An-Najah National University

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The Efficiency of Health Information Management using an Electronic Registry for Maternal Health in West Bank –A Time-Motion Study in a Cluster Randomized Trial

By

Reham Nafez Sameeh Khrawish

Supervisor

Dr. Zaher Nazzal

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This Thesis was defended successfully on 20 /2 /2021 and approved by:

Defense Committee Members	**Signature**
– **Dr. Zaher Nazzal / Supervisor**	.....
– **Dr. Beesan Maraq / External Examiner**	.....
– **Dr. Mariam Al-Tell / Internal Examiner**	.....

الإهداء

بسم الله والحمد لله على نعمه والصلاة والسلام على سيدنا محمد وعلى أله وصحبه اجمعين

اما بعد، ابدا رسالتي بكلمه اهداء الى كل من يهمه امري:

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الإقرار

أنا الموقعة أدناه مقدمة الرسالة التي تحمل العنوان :

The Efficiency of Health Information Management using an Electronic Registry for Maternal Health in West Bank –A Time-Motion Study in a Cluster Randomized Trial.

أقر بأنّ ما اشتملت عليه هذه الرسالة إنما هي نتاج جهدي الخاص ، باستثناء ما تمّت الإشارة إليه حيثما ورد ، و أنّ هذه الرسالة ككل ، أو أي جزء لم يُقدّم لنيل أي درجة أو لقب علمي أو بحثي لدى أي مؤسسة تعليمية أو بحثية أخرى.

Declaration

The work provided in this thesis, unless otherwise referenced, is the researcher's own work and has not been submitted elsewhere for any other degree or qualification.

Student's name: **اسم الطالبة: رهام نافز سميح خريوش**

Signature: **التوقيع :** رهام خريوش

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List of Abbreviations

ANC	Antenatal Care
CRCT	Cluster Randomized Controlled Trial
EHealth	Electronic Health
EHRs	Electronic Health Records
EMRs	Electronic Medical Records
HIE	Health Information Exchange
HIM	Health Information Management
HIS	Health Information System
HISM	Health Information System Management
MCH	Maternal and Child Health
MISC	Miscellaneous
MOH	Ministry of Health
NIPH	Norwegian Institute of Public Health
PHC	Primary Healthcare Care
PNIPH	Palestinian National Institute of Public Health
WHO	World Health Organization

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Abstract

Introduction: Primary Health Care aspires to achieve health care for maternal and child health with high quality. To this purpose, healthcare clinics must be assisted by an efficient health information system (HIS) that encourages and maintains coordination between all centers on patient data.

Paper-based routine health information systems often require repetitive data entry. In the West Bank, the health system was paper-based, with care providers spending considerable time maintaining multiple files and client registers. Primary healthcare clinics have started using an electronic health information system that has replaced this paper-based system – the electronic registry for maternal and new-born care.

Objectives: The study aimed to evaluate whether an electronic registry's use changes care providers' time-efficiency in primary healthcare clinics for antenatal care. This was assessed by measuring the time spent by the care providers on health information management during consultations.

Methods: The electronic Registry Time study collects data using the time-motion design. The observations were conducted in a random sub-sample of intervention and control clusters (primary healthcare clinics) of the eRegQual CRCT. This study had been in action from August 2018 to December 2018 in 24 primary health care clinics (12 clinics with paper-

based systems) control group, and (12 clinics with electronic registry system) intervention group.

Results: In our study results for clinic nurse's information, we found that all variable between the control and intervention clinic (nurse educational level, Ultrasound availability, Lab service availability, nurse age, nurse experience, ANC visits per month, booking visit per month, booking visit at the day of data collection, days of service provision per week) that is no significant difference between the two groups. Control clinics have more booking visits than the intervention clinics, but this difference is not significant.

For the study's primary outcomes, the intervention clinics have less time-consuming during the consultation than the control clinics. There are three primary variables (health information management, client care, and miscellaneous). The difference between the control and intervention clinics for miscellaneous and client care is not significant, but for HIM that reflects the patient documentation, and for writing on paper and computer of the workflow of the care provider in the clinics for intervention, the time consuming is 6.6 min and for control 9.9. This means that electronic registries in PHC clinics take less time, and this difference is significant. **Conclusion**: The electronic registry improves time efficiency during the appointment and promotes coordination between all primary health care centers. Also, it fosters cooperation between all members of primary health clinics that increase the quality of care delivered and improve health outcomes.

Introduction

Health Care System:

The Healthcare system is a group of individuals, institutions, activities, and resources whose mission is to provide healthcare services tailored to individual health needs. All nation seeks to improve the healthcare system that improves the quality of service. The effective healthcare system is comprehensive for all providers and doctors, primary healthcare centers (PHC), hospitals; public healthcare services (Tulchinsky & Varavikova, 2014). Health systems are structured around the world differently. They differ in the proportion of public and private services given, levels and sources of support for the people served by them, the burden of illness faced by the populations, and the degree to which human and technological environments are created (Broyles et al., 2016).

In Palestine, health care systems are divided into three levels: primary, secondary, and tertiary health services. The Ministry of Health (MOH) is Palestine's leading health service provider through various primary, secondary, and tertiary health care institutions distributed throughout the country. Several NGOs and non - profit organizations provide primary, secondary, and tertiary health services. According to MOH 2017, there are 739 Primary health care (PHC) centers in Gaza and West Bank in Palestine, mainly providing maternal and child health care and chronic disease management (Health., 2017).

Primary Health Care:

Primary health care refers to "essential health care" based on scientifically sound and socially acceptable methods and technologies that make general health care available to all individuals and families in the community. It includes having standard primary care through the use of conventional values and beliefs acceptable to the patient with their full participation, and at the expense of obtaining primary care (S. B. Rifkin, 2018; World Health Organization., n.d.). PHC should be systematic for all essential services, including health promotion and education to promote health behavior, disease prevention and cure supporting long-term care and maternal and child health, providing numerous services in the field of maternal and child care for pregnant women, breastfeeding services, regular child care assessment services. It is considered the core of the health system and is based on justice, equality, and financial reason (S. Rifkin, 2018). PHC is a whole-of-society approach to health and well-being based on

Individuals, families, and communities' needs and preferences. Such addresses the broader health determinants and draws on the specific and interrelated aspects of physical, mental, and social health and well-being (S. Rifkin, 2018).

After Alma Ata's declaration, the importance of PHC was highlighted and identified as a key to achieving health for all initiative with high-quality services. PHC programs with high - quality services will increase health outcomes (S. Rifkin, 2018). The evolving process of health programs,

facilities, or providers have been evaluated to support the optimum clinical quality of care. To accomplish such health care, it must be safe, accessible, timely, efficient, equitable, and stable (World Health Organization., 2017a).

There are 739 centers of PHC in Palestine, 152 in Gaza, and 587 in the West bank. Several centers provided PHC services; 466 belong to the ministry of health, 189 managed by NGOs, UNRWA reached 64 centers and 20 military medical centers. Many of these centers offer a range of primary programs, including MCH services, school health, community, mental health, oral and dental health, traffic accidents, environmental health, and health education (Health., 2017).

MCH Health Care Services:

MCH programs are a critical PHC initiative because they prevent preventable deaths between mothers, children, and adolescents. Improving their health is a fundamental right for them. Many women and children do not have the necessary health care, education, immunization, and nutritional needs (Nutrition, 2012; World Health Organization., 2017b). The MCH program must be supported to address all demands of families, children, and youth through a reduction in infant deaths, the provision of pre-birth care during and after birth, discrimination prevention, special care for children and young people, prenatal and maternal services, the provision of child and youth vaccine immunization (Nutrition, 2012; World Health Organization., 2017b).

The most significant need for global health and disease control is to decrease maternal and child mortality and mitigate the factors and challenges that lead to increased maternal and child mortality. These include diarrhea, malaria, premature birth, pneumonia, and other challenges that cause 6 million deaths per year for children under five (Black et al., 2016).

The maternal mortality rate is high globally; in 2015, 303,000 women died during pregnancy and after childbirth, and it is essential to prevent this number of women who died (World Health Organization., 2015). According to the 2017 study, 295,000 women died during pregnancy, and this number is still unacceptable after childbirth (World Health Organization., 2015).

In Palestine, the rate of child mortality has decreased by 5.5% per year in the last three decades, decreased by 4.4% a year since 2000, and decreased to 20 deaths per 1000 live births in 2008. This reduction in child mortality is due to increased access to health care centers and increased breastfeeding duration from 2,5 months in 1997 to 14 months. In the last ten years, the ratio of maternal and child mortality has been stable since employment, education, quality of services, health promotion for breastfeeding, immunization, tax-funded public health services, and the introduction of a national program to improve child health and nutrition are growing (Lindberg, 2017; Palestinian Health Information Center., 2017).

In Palestine, MCH provides several maternity services (prenatal and postpartum) such as high

- risk pregnancy, postnatal care, anemia, supplemental care, family planning, and mammography and ultrasound mammography, and child health, focusing on disabilities and congenital diseases, anemia in children 12 months of age, Phenylketonuria and Thyroid-stimulating hormone testing, child supplements and fundamental growth indicators (Palestinian Health Information Center., 2017; Victora et al., 2011).

Quality of Service in PHC:

Quality of care has been identified as the degree to which health services for individuals and communities improve the probability of desired health outcomes and are compatible with existing clinical knowledge (Bargawi & Rea, 2015). Quality PHC health services must be effective, safe, secure, and comprehensive for all services needed by people continuously (Watson et al., 2018). It is challenging to provide all high-quality care. Still, several items can enhance that care is integrated with the PHC health system to promote cooperation and coordination between different health sectors. (Bargawi & Rea, 2015; Watson et al., 2018). Many of the quality elements have been established over the decades, and many factors must be incorporated into any organizational method to achieve success in high-quality practice (Crossland et al., 2014):

- **Patient-centered approach**: This aspect deals with providing healthcare that should be appropriate for families and communities and use regional resources and cultural expertise to understand the local community's functioning and needs.
- **Leadership and leading**: This includes the leadership's knowledge and attitude and how to improve the services provided and evolve and change the profession's treatment.
- **Focus on staff**: It is based on staff satisfaction, flexibility, expertise, and professionalism. And also, it focuses on the workload and works stresses.
- **Clinical governance**: This includes elements of interaction and collaboration, the clinical governance dimension related to formal systems and structures in place to provide adequate care and clinical health, such as patient complaint protocols; patient call-back processes, and medical alerts; with particular assurance on structures of clinical care and risk management.
- **Multi-professional teams**: The concept of having a multi-professional team in action and successful collaboration in disease management is included and relies on cooperation and awareness-raising between clinical and non-clinical staff.
- **Communication:** There are various concepts on the internally formal and informal contact processes, including environmental and cultural factors that facilitate effective interaction between practice and external

resources and sharing of patient knowledge and methods that enable timely patient referral to enhance his management.

- **Education and training**: It is a crucial factor for quality improvement; it focuses on training, educating, and innovating health care professionals and learning how to respond to changing practices.
- **Process improvement: It** is related to the performance outcome dimension and is also associated with clinical care procedures, the systems in place for controlling the delivery of health care practice, and internal improvements to the practice.
- **Performance results**: It includes a process that enables internal and external control of performance measures. It includes benchmarking against other services
- **Information and information technology**: The use of information technology (clinical software), such as the processing and use of patient information, enables the exchange of patient health status across various facilities and provides a thorough review of the patient's state, and documents his condition.

Health Information System Management:

An integral part of a working health program is the health information system (HIS). This offers proof of policy and program decisions to achieve positive health outcomes for individuals and the general population. However, the meaning of the word "HIS" varies from source to source,

sometimes without a consistent or specific definition. HIS refers to any system that captures, handles, or transmits information related to individuals' health care or the activities of organizations operating within the health sector (Feyzabadi et al., 2015b).

There are different types of HISs; clinical and administrative systems for managing administrative patient details, operational and tactical systems for easy classification of information and topics, and task-based systems such as Electronic Medical Records (EMRs) or Electronic Health Records (EHRs), revenue monitoring and managing financial systems (Hotchkiss et al., 2012). Routine HIS is characterized as the processes that provide information to meet everyday information needs at regular intervals of one year or less. Such reports contain paper or electronic health records obtained at human facilities and institutions at the state, private, and community levels. The collected data gives an overview of health status, health services, and health resources (Ndabarora et al., 2014). Most of the data is collected by health care providers, supervisors, and routine health facility surveys. Generally, the data sources are individual health information, data services records, and health resource records. Even with today's technology data generated by routine health information systems, most low- and middle-income countries are still very poor (Hotchkiss et al., 2012).

