A Qualitative and Quantitative Study on Patients Online Registration System

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ABSTRACT

This work reviews an already published work by adding more details in regard to the methodological design. The details on the undergone qualitative and quantitative study are further explained in this paper. This study attempts to measure the level of satisfaction among patients towards the old-fashioned Traditional Queuing Method (TQM) compared with the proposed Online Registration System (ORS), and to investigate the patients' perceptions of ORS and the feasibility and acceptance of the Registration and Admission (R&A) staff. A mixed methods study was held at the Ministry of National Guard Health Affairs (MNGHA) hospital in Riyadh, Saudi Arabia. At first, a stratified random sampling technique was used to distribute 385 structured questionnaires among outpatients anonymously in the outpatient registration area to gather indicating information and perspectives. Then, eleven face-to-face semi-structured interviews with front line hospital workers in the R&A department was managed using a thematic content analysis approach to analyze the contents and produce results. In order for the researcher to have a direct understanding of the registration processes and activities and to gain a better understanding of the patients' behaviors and attitudes toward them; a non- participant observation approach was conducted where observational encounter notes were taken and then analyzed using a thematic content analysis approach.

In general, this study found that most outpatient population (patients and registration staff) prefer ORS for a range of reasons including time consumption, cost benefit, patient comfort, data sensitivity, effortless, easiness, accuracy, and less errors. On the other hand, around 10% of them chose to go on with the TQM. Their reasons ranged from the unavailability of computer devices or internet connections to their educational backgrounds or physical disabilities. Computing devices and internet availability proved not to be an issue for the successful implementation of the ORS system, as most participants consented to having an internet connection or a device to enter ORS system (91%). Last, as more than the half of participated patients were unhappy with the TQM at registration desks (59.7%), this dissatisfaction should be addressed by an ORS implementation that would reduce waiting times, enhance the level of attention, and improve services from frontline staff toward patients' care.

Keywords: Online Registration System; Patient Registration; Mixed Methods; Health Informatics; Qualitative Research

Abbreviations: TQM: Traditional Queuing Method; ORS: Online Registration System; R&A: Registration and Admission; MNGHA: Ministry of National Guard Health Affairs; DDE: Direct Data Entry; HIPAA: Health Insurance Portability and Accountability Act; KAIMRC: King Abdullah International Medical Research Center; ER: Emergency Room; ISID: Information Systems and Informatics Department

Introduction

Background

Patients' registration is defined as the process by which a patient is diagnosed at a member institution where information is entered into the institution's records for a selected clinical trial and then, issued for a treatment assignment [1]. Herson [1] also defined the objectives of patient registration as to include initiation of data collection, ran- domization of patients, quality control (enforcing protocol adherence, reduction of bias, suggestion of needed protocol amendments, and evaluation of institutional performance), and planning future clinical trials (providing estimates of patient accrual and providing advice on registration matters). There are two accepted approaches to patient registration: either the TQM or through an ORS. The satisfaction of patients and the Registration and Admission staff with the patient's ORS has been discussed in the literature with the aim of proving the

effectiveness and efficiency of this system inadvanced healthcare settings [2-9]. The motivation behind this study is to assure and enhance the quality of the patient's registration processes to help maintain their outmost satisfaction toward the healthcare services provided by a huge medical city such as MNGHA hospital. In this research we are focusing on ORS as it is a technique that has been developed in order to improve the workflow and to lessen the waiting time required by outpatients [2]. At the end of this research, we would be able to answer the following questions: what is the level of perceived satisfaction among patients toward the current old fashion TQM compared to the suggested ORS? What are their perceptions on implementing an ORS System? And what is the acceptance level, constraints, and motivations of the R&A staff regarding this type of implementation?

Related Work

Challenges: Even though the ORS may appear to be a constructive move towards electronic healthcare transactions, many studies have shown certain challenges against its success that should be avoided and addressed in future implementation projects or research [3]. Such challenges include the lack of conducting internal and external marketing and advertising, educational programs, orientation posters, non-attendance occurrences, not having the capability to use the computer, lack of communication between the healthcare providers and the patients and engaging the end users. It is important to consider all of these issues for the sake of a successful system implementation and outcomes [4,5].

Solutions: A discussion about the solutions for ORS project success suggested accomplishing further studies on various interventions such as the promotion of online registration system, and the use of a reminder system [6]. In addition, a new technological solution was suggested such as the direct data entry (DDE) mechanism or the touch-screen computer kiosks in hospital waiting rooms [3]. These technological solutions answer and solve the problem that was raised by both Weiping, et al. [8], Coa, et al. [5], and Zhang, et al. [10] which is the lack of capability of using computers or patients who do not have access to the internet. Also, this research illustrated new benefits of using the ORS such as the eligibility inquiry and response using the Health Insurance Portability and Accountability Act (HIPAA) transaction standards that was indorsed by the Senate and House of Representatives of the Congress of the United States of America in 1996 [6]. The act's main purpose is improving the portability and the steadiness of the coverage of health insurance in markets, fighting fraud and misuse in health care delivery, promoting how people use their accounts of medical savings, improving long-term care facilities access, simplifying health insurance administration, together with several other goals [6]. Another solution by Shortliffe [2] raises the importance of sharing the data between patients and frontline coordinators in case of vital information related to healthcare as discussed in Dent, et al. [7].

Therefore, the input from a patient through the portal could be seen from the healthcare providers' side to be used as an input for other purposes serving the patients' healthcare. This solution saves time of reentering the same data again and also saving money in recruiting extra clerks for this job. A study supporting this theorem is by Friedman, et al. [4] in their book of evaluation methods in biomedical informatics stating that registration data connections were necessary to simplify the importing of demographic data into the system and provide data about which patients are active in the clinic at a particular time [4]. Despite the intelligence of the previous study, it includes some limitations due to the inability to automate some of the paper-based processes because of its structural nature which caused loss of data details, inability to use data for multiple purposes, and limitations in the capacity to aggregate and query patient's data. A cross sectional research by Wani and Sankaranarayanan [11] provides an advanced solution inthe mobile based appointment system [7]. This solution solved many issues in the ORS such as the ability to cancel, reschedule or the capability of reminding patients of their upcoming appointments and the hacking risk of patients' appointments or medications as the online access is a vulnerable point threatening patient's safety and privacy. Even though it has filled so many gaps and was a smart solution, it still has some issues such as the quality of service and security issues in the cloud used to store data while storing patients' appointments and medical details.

Best Practices: Advice toward the ORS success encourages the consideration of user co-design and participation and take their needs requirements prior to the design or implementation to have a broad perspective of the system from the end user's point of view and also to grow the system ownership in the front-line staff who will hold the coordination processes later on whenever the patient gets lost in the system [8]. Furthermore, Dent, et al. [7] argue that for the sake of a successful technical system implementation such as the ORS which will be run in a complex and advanced organization setting, the new invented system needs to be treated as a process of organizational learning in which users are given the time and space to customize their practices and needs within the capabilities of the technology used which will enhance the adoption and ownership of the new system among them.

Objectives of the Study

The main objective of this research was to measure the level of perceived satisfaction among patients toward the current old fashion TQM compared to the suggested ORS. There are also some secondary specific objectives that this study aimed to prove such as investigating the patient perceptions on implementing an ORS System and investigating the feasibility and acceptance of the R&A staff regarding this implementation. In addition, some secondary objectives were under scope for analysis and examination such as enhancing scheduling processes in MNGHA using health informatics techniques, learning how we can manage the implementation of ORS in MNGHA, and studying what are the potential barriers and limitations of implementing ORS in MNGHA.

Methodology

Quantitative Method

Questionnaire: For the quantitative method, questionnaires were used to explore outpatients' perspectives and perceptions of the ORS (Appendix Figure 1), besides analyzing the potential reasons be-hind the success or failure of ORS implementation. Stratified random sampling technique was used to choose the participants. Consent forms were attached with every questionnaire form to be declared understood and signed by the patient (Appendix Figure 2). After the collection of the data, MS Excel sheet was utilized [9] to manage and analyze the data to get valid and accurate frequencies, percentages, and results.

.. Patients' Online Registration System Questionnaire ..

The aim of this questionnaire is to investigate the efficiency and the likelihood of the success of the online appointment system which is a new solution under studying.

For each question, please circle the letter beside your chosen answer. For the open questions, please explain your answer briefly on the dotted line.

....

What is your level of education?

1. Primary or less
2. Elementary
3. Secondary
4. Bachelor
5. Master or above

Do you have a device to enter ORS? Please specify device.

1. Yes
2. No

Device: ....

Do you have internet?
1. Yes
2. No

When you registered in the hospital, were you satisfied with the usual registration method at registration desk?

1. Very satisfied
2. Satisfied
3. Neutral
4. Dissatisfied
5. Very dissatisfied

How long does it take you to finalize your registration process, from getting a number from registration window until you see a physician?

1. 15 min or less.
2. 16 – 20 min.
3. 21 – 30 min.
4. 31 – 40 min.
5. 41 or Above.

Are you satisfied with the level of attention and service you get from frontline staff?

6. Very satisfied
7. Satisfied
8. Neutral
9. Dissatisfied
10. Very dissatisfied

Which one do you prefer?

1. Hospital online registration system (ORS).
2. Hospital normal queuing registration.

If your answer is number 2, what is your reason for not wanting to use the online registration system?

....

....

If your answer is number 1, why do you think ORS is efficient?

....

....

If you can use ORS, what do you prefer?

1. Register from home.
2. Register from hospital kiosks.
3. Register from the registration desk.

How old are you?

