This part of the record aims to provide information about the initial assessment of the patient in the emergency department to determine the main complaint, and general condition by completing fields regarding the medical history, physical examination and some basic investigation such as ultrasound evaluation (figure 4).

Some of the fields within this section are mandatory to remind the health care staff involved in the patients' management of important steps that should not be omitted.

Journal of Theoretical and Applied Information Technology
15th July 2020. Vol.98. No 13

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

Medical and nursing members of staff working in the emergency department are authorized to enter and edit information within this section.

Figure 4: Admission Note Screen

Based on the initial assessment of the patient a decision will then be form regarding the next step in the management process.

Triage:

Here the treating clinician will decide whether the patient should be admitted to labour ward, a different hospital department, or whether they should be discharged home, (see figure 1). Completing this part is within the authorities of the treating medical staff.

If the decision is made to discharge the patient or transfer to a different department, the record is completed and saved and the documentation process for the obstetric EMR terminates at this stage.

If the patient will be admitted to labour ward, the system will now transfer the patient to the labour ward patient list where the patient information documented so far can be easily viewed by the labour ward staff.

Labour ward notes:

A new section of the notes is activated once the patient is transferred to labour ward. The reason for admission to labour ward (in labour, for induction of labour, for monitoring of critical condition, etc …) is documented. There is a section where staff can document patient assessment and progress with regard to labour or any acute obstetric condition that requires admission and monitoring in the labour ward into specified field for history, examination and investigations. This ensures detailed documentation of the patient's journey through labour ward, including the stages of labour and delivery. It is the authority of medical/nursing staff in labour ward to enter, edit, and update patient information. This section includes dedicated fields for documenting outcomes (figure 5) and complications (figure 6) that can be used at a later stage for reviewing performance or research purposes.

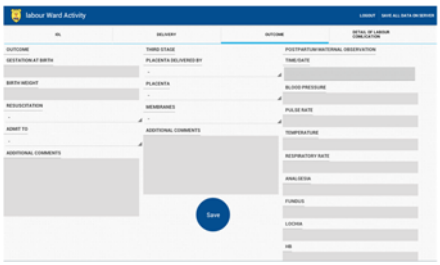

Figure 5: Labour Outcome Screen

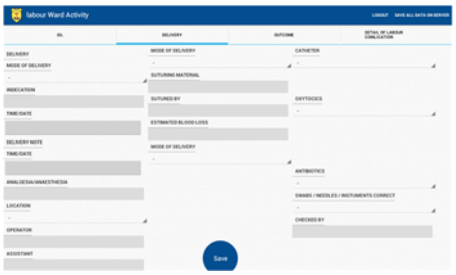

Figure 6: Delivery Documentation Screen

4. EVALUATION

A questionnaire consisting of 21 statements was designed to evaluate the system users' impressions and views of the various system's functions and how implementing such a system in the obstetric emergency department and labour ward may benefit its users in performing different tasks in their work environment, and how it may positively influence patient care.

After demonstrating the system in front of the participants, and allowing them to test the different functionalities and use the various sections of the system, the questionnaire was distributed amongst 30 system users covering the different user groups, i.e. 6 nursing staff and different levels of medical staff (4 consultants, 15 residents, 5 interns).

21 different aspects related to using the novel EMR system were evaluated with responses to each point ranging on a 5-point scale from strongly disagree to strongly agree as follows (Strongly

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

Disagree=1, Disagree=2, Neutral=3, Agree=4, Strongly Agree=5). See table 4.

4.1 Results

The sample was analyzed using SPSS. The sample consisted of 21 female participants versus 9 male participants, with a percentage of 70% female and 30 % male. The distribution of participants according to their job title was: 6 nurses, 5 interns, 15 residents, and 4 consultants.

Cronbach's Alpha

The result of Cronbach's alpha after analysis was found to be 0.94 suggesting that reliability level and level of internal consistency for the scale with this specific sample is more than 90%, signifying that results can be accepted and generalized.

Percentages

The participants' responses to the questionnaire are detailed in table 4.

The percentages reflect the perceptions of potential users of the system, suggesting that it has the ability to achieve the aims it was designed for.