Robust HIS is built upon evidence that is reliable and trustworthy. They play the leading role in supporting health systems and achieving general health coverage in the global health agenda (World Health Organization. et

al., n.d.). However, there is a significant difference in the reliability, timeliness, and efficiency of collecting, analyzing, and using health data in many countries, hampering evidence-based decision-making at all health systems (Ndabarora et al., 2014). Often health care providers are forced to collect, compile, and report redundant health information on several occasions. Time spent exclusively on patient care may thus be shortened (Ndabarora et al., 2014).

The purpose of HISs is to provide better care for patients and encourage the collection of patient data, improve the quality of health care, and allow this information to be analyzed. These data

are used for policy implementation to cure and avoid the spread of disease effectively. HIS improves health care delivery quality, enhances patient safety, prevents medical errors, and strengthens communication between patients and health care providers (World Health Organization. et al., n.d.).

Providing these high qualities, maternal and child health services is vital to PHC. To ensure that these services are of good quality, effective HIS would support clinics providing healthcare. Using HIS in medical clinics enhances the quality of healthcare provided to clients by collecting precise patient records and allowing doctors to understand the better patient medical history and patient needs for specific disease prevention and management. This takes us to one of the six essential building blocks for improving health information systems (HISM) for health management. HISM is a data collection system designed specifically to support health

organizations in planning, management, and decision–making (Hoque et al., 2017).

Health information management professionals are responsible for the accuracy, credibility, and security of patient health information, including medical history, physical examination, blood test/laboratory results, and clinical information. HIM professionals ensure that an organization is given the right information when and where it is needed while maintaining high data quality standards (World Health Organization. et al., n.d.).

Electronic HIS in PHC:

Electronic Health Records (EHR) is a digital form of patient document designed to enhance care continuity in health care centers. It operates on integrating health datasets collected from different databases into person-centered health records. It is a significant health care management initiative that can lead to improved outcomes by reducing medical errors and minimizing likelihood (Broyles et al., 2016). They can improve operational efficiency by having patient information available quicker than the paper-based system, which is better because it includes the patient's medical history and treatment history (Ambinder, 2005).

Currently, the environment is marked by the development of information technology in human activity, primarily biological and health sciences. The integration of information technology with clinical activities can generate a powerful electronic health recording system sharing throughout the world

and generate massive data utilizing scientists and governance of the public health system (Tavazzi & Ventura, 2018).

The implementation of health information technology in PHC could significantly impact the workflow of care providers and clinical work processes that help the care provider make a clinical decision based on evidence-based guidelines specific to the local workflow (Unertl et al., 2010; Zheng et al., 2011). Maternal and child Electronic register system is designed to collect, analyze, restore, store, and share health determinants and outcome data for women and children. It helps in the availability of routine data to take turns worldwide to better care and health outcomes (Myhre et al., 2018)**.**

The Maternal and child health electronic registry in Palestine is implemented through collaboration between the Ministry of Health and the Palestinian National Institute of Public Health (PNIPH)(Venkateswaran et al., 2018). This consists of antenatal, postpartum, and infant care electronic health (eHealth) information to facilitate clinical decision-making by care providers, process management support, and referral capabilities(Lindberg et al., 2019). It faces several health challenges like other countries in the Middle East, but it is doing well compared to other Arab countries; maternal and child health outcomes have gradually improved in the last decade (Lindberg, 2017)**.**

ERegQual Project:

At the end of 2014, the PNIPH began its review of the Maternal and Child Health's Registry in Palestine. Early findings revealed that large volumes of data on antenatal, perinatal, and postnatal treatment were not shared between primary and secondary health care facilities but were instead included in annual reports. Care providers had to record data manually on paper, and confidentiality of health data regulations or agreements was restricted. Following this evaluation, the PNIPH partnered with the Norwegian Institute of Public Health (NIPH) to create the Maternal and Child Health e-Registry in Palestine. In addition to automated data collection and improved tracking and review, the key objective of the e-Registry was to move data from the clinical level to the national level to promote evidence-based decision-making (World Health Organization., 2015).

With stakeholders interested in maternal and child health, the e-Registry was developed and implemented through a consultative process. The registry database was established to identify current facilities, services, human resources, and reproductive health infrastructure. After a series of meetings with doctors, obstetricians, pediatricians, midwives, nurses, community health staff, antenatal and postnatal recommendations, and corresponding treatment algorithms were discussed and modified. Furthermore, a governance system was carefully designed to protect mothers' and children's privacy and confidentiality (Isbeih et al., 2019).

Due to the poor infrastructure in primary health clinics across Palestine, the PNIPH equipped clinics with computers, servers, and networking equipment, while the MoH equipped the Internet. Training courses for registry users have been offered to health care providers in the West Bank and Gaza as part of the PNIPH initiatives to improve quality and ensure sustainability. At the end of 2017, 145 clinics in West Bank and Gaza used a structured data entry system to provide the electronic check-lists for MCH services (Frøen et al., 2016; Venkateswaran et al., 2018).

A cluster randomized controlled trial, eRegQual CRCT, was designed to evaluate the quality, effectiveness, and impact of the e-Registry project. It is an ongoing project embedded in the national implementation of the e-Registry. The cluster is a primary health center providing antenatal, postpartum, and community-based newborn care. Two cluster arms are assigned randomly to the intervention arm: PHC clinics that use the electronic registry system or control arm: PHC clinics that still use the paper-based system (Lindberg et al., 2019).

ERegQual study using a time-motion research to collect data on observations by measuring the time spent by the care provider during the consultation (Frøen et al., 2016; Venkateswaran et al., 2018). Care providers directly enter client information into the eRegistry, built on the clinic's desktop computers, on the District HIS version 2 (DHIS2) software. They have been educated on using the device and dealing with system problems (Frøen et al., 2016; Venkateswaran et al., 2018).

Time- Motion Method:

Time-motion methodology was described in the first part of industrial engineering to address efficiency and waste of material resources, which it has used to increase health care over the years (Lopetegui et al., 2014). It is one of the most robust and reliable studies designed to effectively collect and measure time and performance data to evaluate the workflow of care providers and to assess how care providers spend their time during the day of work, and to investigate changes in the quality of care clinic services following the implementation of the IT system (Zheng et al., 2011)**.** This study design is also used to determine if an electronic health information platform's performance is related to time-efficiency improvements (Lindberg, 2017)**.**

Time-motion research design in health systems includes continuous observation of the role of care providers by measuring the time it takes for observers to perform a series of predefined tasks; this task represents an accurate workflow in health clinics; observers should be eligible and recognized for all workflow tasks in clinics and should not be informed of the hypothesis of this study to minimize bias (Lindberg et al., 2019).

Electronic Time Data Collection Tools are the most effective, accessible, and accurate method than other instruments, including stopwatch and paper type, which are less accurate and raise the risk of inaccurate job tracking. Electronic devices provide all the tasks and activities performed by the care provider, and the observer can automatically pick the activity below that suits the obsequious activity (Lindberg, 2017).

Literature review

Implementing Electronic Health Information System in PHC and Quality of Service.

Several literature studies have assessed the impact of electronic registries on the quality of patient care. Most developing countries worldwide have transformed complete data from paper files to electronic documentation due to the increased development of information technology, increasing use of electronic records, and increased demand for accountability in quality of care (Frøen et al., 2016; Hoque et al., 2017)**.**

The use of systematic data collection tools to improve the quality of care is the goal of quality assessment/improvement registries, and professional training providers should use it to collect patient data correctly, as many of the data quality issues in registries that arise from inadequate training, incomplete case identification or sampling, confusion or misunderstanding. This improvement can be achieved at the population and individual level by providing the care provider with more detailed information about the patient and showing them the history of each patient's disease that facilitates the care provider's decision to give the patient-specific treatment (Quality., 2014)**.**

The use of an electronic registry facilitates communication, and task authorization between the primary healthcare team and secondary health care settings creates evidence-based templates for collecting patient data through medical assistance (O'Malley et al., 2015)**.** Improving the quality

of care in PHC in low- and middle-income settings by introducing a trained health system should be prioritized to improve the quality of care provided by health workers and enhance safety and reduce harm (Venkateswaran et al., 2018).

The impact of electronic records' use on the doctor-patient relationship and communication has been the subject of several studies (Alkureishi et al., 2016). Some studies have shown improvement in patient satisfaction following electronic records and have documented improved communication and relationship between physicians and patients (Furness et al., 2013; Hsu et al., 2005; Rosen et al., 2011). Simultaneously, some other studies have shown that patient satisfaction and patient-doctor communication and relationship have not improved (Stewart et al., 2010).

Pre-and post-implementation research studies on electronic records demonstrated more significant concern for physicians for computer use and improvements in physician and patient speech patterns, such as halting speech before system use is completed (Frankel et al., 2005; Greatbatch et al., 1995). Other studies have shown that physicians have become more interested in clarifying details and encouraging queries when electronic records are used and spoke during computer writing that improved patient attention (Arar et al., 2005; Booth et al., 2004).

Individual behavior has enabled the electronic records to be successfully integrated, such as sharing the screen with the patient, which increases the information time on their health and treatment, thus enhancing their

participation in care decisions (Furness et al., 2013). Other studies directly examined patient perceptions of change in the overall patient-doctor relationship and quality of care or overall satisfaction and found no significant difference due to using Electronic Medical Record (Noordman et al., 2010; Pandit & Boland, 2013). However, a study acknowledged their doctor's high satisfaction or trust level [21].

In a study of the impact and benefit of implementing EHR, it was found that this technology can help patient care and clinical documentation, such as improved documentation quality, increased administrative efficiency, and improved quality, safety, and coordination of care. This study warns future EHR implementers to take greater care of this technology's exercise and inform them of the factors that will affect the improvement and development of EHRs (Nguyen et al., 2014). Another systematic review assessing the impact of clinical registries on the quality of patient care and clinical outcomes shows that clinical registries have significantly contributed to surgical care quality. It improved practitioner performance and led to benefits to patient outcomes (Hoque et al., 2017).

A previous systematic review evaluated the relation between healthcare quality and cost-effectiveness and health information exchange (HIE); the technology of sharing of clinical and administrative data between health care centers. A positive association between HIE and improved service efficiency and cost-effectiveness has been identified (Sadoughi et al., 2018). Few studies were published on the cost of implementing and maintaining electronic medical records in LMIC and their relation with the

cost of health care services. Hoque et al. showed that electronic records reduce hospital stay, increase clinical efficiency, and reduce costs (Hoque et al., 2017).

The development, introduction, and deployment of a wide variety of new eHealth technologies have a clear potential to improve patient and physician access to critical health information, improve the quality of treatment, minimize mistakes in health care, increase cooperation and promote healthier behaviors. These include online health information websites, interactive electronic patient records, health decision support systems, customized health education programs, health care system apps, mobile health networking programs, and innovative telehealth applications (Kreps & Neuhauser, 2010).

A scoping analysis by Carter et al. on the present landscape of mobile phone appointments usage for clinical decision-making in pregnancy and the expected advantages and possible risks of use concluded that, generally, ease of use, portability, and multi-functionality make mobile apps for clinical decision-making in pregnancy effective and appropriate platforms for clinicians (Carter et al., 2019). Most mobile appointment and eHealth research supports clinical decision-making, supports health workforce capability, and enhances universal health coverage (Free et al., 2013; Gurman et al., 2012). The approach offered by electronic health, like mobile health technology, improves the quality of health care (Frøen et al., 2016).

Checklist-based interventions to facilitate the management of challenging or ignored activities that threaten human severe harm have gradually been implemented in recent years. The incorporation of checklist programs into clinical practice has been found to minimize deaths and injuries in intensive care and surgery (de Vries et al., 2010; Neily et al., 2010). The WHO Safe Childbirth Checklist software has dramatically strengthened the implementation of critical safety standards by health care professionals (Spector et al., 2012). Some findings have shown that incorporating checklist programs reduces medical component errors, enhances patient safety, strengthens the quality of medical services, and can improve essential childbirth practices in resource-poor settings (Hales et al., 2008; Nababan et al., 2017).

Health Information Management and Quality of Service:

In 2005, the Indian government implemented a program to reduce maternal mortality and achieve the five MDG goals. According to this report of the evaluation of HISM for maternal health monitoring in India's Balasore district, one of the key obstacles to achieving its target was a poor health management information system for this applied program that prevents the development of maternal health and low communication networks (Dehury & Chatterjee, 2018).