1. 0 - 20
2. 21 - 30
3. 31 – 40
4. 41 – 50
5. 51 – Above

Thank you for your time ☺

Appendix Figure 1: Patients' Online Registration System Questionnaire.

Appendix Figure 2: Cross sectional survey consent form.

Qualitative Method

Interview: Qualitative information was needed from the face-to-face semi-structured interviews with frontline hospital workers in the R&A Department using an interview guide (Appendix Figure 3) to help handling the interviews smoothly serving the collection of only needed data and prevent the deviation to side talks or unimportant subjects' discussions. As per the R&A supervisor, there are 37 registration workers, 17 of them serving in the outpatient area. Since the number of the frontline staff is small, all 17 workers who satisfy the sampling inclusion criteria were interviewed. Interviews were supposed to be recorded after the permission of the interviewee and as per the signature of the consent form (Appendix Figure 4), but due to the refusal of the female participants to record their voices, the recording process was cancelled for both genders to have a steady and unified data collection and analysis method, and instead, notes of the relevant parts of the interviews that answers questions in the interview guide were written down by the researcher. Thematic content analysis approach was used to manage and analyze the contents and to produce valid and accurate results.

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Patients' Online Registration System Perception
Interview Guide

Date of interview: ___/___/___

Interview information :
Gender: M\F
Age: _____
Occupation: _____
Years of experience: _____

Purpose of the interview : |
The main purpose of this interview is to inverstigate the feasability and acceptance of the R&A staff regarding the Online Registration System Perception.

Questions :
Opening question

1. What is your position in the Registration and Admission office? (Probe for the role and daily work activities definition)

Traditional Queuing Method

2. What is your opinion about the current traditional way of outpatients' registration method? (Probe for positive\negative perceptions)

3. What are the most problematic issues in it? (Probe for constructive criticism)

4. How would you define patient's behavior within the traditional registration queuing method? (Probe for specific examples and situations)

5. How do you think it could be improved? (Probe for other strategies might be used to solve current registration method issues)

Online Registration System

6. What do you think of Online registration system for outpatients? (Probe for positive\negative perceptions)

7. What problems do you think it could solve? (Probe for specific examples and situations)

8. How else can we improve the process of outpatients registration? (Probe for specific examples and actions)

Closing Question

9. Any other suggestions or recommendations regarding the ORS implementation project? (Probe for specific actions)

Appendix Figure 3: Patients' online registration system perception interview guide.

Appendix Figure 4: Research study interview consent form.

Non-Participant Observation: Spending 3 hours a day for 5 days which are a total of 15 hours of observational encounters in the hospital outpatient registration area, for the purpose of observing the patients' experiences and behaviors and the whole atmosphere and workflow helped the researcher to understand and have a better perspective of the research topic being studied [11,12], in this case, the efficiency or limitations of the TQM compared with ORS. Notes were taken considering the above- mentioned points (Appendix Figure 5) and analyzed using thematic content analysis mechanism.

.. Patients' Online Registration System Questionnaire Results ..

A. Do you have a device to enter ORS?
1- Yes — 352
2- No — 33

B. If yes, please specify your device.
1- Tablet — 45
2- Smartphone — 206
3- Laptop — 49
4- Computer — 85

C. Do you have internet?
1- Yes — 353
2- No — 32

D. When you registered in the Hospital, were you satisfied with the usual registration method at registration desk?
1- Very satisfied — 0
2- Satisfied — 58
3- Neutral — 97
4- Dissatisfied — 169
5- Very Dissatisfied — 61

E. How long does it take you to finalize your registration process, from queuing on registration window until you see a physician?
1- 15 min or less — 0
2- 16 – 20 min — 33
3- 21 – 30 min — 108
4- 31 – 40 min — 193
5- 41min or Above — 51

F. Are you satisfied with the level of attention and service you get from frontline staff?
1- Very satisfied — 0
2- Satisfied — 54
3- Neutral — 163
4- Dissatisfied — 121
5- Very Dissatisfied — 47

G. Which one do you prefer?
1- Hospital ORS — 343
2- Hospital queuing registration — 42

H. If your answer is number 1, why do you think ORS is efficient?
1- Data sensitivity — 32
2- Time consumption — 220
3- Cost benefit — 63
4- Patient comfort — 324
5- Effortless — 281
6- Easiness — 371
7- Accuracy — 24
8- Errorless — 43

I. If your answer is number 2, what is your reason for not wanting to use the online registration system?
1- No internet — 32
2- No device to enter ORS — 33
3- Educational Issues — 25
4- Physical Disability — 12

J. If you can use ORS, what do you prefer?
1- Register from home — 305
2- Register from hospital kiosks — 51
3- Register from registration de — 29

K. What is your level of education?
1- Primary or less — 26
2- Elementary — 56
3- Secondary — 192
4- Bachelor — 98
5- Master or above — 13

L. How old are you?
1- 0 – 20 years old — 4
2- 21 – 30 years old — 98
3- 31 – 40 years old — 139
4- 41 – 50 years old — 96
5- 51 – Above — 48

Appendix Figure 5: Patients' Online Registration System Questionnaire Results.

Study Design

After having the approval of King Abdullah International Medical Research Center (KAIMRC), the researcher used a mixed method approach as front line staff were interviewed, and outpatients were questionnaired forming a cross-sectional study design, besides the general non- participant observation process. The researcher used a mixed method design because the results should be valid, accountable, and ready to be generalized. To accomplish the previous goal, the researcher used the quantitative method to extract themes from patients that were later used as predetermined themes for the qualitative study whether it is interviews or observations. In that regard, the researcher conducted the outpatients' questionnaire first, then the observation. After that, interviews were conducted at last.

Quantitative Study Design

Questionnaire: Each Outpatient were given 30 minutes to complete the questionnaire using a stratified random sampling method, from which participants were randomly selected to fill up a questionnaire. As received from the MNGHA hospital database section regarding the total number of outpatients currently in the MNGHA hospital up to 24/12/2014 is 2,000,000 patients of them 1,087,326 outpatients. From the outpatients, 385 from 1,087,326 outpatients were randomly selected to be questionnaired according to the sampling calculation considering 95% level of confidence and 5%margin error. The questionnaire assessed satisfaction with the TQM and the time spent making appointments, further investigations about their opinion on the traditional window queuing to get a registration compared with their opinion about the new solution of the ORS were taken, and whether they thinkit's an efficient method to get a registration done. The questionnaire, named "The Online Registration System Questionnaire", is a 12 items questionnaire focusing on feedback from patients on what they think is a better method to get scheduled to assess patients' attitudes toward the new project and to measure their level of satisfaction with behavior of front-line staff. The outcome of those questionnaires was analyzed using MS Excel sheet calculation formulae.

Qualitative Study Design

Interviews: Regarding the front-line staff, and as stated by the R&A supervisor, they are 17 outpatient registration employees, all the employees having 1 year of experience or above were interviewed in their offices using a semi structured interview. The outcomes of those interviews were analyzed using a thematic content analysis mechanism. Interviews contents were transcribed by principal investigator and co-investigator, and results of themes were compared [10,13].

Non-participant Observation: General observations of the current workflow and the processes and procedures in the outpatient registration area were conducted by the researcher to have a better understanding of the current situation. Also, It is used to observe activities, interactions, and events to gain a direct considerate of the natural context. Outpatients were observed together with the front-line attitudes throughout the whole process. Notes were written down describing essential indicator schemes and situations. The results of the observations were analyzed using a thematic content analysis mechanism [12,11].

Project Design

The proposed solution using the ORS is resampled in patients who can select which consultant they prefer and which clinics they need to visit, or any services provided by the hospital through the hospital portal. What a patient is going to need for an ORS is the Medical Record Number (MRN), service date and time, type of service, Personal contact information, patient's condition (Disable, senior citizen, pregnant, infant, or normal patient), gender, and date of birth. Then, they are given an appointment number. After submission of online registration form, the patient will receive a confirmation mobile message from the hospital. They will also be reminded to bring all the related materials with them on the day of their visit along with any items listed on their registration form. At the designated appointment time, patients arrive at the hospital and get the registration that is chosen to their appointment number and check-in with the registration staff to sign the required consent forms. These patients need not to queue at the registration window, but they need to bring their identification and medical cards at the time of service. A description of the two different approaches ORS and TQM were explained in Figure 1.
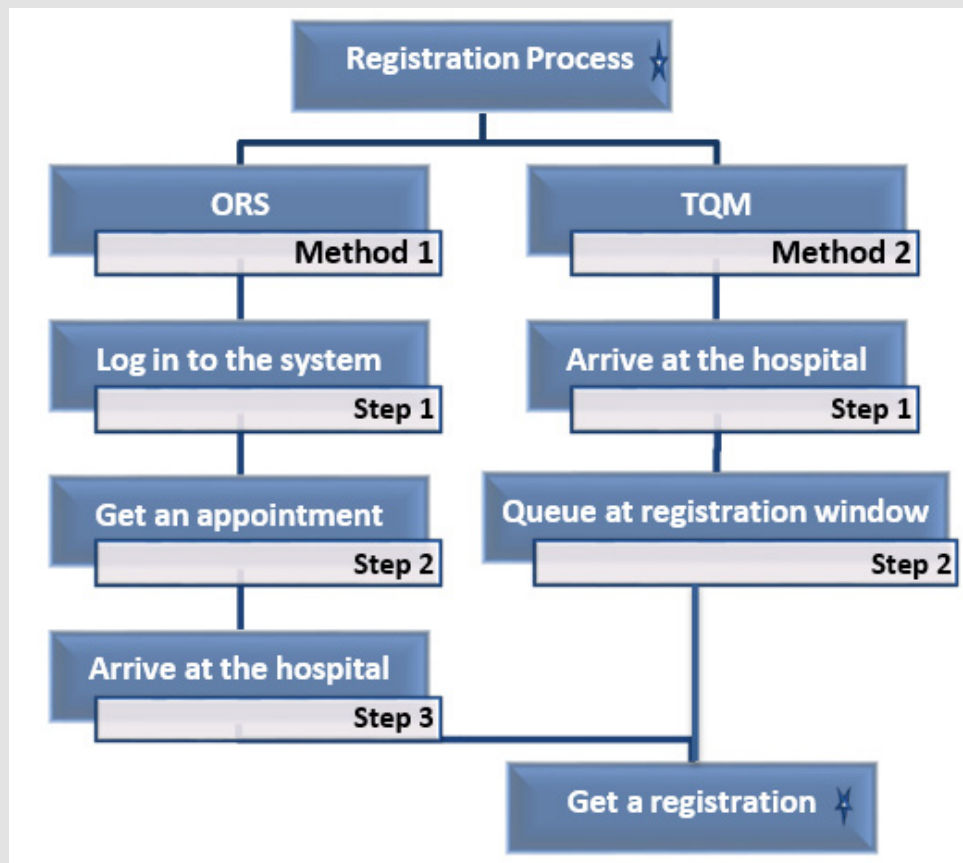
Figure 1: TQM vs ORS registration process.

