



Challenges of Health Information Exchange in Maternal Healthcare in Kenya

A Case Study of Nakuru County Level 5 Hospital.

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Abstract: In Kenya, Medical facilities have made efforts to adopt Electronic Health Records systems at various levels and for different use cases. However, there lacks a robust and secure system for sharing sensitive and confidential health records. This curtails the potential benefits that can be gained by shared electronic health records especially the antenatal care process. Besides, there lacks a portable mechanism of sharing patient medical history especially when the patient seeks care from one provider to another. This situation is even dire and most detrimental to the most vulnerable of citizens, in expectant mothers, children and marginalized groups. This study seeks to determine the challenges of Health Information Exchange in Maternal healthcare, Antenatal Care Process. The findings were drawn from a qualitative research study conducted at the Nakuru County Level Five Hospital utilizing a case study methodological approach

Key Words: *Electronic Health Records systems, Health Information Exchange.*

1. Introduction

Like other developing countries the achievement of universal health coverage in Kenya has been prioritized by the current government for the period 2017 – 2022. There is a key focus on the following areas as part of these efforts: reproductive health, maternal health neonatal, child and adolescent health (MOH, 2009). To this end, the Kenyan government has made a number of key efforts such as the introduction of free maternity with an aim of increasing access to skilled delivery service, beyond zero campaign, aiming to improve maternal and child health outcomes in the country, among others.

However, these efforts are yet to bear much fruit given that the offering of these services is still largely facility-specific and relies on manual records where data captured are retained by the patients and at the same time transcribed on a clinical register for the health facility so that health facilities can have a record of the encounters (Sue Bowman, 2013). Much of this intervention is evident in antenatal care process; during this care process, Professional health workers normally use the Antenatal Health Cards as a medical tool for recording patient data (Adeniyi Francis Fagbamigbe, 2017). The data in these registers form the basis for the compilation of required routine reports (Chawani, 2014).

This, as a result, prevents continuity of care when mothers move from one location to another, Incomplete and inconsistency of data collection, inaccurate and unreliable reports, records redundancy, data inaccessibility, missing data in the records due to regular



oversight, and data being difficult to read as records grow so large over time (Adeniyi Francis Fagbamigbe, 2017). In addition, the process is tedious and difficult to extract data from it for clinical research and reporting in health centres. (Elesban Kihuba, 2014), [6]. Ordinarily, pregnant mothers take their ACH cards home, creating risks of losing information and failed the continuity of the care when the cards are misplaced or lost.

1.1 Health Information Exchange

Health Information Exchange (HIE) is a dissemination system for medical or healthcare data between different parties. It involves mobilization of health care information electronically across organizations within regions, community or hospital system (Reiner, 2015)]. Consequently it guarantees accuracy by ensuring, every party involved in a patient's care whether in a primary care setting, a specialists' health institutions has access to the same information (Sylvestre Uwizeyemungu, 2017).

Healthcare providers interact in health information exchange which in-turn helps facilitate coordinated patient care, reduce duplicative treatments and avoid costly mistakes (Athenahealth, 2018). HIE encourages efficient care by enabling automatic appointment reminders or follow-up instructions to be sent directly to patients, and prescriptions directly to pharmacies which reduces the amount of time patients spend filling out paperwork and briefing their providers on their medical history, allowing more time for discussions making on health concerns and treatments (Claudia Williams, 2012).

By saving time for patients and providers along the entire continuum of healthcare delivery, HIE has the potential to reduce costs and improve health outcomes thus becoming an intervention intended to address the threats to quality, safety, and efficiency posed by inaccessible or missing information at the point of care (WHO, Integrated care, 2016). However, in review of the problems, a number challenges are being faced in achieving these goals i.e. lack of integrated ICT systems, lack of the requisite infrastructure for the secure capture, storage and sharing of this information. Nevertheless, despite of having many efforts to address these challenges there is still no solution in place in the country.

Similar challenges have been addressed by use of various ICTs e.g. District Health Information System 2 (DHIS2) for data management, KenyaEMR, to support the care and treatment of HIV/AIDS among others. While many approaches have been examined for the solution of this challenge, there is still no solution that is presently able to achieve what blockchain has through its design patterns i.e. multiple stakeholder participation, distributed ledger and digital transactions (Peng Zhang, 2017). These challenges can be addressed in part by the adoption of block chain technology as a solution (Andoni, 2018).