Areas, where respondents thought that EHR functionalities were weakest in electronic medical recording and increased barriers to cooperation, included the lack of integrated care management tools and care plans in EHRs, bad

practice registry accessibility and interoperability, and insufficient monitoring of patient data in EHR over time (O'Malley et al., 2015).

A study on the obstacles and barriers facing the HIS in PHC concluded that one of these barriers is the HIS structure classified for the HIS management and information process. For organizational HIS management, there are many disadvantages in the integration of information systems, and there are no equal guidelines for records among different areas and low-performance evaluation systems among staff (Feyzabadi et al., 2015a).

The effect of Electronic Registry in Time and Workflow:

A previous study assessed the benefits of an electronic registry in the workflow of physicians and nurses. When physicians work in the clinic still use paper systems alone, there is reduced in the time per work. When working on a paper using a computer system and working in a computer system alone, there was increasing time spent, and it is significant. Additionally, the nurses have increased time spent when they shift the using from paper to paper with computer or computer alone, and this increase was significant (Asaro & Boxerman, 2008).

According to another previous time-motion study, after implementing the electronic registry in the first month to the third month, an increase in the time spent per procedure, and the increase is statistically significant compared to the paper baseline. After the EHR period (4-12 month), they also increased in the time spent per procedure, but the second period's increase is less than the first period (Read-Brown et al., 2013).

In another study of implementing the EHR in ICU, they found after the implementation of EHR, there is increasing in the time spent on clinical review and documentation for both resident and attending physician. It is also affected the switching of tasks between them, but there is no difference after implementing the EHR in the physical care of a patient (Carayon et al., 2015). On the other hand, according to a previous time-motion study on primary care physician, they found that after implementing the electronic health records, there was a decrease in time; approximately 0.5 min for each patient visit and this decrease was not statistically significant, and they believe that the uses of electronic record improve the quality of service (Pizziferri et al., 2005).

According to a previous time-motion study in Saudi Arabia, there is no significant difference in the time spent during a consultation in PHC between the centers using electronic registry and centers using the paper-based system. Still, there is a significant difference in all tasks between the PHC centers located in metropolitan and rural areas (Jabour, 2020).

A study of time spent for 439 consultations during patient care and documentation tasks before and after implementation of EHR shows there is no significant difference in consultation duration and for consultation number /hour. According to the old legacy EHR center, they found that the electronic system's implementation decreased the time consuming during the patient care, in contrast to a paper-based system that increases the time consuming on documentation and reduces the time spent on patient care (Joukes et al., 2018).

The time consumed by a physician when looking into medical records in EHR visits was significantly longer than paper-based systems. According to a study conducted in which 80 physician visits by eight families were observed. It was found that there was a vastly more significant time needed for a physician to look into a patient's EHR as compared to a paper-based system (Asan et al., 2014)**.**

The Significance of the Study:

The eRegistry project is being implanted in primary health care clinics that offering antenatal care, in Palestine we have approximately 605 pregnant woman visits primary health clinic during pregnancy. Therefore, it is important to make studies on the benefits of this project, on reducing the time consuming during consultation, quality of health care and patients and care provider’s satisfaction, to enhance the implementing it in all primary clinics and highlight the importance of this project.

This study's value stems from its goal of examining whether the electronic register's use leads to improving the time-efficient processing of health information by the health care provider paper-based systems. Research evidence shows that access to appropriate health information increases with electronic HIS and that the time spent in PHC clinics has decreased.

The quality of the care service and the performance of the care provider improves in the clinics that use the electronic registry, so that the safety increases and the harm decrease, and we will have a better health outcome in the world, and facilitate communication between all departments in the

health sector, to support clinical decision-making. It also strengthens task management to enable cooperation in all industries.

Most Low and Middle Countries are still using a paper-based system and decreasing healthcare providers' productivity in the healthcare sector, so we plan to incorporate an electronic register in all health sectors to have an efficient HIS.

AIM of this Study:

The electronic Registry Time Motion Study aims to assess whether an electronic registry changes care providers' time-efficiency for antenatal care in primary healthcare clinics. Time-efficiency was measured by evaluating the time the health care providers spent on handling health information.

Specific Objectives:

1. To assess the time-consuming difference between clinics using an electronic registry and the other using a paper-based system during PHC consultation.
2. To evaluate the electronic registry's efficiency to improve PHC staff's performance in clinics using the electronic registry.
3. To analyze the statistical relationship between the use of PHC electronic registry and time usage.

Research Question:

Does using the electronic Registry system change the time efficiency of care providers in PHC clinics for antenatal care compared to clinics using a paper-based system?

Research Hypothesis:

The time efficiency of care providers in a primary health care clinic using an electronic Registry system for antenatal care is different from clinics using a paper-based system.

Materials and Methods:

The eRegTime study collects data using the time-motion design (Zheng et al., 2011). The observations were conducted in a random sub-sample of intervention and control clusters (primary healthcare clinics) of the eRegQual CRCT. In this protocol, we have followed the Suggested Time and Motion Procedures (STAMP) checklist for standardized reporting of studies using the time-motion design (see additional file 1) (Zheng et al., 2011)**.**

Study Setting:

West Bank primary health clinics (n=135) offer antenatal, postpartum, and community-based care for new-borns. In the first part of the registry's phased national implementation, 68 primary health clinics began using the system and were included as intervention clusters in the eRegQual CRCT.

The control clusters in the eRegQual CRCT (n=67) are primary health clinics that continue to use paper-based systems.

The various health care providers working in maternal and child health in these primary health clinics include midwives, nurses, general practitioners trained in maternal and child health care, obstetricians, and health workers. Smaller clinics (less than 50 new pregnancy registrations per year) usually have a midwife nurse working throughout the week, while a doctor visits the clinic once every two weeks. Also, major clinics (more than 50 new pregnancy registrations per year) and referral clinics have specialized obstetricians. The nurse-midwife in the clinics performs most antenatal and post-consultation consultations involving the management of health information and will be the only group of health care providers we observe in this study.

Eligibility Criteria:

All primary health clinics (n = 135 cluster) that are part of the eRegQual CRCT are eligible for a time-motion study (Venkateswaran et al., 2018). The clinics which are excluded from the observations are those who have: less than one booking visit, on average, per working day (to ensure that a sufficient number of booking visit observations are documented); more than one care provider offering antenatal care services to the same clients on a working day (to maintain a 1:1 subject-to-observer ratio); and NGO-run clinics (due to a different clinical experience). Following the application of these criteria, 41 clinics remain eligible for inclusion in time-

motion observations (19 intervention clinics and 22 control clinics) see (figure 1). After the randomly allocated of sample of our study we have 12 intervention clusters using the eRegistry and 12 control clusters using paper based system.

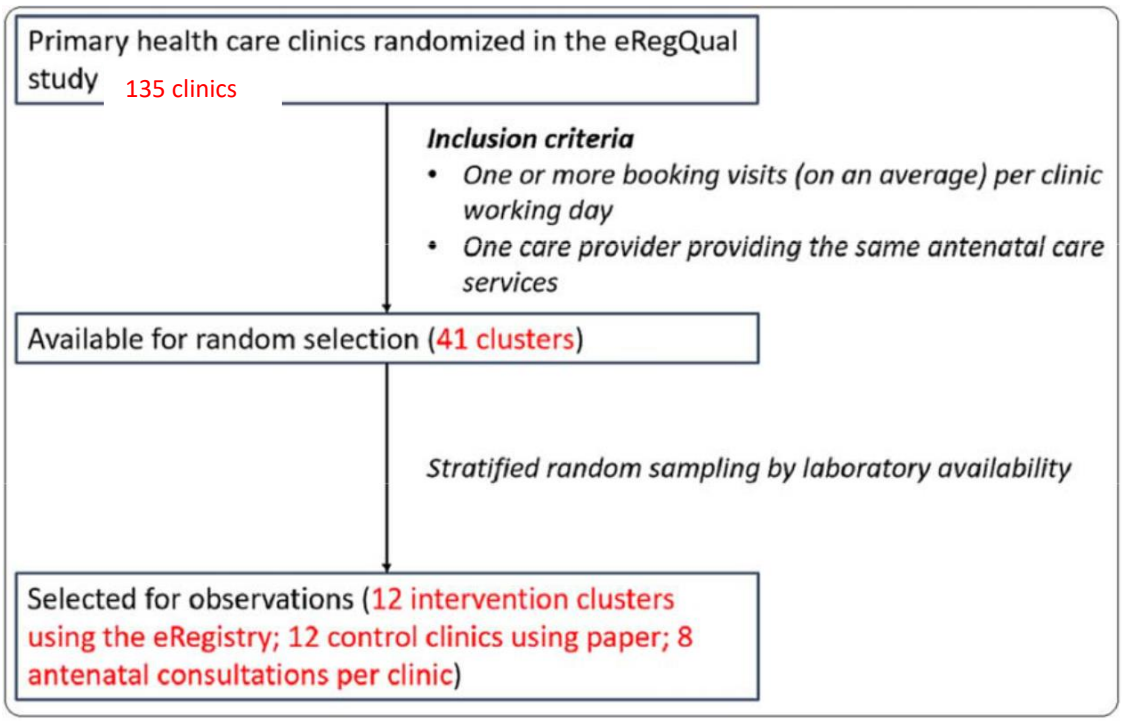

Figure 1 1: Selection of clusters in primary health care clinics for observations**.**

Sample Size:

For sample size calculations, we estimated that clinics using paper-based systems spend an average of 10 minutes on health information processing per client per nurse-midwife. We also assumed unequal and higher standard deviations in the mean health information management period for clinics using the e-Registry (SD = 5) relative to clinics using paper-based systems (SD = 2).

Sample size calculations were made using the STATA command 'clustersampsi' to detect a 25% difference in 90% power and 5% significance using an a priori intra-cluster correlation coefficient of 0.1(Hemming & Marsh, 2013)**.** Twenty-four primary health clinics, 12 of each arm of the CRCT, were observed, with eight prenatal consultations per clinic. (Table 2) Statisticians independent of the eRegTime research team made a random sample of primary health clinics for observations. The statisticians repeated a simple random sample until an appropriate balance was achieved between the two arms of the eRegQual CRCT in terms of the laboratory availability in the clinics and the clinic's size.

We selected 12 clinics that use a paper-based system (control group), but we collect the data in 10 Clinics. Two clinics were excluded from the study; one in Ramallah (Kofr Malik Clinic) because during the data collection time, no pregnant women were being followed in the clinic

and the other in Jenin (Barta'h Clinic). We were unable to access it because we needed a permit from the occupation to enter the village. The control clinics were from different villages on the West Bank; in Bethlehem (Hosan and Harmalah), in Jenin (Jalboon, Deir Abu D'eef, Barta'h, Al-Mayer, and Borqeen), in Nablus (Sarah and Deir Sharaf), in Salfit (Masha) and Ramallah (Dora Alqara and Kofr Malik).

For the intervention group, we selected 12 clinics that use electronic registry from Jenin (AL-A'rakah, Al-Hashmeyeh, Jalqamoos, Misilyah),

Nablus (Doma, Al-Naqorah, Beita, Qabalan), Ramallah (Kharbatha Al-Mesbah), and Salfit (Farkha, Yasoof, and Izkaka clinic, Sartah) (Table 2).