Study Setting

The study setting was the outpatient registration area in MNGHA hospital in Riyadh, Saudi Arabia where the workstation was put to administer the questionnaire distribution and collection to and from patients. In addition to the frontline staff offices in the R&A department where personal interviews were conducted. The researcher chose to conduct interviews in employees' offices for the purpose of pure convenience, applicability, and comfortability for interviewees.

Selection and Description of Participants

Study Subjects

The research study included outpatients attending in the outpatients' registration area and the frontline staff in the R&A Department in MNGHA hospital.

Quantitative Study Subjects: The inpatients in the hospital were excluded because this research serves the outpatients ORS service. Furthermore, all kinds of patients must first register in the hospital through registration windows and thus inpatients were originally outpatients before they have been admitted as inpatients. Also, new patients who have no previous visits to the outpatient clinics were

excluded as well; because the research aim to test the level of acceptance and satisfaction of the ORS compared with the TQM, and this requires the patient to be totally aware of the current situation to be able to compare between the two methods. In addition, all age groups including disabled patients were included; because the research should address all ORS potential users and the usability limitations whether it is computer usability, obstacles due to age, education, physical impairment, or simply lack of awareness.

Qualitative Study Subjects: Regarding the frontline staff in R&A department, all R&A workers with at least 1 year of experience or above in the same field were interviewed. Excluding all newly employed staff as the study needs the information to be valid and out of expert people in the MNGHA hospital. For the non-participant observation process, all patients and employees in the outpatient area were included in the qualitative study subjects for observation and analysis excluding people passing through the area.

Sample Size

Quantitative Sample Size: The total number of the patients in the MNGHA hospital according to the database administrator is 2,000,000 patients. Of them, there are 1,087,326 outpatients. As the study is

about outpatients' visits, a patients' sample size of 385 patients was considered based on the sampling calculation with level of confidence equals 95% and 5% margin error [14].

Qualitative Sample Size: Regarding R&A staff, the total number of registration employees in MNGHA hospital is 37 employees according to the R&A supervisor. Twenty of them in the emergency room (ER) department, and 17 employees in the outpatient area (11 males, 6 females). Figure 2 below show the hierarchical illustration of the qualitative sample size. Since the number of hospital frontline staff in the outpatient area is not so big, all staff with 1 year of experience or above were included in the interview process which means 4 females and 7 males were included in the study interviews, excluding all newly hired employees, excluding all newly hired employees.
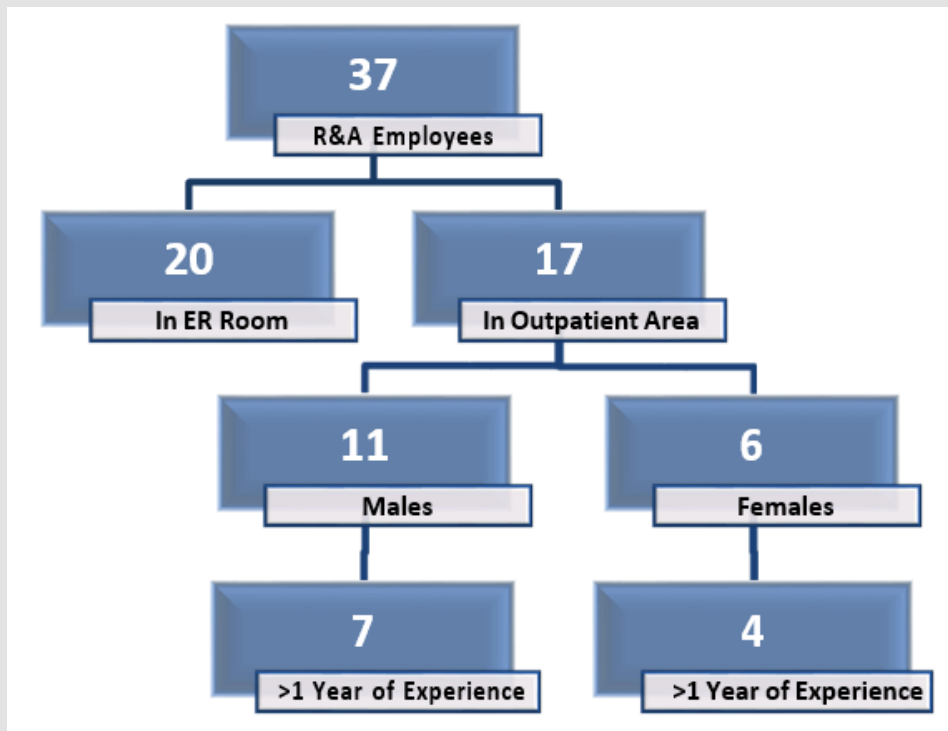
Figure 2: Qualitative Study Sample Size.

Sampling Technique

Quantitative Technique

Questionnaire: Structured questionnaires were used to collect data from outpatients in the hospital of MNGHA after having the KAMCRC approval to personally administer the questionnaires distribution and collection to and from outpatients each for 30 minutes to complete the questionnaire using a stratified random sampling method, from which participants were randomly selected to complete the questionnaire. Data was analyzed to measure their satisfaction and views about the ORS or the TQM. All questionnaires were administered anonymously to discourage acquiescent or socially- desirable responses. Outpatients were also asked to sign a consent form of acceptance to participate in voluntary questionnaires prior to any questionnaire distribution.

Qualitative Technique

Interview: Using purposive sampling for the frontline staff, all 1 year of experience or above staff among the 17 outpatient registra-

tion employees were interviewed for a maximum of 1 hour each or until no significant new information is forthcoming.

Non-Participant Observation: For the non-participant observation process, all patients and employees in the outpatient area were included in the qualitative study subjects for observation and analysis excluding people passing through the area.

Ethical Considerations: IRB approval was received from the KAIMRC research center and was registered under Research Protocol SP15/074. The KAIMRC had approved the project idea, processes and methodology, and other data collection forms and procedures. An informed consent was clarified and signed by every participant whether to the interview or the questionnaire as the participation was optional and not compulsory. Also, participants were informed that their input will be used for the sake of the research study and analysis only and not for any other personal publications. In addition, participants' names and personal contact numbers or any identification information were optional as well.

Data Collection

Quantitative Data

Questionnaire:

Goals of the Instrument: The aim of using patients' questionnaires is to investigate the satisfaction level, perception, acceptance, and the likelihood of the feasibility of the ORS which is a new solution under studying from the perspective of the R&A staff and the patients themselves. Questionnaires were used especially because it allows the researcher to reach a big number of participants in a small amount of time. It also allows measuring quantitative variables that allow the researcher to have reliable data that help decide and conclude the final result of the study.

Overview of its content: Questionnaires were started by defining who are and what is the purpose of doing this questionnaire to encourage the participants on completing the survey. Then two guide statements were mentioned in order to instruct the patients to choose only one answer to multiple choice questions and write short answers on the dotted lines below each open question.

The variables that were measured using questionnaire tool are the percentage of patients' satisfaction and dissatisfaction rates toward TQM and ORS, their level of education, age group, and their capability to access the internet or computer devices.

Qualitative Data

Interview: Frontline staff were interviewed in their offices using face-to-face semi-structured interviews. Interviews were supposed to be recorded after the permission of the interviewee, but due to the refusal of the female participants to record their voices, the recording was cancelled and instead notes of the relevant parts of the interviews were written down by the researcher. The results were analyzed using a thematic analysis mechanism.

Non-participant Observation: The goal of using this systematic data collection approach in the qualitative method is to have a general perspective of the atmosphere and the way outpatients' appointments are handled and processed. This method helped the researcher to generalize the thoughts and the perspectives of the current TQM method by writing down noteworthy indicators to be analyzed later using a thematic content analysis mechanism. The variables that were measured by qualitative data collection methods are finding ideas and suggestions to enhance scheduling processes in MNGHA using health informatics approaches, their perspective of how the organization and its top managers can manage the implementation of ORS in MNGHA, and to discuss with them about potential barriers and limitations of implementing ORS in MNGHA to serve at the end the main objective of the interviews which are testing the acceptance and the feasibility of R&A staff towards ORS implementation.