Blockchain, originally block chain, is a growing list of records, called Blocks, which are linked using cryptography . Each block contains a cryptographic hash of the previous block known as the timestamp, and transaction data. It is an open, distributed ledger that can record transactions between two parties efficiently and in a verifiable and permanent way (Marco Iansiti, 2019). By design, a blockchain is resistant to modification of the data.

The first and probably most well-known implementation of blockchain technology is Bit-coin, but there has been a massive expansion of blockchain use-cases since Bit-coin's initial introduction. In particular, blockchain and its smart contract capabilities have the potential to address healthcare interoperability issues, such as enabling effective interactions between users and medical applications, delivering patient data securely to a variety of organizations and devices, and improving the overall efficiency of medical practice workflow (Peng Zhang, 2017). Interoperability challenges between different



provider and hospital systems pose additional barriers to effective data sharing (William J.Gordonabc, 2018)].

Blockchain replaces the centralized infrastructure with a distributed one. The blockchain software runs on thousands of nodes distributed across an entire network. To process a transaction, it is distributed to all the network nodes, and the transaction is cleared when the nodes have reached a consensus to accept the new transaction into the common ledger. The process is technologically sophisticated, but it replaces entire record keeping and transaction processing institutions. This lowers transaction overhead in terms of price and execution time. It also means there is no single point of failure, providing a more robust, safer infrastructure (Szewczyk, 2017).

In a healthcare context, transactions would consist of documentation of specific episodes of healthcare services provided (Szewczyk, 2017). Healthcare providers, payers and patients would contribute encrypted data, which would reference a patient ID, to a public blockchain. This could include clinical data that is stored in EHR systems today, claims history and gaps in care from payers and family history and device readings from patients. This information would be encrypted and stored in the blockchain and could only be decrypted by parties that have the patient's private key (Guy Zyskind, 2015).

2. Problem Statement

Medical facilities in Kenya lack a robust and secure system for sharing sensitive and confidential health records curtails the potential benefits that can be gained by shared electronic health records especially the antenatal care process. The methods employed in the market currently do not have strong confidentiality, privacy and data integrity whose threshold is extremely high. Besides, there lacks a portable mechanism of sharing patient medical antenatal history especially when a mother seeks care from one healthcare provider to another. Medical institutions still rely on manual data records systems-*antenatal booklets*, which are slow, error-prone and redundant. These systems do not provide health officers with the ability to reconstruct patient's medical footprints and to accurately predict and forecast possible ailments or complications through reports. This study, therefore, seeks to address the challenges of inconsistency, unreliability and security of medical records in maternal healthcare.

3. Objective

The overall objective of this study is to determine the challenges of Health Information Exchange in Maternal healthcare.

Specific Objectives:

1. To determine the current method of Health Information Exchange in Maternal Healthcare.
2. To establish the challenges of the current methods in use for Health Information Exchange in Maternal Healthcare.

4. Literature Review

In Kenya, maternal and child health is gaining concern due to increasing cases of morbidity and mortality. One of the key challenges in the Kenyan health sector identified in First Medium Term Plan of Vision 2030 document is weak health information systems (MOH, 2009). Various weaknesses identified in the existing information systems include lack of policy and guidelines, inadequate capacities of HIS staff, unskilled personnel handling data, lack of integration, many parallel data collection systems, and poor



coordination, amongst others (MOH, 2009). Overall, the current HIS provides limited information for monitoring health goals and empowering communities and individuals with timely and understandable information on health.

Use of ICTs in the healthcare sector also creates its own set of concerns. These includes the right to privacy of individuals and the protection of this right in relation to health information and the development of suitable standards for regulating the provision of healthcare services by the use of technology (Chao, 2016)]. Proper regulation of the creation and use of healthcare information is imperative and is a matter of special concern to the government as well as other stakeholders in the field of healthcare (MOH, 2009).