Table 2.1: Distribution of primary health centers included in the study

	Control clinics		**Intervention clinics**	
District	**Name** *(English)*	**Name** *(Arabic)*	**Name** *(English)*	**Name** *(Arabic)*
Bethlehem	**Hosan PHC**	نﺎﺳوﺣ		
	Harmalah PHC	ﻩﻠﻤﺮﺣ		
Jenin	**Jalboon PHC**	نوﺑﻠﺟ	**AL-a'rakah PHC**	ﻩﻘﺮﻋﻠا
Jenin	**Deir Abu D'eef**	ﻓﻴﻌﻀﻮﺑﺃ ريد	**Al-hashmeyeh PHC**	ﻩﻴﻤﺸﺎﻬﻠا
Jenin	**Barta'h PHC**	ﻩﻌﻄﺮﺑ	**Jalqamoos PHC**	سﻮﻣﻘﻠﺟ
Jenin	**Al-mghayer PHC**	ريﻐﻤﻠا	**Misilyah PHC**	ﻩﻴﻠﺴﻣ
Jenin	**Borqeen PHC**	نﻴﻘﺮﺑ		
Nablus	**Sarah PHC**	ﻩﺮﺻ	**Doma PHC**	ﺍﻣﻮﺩ
Nablus	**Deir Sharaf PHC**	ﻓﺮﺷ ريد	**Al-naqorah PHC**	ﻩﺮﻮﻗﺎﻨﻠا
			Beita PHC	ﺍﺗﻴﺑ
Nablus			**Qabalan PHC**	نﻼﺒﻗ
Ramallah	**Kafr Malik PHC**	كﻠﻣ رﻔﻛ	**Kharbatha Al-mesbah**	ﺡﺎﺑﺼﻤﻠا ﺍﺛﺒﺮﺧ
			PHC	
& Al-bireh				
	Dura al Qarea' PHC	عﺮﻘﻠا ارود		
Salfit	**Masha PHC**	ﻩﺤﺴﻣ	**Farkha PHC**	ﻩﺨﺮﻓ
Salfit			**Yasoof and Iskaka PHC**	ﺍﻛﺎﻛﺴﻭ ﻓـﻮﺳﺎﻳ
Salfit			**Sartah PHC**	ﻩﻄﺮﺳ

Control Clusters Workflow:

Pregnant women visit PHC clinics on specific workdays for their first antenatal (booking) visit (clinics can work 1-4 days a week). The nurse-midwife in the clinics receives pregnant women for a booking visit and registers a collection of demographic details (e.g. name, national identification number, address, telephone number, and date of birth) and

medical surgical, and obstetric history. Then, the nurse-midwife measures and documents the woman's height and weight, blood pressure, and fundal height, and orders and fills out routine laboratory results appropriate for each antenatal visit. As part of the booking visit, the doctor examines women on the same working day or in some clinics a few working days later.

The midwife-nurse assists the doctor in medical and ultrasound examinations. In the case of pregnant women identified with risk factors that warrant referral, the nurse-midwife shall make the necessary arrangements for transfer to the referral health facility. There is a flexible appointment system for all subsequent antenatal visits. For uncomplicated pregnancy, the nurse-midwife shall measure and document blood pressure, fundal height, fetal presentation checks, and order laboratory investigations during subsequent antenatal visits.

Nurse-midwives typically take care of pregnant and postpartum women and new-borns in the first part of the working day. After the day's clinical care, the midwife may complete antenatal treatment registries, referrals, ultrasound, laboratory examinations, and vaccinations. The nurse-midwife also compiles data from various public health registries to the Palestinian Ministry of Health, focusing on one or two working days per month.

Intervention Clusters Workflow:

All clinical tasks listed for control clusters are the same for intervention clusters. The management of health information varies only. Care providers

use the eRegistry to record clinical data in real-time during the client's appointment. The eRegistry provides automated decision support and workflow support for a referral (Frøen et al., 2016; Venkateswaran et al., 2018). Lab systems are not incorporated into the eRegistry, and care professionals need to report the test findings on paper to the eRegistry retrospectively. The eRegistry automatically aggregates and submits monthly public health reports to the Palestinian Ministry of Health.

Outcome Measures:

The primary outcome indicator is the time spent on managing health information by consultation. Health information management is characterized as the planning, collection, processing, analysis, and distribution of clinical data, both at the individual and aggregate level, to ensure the availability of appropriate decision-making information by managing health data and information resources (Zeng et al., 2009). To define our context's primary outcome based on the general definition, we used workflow mapping exercises to list all tasks typically performed by nurse-midwives in primary health clinics during antenatal care on a typical working day (Lindberg, 2017). We then defined six types of activity: access to information, reporting, documentation, processing, client care, and other activity types.

- '**Information Access**' involves, as it were, all operations involving the search and identification of specific health or demographic information on the client.

- '**Information reporting**' is defined as all tasks that involve writing to public health registries.
- '**Data collection**' consists of all activities that include writing client information on antenatal documents, lab, and ultrasound forms.
- '**Information processing'** refers to all tasks involving collecting and interpreting written or spoken client information.
- '**Client Care**' covers all tasks in which the care provider is entirely concentrated on the client without any form of writing.
- '**Miscellaneous activities'** are tasks not relevant to the client, including personal activities or the planning and preparing a meeting room for new clients.

The clinical task was then classified into one of the six categories of operation. The primary outcome measure – health information management time – is defined as time spent on all tasks involving the activity category 'information access,' 'information documentation' information processing and 'information reporting.' (rows 9-30, table 1)

Table 2.2: analyses categories, including outcome measures, corresponding task, and task category in the data collection tool. Adapted from Pizziferri et al. (Pizziferri et al., 2005) and tailored to the local context

Task #	Analysis of Categories	The task in the data collection tool	Task category in the data collection tool
1	Client care	Group education	Between/ after consultations
2	Client care	Assisting the doctor	Outside
3	Client care	Examination in other room	Outside
4	Client care	Clinical/medical examination	Procedures
5	Client care	Injections/blood-take	Procedures
6	Client care	Giving tablets	Procedures
7	Client care	Other	Procedures
8	Client care	Education and counseling	Talking
9	Health information management	Writing in a statistics book	Between/ after consultations
10	Health information management	Client file	Computer - find
11	Health information management	Lab/ultrasound results	Computer - find
12	Health information management	Client file (including history)	Computer - writing
13	Health information management	Lab/ultrasound form	Computer - writing
14	Health information management	Schedule appointment	Computer - writing
15	Health information management	Text message in eRegistry	Computer - writing
16	Health information management	Client file	Paper - find
17	Health information management	Lab/ultrasound results	Paper - find
18	Health information management	MCH Handbook (including history)	Paper - writing
19	Health information management	Client file (including history)	Paper - writing
20	Health information management	Register book	Paper - writing
21	Health information management	MCH Handbook/register book	Paper - writing
22	Health information management	Register book/client file	Paper - writing
23	Health information management	Client file/MCH Handbook	Paper - writing

24	Health information management	Lab/ultrasound/prescriptions/referrals	Paper - writing
25	Health information management	Schedule appointment	Paper - writing
26	Health information management	Writing on other paper	Paper - writing
27	Health information management	Talking to family	Talking
28	Health information management	Test results forms - lab/ultrasound	Talking
29	Health information management	Clinical support	Talking
30	Health information management	Technical support	Talking
31	Information access/processing	Call client/family	Talking
32	Information processing	Appointment list	Computer - read
33	Information processing	Client file	Computer - read
34	Information processing	Lab/ultrasound/results	Computer - read
35	Information processing	Guidelines, treatment	Computer - read
36	Information processing	Other info	Computer - read
37	Information processing	Appointment list	Paper - read
38	Information processing	MCH Handbook	Paper - read
39	Information processing	Client file	Paper - read
40	Information processing	Lab/ultrasound results	Paper - read
41	Information processing	Guidelines, treatment, official letter	Paper - read
42	Information processing	History: demographic and medical	Talking
43	Information processing	Referrals	Talking
44	Miscellaneous	Cleaning, arranging files	Between/ after consultations
45	Miscellaneous	Phone/computer (personal)	Between/ after consultations
46	Miscellaneous	Other: praying, eating, toilet, etc.	Between/ after consultations
47	Miscellaneous	Other	Talking

Data Collection Methods:

We developed a data collection tool based on a Microsoft Access database prototype made available online by the US Agency for Health Research and Quality (Quality., n.d.)**.** The data collection tool installed on hand-held tablets includes a list of tasks, and each task can be time-stamped by clicking on it (Figure 2).

The data collection tool tasks represent the clinical context and are based on local workflow mapping in primary health clinics, and are associated with primary outcomes (Lindberg, 2017). The task categories encompass the entire working day of care providers, consisting of both clinical and non-clinical activities, including post-consultation and inter-consultation work (Quality., n.d.). One observation unit, identified as one full antenatal consultation, was initiated when the observer clicks on any task in the data entry form (Figure 2). The observer can assess the type of task being observed and click on the data collection method's corresponding task.

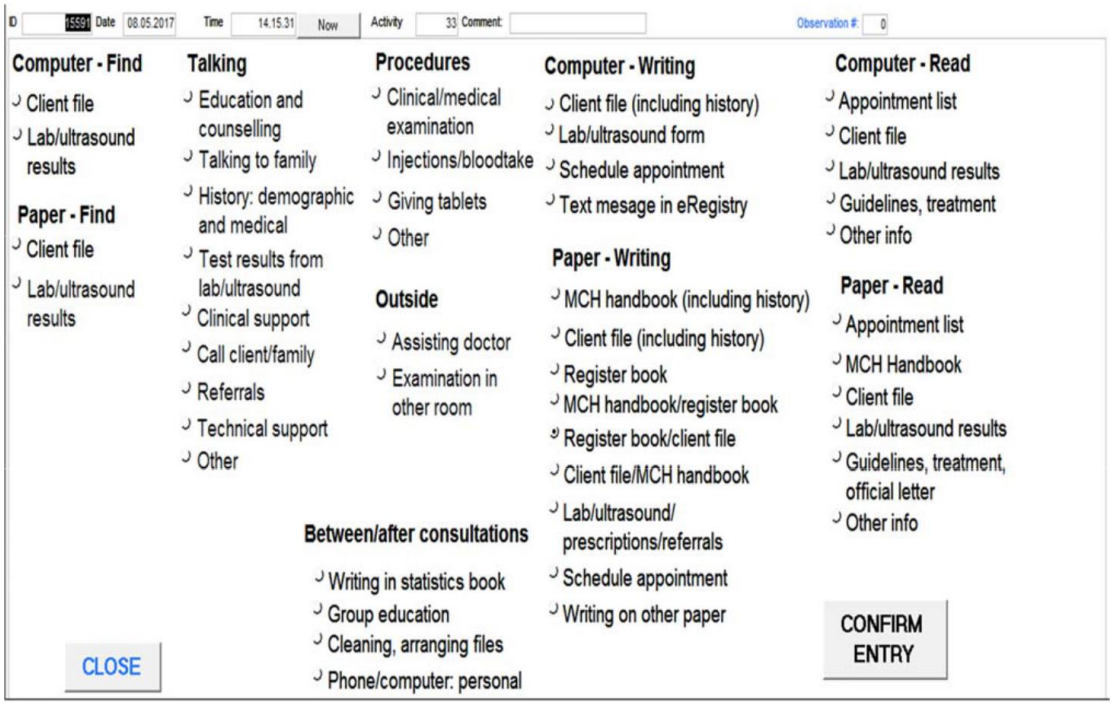

Figure 2 .1: Electronic Time Data collection tool (data entry form)

The tasks in the tool are sorted into major and minor task categories.

- The major ones reflect the physical action used to perform the task, e.g. talking, writing on the computer, or reading on paper.
- The minor categories are the actual task performed, e.g. reading in the client's paper file.

These, in turn, represent the total number of activities performed by the care providers. The main categories are shown in bold font (Table 3). At a time, only one task can be identified. If the caregiver carries out several tasks simultaneously, the observer must assess the purpose of the activity to be performed. For example, if the caregiver writes in the client file simultaneously that the client's history is taken, this would be reported as

"Document – writing – file" and not "Talking – history-taking" since the care provider is primarily writing.

Talking would also still come second when the caregiver is speaking simultaneously as doing something else. History-taking is included in the "paper-writing-file" scenario since the individual's data is written down in the book. See the detailed overview in the following table (Table 3).

The tool starts records when the observer clicks on any minor task description under the major task; before clicking on a new task, the observers clicked on the 'confirm entry' button to save the time it took to execute the task. The observer terminates the observation by pressing the 'close' button in the data entry form when the antenatal consultation is finished. In the case of multi-tasking by the care providers, the observers will choose the main activity. The post-consultation work will be reported as a separate observation. Observation times for activities will be stored in the database with the corresponding activity code linked to it. No identification or demographic details relating to the client or the care provider have been obtained, and the clinic's names have only been stored as computer-generated codes.

Four trained observers (data collector) took part in the data collection and there are blinded for our major outcome objective of our study. Observers have been trained in time-motion methods and task categories, and the use of the data collection tool. We have developed simulated videos of clinical practice mimicking traditional antenatal consultations for the hands-on

training of observers. After preparation, observers performed realistic observations in non-study clinics using the eRegistry and the use of paper. Observations in primary health clinics accompanied this. Observers followed the midwife nurse's full day of work and reported

All consultations on antenatal care during that day. If the required number of antenatal care consultations per clinic (n=8) is not completed within one day, additional days of observation have been carried out until the required cluster size is reached.