Internal Validity

Quantitative: Beside the registration processes validity which has been emphasized by Hommel, et al [15] stating that the major importance in the patient's registration processes is to be valid and complete [16], correct procedures were applied to assure research project internal validity as wellto be able to find reliable answers to the research questions as a pre-testing (piloting) of the survey on a small group of experts were conducted prior to applying it upon outpatient participants. Accepted scientific principles of analysis and methods were applied to produce reliable, valid, accurate and unbiased data and relevant to the research question. For this research study, quantitative results were analyzed using MS Excel calculation formulae for data that were collected from ambiguous and random participants to assure research validity. In addition, regarding internal validity, dependent variable (ORS satisfaction) was assured to be only caused by the independent variables rather than other external variables to make sure that results are valid, concise, and generalizable.

Qualitative: Predetermined themes, which were derived from the quantitative data collection method were used to conduct qualitative data collection. Qualitative data was transcribed by principal investigator and co-investigator using thematic content analysis. The 2 transcript themes were then compared to guarantee validity. The final result was decided by a unified agreement after using multiple methods to review and validate findings [17].

External Validity

To assure the external validity, participant's selection bias was avoided and thus the research must include participants who are frequently under medical care and visiting hospitals regularly. Choosing all participants randomly eliminated the potentiality of a population selection bias and be representative of the population and therefore the results can be generalized to all patients in the National Guard Hospital and to the whole population of Saudi Arabia accordingly. The mixed method approach served the research validity in the way that qualitative themes were extracted from quantitative results which was dome first. In addition, the research idea consists of2 groups of participants, outpatients, and R&A staff. As patients sample size is 385 patients, it was feasible to use questionnaires to save time and effort. And because the R&A sample size is only 17, besides the need to analyze their perception about ORS, we used semi-structured interviews to collect as much important relevant information as possible. Doing mixed methods study would support the final result validity of the research paper in that both group of participants' data and information were collected justifiably and thoroughly.

Data Analysis

Quantitative Data

Questionnaire: Categorical variables (age group, level of education, level of satisfactory) were presented as frequencies and percentages (Appendix Table 1) using Microsoft Excel Sheet calculation formulas. Coding scheme of qualitative parts in questionnaires were

conducted to convert qualitative results into quantitative frequencies. Percentages of a particular category under each measurable variable are calculated by subtracting all other categories frequencies from the total number of participants (385 patients). Percentages then are compared to analyze and examine which variables have the most

effect on the success or failure of ORS system implementation and which variables are against or with TQM registration process. Results and discussion of the outputs from those calculations are presented in the results section.

Appendix Table 1: Non-participant observation encounters summary.

ID	Time Stamp	Notes
OE1	Day 1 (16/8/2015), 9:36 – 9:40 a.m.	A crowd of above 40 patients both males and females are waiting in the outpatient's waitingarea, ground floor, gate 6. They are being called every now and then for vital signs capturing and paper documenting.
OE2	Day 1 (16/8/2015), 10:05 – 11:12 a.m.	A nurse comes out of the clinic and call for next patient's name multiple times until theyrespond, otherwise she'll call for the patient next to them. Missing patients show up and ask the nurse for his lost turn, he waited for another 35 minutesto be called to the clinic again.
OE3	Day 1 (16/8/2015), 11:25 – 11:33 a.m.	Additional group of patients came to the registration window seeking medical care, the registration staff told him to come in another time in the afternoon after 12:00 p.m. or the nextday as there are lots of patients already in the waiting room. Two follow up patients have been waiting for more than 4 hours. They started to come backand forth from the registration window asking about their turn.
OE4	Day 2 (17/8/2015), 9:18 – 9:30 a.m.	A crowd of around 35 patients are already setting in the waiting area. There are 2 disabled patients, 1 in wheel-chair and 1 with a foot injury leaning on a woodenstick. There are 4 mothers with their children waiting in the area, among those children in thewaiting area, there are 2 infants.
OE5	Day 2 (17/8/2015), 10:26 – 10:35 a.m.	I hear patients sneeze and cough continuously as per their arrival. Apparently, they have got influenza.
OE6	Day 2 (17/8/2015), 10:42 – 10:50 a.m.	Three children started to play around touching wall, trash baskets, leaflets, and otherdecorations.
OE7	Day 2 (17/8/2015), 11:00 – 11:11 a.m.	There is a long loud and clearly unfriendly negotiation between a patient who just arrived wanting to see the doctor while the registration staff are trying to tell him there is no available slot for him and the doctors are overwhelmed with many patients.
OE8	Day 2 (17/8/2015), 11:37 – 12:00 a.m.	Seven new patients started queuing 23 minutes ahead of time before the next registrationsession starts at 12:00 p.m..
OE9	Day 3 (19/8/2015), 9:10 – 9:21 a.m.	A crowd of about 40 patients are setting in the waiting area. Among them, there are 5patients in the national guard uniform. Some patients haven't seen the doctor until now as she did not arrive yet. They went to the registration window asking about her 3 times already.
OE10	Day 3 (18/8/2015), 10:15 – 10:36	There is a male with his wife screaming and shouting with the registration staff at the window about how long they have been waiting and the reason behind the delay. She (the registration staff) became angry and respond-ed aggressively that this is how things work and then she leftthe station for 15 minutes to calm down.
OE11	Day 3 (19/8/2015), 11:24 – 11:35 a.m.	More than 15 patients are standing by the clinic door waiting for their turns as they have been waiting for hours. The atmosphere is chaos and voices are getting louder and more stressed.
OE12	Day 4 (19/8/2015), 10:55 – 11:23 a.m.	A female patient went to the registration window asking why she is still waiting while another patient who ar-rived after her was called into the clinic. The registration staff explained that she has been called for vital signs checking and will be out shortly for her turn.
OE13	Day 5 (20/8/2015), 11:34 – 11:40 a.m.	There are more than 20 patients lining up for the next registration session that starts at 12:00p.m. The waiting area is too crowded that the queuing line is stopping other people to cross thelobby to the other side.

Qualitative Data

Interview: Regarding the purposive interviews conducted to frontline staff in their offices using a semi- structured interview form, their outcome information was transcribed and translated whenever necessary, analyzed, and managed by the researcher using a thematic content analysis mechanism.

Non-participant Observation: For the 15 hours observation-al encounters management and analysis, a noteworthy and relevant observation notes were written down. In addition, general observa-tions to the outpatient's processes and workflow were noticed and summarized. Non-participant observation information outcome was

analyzed and managed by the researcher using a thematic content analysis mechanism.

Results and Discussion

Quantitative Questionnaire Results

To investigate the outpatients' perceptions on implementing an ORS System, and to measure the level of satisfaction among patients toward the current old fashion TQM compared to the suggested ORS, 385 structured questionnaires were used to collect data from out-patients anonymously to discourage an acquiescent or socially-de-sirable responses in the hospital of MNGHA after signing a consent form to assure the voluntarily participation using a stratified random

sampling method. The collected data presented in Table 1 were analyzed to measure their satisfaction and views about the ORS or the TQM. After explaining to patients what ORS is before they are let alone to answer the questions, they were asked to choose between ORS or TQM for registration process, 89.1% surprisingly voted for ORS implementation. To further investigate their perception of ORS, they were asked to explain why they chose to go with ORS. Their answers ranged from Data sensitivity (2.4%), Time consumption (16.2%), Cost benefit (4.5%), Patient comfort (23.9%), Effortless (20.7%), Easiness (27.3%), Accuracy (1.8%), Errorless (3.2%). From those statistics, we understand that their biggest concern is the easiness of using the ORSsystem compared to the effort spent in coming to hospital, queuing for hours until they get screened or given the kind of service they are after.

Table 1: Quantitative data presentation.

SN	Category	Values	Frequency	Percentage
1	Do you have a device to enter ORS?	Yes	352	91.5%
		No	33	8.5%
2	If yes, please specify your device.	Tablet	45	11.7%
		Smartphone	206	53.5%
		Laptop	49	12.7%
		Computer	85	22.1%
3	Do you have internet?	Yes	353	91.7%
		No	32	8.3%
4	When you registered in the Hospital, were you satisfied with the usual registration method at registration desk?	Very satisfied	0	0%
		Satisfied	58	15.1%
		Neutral	97	25.2%
		Dissatisfied	169	43.9%
		Very Dissatisfied	61	15.8%
5	How long does it take you to finalize your registration process, from queuing on registrationwindow until you see a physician?	15 min or less	0	0%
		16 - 20 min	33	8.6%
		21 - 30 min	108	28.1%
		31 - 40 min	193	50.1%
		41 min or Above	51	13.2%
6	Are you satisfied with the level of attentionandservice you get from frontline staff?	Very satisfied	0	0%
		Satisfied	54	14%
		Neutral	163	42.3%
		Dissatisfied	121	31.4%
		Very Dissatisfied	47	12.3%
7	Which one do you prefer?	Hospital ORS	343	89.1%
		Hospital queuing registration	42	10.9%
8	If your answer is number 1, why do you thinkORSis efficient?	Data sensitivity	32	2.4%
		Time consumption	220	16.2%
		Cost benefit	63	4.5%
		Patient comfort	324	23.9%
		Effortless	281	20.7%
		Easiness	371	27.3%
		Accuracy	24	1.8%
		Errorless	43	3.2%