Firstly, the EMR was designed to standardize the process of patient care documentation. 83.3% of users agree or strongly agree that it covers all aspects of documentation required in OED, and 93.3% agree or strongly agree on the same point regarding LW. 90% also agree or strongly agree that patient privacy would be improved.

As for the second aim, streamlining the patient journey from OED to LW, 93.3% of users agree or strongly agree that this will be achieved by the EMR.

Thirdly, users generally agree or strongly agree that high efficiency of record keeping would be achieved through increased portability (93.3%), prevention of data loss due to retrospective documentation (90%) and paper record loss or damage (93.4%), and facilitating risk management (93.4%).

5. DISCUSSION

The novel tablet-based EMR system was developed based on requirements of its users within the OED and LW. Following development, a prototype of the system was evaluated by a sample of its potential users by means of completing a questionnaire, to determine whether the new system will fulfill the requirements of the users, and achieve the aims that were specified for this system prior to development.

The overall impression from participants' responses in the provided questionnaire points towards a perception that the implementation of the novel tablet-based EMR system would be useful and beneficial within the obstetric emergency department and labour ward environment, as the majority of responses for all 21 questions were either agree, or strongly agree (in favour of EMR). Several benefits were identified for the proposed system. Table 5 classifies these according their applicability within the patient's journey.

Across the whole journey, a number of benefits are achieved including decrease data storage space, better communication, reduced error and data loss, improved privacy settings, better data retrieval, remote access of multiple patient records by multiple users, and improved clinical supervsion and risk management.

In OED, one of he the main benefits is faster admission and reduced waiting time, and better overview over patients in the department.

As for the handover process, electronic data transfer reduces data loss, duplication and delay.

Finally, in the LW setting it facilitates communication and multidisciplinary team work, on the spot bedside documentation, and handover between shifts.

6. CONCLUSION

The use of electronic medical records in the field of obstetrics has the potential to improve many aspects of medical care and administrative tasks with regard to data collection, storage and retrieval.

Moreover, making the electronic notes portable by using a tablet-based system adds further

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

benefits in terms of easy and speedy use of the record at the point of care.

The developed system provides a wholistic, comprehensive template for a streamlined record that follows the patient's journey from admission to the emergency department and the initial care provided there, through the triage process whereby the final destination of the patient is decided, to documenting the process of assessing and managing the patient in the labour ward until her treatment is completed.

Evaluation of the system has demonstrated that its implementation in the obstetrics department would be welcomed by existing staff, who perceived it as user friendly and useful in terms of efficiently recording clinical information in a dynamic environment that requires rapid decision making and actions, and found it to offer several benefits over traditional paper notes, both in terms of facilitating the different duties of the members of staff and communication between them, as well as protecting the patient's privacy and streamlining her journey from OED to LW.

The use of a portable electronic record in the obstetric department will therefore contribute significantly to the enhancement of the patients' care within the labour ward and emergency department, and will be of benefit to all members of staff involved in providing a service to the patient.

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ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

Table 3: Questionnaire statements, results of the questionnaire: participants' responses in percentages