Table 2.3: Detailed description of the tasks according to the major (bold) and minor task categories

	Task	**Description**	**Further comments**
Major category :**Computer – find**			
	Client file	Finding client file	Booking visit, ANC follow-up visit, previous pregnancy table
			Finding the client's file in the eRegistry by running the search
			function
	Lab/ultrasound results	Looking for lab/ultrasound results	Finding lab and/or ultrasound results
Major Category :**Paper – find**			
	Client file	Looking for client file	Booking visit, ANC follow-up visit, previous pregnancy table
			Finding the client's file in archive/storage.
	Lab/ultrasound results	Looking for lab/ultrasound results	Lab and/or ultrasound result
Major Category :**Talking**			
	Education &	Only for the	Process of pregnancy and its

	counseling	pregnant woman	complications, danger signs in
			pregnancy, diet and nutrition, rest, exercise in pregnancy,
			personal hygiene, use of drugs or supplements in pregnancy
			(e.g., iron and folic acid), care of breasts and breastfeeding,
			symptoms/signs of labor, plans of delivery, plans for postpartum
			care, family planning, harmful habits (e.g. smoking, cultural
			habits), explaining referral procedure
	Talking to family	Talking to the client's family in the	This may take place both during and/or after consultation hours.
		clinic	
	History taking	Demographic information and client	Only report as history-taking if the care provider is clearly not
		history (past medical/surgical,	doing anything else than asking/listening to the client,
		obstetric, family; current pregnancy)	meaning not writing
	Test results from	Calling for scheduling tests or results,	
	lab/ultrasound	e.g., lab or ultrasound results from	
		another lab/clinic.	
	Clinical support	Talking to a colleague about client-	Talking to the doctor/another nurse about the client, schedule
		related matters, seeking client-related	tests (incl. on the phone), meaning not writing

		support	
	Call client/family	Care provider talks with the client or	This may take place both during and/or after consultation hours.
		her family on the phone: schedule	
		appointment, getting/conveying results	
	Referrals	Talking related to arranging referrals,	
		high-risk clinic/hospital to notify about	
		referrals	
	Technical support	Seeking help in case of technical	Technical problems related to either the eRegistry or the
		problems	internet. Talking to the MCH supervisors/field support
	Other		
Major category: Procedures			
	Clinical and/or medical	Performing examination	Blood pressure, fundal height, height, weight, pallor, pulse,
	examination		edema, breast, temperature, fetal presentation and engagement,
			fetal heart sound, and others. Some of these might take place in
			another room.
	Injections/blood take	Giving injections and taking blood	Most often, tetanus toxoid
	Giving tablets		e.g., iron tablets
	Other		
Major Category: Outside			
	Assisting the doctor	Leaving the consultation room to go to	When the care provider follows the client to the doctor's room
		the doctor's office	(especially in the case of a male doctor), or if the nurse

			assists
			the doctor in another room than the consultation room
	Examination in other room	Leaving room to perform the	
		examination in another room than the	
		consultation room	
Major category: Computer – writing			
	Client file (including	Entering data into the client's file,	Entering data (from registration, history-taking, examination, lab
	history)	including writing during history-	results) and other documentation in client file, incl. back-up file
		taking.	in case of Internet problems
	Lab/ultrasound form	Enter lab/ultrasound results into the	From lab/ultrasound results paper
		system	
	Schedule appointment	Write new appointment in the system	Recognises activity either by looking or based on what the care
			provider is saying
	Text message in eRegistry	Writing other places than in the client	E.g. notes, messages to other care providers
		file, in the eRegistry	
Major category: Paper – writing			
	MCH handbook (including	Write information in the woman's	
	history)	MCH handbook, including writing	
		during history-taking.	
	Client file (history)	Write data, including writing during	Write data from history-taking, examination, lab results and
		history-taking.	other documentation in a

			client file
	Register book	Write in the register book	
	MCH Handbook/register	Writing in the MCH handbook at the	If the nurse writes in different places interchangeably
	book	same time as writing in the register	
		book	
	Register book/client file	Writing in the register book at the	If the nurse writes in different places interchangeably
		same time as writing in the client file	
	Client file/MCH handbook	Writing in the client file at the same	If the nurse writes in different places interchangeably
		time as writing in the MCH handbook	
	MCH handbook		
	Client file	Reading client information from paper	Only reading without writing.
		file	
	Lab/ultrasound results	Reading lab and/or ultrasound results	Only reading without writing.
		from forms	
	Guidelines, treatment,	E.g. guidelines, books, journals,	Using books or other literature for guidelines
	official letter	official letters	
	Other	Any other patient- or health	
		information-related reading on	
		book/paper	
Major category: Between/after consultations			
	Statistics book	Filling in information in the	

		daily	
		statistics book	
	Group education		
	Cleaning, arranging files	Organizing cleaning of equipment,	
		prepare for next client	
	Phone/computer: personal	Use of phone/computer for social	
		media, email, etc.	
	Other: Eating, praying,	Praying etc.	
	toilet etc.		

Data Analysis:

The primary outcome variable measurement is Health Information Management Time per client per provider of care, where time was measured in minutes. All statistical analyses were performed using the statistical package for social science (SPSS v. 21) software. P-value <0.05 was considered statistically significant.

Differences in health information management time between clinics with and without the e-Registry were evaluated for significance using the Chi-square test, the Independent Sample T-Test, and the Mann-Whitney U test, as applicable. Secondary analyses were also performed to test differences in the time spent handling health details separately for booking visits and antenatal follow-up visits and differences in client care time in both arms.

Ethics Approval and Consent to Participate:

The An-Najah National University, Institutional Review Board, approved the eRegTime study (Appendix I) and permissions for clinical observations were obtained from the Palestinian Ministry of Health. Health care providers and primary health service managers have been told of the information gathered for this study. Pregnant women have been asked to consent to allow observers to be present in the rooms during a consultation and have the right to withdraw from the study at any time (Appendix II). No data were obtained on the individual characteristics of pregnant women or care providers

Pilot Study:

Pilot research was conducted to identify the feasibility and time needed to perform the study. Also, the skills of data collectors have been tested, and any legal issues have been taken into account. The results suggest that care providers in clinics with the MCH e-Registry spend more time on antenatal care consultations and health information management than care providers in clinics still using the paper-based system.

Result

This section describes the findings of all clinics involved in research and nurses working in those clinics. 10 PHC clinics were involved in the control group compared with 12 clinics in the intervention group.

Background Characteristics:

Table 1 shows the background characteristics of the nurses in the clinics concerned. The availability of ultrasound laboratory services was evaluated in all participating clinics. Ultrasound was found to be almost equally available in both group clinics; it was available in seven (58.3%) of the intervention arm clinics compared with four (40.0%) of the control arm (P = 0.670). Laboratory services were available in five (41.7%) intervention-arm clinics than six (60.0%) control-arm clinics. The difference was not statistically significant (P = 0.670).

The frequency of ANC visits per month was almost equal for both study arms (P-value = 0.418); median ANC visits per month were 22.9 for intervention clinics (range 6 to 67 visits) and 23 for control clinics (range 10.3 to 31.6). The median booking visit per month was 4.1 for intervention clinics (range of 1.5 to 16.7 visits) and 5.7 for control clinics (range of 2.5 to 7.9 visits). However, this slight difference between the two groups was not significant (P = 0.497). On the other hand, the frequency of booking visits at the data collection date was significantly higher in the control arm (P = 0.08).

The median service days per week in intervention clinics were 1.5 (range 1-5 days) and one day (range 1-5 days) for control clinics. This slight difference was not statistically significant (p = 0.582).

Table 4. 1 Characteristic of the clinics involved in the study (n=22)

	Primary Health Care Clinic		
	Intervention	**Control**	**P-Value**
	n= 12 nurses	n= 10 nurses	
US available			
Yes	7 (58.3%)	4 (40.0%)	0.670*
No	5 (41.7%)	6 (60.0%)	
Lab services available			
Yes	5 (41.7%)	6 (60.0%)	0.670*
No	7 (58.3%)	4 (40.0%)	
***ANC visits** per month*			
Median (min-max)	22.9 (6-67)	23 (10.3-31.6)	0.418**
Mean (± SD)	14.8 (±20)	21.8 (±8.9)	
Booking visits per month			
Median (min-max)	4.1 (1.5-16.7)	5.7 (2.5-7.9)	0.497**
Mean (± SD)	5.8 (±4.9)	5.5 (±2.2)	
***Booking visits** (at the day of data collection)*			
Median (min-max)	0(0.0-5.5)	2 (0-4)	0.08**
Mean (± SD)	1 (±1.6)	1.9 (1.1)	
***Days of service provision** per week*			
Median (min-max)	1.5 (1-5)	1 (1-5)	0.582**
Mean (± SD)	2.0 (±1.5)	1.7 (±1.3)	

**Fisher exact test*

Table 2 explains the background characteristics of identified nurses at clinics concerned. The nursing staff's median age who work in intervention clinics was 44 years (range from 25 to 59 years), while the nursing staff's median age working in the control clinics was 41 years (range from 27 to 57 years). The age difference between the two groups was not statistically significant (p-value = 0.674).

The educational level of nurses in the intervention clinics was slightly higher; nine (75.0%) were holders of bachelor's degrees or higher than three (30.0%) of the control group. However, this difference was not statistically different (P-value, 0.084).

For nursing experience, the median years of experience in intervention clinics were 21 years. They ranged from 1 to 26 years, compared to 15.5 years for control clinic nurses (range is 1 to 26 years), and this difference was not statistically significant (P-value= 0.674).

Table 4. 2: Background characteristics of the clinics' nurses (n= 22)

	Primary Health Care Clinic		
	Intervention	**Control**	
	n= 12 nurses	n= 10 nurses	
Nurse Age			
Median (min-max)	44 (25-59)	41 (27-57)	0.674**
Mean (± SD)	43.1 (±8.7)	42.6 (±9.3)	
Nurse Educational Level			
Less than BA	3 (25.0.0%)	7 (70.0%)	0.084**
BA and higher	9 (75.0%)	3. (30.0%)	
Nurse Experience			
Median (min-max)	21 (1-26)	15.5 (1-26)	0.674**
Mean (± SD)	17.4 (±8.8)	16.0 (±8.1)	

**Mann-Whitney U test*

Characteristic of pregnant women in terms of visit type is compared between the control and the intervention classes. Eleven (9.0%) of the pregnant women in the intervention group had the type of booking visits, compared to 19 (16.1%) in the control group. That difference, however, was not statistically significant (P-value = 0.097).

The average time spent for the intervention group by nurses with pregnant women outside the assessment room was 5.1 (± 5.5) min, compared with 2.5 (± 2.3) min for the control group. High times in the intervention group outside the evaluation room were not significant (P-value = 0.07)

Table 4. 3: Comparison of type of visit and the time spent outside the assessment room between the control and intervention clinics

	Intervention	**Control**	**P value**
	n= 123 clients	n= 118clients	
Visit Type			
Booking	11 (9.0%)	19 (16.1%)	0.097*
Follow up	111 (91.0%)	99 (83.9%)	
Outside assessment room client care			
Time in minutes, *Mean (*±SD)	5.1 (±5.5)	2.5 (± 2.3)	0.07**
**Chi-square test, ** Independent t-test*			

Study Primary Outcomes:

The study's primary outcome is the average visit time, which is the overall time spent with each client in the clinic by health care staff. In the intervention clinics, the mean time spent with pregnant women was 11.9± 6.7 min compared to 13.3± 7.9 min spent by health care workers in the control clinics. The lower average time spent in the intervention group with the pregnant women was not statistically significant (P-value = 0.136).

The mean time for average client service in consultation, which is when the care provider focuses on the clients without writing, in the intervention group was almost equal (5 ± 4.0 minutes) to the time spent in the control clinics (4.9± 3.6 minutes) (P-value = 0.843).

The research key outcome, health information management, is to quantify the time spent in all the activities concerning 'access to information,'

'information collection' and 'information reporting' through consultation. The average time for intervention group health information management was significantly lower than the control group's time; 6.6± 4.3 minutes vs. 9.9 (± 8.0 minutes (P-value < 0.001).

Miscellaneous consultation time, which is the time spent on non-client related activities, including personal activities or tidying up and preparing the consultation room for new clients, was almost equal between the intervention group (1.7± 1.7 minutes) and the control group (1.9± 1.8 minutes), with a P-value of 0.661 (table 4).

Table 4. 4: Comparison of consultation time, client care, health information management, per clients between intervention and control clinics

	Primary Health Care		
	Intervention	**Control**	**P-value***
	n= 123 clients	n= 118clients	
HIM time per consultation *in minutes*			
Mean (±SD)	6.6 (± 4.3)	9.9 (± 8.0)	<0.001
Consultation time *in minutes*			
Mean (± SD)	11.9 (± 6.7)	13.3 (± 7.9)	0.136
Client care time within a consultation *in minutes*			
Mean (± SD)	5.0 (± 4.0)	4.9 (3.6)	0.843
Miscellaneous time within a consultation *in minutes*			
Mean (±SD)	1.7 (± 1.7)	1.9 (± 1.6)	0.661
**Independent sample T-test*			

The total time for all primary outcomes variables is listed in Table 5. The median duration of health information management spent in

intervention clinics was 71.6 minutes (range 36.4-95.3) than 104.7 minutes (range 66-187.2) in control clinics. The difference was statistically significant (P = 0.003).