9	If your answer is number 2, what is yourreason fornot wanting to use the online registration system?	No internet	32	31.4%
		No device to enter ORS	33	32.4%
		Educational Issues	25	24.5%
		Physical Disability	12	11.7%
10	If you can use ORS, what do you prefer?	Register from home	305	79.2%
		Register from hospital kiosks	51	13.3%
		Register from registrationdesk	29	7.5%
11	What is your level of education?	Primary or less	26	6.8%
		Elementary	56	14.5%
		Secondary	192	49.9%
		Bachelor	98	25.5%
		Master or above	13	3.3%
12	How old are you?	0 - 20 years old	4	1%
		21 - 30 years old	98	25.5%
		31 - 40 years old	139	36.1%
		41 - 50 years old	96	24.9%
		51 - Above	48	12.5%

To have a comfortable treatment environment and their ability to book for appointments or register from home in an effortless manner comes as a second goal as 79.2% of patients expressed their wishes of registering and booking appointments from their homes. It is also important to notice that most patients were unaware of the main goal of ORS implementation which is data sensitivity, accuracy, and its potentiality of being error-free.On the other hand, those who chose to continue with the TQM (10.9%) were also asked for theirmotives. Their reasons of choosing TQM were because of the unavailability of computer devices (32.4%) or internet connections (31.4%), besides other secondary reasons such as educational background (24.5%) and physical disabilities (11.7%). We can notice from those statistics that their refusal of the ORS system and their desire of maintaining the TQM is not mainly because of any defects or failings in ORS itself, but rather to other probable economical or educational issues. Computing devices and internet availability have proved to be not an issue for the successful implementation of the ORS system as most of participating patients have consented to have an internet connection and a device to enter ORS systems (91.5%, 91.7% respectively) whether it is atablet, smart phone, laptop, or a computer.

More than the half of participated patients were unhappy with the usual registration method at registration desk (around 59.7%). This percentage doesn't indicate how much patients are indeed unsatisfied as quarter of them voted for neutral. The percentage of neutrals tells us that they were not able to judge possibly because they have not tried ORS yet in order to have a better understanding of what they are being asked about. Another possible reason for their dissatisfaction could be related to the amount of waiting time they have to tolerate per visit. Almost half of participants (50.1%) said they have to wait from 31 to 40 minutes, and 13.2% stated that they have to wait for

more than 41 minutes. In addition, participating patients were asked whether they are satisfied with the level of attention and service they get from frontline staff, only 14% of them saidthey are satisfied. This is a big indication in that front line staffs are too overwhelmed with their daily routine duties instead of assuring patients' comfort, guidance, and good care. Patients' demographics could also be possible reasons of ORS systems failure or refusal as more than 12% of patients were above 51 years old and more than 21% held elementary certificates or lower.

Even though there are elderly patients who are highly educated (possibly 3.3%), but still this can be taken as a reasoning factor behind the inability to cooperate with ORS system. Finally, those statistical results conclude and justify the main objective of questionnairing outpatients which is to measure patients' satisfaction or dissatisfaction toward the ORS implementation compared with current TQM. In addition, this study gave us a general perspective of the potential reasons behind patients' perception and cooperation or the lack of regarding the use of ORS.

Qualitative Interview Results

To investigate the feasibility and acceptance of the R&A staff, predetermined themes were derived from the quantitative data collection method and used to conduct qualitative data collection presented as 11 purposive interviews with the outpatient registration staff in their offices. Semi- structured interviews were transcribed, translated, and analyzed using thematic content analysis mechanism. Only the relevant sections of the interviews were transcribed because participated female registration technicians refused to record their voices in tapes. The interviews highlighted nine themes of concern clarifying the predetermined themes derived from the questionnaires (Appendix Table

2). After that, interviews were summarized in a table to absorb and analyze only highly relevant statements (Appendix Table 3). To some extent, time factor, cost benefit, crowded environment, health related issues, patient's educational background, hard\software availability, privacy and security concerns, higher management involvement, and

age group had a direct impact on registration staff's perspective and acceptance toward ORS system implementation. Weiping, et al. [8] explained how front-line hospital employees are often times-overwhelmed, besides the necessity of building a good relationship with the patients for more service satisfaction [7].

Appendix Table 2: Highlighted interview table.

SN	Interviews
1	1. **Reg. senior staff 1**, taking care of the managerial and administrative issues of the registration department.
	2. I see patients spend hours daily in the registration windows and I think it's a complete waste of time and effort as it could be done easily electronically in less than 15 minutes in their homes.
	3. 3-I think old, uneducated, and some educated type of patients prefer to be served rather than be initiative and self-dependent when coming to health services. That's basically the main reason why ORS would be a bit difficult to implement in MNGHA community.
	4. We don't prefer to receive massive numbers of patients, sometimes reaching 1 million patients a dayin KAMC and other facilities, all the time which causes unnecessary crowd and extra effort, work, andattention from registration staff.
	5. For the sake of improvement, we have already submitted a proposal to higher management regarding the use of e-service for the appointment management and file opening processes to be automated in the system, but it was refused for the privacy and documentation misuse. But we will continue the investigations and propose it again with some amendments.
	6. I believe that ORS will save a tremendous amount of time for the registration staff and allow them tofocus more often in auditing files, improving the workflow, and guiding lost patients.
	7. 7-I believe that ORS would limit the danger of infection, solve crowd issues, and limited car parking area problems.
	8. 8- New strict rules to guide the electronic workflow of the registration process should be invented to teach lazy patients how to depend on themselves in their health service.
	I wish you good luck and I offer you a total support anytime you need my help.
2	1. **Reg. senior staff 2**, responsible for proposing enhancement ideas to upper management to improve the registration processes and procedures. Also, keeping track of the patient's contact details changing through emails besides the general supervision tasks over the registration technicians and tasks assigned to them.
	2. I think that the current traditional method of queuing and occupying the whole outpatient area with patients waiting for their turn to see the doctor is wasting patients time and the registration staff time aswell as they keep trying to expedite the process of seeing a doctor all the time and inquiring about the available slots which distracts the staff and prevent them from doing a beneficial and productive task.
	3. The most problematic issue in his point of view in this old fashion registration is occupying a hospital area unnecessarily and distracting the staff.
	4. we insist that patients use e-services at least for some small issues like updating mobile numbers but they still come to hospital, queue in the line for hours just to change the contact details!
	5. The hospital higher management should decide to automate the registration process to leave a room for improvement for registration staff rather than following patients along the corridors.
	6. We strongly believe that such a move like ORS will entirely improve the process of registration whether it is a file opening or an appointment making.
	7. I don't believe that age is a matter to not use electronics because elderly people can already use financial credit cards perfectly, so why can't they pay a little effort to learn how to fill the blanks in an electronic form?! >> "i found this an interesting point of view!"
	8. I think that if the MNGHA government unify the process of registration to be only through e- services from the MNGHA website on the internet, the patients, regardless of their backgrounds, will start to follow the new method of registration.
	9. I will give you an official form used for patient's registration, and I suggest making it built in the e- services system to automate the registration process individually by the patient himself. I will also give you a user manual booklet that was distributed a while a go to teach patients how to use the e-services tools for appointments cancellation and amendments to help me figure out the level of knowledge MNGHA patients already have and start building from there.

3	1. **Reg. junior staff 1**, responsible for opening new files for the newly hired MNGHA staff, updating information in the registration system, printing medical cards for the eligible staff and their dependencies, receive and process referrals from other hospitals or primary health clinics belonging to MNGHA, and receiving renewing requests for expired medical cards. 2. I believe that the current outpatient situation is exhausting for registration staff and for the patients themselves. 3. the most problematic issue is the educational background of patients and their willingness to cooperate with ORS. 4. I think that the target patients in the MNGHA community is limited to soldiers and generals who have no idea that electronics even exist, and their whole life have been narrowed to gun skills! 5. I don't believe the old traditional queuing method could be improved as most of MNGHA patients do not have the capability to use the computer or even can read sometimes. It would also require the availability of scanners to scan identity cards or other important documents besides the internet connectivity throughout the whole online registration process. 6. I think that even with the ORS establishment, most patients will still come to hospital for registration. 7. If the patients are willing to commit to the ORS system, it could save patients time and money of transportation and wasted efforts. 8. We have distributed boxes of user manuals to patients previously when we established the connectivity between e-services and mobile numbers of patients, but almost 30% of patients actually used them only. That's why i don't believe posters and advertising or knowledge distribution campaigns will ever work. " no further recommendations"
4	1. **Reg. junior staff 2**, responsible for opening new files for the newly hired MNGHA staff, updating information in the registration system, printing medical cards for the eligible staff and their dependencies, receive and process referrals from other hospitals or primary health clinics belonging to MNGHA, and receiving renewing requests for expired medical cards. 2. It's a daily chaos and an uncontrollable process. We are suffering from daily routines that could be easily automated and then taught to patients. 3. I believe that information loss is the biggest issue in manual registration process due to the big patient's flow that would reach more than 500 patients a day. 4. I think patients' behaviors are difficult to be adjusted or systemized, but we should focus on the long-term advantage to make the effort of teaching and convincing them reasonable. 5. I think implementing the ORS would be a reliable solution for systemizing patient's flow. 6. Using the ORS would help us to easily investigate the eligibility of the patient and whether he is actually an MNGHA current staff or a retired staff. It would also clarify the coverage level and make the connectivity between the MNGHA staff and their dependencies clearer to us when it is systemized and complete. 7. I believe that ORS has the potential of minimizing crowd issues from losing important information to controlling the registration process in general. 8. As far as i know, the registration improvement processes are somewhat difficult due to the necessity of dealing with people which is the most critical point in any project implementation. " no further recommendations"