Health data is generated from many sources; individuals, health facilities, disease surveillance sites, the community and geographical areas or units. The data is then summarized, analysed and used at the district, province and the national levels depending on needs. Data is transmitted from these sources to the districts, then to the provinces and to the national level. Feedback loops exist at all levels. Within the health sector, data management is either paper based or electronic in different parts of the country. Data is collected manually (paper based) and reported to the districts where it is summarized and analysed, then transmitted to the national level through the province.

5. Methodology

5.1 Case Study

Case study research is an empirical research method used to investigate a phenomenon by focusing on the dynamics of a particular situation or history. The basic goal is to understand the complexity of a case via the most appropriate descriptive sources of data available to the researcher (Zaidah, 2007). A case study research types can be explanatory, descriptive or exploratory. In this study exploratory case study approach was used to seek an in-depth understanding on the current method of maternal health exchange and establish the challenges experienced within the Antenatal Care process at the Nakuru County Level Five Hospital.

5.2 Methods

The study employed the use of expert interviews, discourse analysis and a combination of literature review. The process entailed conducting expert interviews at the Antenatal Care Clinic, Records sections and IT department within Nakuru County Level Five Hospital in Kenya. The interview seeks out to identify the challenges of Maternal Health Information exchanged within the various entities involved in the ANC care process and its data collection method.

5.3 Study Area

The study was conducted in Nakuru County Level 5 Hospital, Kenya, Antenatal care clinic. The hospital has 700 beds and is currently serving a population of more than 2.1 million people, with various departments and sections which include; a new oncology unit, maternity, paediatric, diagnostic and gynaecological services. The hospital also enjoys an eye unit, modern theatres, an intensive care unit, a pharmacy, laboratory, an imaging centre, renal centre, antenatal and postnatal clinics. Recently, the hospital has unveiled a Sh500 million state of the art specialized mother and baby unit by First Lady Margaret Kenyatta with a 250-bed capacity maternity facility.



5.4 Sampling Method

Purposive sampling technique was utilized in this study with an objective of giving a logical representation of the population. An expert sampling type within the purposive sampling technique was used so as to glean more information on the data collection method and its challenges at the clinic from the expertise being interviewed. The expert being interviewed was an ANC Nurse, a Records Officer and an IT administrator.

5.5 Data Collection Methodology

This study utilized a combination of literature search to identify the challenge of maternal health exchange and expert interviews in the field of study to gather information about the maternal healthcare specifically the antenatal care process and data collection method. The interviewees were chosen through their head of sections who positively identified the appropriate and experienced person within their section to give information in their area of expertise. These persons were those who had served the antenatal section understand the challenges of data handling and information exchange.

6. Results and Discussions

The antenatal care Nurse is responsible for avoiding and recognizes health problems that might present before, during, or after birth. The Nurses aid the mothers in learning and implementing healthy habits during pregnancy, regularly assess the wellbeing of the fetus. All these pregnancy details must be recorded on the Mother and Baby Booklet retained by a patient and the same information replicated on the Maternity Case Records, in this case, the Antenatal Care Register MOH 405 by the Nurse. The records officer and IT administrator are responsible for the support collation, consolidation and safekeeping of antenatal care records gathered within the care process. The three experts aided the study with the ability to understand the maternal health exchange process.

6.1 Results from Literature

S/ No.	Existing Data Collection Systems	Challenge With The Existing Method
1.	Kenya Maternal Health Care Process	<ul style="list-style-type: none"> - Manual Process. - Use of ACH cards creating risks of losing information and failed continuity of care when misplaced (Antenatal Care Process) - Data collected manually (Paper Based) - Lack of interoperability the issue of portability, confidentiality, privacy and data integrity - No comprehensive data integrity on patients' medical history.
2.	District Health Information System ²	<ul style="list-style-type: none"> - Used to aggregate statistical data collection, validation, analysis, management, and presentation.