The median time spent on client care was 49.5 minutes (range 15.8 to 78.3 minutes) for intervention clinics and 59.7 (range 7.3 to 95.1 minutes) for control clinics. The mean time for miscellaneous tasks in the intervention clinics was 3.6 minutes (range 0-20.1 min) compared with 8.7 minutes (range 0-20.3 min) in the control clinics. The difference in time spent for the last two variables between intervention and control clinics was not statistically significant, P-value =0.418 and 0.314, respectively.

Table 4. 5: Comparison of health information management, client care, and miscellaneous between clinics

	Intervention	**Control**	**P value***
	n= 12 clinics	n= 10 clinics	
HIM Total			
Median (min-max)	71.6 (36.4 -95.3)	104.7 (66-187.2)	0.003
Mean (± SD)	70.2 (±20.0)	116.1 (±41.7)	
Client care total			
Median (min-max)	49.5 (15.8-78.3)	59.7 (7.3-95.1)	0.418
Mean (± SD)	48.9 (±19.1)	57.9 (±30.1)	
Miscellaneous total			
Median (min-max)	3.6 (0-20.1)	8.7 (0-21.3)	0.314
Mean (± SD)	6.5 (±7.0)	9.7 (±7.1)	

**Mann-Whitney U test*

Study Secondary Outcomes:

One of the main secondary outcomes of this study is procedures that include all activities such as measuring the weight and blood pressure of a pregnant woman, giving her medications, etc. The time spent on procedures between the intervention group (3, 0±2, 5 mins) and the control group (2,9±2,1 mins) was almost equal, and P-value was equivalent to 0,587. On the other hand, it took an average of 2 ± 1.8 minutes for health professionals to communicate with clients in intervention clinics (advising pregnant women and teaching how to use medicines and others) and 2.9 ± 2.1 minutes for the same role the control group (P-value 0.524).

The time spent on paper writing, which is all activities in writing in the MCH handbook and register book for control clinics and writing for intervention in the computer, was more for control clinics; it takes 1.8 min for intervention clinics and 6.3 min for control clinics. P-value is 0.001, so this difference is significant.

As a paper for the control group and on the computer for the intervention group, the time spent to find clients' files was statistically less in the intervention group; 0.9 minutes vs.

0.7±0.8 minutes, P-value equals 0.047(Table 6).

Table 4. 6 Comparison of time spent on procedures, talking to clients, paper writing, and finding clients' files between intervention and control clinics

	Primary Health Care		**P-value***
	Intervention	**Control**	
	n= 123 clients	n= 118 clients	
Procedures time *in minutes*			
Mean (± SD)	3.0 (± 2.5)	2.9 (± 2.1)	0.587
Time for talking with a client *in minutes*			
Mean (±SD)	2.0 (±1.8)	2.2 (2.1)	0.524
Time for paper writing HIM *in minutes*			
Mean (±SD)	1.8 (± 2.0)	6.3 (± 5.2)	<0.001
Time for finding client file			
(Paper/Computer) *in minutes*			
Mean (±SD)	0.9 (±0.8)	0.7 (±0.8)	0.047

Discussion

Quality healthcare services in primary healthcare must be effective, safe, and people focused on building patient confidence in services that promote healthcare access. Many factors improve the quality of services, such as the electronic healthcare system in clinics, to enable communication and coordination across the healthcare sector. Most previous studies show that using an electronic registry improves the quality of services, promotes patient decision-making to provide specific treatment, enhances communication between doctor and patient, and increases patient confidence and satisfaction (Frøen et al., 2016; Isbeih et al., 2019; Lindberg et al., 2019; Venkateswaran et al., 2018). Other studies have shown that eRegistry reduces hospital stays to reduce patient costs, and other studies show that the use of checklist programs in the part of the medicine reduces the error (Pandit & Boland, 2013; Street et al., 2014; Unertl et al., 2010). On the other hand, some studies found no statistical difference in implementing eRegistry and patient satisfaction, communication, and the relationship between doctors and patients (Stewart et al., 2010).

Electronic Registry Time Motion Study is a robust study to assess implementing an electronic health system on clinical workflow and PHC consultation time. The decrease in diagnostic time and care providers' workload is important because it increases the patient and staff's productivity and service quality. Many studies evaluating the effect of electronic workload registration on health care providers and time-consuming have found no statistical difference (Gurman et al., 2012; Kreps

& Neuhauser, 2010). However, several studies have shown that electronic registration decreases the time spent by PHC providers (Free et al., 2013; Neily et al., 2010). This supports our research objective of exploring whether electronic registration reduces the time spent on care.

In this analysis, 12 PHC clinics were involved as an intervention group compared to 10 clinics in the control group. We found that laboratory services are similarly available for intervention and control groups, and ultrasound services are more general in intervention clinics than in control clinics but are not statistically significant. The availability of diagnostic services in healthcare settings helps to evaluate the patient's condition before clinical occurrence in many situations. It allows the physician to identify the patient's health issue by providing an accurate diagnosis for each illness, enabling the care provider to minimize the time spent on diagnosis

(Committee on Diagnostic Error in Health Care; Board on Health Care Services; Institute of Medicine; The National Academies of Sciences, Engineering, and MedicineCommittee on Diagnostic Error in Health Care; Board on Health Care Services; Institute of Medi, 2015)**.**

The number of ANC visits per month is similar for both groups. On the other hand, the number of booking visits per month and the number of data collection visits per day is lower in the intervention group than in the control group, making the control clinics time during consultation increases. Booking visits take longer than follow-up visits as the care

provider has to open a file for the pregnant woman and fill in their details (name, ID number, telephone number, etc.). Their health and surgical status and number of children, etc., while the health care provider deals directly with her during the follow-up visits. Although the booking visit takes more time than follow-up in our research, we also have two more clinics in intervention clinics, raising the number of ANC visits in the intervention arm. Still, the average time for consultation in intervention clinics is lower than in control, so the EHR decreases the time taken during consultations.

For the nurses' characteristics, their median age is 44 years in the intervention clinics, and 41 years for nurses in the control clinics; this difference is not statistically significant. Increasing the age of nurses ensures that they have more professional experience and expertise. Nurses in intervention clinics have more educational backgrounds and expertise than nurses in control clinics. Previous studies in the future of nursing have shown that an increase in education level is associated with a better understanding and experience of client management and increased quality of care (Institute of Medicine (US) Committee on the Robert Wood Johnson Foundation Initiative on the Future of Nursing, 2011). Therefore, the education level should be a part of the ongoing development of nurses' life and training to increase their skills and work experience and improve their management of problems and difficulties.

Intervention clinics have fewer booking visits than control clinics and more follow-up visits. As mentioned above, booking visits take longer than follow-up visits. For the external assessment room, we found that the

intervention clinics spent more time than the control clinics, during which time the nurse was in another room with a pregnant woman or in another room with a doctor. The use of the electronic register reduces the consultation time so that theCare provider has more time to support the doctor in another room and perform more clinical work.This study's primary outcome is health information management, which covers all paper or computer writing activities. It is the time spent per consultation on all tasks involving the activity type information access, information documentation, and information reporting. HIM's median time is 6.6 min in intervention clinics and 9.9 min in control clinics; $p<0.05$. This time difference lets the health care provider see more patients, give them more time to ask more questions, and collect more information about their health. That will increase patient satisfaction because the care provider focuses more on patient and quality of care service, which will enhance process management in outpatient clinics. Effective writing patient information record helps the patient and their families remember to discuss anything pertinent to their wellbeing and allow all care providers to remember particular points to be addressed with the patient (Fathers & Stevens, 2008)**.** So, in managing their health status, patients' involvement with their health information is more effective.

In many clinics that use a paper system without electronic records, the booked woman often gets the service and provides the data, and then puts it in the file, so that the data required for program management and policy

implementation is not accessible promptly. The subsequent retrieval of data from patient files is week.

The Institute of Medicine committee outlined the main role of health information records. Results management and order entry management are one of these functions; when the doctor places the number of patients on the system, all patient appointments will appear with medicine, disease history, images and laboratory tests and records of diagnostic procedures, functional status evaluation, schedule of preventive care and allergies. Thus, if the physician is aware of all this knowledge, the management would increase during diagnosis (Institute of Medicine (US) Committee on the Work Environment for Nurses and Patient Safety., 2004)**.**

A paper developed by the national alliance for primary care discussed that patient and provider information and decision support could be achieved only when using EMRs. Benefits of routine use of EMR in PHC increase the quality of service, safety, and efficiency, with increased ability to conduct education and research. However, this increases the benefit of EMR (Bates et al.2003). Over the years, the U.S, Australia, Newslanda, and England officially implemented the EMR in PHC (Bates et al., 2003)**.**

Our study discussed the time spent in clinics' information documentation that using an electronic registry was less than the paper-based system clinics. The nurses spend much of their time documenting the notes for patients, which raises stress during work and decreases satisfaction for each patient and care provider, so EHR must be continually improved to

improve documentation quality and reliability and improve the workflow of nurses and doctors (Gazarian et al., 2019).

Several studies have identified a decrease in documentation time by using an EHR in systematic analyses of the impact of electronic records on nurses and physicians (Poissant et al., 2005)**.** In another Time Motion-Analysis of Clinical Nursing Documents, during the introduction of an Ophthalmic Surgery Electronic Operating Room Management System, it was found that there is a reduction in document time relative to paper with the time of use of electronic documentation, and this reduction is statistically significant (Read-Brown et al., 2013). In a study of the impact of electronic records on health care delivery hospitals in KISSI, the care provider notified the advantage of using electronic records. First, it helps with time management and patient order management. It is also more comfortable to restore patient information, increase patient information confidentiality, and increase communication between hospitals' health sectors. Electronic records' advantages lead-up to an increase in patient care quality and better decision-making in inpatient management, so patient and care provider satisfaction increases (Waithera et al., 2017)**.**

EHR also has the benefit of improving health information and reporting by making routine reports from clinical data to support quality improvement and generate these reports to submission to health ministries. And also for information access, electronic records prove that it is far easier and faster (Bowman, 2013)**,** and its enable different members of the treatment team to access to patient files, and added notes to clinical documentation from

various locations at various time (Graber et al., 2017), in contrast, that impossible in a paper-based system.

The time spent in the care of the client is roughly equal in both groups. Therefore, it does not take more time for the electronic-based registry than for the paper-based system. Other benefits of the electronic register, however, are to be considered. A useful electronic registry would

enhance clinical results by increasing teamwork in the health sector, reducing duplication of testing for patients, reducing dispute advice from care providers, and mitigating adverse drug reactions by saving the medications of the patient, so if the doctor gives him any medication he will be alerted (Burton et al., 2004)**.** Also, it enhances the care of patients and cost-saving by providing the clinical status of the patient for clinical decisions making (Ammenwerth et al., 2012). According to a Cost-Benefit Analysis of Electronic Medical Records in Primary Care, it found that electronic health records have positive financial returns on investment in PHC organization (Wang et al., 2003). EHR can quickly recognize and fix operational problems, but it is complicated in paper-based systems, and it takes much longer to correct problems (Ammenwerth et al., 2012)**.**

For all procedures (including all activities such as checking the weight and blood pressure of the pregnant woman and giving her a tablet, etc.) and talking to the client (speaking to the pregnant woman by providing advice and asking her about it). EMR also takes no more time than the paper-based system. Still, the electronic registry promotes patient-doctor contact

and is more patient-centered, increases knowledge clarity, and allows patients to ask doctors more questions. When a doctor uses EMR, he talks more quietly with the patient, and he talks with computer typing so that the patient's knowledge of their wellbeing improves (Alkureishi et al., 2016).

It is also similar for intervention and control for miscellaneous, which covers all non-patient related activities and personal activities. On the other hand, the electronic register decreases the overall time during the consultation, allowing the care provider to tidy the consultation room, eat, pray, and other personal activities that increase satisfaction and decrease job stress. It took more time to find the client file in the folder or computer in the intervention clinics than the control clinics, and that difference was significant. This difference in time usage is because the care providers in the intervention clinics scan the computer to find the client's file by entering his ID number. It will take longer to enter the client information after the file is located. The care provider in the control clinic, on the other hand, records client information directly in their files.