5	1. **Reg. junior staff 3**, responsible for opening new files for the newly hired MNGHA staff, updating information in the registration system, printing medical cards for the eligible staff and their dependencies, receive and process referrals from other hospitals or primary health clinics belonging to MNGHA, and receiving renewing requests for expired medical cards.
	2. I believe that for now, the traditional queuing registration method is dangerous sometimes which led to the corona crisis which could have been avoided if the system helped to recognize potential corona patients through the kind of services registered in the system.
	3. The biggest problem is when we have infectious diseases that couldn't be figured out and isolated earlier than the patient's arrival to the outpatient area.
	4. Patients' behavior now is kind of ad hoc daily processes. We don't expect what kind of patients will come in any minute.
	5. I think this problem could be improved if there was a prior communication between the hospital and the coming patients.
	6. I believe in the importance of the capability to share the data between patients and registration staff in case of critical information related to, for example is an elderly patient with regular heart attacks would be taken care of more precisely if he or she was expected at particular registered timing through the system.
	7. I believe that ORS will have a big impact on controlling infectious diseases that would lead for a better public health.
	8. I believe that any new invented system such as ORS needs to be treated as a process of organizational learning in which users are given the time and space to practice the system and get familiar with it within the capabilities of the technology used (e.g., Portable kiosks with a trainer), as is the case in the KACSH hospital, which will enhance the adoption and ownership of the new system.
	I would suggest ideas such as clear and simple brochures with big fonts describing ORS in few words for a beginning, and in the second stage, a more teaching concepts be adopted.
6	1. **Reg. junior staff 4**, responsible for opening new files for the newly hired MNGHA staff, updating information in the registration system, printing medical cards for the eligible staff and their dependencies, receive and process referrals from other hospitals or primary health clinics belonging to MNGHA, and receiving renewing requests for expired medical cards.
	2. I think that currently patient's satisfaction is at risk because of the long waiting times that would reach up to 4 to 5 hours per visit.
	3. The biggest issue is that most patients are from a limited knowledge background which takes a lot of our time to cooperate with. Patient's behavior currently is strenuous to patients and staff.
	4. 5- I think using technology in general would benefit the general process of registration in any way higher management decide and believe is reliable and workflow improving.
	5. We have already adopted a solution as a mobile based appointment system. I believe that this solution has solved many issues in the registration process such as the ability to cancel, reschedule or the capability of reminding patients of their upcoming appointments.
	6. But I'm a bit anxious about the ORS idea because of the hacking risk of patients' appointments or medications as the online access is a vulnerable point threatening patient's safety and privacy.
	7. My biggest fear is risking patient's safety by compromising privacy by replacing direct communication to telecommunication. On the other hand, ORS would be extremely beneficial to impaired or very sick patients who cannot take the burden to come to hospital for booking an appointment or handling the long setting hours to finish their screening or treatment process.
	8. To improve the registration systems in general, we should concentrate on the quality of service and security issues in data centers where we store patient's appointments and medical details with personal information.
	" no further recommendations"

7	1. **Reg. junior staff 5**, responsible for opening new files for the newly hired MNGHA staff, updating information in the registration system, printing medical cards for the eligible staff and their dependencies, receive and process referrals from other hospitals or primary health clinics belonging to MNGHA, and receiving renewing requests for expired medical cards.
	2. I think that current method of traditional queuing at windows would mostly help people with no technical background.
	3. Long waiting times for registration is problematic and in all kinds of public hospitals, reductions in waiting times for medical services could help promote patients' satisfaction.
	4. Even though currently we are using mobile communication techniques in some areas of registration and booking, people are not cooperating and simply ignoring all kinds of technical solutions. Imagine the resistance situation with e-communications!
	5. Maybe awareness campaigns would emphasize the importance of their cooperation with the telecommunication utilities for the sake of a general benefit to the MNGHA community.
	6. The use of technical tools such as online registration system (ORS) can help to reduce total waiting time, and substantially increase patients' satisfaction with outpatient services.
	7. ORS might be the solution for expediting registration processes and increases patients' comfort, cost,and time expenditure.
	MNGHA governors may also follow more strict routines to control this process technically.9- " no further recommendations"
8	1. **Reg. junior staff 6**, responsible for opening new files for the newly hired MNGHA staff, updating information in the registration system, printing medical cards for the eligible staff and their dependencies, receive and process referrals from other hospitals or primary health clinics belonging to MNGHA, and receiving renewing requests for expired medical cards.
	2. I don't think that the current method serves the patients privacy as much as if it is done electronically because currently patient's files are reviewed by multiple staff members in the reception desk or by medical records employees or the registration and admission office.
	3. My biggest concern is that more people than necessary are reviewing patient's files that could be myown file sometimes which violates patient's privacy that strictly belongs to the Saudi culture.
	4. Internal patients from the same hospital who are MNGHA employees are completely aware of the easy privacy violation happens daily. But external patients are not aware of the registration process and how the system provides access to most of medical and technical staff.
	5. I strongly suggest that all registration processes be automated and access to these kinds of systems becomes strict and highly limited to those who needs to know.
	6. I strongly agree upon the necessity to move forward and adopt the ORS because it would eliminate ahuge amount of unnecessary daily routine works. I support ORS because the input from patient throughthe portal (e-services) could be seen by the registration staff side to be used as an input for other purposes serving the patients' healthcare services and saving a lot of time that was used previously for data entry.
	7. even though I've heard that higher management have refused the idea of automating the registration process through e-services in the MNGHA portal for the sake of security maintenance, i still believe that ORS would maintain patient's safety and privacy more precisely.
	8. We should think through the whole process again and study all of the idea's dimensions to be able to convince the higher management with our modern plan and assure them that patients' privacy will not be compromised.
	I believe that there will be a lot of work in the beginning of the transmission to paperless or electronic systems, but we should be patient and absorbing to all obstacles and difficulties.

9	1. **Reg. junior staff 7**, responsible for opening new files for the newly hired MNGHA staff, updating information in the registration system, printing medical cards for the eligible staff and their dependencies, receive and process referrals from other hospitals or primary health clinics belonging to MNGHA, and receiving renewing requests for expired medical cards.
	2. As there is no ORS implemented in any way in the MNGHA website portal, the current old traditional method of ==queueing and waiting for 2 to 5 hours to see the healthcare provider in a very crowded waiting area makes patients dissatisfied== from the overall hospital service.
	3. Crowding the hospital with patients on hold is the biggest problem because it would lead to a chaos atmosphere and also would distract the front desk staff and lower their productivity.
	4. we receive huge number of patients in a daily basis. Most patients are used to queuing and I'm not sure what would their reaction be with registration automation idea.
	5. Adjusting the registration automation process step by step would have a bigger impact on patient's collaboration.
	6. ==Automating the scheduling process where it can be provided online by the organizations' portal will allow the front-line employees to finally be more sophisticated around customer service, files auditing and checking, improving workflows and even financial planning.==
	7. ==In my opinion, ORS would help save some time for front-line staff to help lost patients who need guidance.==
	8. In the first phase of implementing ORS, i would suggest to kind of tutor patients toward the system to some extent to get them familiar with it and then they can go along with other features by themselves.
	"no further recommendations"
10	1. **Reg. junior staff 8**, responsible for opening new files for the newly hired MNGHA staff, updating information in the registration system, printing medical cards for the eligible staff and their dependencies, receive and process referrals from other hospitals or primary health clinics belonging to MNGHA, and receiving renewing requests for expired medical cards.
	2. We have been practicing this method a long time ago and moving to systemic approach will be a bigburden on our shoulders.
	3. The biggest issue in current method is paper loss or missing information sometimes due to files mismanagement.
	4. Nowadays, patients are used to the traditional method of queuing. Even though some educated patients would highly recommend systemizing the registration specially the MNGHA employees or other employees who are obliged to be in some other places and coming to hospital during working hours is a bit difficult.
	5. Utilizing telecommunication before patient arrives to hospital would benefit the patients and the registration staff as well by ==minimizing the time taken for preprocesses before the physicians' actual visit.==
	Despite the intelligence of ORS solution, this move would include some obstacles due to the ==inability to automate some of the paper-based processes because of its structure nature which causes loss of data details==, inability to use data for multiple purposes, and limitations in the capacity to aggregate and query patient's data.

Note:

▢ _____ Time related

▢ _____ Cost related

▢ _____ Crowd related

▢ _____ Health related

▢ _____ Education related

▢ _____ Hard\software issues

▢ _____ Privacy and security issues

▢ _____ Strict rules

▢ _____ Age issues

The table above include the numbered-answers to the questions in the "patients' onlineregistrationsystem "interview guide.

Appendix Table 3: Interviews Summary Table.