		<ul style="list-style-type: none">- Only based for data collection.-
3.	Kenya Health Referral Process	<ul style="list-style-type: none">- Information about patients on referral are mostly maintained in manual format.- Lack of interoperability



6.2 From Expert Interview.

Nurse Report		
	Challenge	
1.	Documentation	Documentation of the data collected is tasking as each patients information has to be replicated to the maternal register and reports be generated by the nurse in-charged and be fed on the District Health Information System2
2.	Understaffed	With the introduction of free maternal care, there has been an increase in the number of clients seeking for services in government hospitals. Due to this the nursing staff has always been relying on nursing interns and assistance for service delivery
3.	Misunderstanding	Clients misunderstanding of the maternal process
4.	Follow-ups	Clients moving from one station to another becomes difficult for the hospital to do follow-ups and continuity of care especially for patient who need close monitoring during the antenatal care process
5.	Health Information System	There has never been any HIS for the antenatal care process
IT Personnel Report		
	Challenge	
1.	Change Management	Staff resistance to change especially those working within the department that will be affected with the change
2.	Reports and Documentations	Tasking in transfer of manual record captured buy the nurse in charge from the maternal register to be fed in the DHIS2.
3.	HIS	The has never been any system for the maternal care process

6.3 Summary of Health Information Exchange in Maternal Healthcare.

The current method of information exchange and data collection within the maternal healthcare is still manual (Paper Based), where information captured is retained by the patient and at the same time the information is transcribed on a health registers so that health facilities can have a record of the encounters (Sue Bowman, 2013). Much of this intervention is evident in Antenatal Care process; during this care process a professional health worker (The Nurse) uses the Antenatal Card *Fig. 1* as a medical tool for recording a patient data (Tirsit Mehari Abate, 2015) and at the same data transferred to the Antenatal Health Register *Fig. 2a, 2b, 2c*. The ANC card is source of health information which complements information in the Antenatal Register and provides each expectant mother with an individual record of her medical and obstetric history (Paul B Spiegel, 2004). The card is carried at all times and updated at each visit alongside the Antenatal Register. The data in these registers form the basis for compilation of required routine reports (Chawani, 2014), given in a summary form *Fig. 3*, which are entered on the DHIS2 on a monthly basis.

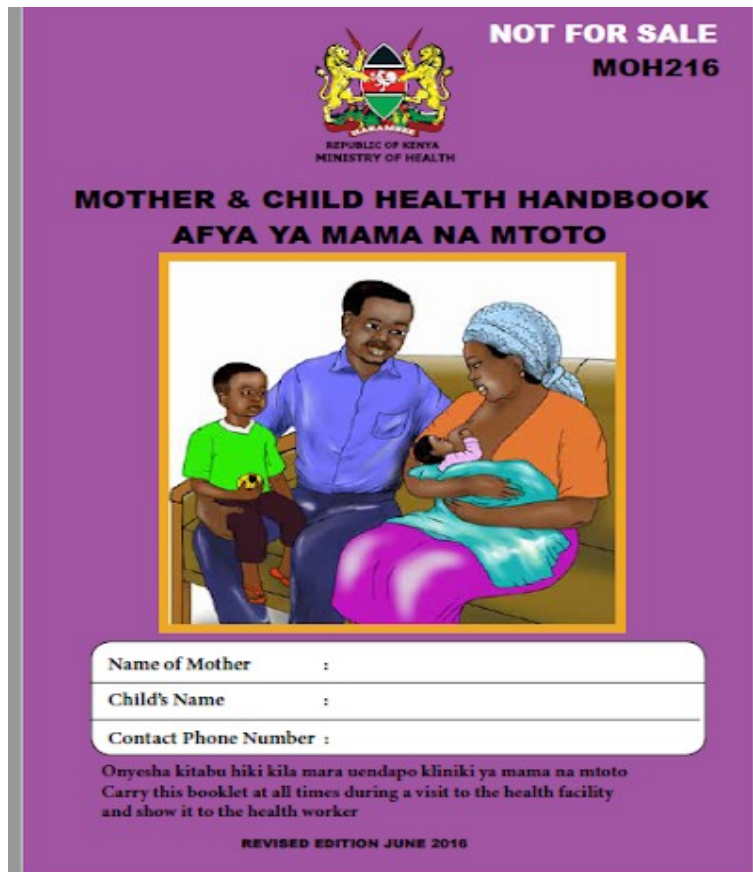



Fig. 1. Antenatal Health Book (Mother and Baby Book)