This study has strong points that is the first study in Palestine to study the effects of introduction of electronic registry in PHC clinics over time consuming by the care provider, And there are few studies in the Arab countries in the eRegistry and the time consuming, there are severalstudies in many countries studying the effect of introducing electronic registry in time consuming and workflow, Showing that the use of electronic registry reduces the time consuming that supports our results and gives our study more strength, And the random allocation of clinics in our sample will

increase the strength of our study by decreasing the bias and confounder, And the data collection tools (time-motion study that we used to collect the data is more efficient than other tools and more comprehensive for all activities that care providers do in PHC clinics , data collectors have been trained in data collection tools and activities that care providers do in the clinics that reduce measurement bias in our results .

We have some limitations that need to be acknowledged in this research. Two control group clinics were not included in the final analysis; Bartaa clinic required permission from the Israeli police to reach the village. We were unable to get there; there were no pregnant women registered at the Koformalik clinic during the study period. This lowered the number of clinics in the control group and influenced the overall consultation time as the intervention group had two more clinics than the control group. Another limitation in this study is that the internet frequently disconnects due to electric power cut or disconnect of Wi-Fi, in this case the observers stop collect the time consuming related to use the eregistry and put it to activities that related to between and after consultation or outsides . Therefore, because the nurse is not every time can do aactivities with the patient and in this case she disconnects the device and restart it or does anything outside the care room. Which hinders the care provider from continuing to enter the data on the computer and takes more additional time during the consultation so this increase the bias. Despite these limitations, the median of total time-consuming in the intervention clinics is was 11.9 min, and in the control clinics was 13.3 min. Intervention clinics have less

time-consuming than the control that proves the study hypothesis the electronic registry improves the time efficiency in PHC clinics.

Conclusion:

eRegistry Time Motion Study is one of the most important studies to evaluate the effect of electronic system implementation on time efficiency and clinical workflow. As our findings show, that electronic registry increases time efficiency by reducing time consumption during care provider consultation. For the time that consumes in the activity related to writing in a computer or paper included in HIM, the time-consuming in clinics that using the electronic registry is less than the clinics that use a paper-based system, and this is the important section of our study. It is proved that the clinics that supported an efficient and strong health system will increase the quality of service and patients' satisfaction. Also, the activities related to client care and other activities not associated with a patient for each group are approximately similar. However, the electronic registry has some advantages. It facilitates access to patient history,

continuously updates a patient's clinical data, and saves patient medication. Additionally, it smoothes the communication between all health sectors, which enable a physician to treat the patient more quickly and give him the correct diagnosis, to increase the quality of service; poor coordination leads to poor clinical outcomes such as duplicated test, conflicting clinical advice, and adverse drug reactions (Burton et al., 2004).

Recommendation

Implement an electronic registry in all clinics in PHC centers by converting the clinics using a paper-based system to an electronic health system.

Design a special section with a specialist to collect the data, serve it correctly, and continuously assess the health system.

Increase care provider skills and awareness by conducting workshops on an electronic registry's value and educating them in an electronic registry to make them more efficient in using electronic health systems.

Further studies on the impact of adopting an electronic health system on the quality of service and the patients' satisfaction and care providers highlight and encourage the application of the electronic health system.

The adoption of medical data protection laws and ensuring patient data safety breaches rules.

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Appendix

Appendix I: The An-Najah National University, Institutional Review Board, approved the e-RegTime study

An-Najah
National University
Faculty of Graduate Studies
Dean's Office

جامعة
النجـــاح الوطنية
كلية الدراسات العليا
مكتب العميد

التاريخ : 2018/5/29

حضرة الدكتور حمزة الزبدي المحترم
منسق برنامج ماجستير الصحة العامة

تحية طيبة وبعد،

الموضوع : الموافقة على عنوان الاطروحة وتحديد المشرف

قرر مجلس كلية الدراسات العليا في جلسته رقم (359)، المنعقدة بتاريخ 2018/5/24، الموافقة على مشروع الأطروحة المقدم من الطالب/ة رهام نافز سميح خريوش، رقم تسجيل 11558692، تخصص ماجستير الصحة العامة، عنوان الأطروحة:

(كفاءة ادارة المعلومات الصحية باستخدام نظام التسجيل الالكتروني لصحة الام والطفل:
دراسة الوقت و الحركة لتجربة عنقودية عشوائية)
(Efficiency of Health Information Management using a Registry for Maternal and Child Health: Time and Motion Study in a Cluster Randomized Trial)

باشراف: د. زاهر نزال

يرجى اعلام المشرف والطالب بضرورة تسجيل الاطروحة خلال اسبوعين من تاريخ اصدار الكتاب. وفي حال عدم تسجيل الطالب/ة للاطروحة في الفترة المحددة له/ا ستقوم كلية الدراسات العليا بالغاء اعتماد العنوان والمشرف

وتفضلوا بقبول وافر الاحترام ،،،

د. محمد سليمان
عميد كلية الدراسات العليا

نسخة : د. رئيس قسم الدراسات العليا للعلوم الطبية والصحية المحترم
: ق.أ.ع. القبول والتسجيل المحترم
: مشرف الطالب
: ملف الطالب

ملاحظة: على الطالب/ة مراجعة الدائرة المالية (محاسبة الطلبة) قبل دفع رسوم تسجيل الاطروحة للضرورة

فلسطين، نابلس، ص.ب 7،707 هاتف: 2345115/، 2345114، 2345113 (09)(972)* فاكسميل: 2342907(09)(972)
Nablus, P. O. Box (7) 7،707 Tel. 972 9 2345113, 2345114, 2345115 هاتف داخلي (5) 3200
* Facsimile 972 92342907 *www.najah.edu - email fgs@najah.edu

الموضوع: دراسة بحثية لتقييم الوقت اللازم لتنفيذ خدمات رعاية الحوامل من قبل مقدمي الخدمة الصحية في مراكز الرعاية الصحية الاولية

تقوم وزارة الصحة الفلسطينية – بالتعاون مع المعهد الوطني الفلسطيني للصحة العامة ومنظمة الصحة العالمية– بتنفيذ .مشروع سجل الصحة الإنجابية الإلكتروني في مراكز الرعاية الصحية الأولية /عيادات صحة الأمومة والطفولة

تقوم هذه الدراسة على تقييم استخدام سجل الصحة الإنجابية الالكتروني وتاثيره على الوقت اللازم لمقدمي الخدمة الصحية .أثناء تنفيذ النشاطات المتعلقة بخدمات رعاية الحوامل في مراكز الرعاية الصحية الأولية

وبناء على ذلك ندعوكم للمشاركة في في هذه الدراسة لتسجيل الوقت اللازم لتنفيذ النشاطات المختلفة اثناء تقديم خدمات رعاية الحوامل. سيقوم شخص من قبل المعهد الوطني الفلسطيني للصحة العامة بزيارتكم خلال الأيام المخصصة لتقديم خدمات رعاية الحوامل في العيادة لمشاهدة وتقييم نشاطاتهم المختلفة أثناء تقديم خدمة رعاية الحامل، وسيتم تسجيل الوقت .اللازم لهذه الأنشطة باستخدام لوح الكتروني

سيقوم هذا الشخص ايضا باخذ الاذن من المرأة الحامل التي ستكون موجودة أثناء عملية المراقبة للخدمة الصحية، لن يقوم هذا الشخص بتسجيل أي معلومات تتعلق بالمرأة الحامل وكل المشاهدات والمعلومات التي سيتم تسجيلها ستبقى غير .معروفة ولن تستخدم لتتبع عملك او عيادتك

ولقد تم مراجعة وقبول هذا البحث في المؤسسات البحثية التابعة للنرويج وفي فلسطين أيضا وذلك من أجل الحفاظ على خصوصية المشاركين في البحث وحمايتهم

.

- في حالة رغبت بعدم المشاركة في البحث، الرجاء إبلاغ المعهد الوطني الفلسطيني للصحة العامة.
- يرجى الاتصال برئيس قسم صحة الأمومة والطفولة في مديريتكم (ممرضة) في حال وجود أي أسئلة أو استفسارات.

وتفضلوا بقبول فائق التقدير والاحترام

Additional file 1

Training manual for observers

Introduction

This study is a so-called time-motion study, in which we want to know how much time care providers spend on performing different activities, and compare the time spent in the clinics that use the eRegistry versus those who still use paper. The observers' role will be to take the time on all the various tasks that care providers do during an antenatal care workday in primary healthcare clinics. We have developed a data collection tool in the software Microsoft Access. The tool contains a list of activities, and the observer is supposed to click on the corresponding button according to the activity she observes. The time will then automatically be stored in a database linked to the data entry form, which then can be used for analysis. The tool template has been downloaded from the Agency for Healthcare Research and Quality's website: https://healthit.ahrq.gov/health-it-tools-and-resources/time-and-motion-studies-

database (under "Resources for Time and Motion Studies"). It has further been adjusted to our setting.

Training

Training will take place over three days, and the following points will be covered:

Day 1:

Introduction to study and methods Outline of workflow in clinics

Introduction to data collection tool

Training of different data points on tool

Testing data collection tool hands-on with videos Day 2:

Testing for inter-rater reliability with videos (whether observers make approximately similar time measurements)

Discussions about schedule and timelines Informed consent from women – training Signing confidentiality agreement

Day 3:

Mock observations on non-study care providers

The observers will use tablets with Microsoft Access installed on it. During the observations, the observers will sit on a chair in the consultation room. It is important that the observer is sitting in a place where she can clearly observe what the care provider is doing, while at the same time keeping a distance in order to avoid any interruption of the care provider's work.

Description of the tool

The tasks in the tool are sorted into major and minor task categories. The major ones reflect the physical action used to perform the task e.g. talking, writing on the computer, or reading on paper. The minor categories are the actual task performed, e.g. reading in the client's paper file. Combined, these constitute the total amount of tasks performed by the care providers. The major categories are depicted with a bold font (see Table 1 and Figure 1 below). Only one task can be captured at a time. If the care provider is doing multiple activities at the same time, the

observer must determine by the nature of the task which one to record. For example, if the care provider is writing in the client file at the same time as she is taking the client's history, this will be recorded as "Paper – writing – file", and not "Talking – history-taking" since the care provider is *primarily* writing. Talking will therefore always come second when the care provider is talking at the same time as doing something else. History-taking is in this case included in "paper – writing – file", since the woman's history is written down in the file. See detailed description in the table below (Table 1).

Table 1: Detailed description of the tasks according to the major (bold) and minor task categories:

	Task	**Description**	**Further comments**
Major category	**Computer – find**		
49.	Client file	Finding client file	Booking visit, ANC follow-up visit, previous pregnancy table Finding the client's file in the eRegistry by running the search function
50.	Lab/ultrasound results	Looking for lab/ultrasound results	Finding lab and/or ultrasound results
Major category	**Paper – find**		
51.	Client file	Looking for client file	Booking visit, ANC follow-up visit, previous pregnancy table Finding the client's file in archive/storage.
52.	Lab/ultrasound results	Looking for lab/ultrasound results	Lab and/or ultrasound result
Major category	**Talking**		
53.	Education & counselling	Only for the	Process of

		pregnant woman	pregnancy and its
			complications,
			danger signs in
			pregnancy, diet
			and nutrition, rest,
			exercise in
			pregnancy,
			personal hygiene,
			use of drugs or
			supplements in
			pregnancy (e.g.
			iron and folic
			acid), care of
			breasts and breast-
			feeding,
			symptoms/signs of
			labour, plans of
			delivery, plans for
			postpartum care,
			family planning,
			harmful habits
			(e.g. smoking,
			cultural habits),
			explaining referral
			procedure
54.	Talking to family	Talking to client's	This may take
		family in the	place both during
		clinic	and/or after
			consultation hours.
55.	History taking	Demographic	Only report as
		information and	history-taking if
		client history (past	care provider is
		medical/surgical,	clearly **not doing**
		obstetric, family;	**anything else**
		current	**than**
		pregnancy)	**asking/listening**
			to the client,
			meaning not
			writing