SN	Themes	Categories	Quotes
1	Time	With	"patients spend hours daily in the registration windows and I think it's acomplete waste of time and effort" "ORS will save a tremendous amount of time for the registration staff and allowthem to focus more often in auditing files, improving the workflow, andguiding lost patients" "patients waiting for their turn to see the doctor is wasting patients time and theregistration staff time" "they still come to hospital, queue in the line for hours just to changethecontact details" "it could save patients time" "patient's satisfaction is at risk because of the long waiting times that wouldreach up to 4 to 5 hours per visit" "Long waiting times for registration is problematic" "system (ORS) can helpto reduce total waiting time," " ORS might be the solution for expediting registration processes andincreasespatients' comfort, cost, and time expenditure" "I strongly agree upon the necessity to move forward and adopt the ORS because it would eliminate a huge amount of unnecessary daily routine works.I support ORS because the input from patient through the portal (e-services) could be seen by the registration staff side to be used as an input for other purposes serving the patients' healthcare services and saving a lot of time that was used previously for data entry." "- Automating the scheduling process where it can be provided online by the organizations' portal will allow the front-line employees to finally be more sophisticated around customer service, files auditing and checking, improving workflows and even financial planning." "In my opinion, ORS would help save some time for front-line staff to help lostpatients who need guidance" "Utilizing telecommunication before patient arrives to hospital would benefit the patients and the registration staff as well by minimizing the time taken for preprocesses before the physicians' actual visit" "ORS is believed to solve certain registration issues such as time minimizing""I think that the ORS solution will save time of re-entering the same data againas it will be registered once by the patient through the system"
		Against	N\A
2	Cost	With	"it could save patients time and money" ORS might be the solution for cost, and time expenditure." "and will also save money in recruiting extra clerks for this job. In addition, itwould also be cost beneficial for patients"
		Against	N\A
3	Crowd	With	"We don't prefer to receive massive numbers of patients, sometimes reaching 1million patients a day in KAMC and other facilities, all the time which causesunnecessary crowd and extra effort, work, and attention from registration staff." "I believe that ORS would limit the danger of infection, solve crowd issues, andlimited car parking area problems. Solve crowd issues, and limited car parking area problems" "occupying the whole outpatient area with patients waiting for their turn to seethe doctor is wasting patients time and the registration staff time" "occupying a hospital area unnecessarily and distracting the staff""It's a dailychaos and an uncontrollable process" "ORS would be a reliable solution for systemizing patient's flow""ORS hasthe potential of minimizing crowd issues" "Patients' behavior now is kind of ad hoc daily processes" "I think this problem could be improved if there was a priorcommunicationbetween the hospital and the coming patients" "Crowding the hospital with patients on hold is the biggest problem because it would lead to a chaos atmosphere and also would distract the front desk staff and lower their productivity." "queueing and waiting for 2 to 5 hours to see the healthcare provider in a very crowded waiting area makes patients dissatisfied"
		Against	N\A

4	Health	With	"ORS would limit the danger of infection" "current outpatient situation is exhausting for registration staff and for thepatients themselves" "queuing registration method is dangerous sometimes which led to the coronacrisis" "The biggest problem is when we have infectious diseases that couldn't befigured out and isolated earlier" " share the data between patients and registration staff" "ORS will have a big impact on controlling infectious diseases" "ORS would be extremely beneficial to impaired or very sick patients who cannot take the burden to come to hospital for booking an appointment or handling the long setting hours to finish their screening or treatment process."
		Against	N\A
5	Education	With	"to teach patients how to use the e-services tools" "I would suggest ideas such as clear and simple brochures with big fonts describing ORS in few words for a beginning, and in the second stage, a moreteaching concepts be adopted" "Maybe awareness campaigns would emphasize the importance of theircooperation with the telecommunication utilities" "In the first phase of implementing ORS, i would suggest to kind of tutorpatients toward the system to some extent to get them familiar with it" "Patient's educating and awareness is a huge starting step before any implementation of ORS" "ORS would indirectly teach patients of new methods of registration"
		Against	"the most problematic issue is the educational background of patients" "I think old, uneducated, and some educated type of patients prefer to beservedrather than be initiative and self-dependent when coming to healthservices" "We have distributed boxes of user manuals , 30% of patients actually used them only. That's why i don't believe posters and advertising or knowledge distribution campaigns will ever work." "- The biggest issue is that most patients are from a limited knowledgebackground" "current method of traditional queuing at windows would mostly helppeoplewith no technical background." ", patients are used to the traditional method of queuing. Even though some educated patients would highly recommend systemizing the registration specially the MNGHA employees"
6	Hard\software	With	"- I think using technology in general would benefit the general process ofregistration" "- We have already adopted a solution as a mobile based appointment system"
		Against	"I don't believe the old traditional queuing method could be improved as most of MNGHA patients do not have the capability to use the computer or even canread sometimes. It would also require the availability of scanners to scan identity cards or other important documents besides the internet connectivity throughout the whole online registration process." "Even though currently we are using mobile communication techniques in some areas of registration and booking, people are not cooperating" "Despite the intelligence of ORS solution, this move would include some obstacles dueto the inability to automate some of the paper-based processesbecause of its structure nature which causes loss of data details"

7	Privacy and security	With	" information loss is the biggest issue in manual registration process" "ORS would help us to easily investigate the eligibility of the patient" "ORS has thepotential of minimizing crowd issues from losing importantinformation to controlling the registration process" "we should concentrate on the quality of service and security issues in datacenters" "I don't think that the current method serves the patients privacy as much as ifitis done electronically" "ORS would maintain patient's safety and privacy more precisely" "the biggest issue in current method is paper loss or missing information"
		Against	"it was refused for the privacy and documentation misuse " "I am a bit anxious about the ORS idea because of the hacking risk of patients'appointments or medications as the online access could be vulnerable which could threat patient's safety and privacy." "My biggest fear is risking patient's safety by compromising privacy by replacing direct communication to telecommunication" "My biggest concern is that more people than necessary are reviewing patient's files that could be my own file sometimes which violates patient's privacy"
8	Strict rules	With	"New strict rules to guide the electronic workflow of the registration process should be invented to teach lazy patients how to depend on themselves in theirhealth service" "The hospital higher management should decide to automate the registrationprocess to leave a room for improvement for registration staff rather than following patients along the corridors" "MNGHA governors may also follow more strict routines to control thisprocess technically." "I strongly suggest that all registration processes be automated and access to these kinds of systems becomes strict and highly limited to those who needs to know" "Patients in general are following the hospitals rules and regulations and must commit to the approved processes" "Putting strict guidelines and implementing a hotline for inquiries about howto use the ORS in the first couple of months of ORS go-live would help patient's practicality with the system"
		Against	N\A
9	Age	With	"I don't believe that age is a matter to not use electronics"
		Against	"I think old, uneducated, and some educated type of patients prefer to beserved rather than be initiative and self-dependent when coming to health services"

Note:

▢ _____ quotes used in the discussion summary

Through the non-participant observations, live as they happen, the researcher noticed an event acts as an indicator to the 15 stressful atmosphere for both frontline staff and patients resulted in an aggressive and unprofessional scene. "There is a male with his wife screaming and shouting with the registration staff at the window about how long they have been waiting and the reason behind the delay. She (the registration staff)became angry and responded aggressively that this is how things work and then she left the stationfor 15 minutes to calm down" (Day 3 (18/8/2015), 10:15 – 10:36) As the MNGHA hospital receives up to 500 patients a day and over 1 million patients including itsother 5 primary health care facilities, it would take almost all of the employee's time and effort to control and guide those continuous streams of patients flow. "ORS will save a tremendous amount of time for the registration staff and allow them to focus more often in auditing files, improving the workflow, and guiding lost patients." (MNGHA Reg. senior staff 1) "Automating the scheduling process where it can be provided online by the organizations' portal will allow the frontline employees to finally be more sophisticated around customer service, files auditing and checking, improving workflows and even financial planning." (Reg. junior staff 7) Time has proved to be an important factor with a direct impact on the registration process quality and Improvement.

Front line staff reported to be fed up with daily registration routines as patients flow over the registration desk is uncontrollable and require long times to serve each one of them. Amatayakul [3] believe that long waiting times of registration to see a healthcare provider is problematic and in all kinds of public hospitals, reductions in waiting times for medical services could help promote patients' satisfaction [15]. As been noticed during the non- participant observation encounters, several aggressive fights happen every now and then due to the problematic long waiting times. "There is a long loud and clearly unfriendly negotiation between a patient who just arrived wanting to see the doctor while the registration staff are trying to tell him there is no available slotfor him and the doctors are overwhelmed with many patients." (Day 2 (17/8/2015), 11:00 – 11:11 a.m.) As a major goal, MNGHA aims to maintain patient's satisfaction at all times in epidemiological conditions or healthy seasons. The use of tools such as ORS is believed to help reducing total waiting times, and substantially increase patients' satisfaction with outpatient services. "Patient's satisfaction is at risk because of the long waiting times that would reach up to 4 to 5 hours per visit."

(Reg. junior staff 4) In addition, the process of automating scheduling processes and having patients information available online through the organizations' portal will give front-line employees to dedicate their time for more sophisticated duties that would improve the general workflow of registration process and provide a better patient service, auditing and checking patients' files "I strongly agree upon the necessity to move forward and adopt the ORS because it wouldeliminate a huge amount of unnecessary daily routine works. I support ORS because the input from patient through the portal (e-services) could be seen by the registration staff side to be used as an input for other purposes serving the patients' healthcare services and saving a lot of time that was used previously for data entry." (Reg. junior staff 6) ORS is also believed to be a solution that saves time of re-entering the same data again and also saving money in recruiting extra clerks for this job which causes unnecessary extra expenditures. "And will also save money in recruiting extra clerks for this job. In addition, it would also be costbeneficial for patients." (Reg. junior staff 9) Also, the waiting time in a very crowded waiting area makes the patients dissatisfied. In the MNGHA hospital case, there are a huge patients streams flowing to the registration windows has been observed by the researcher from the first day of observation until the last day.