Question statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Total
The EMR is practical and easy to use.	0 (0%)	1 (3.3%)	1 (3.3%)	19 (63.3%)	9(30%)	30
The EMR covers all aspects that are relevant to my documentation during the patient's stay in OED.	0 (0%)	2 (6.7%)	3 (10%)	15 (50%)	10 (33.3%)	30
The EMR covers all aspects that are relevant to my documentation during the patient's stay in LW.	0 (0%)	1 (3.3%)	1 (3.3%)	16 (53.3%)	12 (40%)	30
The use of EMR would reduce the space needed for data storage in OED and LW	0 (0%)	1 (3.3%)	1 (3.3%)	17 (56.7%)	11(36.7%)	30
The use of EMR would reduce error or information loss related to retrospective documentation	0 (0%)	0 (0%)	3 (10%)	12 (40%)	15 (50%)	30
The use of EMR would reduce information loss related to loss or damage of paper notes	0 (0%)	0 (0%)	2 (6.7%)	14 (46.7%)	14 (46.7%)	30
Patient privacy is protected by using a unique username and password for each user, unlike paper note which can be accessed without a personal login.	0 (0%)	1 (3.3%)	2 (6.7%)	19 (63.3%)	8 (26.7%)	30
Retrieval of patient data from the computerized notes is easier that retrieval of information from paper notes.	0 (0%)	1 (3.3%)	2 (6.7%)	13 (43.3%)	14 (46.7%)	30
Linking the admission notes to the labour ward note will help to streamline patient care.	1 (3.3%)	1 (3.3%)	0 (0%)	13 (43.3%)	15 (50%)	30
Linking the admission notes to the labour ward note will reduce delays in patient transfer to labour ward.	0 (0%)	0 (0%)	3 (10%)	13 (43.3%)	14 (46.7%)	30
The triage process is supported and simplified by the systems functionalities	0 (0%)	0 (0%)	1 (3.3%)	18 (60%)	11(36.7%)	30
The ability to access multiple patient files simultaneously on one device would be useful in planning and prioritizing workload on the labour ward	0 (0%)	1 (3.3%)	1 (3.3%)	14 (46.7%)	14 (46.7%)	30
Clinical supervision is improved as multiple users can access the patient's notes simultaneoulsly, hence improving patient safety	0 (0%)	0 (0%)	2 (6.7%)	20 (66.7%)	8 (26.7%)	30
The use of EMR improves communication between members of staff involved in the care of patients in OED and LW	0 (0%)	0 (0%)	3 (10%)	12 (40%)	15 (50%)	30
The availability of portable notes on the tablet device is useful in a dynamic environment such as the labour ward.	0 (0%)	1 (3.3%)	1 (3.3%)	18(60%)	10 (33.3%)	30
The ability to overview clinical information in the given format would support decision making by the doctor.	0 (0%)	1 (3.3%)	2 (6.6%)	20(66.7%)	7 (23.3%)	30
The presence of a template for the important areas to cover while filling in the notes prompts the user to enquire about these fields and helps to avoid missing important information	0 (0%)	1 (3.3%)	1 (3.3%)	21 (70%)	7 (23.3%)	30
The patient's outcome can be clearly determined by accessing the EMR	0 (0%)	0 (0%)	2 (6.7%)	20 (66.7%)	8 (26.7%)	30
The presence of EMR supports risk management	0 (0%)	0 (0%)	2 (6.7%)	17 (56.7%)	11(36.7%)	30
It is easy to understand the functionalities of the system without much prior experience.	0 (0%)	1 (3.3%)	3 (10%)	16 (53.3%)	10 (33.3%)	30
If a portable EMR system was available at my place of work I would be happy to use it.	0 (0%)	3 (10%)	0 (0%)	14 (46.7%)	13 (43.3%)	30

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

Table 4: Benefits Of Implementing The New System

Across the whole patient journey	
1	Computerization of data entry reduces the space required for data storage
2	Computerization of data entry is more practical and easier to use
3	Coordination and improved communication across the patient journey
4	Streamlines patient care and reduces delays
5	Reducing duplication of patient's data by providing access to all staff members in different departments
6	Patient privacy is protected
7	Retrieval of data is easier than with paper notes
8	Helps to avoid missing important information by prompting the user to fill in mandatory fields
9	Prevents data loss due to damage of paper notes
10	The user can access multiple patient notes simultaneously
11	The notes can be accessed by multiple users simultaneously
12	Notes can be accessed remotely
13	The use of EMR supports decision making, clinical supervision, and risk management
Obstetric Emergency Department	
14	Faster admission procedure and assessment for the first time patient
15	Linking patient registration with assessment record
16	Easy patient overview by creating live patient list
17	Reducing waiting time between registration and assessment
18	Incorporating the triage process into the management documentation thus avoiding delays
19	Covers all areas of documentation at admission
Handover	
20	Electronic transfer of all patient data from previous stages avoids data loss, delay, and reduces unnecessary repetition
21	Automatic addition of patient to LW patient list provides better overview for LW staff
Labour Ward	
22	Faster admission and allocation of space within LW
23	Supports multidisciplinary team work in LW
24	Supports the need for on the spot access to notes in emergency situations
25	Support quick handover between different members of staff within LW
`26	Covers all areas of documentation in labour ward
27	Supports bedside documentation