56.	Test results from lab/ultrasound	Calling for	
		scheduling tests or	
		results, e.g. lab or	
		ultrasound results	
		from another	
		lab/clinic.	
57.	Clinical support	Talking to	Talking to
		colleague about	doctor/other nurse
		client-related	about the client,
		matters, seeking	schedule tests
		client-related	(incl. on the
		support	phone), meaning
			not writing
58.	Call client/family	Care provider	This may take
		talks with client or	place both during
		her family on the	and/or after
		phone: schedule	consultation hours.
		appointment,	
		getting/conveying	
		results	
59.	Referrals	Talking related to	
		arranging	
		referrals, high-risk	
		clinic/hospital to	
		notify about	
		referrals	
60.	Technical support	Seeking help in	Technical
		case of technical	problems related
		problems	to either the
			eRegistry or the
			internet. Talking

			to the MCH
			supervisors/field
			support
61	Other		
Major Procedures category			
62.	Clinical and/or medical examination	Performing	Blood pressure,
		examination	fundal height,
			height, weight,
			pallor, pulse,
			oedema, breast,
			temperature, foetal
			presentation and
			engagement, foetal
			heart sound +
			others. Some of
			these might take
			place in another
			room.
63.	Injections/blood take	Giving injections	Most often,
		and taking blood	tetanus toxoid
64.	Giving tablets		e.g. iron tablets
65	Other		
Major Outside category			
66.	Assisting doctor	Leaving	When care
		consultation room	provider follows
		to go to the	the client to the
		doctor’s office	doctor’s room
			(especially in the
			case of a male
			doctor), or if the

			nurse assists the
			doctor in another
			room than the consultation room.
67.	Examination in other room	Leaving room to perform examination in another room than the consultation room	
Major category	**Computer – writing**		
68.	Client file (including history)	Entering data into the client's file, including writing during history-taking.	Entering data (from registration, history-taking, examination, lab results) and other documentation in client file, incl. back-up file in case of Internet problems
69.	Lab/ultrasound form	Enter lab/ultrasound results into the system	From lab/ultrasound results paper
70.	Schedule appointment	Write new appointment in the system	Recognises activity either by looking or based on what the care provider is saying
71.	Text message in eRegistry	Writing other places than in the client file, in the	E.g. notes, messages to other care providers

		eRegistry	
Major category	**Paper – writing**		
72.	MCH handbook (including history)	Write information	
		in the woman's MCH handbook, including writing during history-taking.	
73.	Client file (history)	Write data, including writing during history-taking.	Write data from history-taking, examination, lab results and other documentation in client file
74.	Register book	Write in the register book	
75.	MCH Handbook/register book	Writing in the	If the nurse writes
		MCH handbook at	in different places
		the same time as	interchangeably
		writing in the	
		register book	
76.	Register book/client file	Writing in the	If the nurse writes
		register book at	in different places
		the same time as	interchangeably
		writing in the	
		client file	
77.	Client file/MCH handbook	Writing in the	If the nurse writes
		client file at the	in different places
		same time as	interchangeably
		writing in the	
		MCH handbook	
78.	Lab/ultrasound/p	Write orders	Write orders: lab

	rescriptions/referrals		
			form, ultrasound,
			referrals,
			prescriptions
79.	Schedule next appointment	Write next	
		appointment in the	
		appointment book	
		(schedule book)	
80.	Writing on other paper	Any other writing	
Major	**Computer – read**		
category			
81.	Appointment list	Read client	Read list of
		appointments	appointments in
		from the system	the eRegistry.
82.	Client file	Reading from the	Only reading
		client file on the	without typing or
		computer	writing.
83.	Lab/ultrasound results	Reading lab	Only reading
		and/or ultrasound	without typing or
		results from	writing.
		computer	
84.	Guidelines, treatment	Searching for	Internet search not
		guidelines, etc. on	in the eRegistry
		the computer	platform
85.	Other info	Any other patient-	
		or health	
		information-	
		related reading on	
		the computer	
Major	**Paper – read**		

category			
86.	Appointment list	Read client	Read list of
		appointments	appointments in
	from appointment		the appointment
	book		book.
87	handbook		
88.	Client file	Reading client	Only reading
		information from	without writing.
		paper file	
89.	Lab/ultrasound results	Reading lab	Only reading
		and/or ultrasound	without writing.
		results from forms	
90.	Guidelines, treatment, official letter	E.g. guidelines,	Using books or
		books, journals,	other literature for
		official letters	guidelines
91.	Other	Any other patient-	
		or health	
		information-	
		related reading on	
		book/paper	
Major	**Between/after consultations**		
category			
92.	Statistics book	Filling in	
		information in the	
		daily statistics	
		book	
93	education		
94.	Cleaning, arranging files	Organising	

		cleaning of	
		equipment,	
		prepare for next	
		client	
95.	Phone/computer: personal	Use of	
		phone/computer	
		for social media,	
		email, etc.	
96.	Other: Eating, praying, toilet etc.	Praying etc.	

How Microsoft Access' data entry form works:

The observer initiates the observation by clicking any of the minor task descriptions under the bold major tasks on the entry form (Figure 1). The click will make the tool start recording the time. The observer then determines the nature of the current activity and clicks the corresponding button on the form followed by the "Confirm entry" button to store the activity. If the observer realises that she misinterpreted an activity and hit the wrong task button, the observer can switch to the correct task button, since the entry of the task is not stored until the "Confirm entry" button is clicked. Similarly, as soon as the care provider switches to a different task or activity, the observer clicks the "Confirm entry" button to complete the current entry. To finish the observation, the observer clicks the "CLOSE" button.

An example may be helpful:

1. Provider starts writing observer clicks: “computer – writing – file”
2. Provider starts talking (history-taking) observer clicks: “Confirm entry” “talking – history-taking”
3. Provider starts writing observer clicks: “Confirm entry” “computer – writing – file”

It is important to always click “Confirm entry” before switching the task or before ending the whole observation by clicking “CLOSE”.

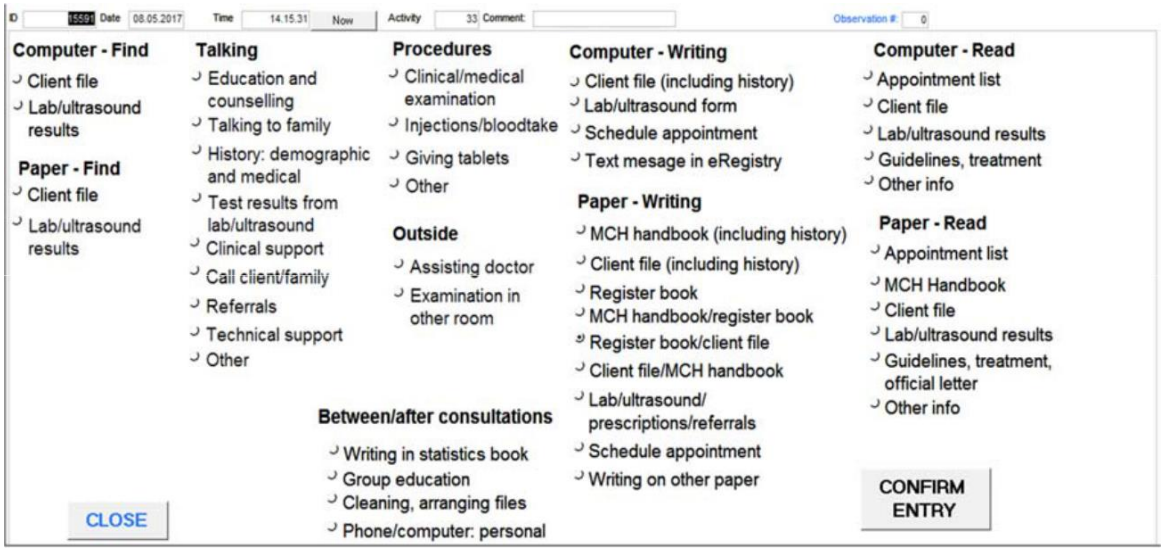

Figure 1: Screenshot of data collection tool

As can be seen both from Table 1 and Figure 1, some of the major categories have an “other” task. This is meant for unexpected activities that the activities described in the tool are unable to capture. For example, if the care provider starts reading something else than any client-related information, then the “Paper – read – other” task button will be pressed. If the observer clicks on an “other” task, then it is important that the observer

writes a short comment in the right corner of the tool or on a paper note. This will make the distinction between care- and non-care-related tasks easier to capture.

At the beginning of each observation, the observer will note whether the consultation is a booking or a follow-up visit. For the observations conducted after consultation hours, this should be stored as one single observation.

جامعة النجاح الوطنية

كلية الدراسات العليا

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إشراف

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قدمت هذه الأطروحة استكمالاً لمتطلبات الحصول على درجة الماجستير في الصحة العامة بكلية الدراسات العليا في جامعة النجاح الوطنية في نابلس، فلسطين

2021

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الملخص

المقدمة: تطمح الرعاية الصحية الأولية إلى تحقيق رعاية صحية للأم والطفل بجودة عالية. للحصول على هذا، يجب أن تكون العيادات التي تقدم الرعاية الصحية مدعومة بنظام فعال للمعلومات الصحية، من شأنه تسهيل وإدارة الاتصال بين المراكز فيما يتعلق ببيانات المرضى.

غالبًا ما تتطلب أنظمة المعلومات الصحية الروتينية المستندة إلى الورق إدخال بيانات بشكل متكرر. في الضفة الغربية، كان النظام الصحي قائماً بالكامل على الورق. مع قضاء مقدمي الرعاية وقتًا طويلاً في الحفاظ على ملفات متعددة وسجلات المرضى. بدأت عيادات الرعاية الصحية الأولية في استخدام نظام المعلومات الصحية الإلكتروني الذي حل محل النظام الورقي – السجل الإلكتروني لرعاية الأمهات والأطفال حديثي الولادة.

هدف الدراسة: هدفت الدراسة إلى تقييم ما إذا كان استخدام السجل الإلكتروني يغير كفاءة الوقت لمقدمي الرعاية في عيادات الرعاية الصحية الأولية للرعاية السابقة للولادة. تم تقييم ذلك من خلال قياس الوقت الذي يقضيه مقدمو الرعاية في إدارة المعلومات الصحية أثناء تقديم الرعايه الصحيه.

تقوم دراسة وقت التسجيل الإلكتروني بجمع البيانات باستخدام تصميم حركة الوقت. تم إجراء الدراسه في عينة فرعية عشوائية من مجموعات التدخل (عيادات الرعايه الصحيه الأولية التي تستخدم نظام التسجيل الالكتروني) والتحكم (عيادات الرعاية الصحية الأولية التي تستخدم النظام الورقي) .

كانت هذه الدراسة قيد التنفيذ من أغسطس 2018 إلى ديسمبر 2018 في 24 عيادة للرعاية الصحية الأولية (12 عيادة مع نظام التسجيل الورقي) (12 عيادة بنظام التسجيل الإلكتروني) .

نتائج الدراسه: في نتائج دراستنا لمعلومات ممرضات العيادات، وجدنا أن جميع المتغيرات بين عيادات التحكم والتدخل (المستوى التعليمي للممرضة، توافر الموجات فوق الصوتية، توافر خدمة المختبر، عمر الممرضة، خبره الممرضة، عدد الزيارات الشهريه للرعايه الصحيه، عدد الزيارات الشهريه لفتح ملفات لرعايه الحوامل، عدد الملفات التي فتحت بيوم جمع المعلومات، عدد ايام تقديم الخدمه خلال الاسبوع) لا يوجد فرق كبير بين المجموعتين. عيادات التحكم لديها زيارات لفتح ملفات أكثر من عيادات التدخل، لكن هذا الاختلاف ليس مهماً.

بالنسبة للنتائج الأولية للدراسة، فإن عيادات التدخل تستغرق وقتاً أقل أثناء الرعايه الصحيه مقارنة بعيادات التحكم. هناك ثلاثة متغيرات أساسية (إدارة المعلومات الصحية، رعاية الحوامل، ومتغيرات متنوعة). الفرق بين عيادات التحكم والتدخل للمتغيرات المتنوعه ورعايه الحوامل ليس مهما، ولكن بالنسبة لاداره المعلومات الصحيه التي تعكس توثيق

المريض، وللكتابة على الورق والكمبيوتر لسير عمل مقدمو الرعاية في عيادات التدخل فإن الوقت المستغرق هو 6.6 دقيقة وللتحكم (9.9). فان هذا يعني أن السجلات الإلكترونية في عيادات الرعاية الصحية الأولية تستغرق وقتاً أقل، وهذا الاختلاف مهم.

الخلاصة: يعمل السجل الإلكتروني على تحسين كفاءة الوقت أثناء التعيين ويعزز التنسيق ويحافظ عليه بين جميع مراكز الرعاية الصحية الأولية. بالإضافة إلى ذلك، فإنه يعزز التعاون بين جميع أعضاء عيادات الصحة الأولية التي تزيد من جودة الرعاية المقدمة وتحسن النتائج الصحية.