"A crowd of above 40 patients both males and females are waiting in the outpatient's waiting area, ground floor, gate 6." (Day 1 (16/8/2015), 9:36 – 9:40 a.m.) Besides the dangerous potential hazards in case of any infectious diseases distribution among outpatients occupying the whole outpatient area leading to a general chaos especially with the existence of children or infants. Below are three observations supporting these statements. "There are 4 mothers with their children waiting in the area, among those children in the waiting area, there are 2 infants." (Day 2 (17/8/2015), 9:18 – 9:30 a.m.) "I hear patients sneeze and cough continuously as per their arrival. Ap-

parently, they have got influenza." (Day 2 (17/8/2015), 10:26 – 10:35 a.m.) "Three children started to play around touching wall, trash baskets, leaflets, and other decorations." (Day 2 (17/8/2015), 10:42 – 10:50 a.m.) Another angle of the crowd is saving money of building extra parking slots for those patients coming to hospital. "I believe that ORS would limit the danger of infection, solve crowd issues, and limited car parking area problems." (Reg. senior staff 1) Shortliffe [2] raises the importance of sharing the data between patients and front-line coordinators in case of vital information related to healthcare as discussed in Dent & Eason's research [2]. Therefore, the input from the outpatient through the portal could be seen from the healthcare providers' side to be used as an input for other purposes serving the patients' healthcare.

"ORS would be extremely beneficial to impaired or very sick patients who cannot take the burden to come to hospital for booking an appointment or handling the long setting hours to finish their screening or treatment process." (Reg. junior staff 4) Weiping, et al. [8] thinks that the major possible limitation against the success of ORS is the lack of conducting Internal and external marketing and advertising, educational programs, or orientation posters [7]. It is important to consider all of patient's educational issues for the sake ofa successful system implementation and outcomes. "I would suggest ideas such as clear and simple brochures with big fonts describing ORS in few words for a beginning, and in the second stage, a more teaching concepts be adopted." (Reg. junior staff 3) And as most of MNGH hospital patients are from a limited educational background according to the nature of the National Guard recruitment requirements and skills. It is believed that this factor would be fatal in the ORS implementation life cycle. " A crowd of about 40 patients are setting in the waiting area. Among them, there are 5 patients inthe national guard unifom." (Day 3 (19/8/2015), 9:10 – 9:21 a.m.) "We have distributed boxes of user manuals, 30% of patients actually used them only. That's why idon't believe posters and advertising or knowledge distribution campaigns will ever work."

(Reg. junior staff 1) Furthermore, not having the capability to use the computer or internet availability would also be another requirement for the sake of a successful ORS implementation. Also, Zhang, et al. [10] considers the absence of internet connectivity or not having a computer device will lead to the lackof communication between the healthcare providers and the patients [18]. "I don't believe the old traditional queuing method could be improved as most of MNGHA patients do not have the capability to use the computer or even can read sometimes. It would also require the availability of scanners to scan identity cards or other important documents besides the internet connectivity throughout the whole online registration process." (Reg. junior staff 1) Wani, et al. [11] provides a solution of the mobile based appointment system to solve some of the ORS issues such as the hacking risk of patients' appointments or medications as the online access is a vulnerable point threatening patient's safety and privacy. Yet it still has some issues such as the quality of service and security

issues in cloud which is used to store the data while storing patient appointment and medical details. Besides the harmful danger of violating patient's privacy, paper loss and patient's missing information plays a big role in withdrawing ORS one step backward [8].

"I am a bit anxious about the ORS idea because of the hacking risk of patients' appointments or medications as the online access could be vulnerable which could threat patient's safety and privacy." (Reg. junior staff 4) Another ORS successful factor could be the level of the higher management involvement in the implementation of strict rules and regulations for the registration workflow. If a new registration process was put in place taking all the pre-requirements facilities of educating and teaching patients, patients will gradually obey the new movement in a slow and steady base as there will always be a first time for every invention and patients' ignorance should not be taken as an excuse to stay still. "New strict rules to guide the electronic workflow of the registration process should be invented toteach lazy patients how to depend on themselves in their health service" (Reg. senior staff 1) The last possible factor that is believed to affect the smooth ORS success is the most common age group MNGHA outpatients belong to. Even though some patients are used to be served at the pointof visit, still age is not considered a crucial turning point in the ORS life cycle. "I think old, uneducated, and some educated type of patients prefer to be served rather than be initiative and self-dependent when coming to health services."

(Reg. senior staff 1) At the end, those quotations prove and explain the reason behind the qualitative analysis in describing the main common factors affecting the acceptance level of R&A staff toward ORS system implementation and an illustration of the pros and cons of the ORS system from their point of view. In addition to that, it clarified how and through what possible mechanisms can ORS system implementation result in a positive outcome in a cultural and sociological manners in the environment of the MNGHA hospital. However, this research encountered some limitations suchas the inability to have a complete interview recording and transcription as some of the participants refused to record their voices on tapes, so we had to remove recording mechanism from the data collection method to have a unified data collection process for all participants.

Conclusion

Health informatics has become an important component in healthcare fields [19] as it aims to deliver the right information or service to the right person at the right time. It is growing swiftly and is involved in every health care delivery aspect [20]. The emergence of informatics in the healthcare field is causing rapid advances in the way healthcare is delivered technologically [21]. One essential area of health informatics that does not always receive enough attention is the scheduling process. It might look like a simple step with no remarkable impact on the organization's workflow, but by analyzing current registration processes and utilizing health informatics solutions, the workflow will ease significantly according to Dent & Eason's research

[6]. Front line hospital employees are often times-overwhelmed, besides the necessity of building a good relationship with the patients for more service satisfaction [7]. Additionally, and as the main focus of most hospitals is the front end of the revenue cycle, an informatics solution can be utilized by automating the scheduling process where it can be provided online through the organizations' portal. Not only to schedule a date and time, but the desired services as well with the payment of part or all of the fees to business center in order to allow the front-line employees to finally be more sophisticated around revenue cycle, customer service, and even financial planning.

Also, long waiting times for registration to see a healthcare provider has proved to be extremely problematic and in all kinds of public hospitals, reductions in waiting times for medical services could help promote patients' satisfaction [3]. The use of tools such as ORS can help to reduce total waiting time, and substantially increase patients' satisfaction with outpatient services. There are two accepted approaches for patients' registration: either the TQM or through an ORS. In this study, we focused on ORS as it is a technique that aims to improve the workflow, lessen patient's waiting time, and enhance patient's care. In that regard, the current situation of registration workflow in the MNGHA hospital is the old traditional method of queueing and waiting for 2 to 3 hours to actually see the healthcare providers. The waiting time in a very crowded waiting area frustrates the patients leading to their dissatisfaction. Furthermore, as there isno ORS implemented in any way in the MNGHA website portal, the purpose of this study was to investigate the patient perceptions on implementing an ORS System and also to study the feasibility and acceptance of the R&A staff. The results of this study justify the main objectives in that it proved that more than the half of participated patients were unhappy with the TQM at registration desks (59.7%), this dissatisfaction should be addressed by ORS implementation that would reduce waiting time, enhance the level of attention and service from frontline staff toward patients' care.

In addition, it helped to analyze the acceptance factors of ORS system among R&A staff. In the future, the results taken out of this study is advised to be used and presented to convince the ISID department and the higher management of the high necessity of such an essential technical project. It would allow the researchers to study the level of ORS success and patients' satisfaction after 6 months of implementation and if it suits their outmost expectations of easy access to such an advanced hospital. Also, as an extra effort, the researcher would be able to document the ORS implementation management process in MNGHA hospital to have a prove of the incredible technical projects management experience. This paper complements a previously published paper [22] and adds more methodological details in terms of qualitative and quantitative details.

Conflict of Interest

As the researcher who handled the interviews with R&A staff is from Information Systems and Informatics Department (ISID), in-

terviewers were totally focused on the technical side of the problem whether as solutions, suggestions, limitations, or problems. This fact could have led the project to have technically-driven conclusions instead of social or other humanitarian impacts.

Summary Table

Below table shows some previously discovered facts and additional identified proves around the patient's online registration system implementation feasibility and perceptions (Table 2).

Table 2: Study Facts Summary Table.

SN	Features	Known Facts	Discussed In	Discovered Facts
1	ORS Implementation Limitations	It's been well known that ORS marketing and advertising, educational programs, orientationposters, non-attendance occurrences, not having the capability to use the computer, lack of communication between the healthcare providers and the patients and engaging the end users are main causes for ORS implementation failure discussed in many previous studies.	Coa, et al. [5,8,12]	Throughout the research process, it was realized that additional ORS implementation limitations and according to the MNGHA setting and population would include unavailability of computer devices or internet connections besides the educational background or physicaldisabilities.
2	ORS Implementation Solutions	Technological solutions for ORS project success include the promotion of the registration system to mobile based appointment system that has the ability to cancel, reschedule or thecapability of reminding patients of their upcoming appointments, and the hacking risk of patients' appointments or medications.	Wani, et al. [11]	To solve the issues related to ORS implementation, it was discovered that certain parameters should be put in considerations and emphasized such as time consumption, cost benefit, patient comfort, data sensitivity, effortless,easiness, accuracy, and errorless
3	ORS Implementation Recommendations	Recommendations about ORS implementations included the necessity of treating the new system as a process of organizational learning in which users are given the time and spaceto customize their practices and needs within the capabilities of the technology used which will enhance the adoption and ownership of the new system.	Dent, et al. [7]	As a conclusion of this research, certain recommendations were raised up such as user co-designandparticipation prior to any to any design or implementation to have a broad perspective of the system from the patients' point of view andalso to grow the system ownership in the front-line staff who will hold the coordination processes later on whenever the patient gets lost in the system.

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