REPUBLIC OF KENYA
MINISTRY OF HEALTH

Antenatal Care Register (MoH 405)

Service Delivery Point:	
SDP Number:	
Facility Name:	
MFL Code:	
Sub-County:	
County:	
Start date:	End date:

Version 25 August 2016

Fig 2a. Antenatal Care Register MOH 405 Cover Page

PGH Nakuru MOH 711
MCH/FP ANCclients
For the month of

Data element	New	Re-visits	Total
CWC Attendance			
ANC Attendance			
PNC Attendance			
FP Attendance			

ANC

Data element	No.
New ANC Cliets	
Re-visit ANC Clients	
Clients given IPT 1st Dose	
Clients given IPT 2nd Dose	
Clients with Hb <11g/dl	
No. of Clients completed 4 Antenatal Visits	
LLITNS distributed to children under 1 year	
LLITNs distributed to ANC clients	
ANC clients tested for syphilis	
ANC clients Syphilis +ve	
Mother counselled on infant feeding options	
Total women done breast examination	
ANC given exercises	
Adolescents (10-14 years) presenting with pregnancy	
adolescents (15-19 years) presenting with pregnancy	
ANC Client given Iron	
ANC Client given folate	
ANC Client Supplemented with Combine Iron and Folate	

Indicator	<25 yrs	25-49 yrs	50 Yrs and above	Total
Cervical cancer receiving VIA /VILI /HPV VILI / HPV				
Cervical cancer clients screened for Pap smear				
Cervical cancer clients screened for HPV test				
Cervical cancer clients with Positive VIA/VILI result				
Cervical cancer clients with Positive Cytology result				
Cervical cancer clients with Positive HPV result				
Cervical cancer clients with suspicious cancer lesions				
Cervical cancer clients treated using Cryotherapy				
Cervical cancer treated using LEEP				
HIV positive clients screened for cervical cancer				

Fig. 3 ANC Reporting Tool

7. Conclusions

This study established that the current method of data collection in use results to prevents continuity of care when mothers move from one location to another, Incomplete and inconsistency of data collection, inaccurate and unreliable reports, records redundancy, data inaccessibility, missing data in the records due to regular oversight, and data being difficult to read as records grow so large over time (Tirsit Mehari Abate, 2015). In addition the process is tedious and difficult to extract data from it for clinical research and reporting in health centres. (Tirsit Mehari Abate, 2015) (Chao, 2016).



7.1 Data/Information Bottlenecks When A Mother Changes Institution

A mother can be forced to change her living location. This change can be due to work, security, and convenience or family reasons. This forces her to seek antenatal care in a new medical institution. When a mother changes health institutions, there is also a disconnect or lack of continuity of care when mothers move from their previous facility to another. This also creates the inconvenience and increases the turnaround time in response since the new medical officers have to study the mother's health history from the start. The experience is compounded if the mother changes her institution yet again.

7.2 Data/Information Bottlenecks When A Mother Loses/Misplaces/Disfigures the Record Booklet.

A mother due to human error, can misplace, lose or deliberately visit the health facility without the antenatal care booklet. This situation makes it difficult for the nurses and caregivers to reconstruct the mother's health history. This makes the process of performing checks and reconstructing the medical history a long and tedious process.

7.3 Difficulty in Data/Information Retrieval.

The process of detailed data retrieval and extraction is tedious and cumbersome for records that were stored in textual document *Antenatal Care Register* over a longer period of time within the institution. This results a number of outcomes including data redundancy, lengthy patient waiting time, decreased diagnostic trust, excessive and/or unnecessary appointments, and the performance of intervention procedures that could have been prevented if the full complement of data/information were readily available (Reiner, 2015).

8. Recommendation

This study establishes that despite the use of ICTs in most public healthcare facilities, there is still a challenge in documentation and seamless exchange data. With the use of systems like Q-Afya an Electronic Management System and other emerging technologies in IT, management of patient's data, documentation and reporting within the maternal care process would be made easier for public hospital. The following should be achievable future research areas that should ensure the data confidentiality and privacy concerns are addressed. Therefore, the resultant prototype design should encompass the following aspects;

1. Creation of a cross-platform ubiquitous, secure blockchain infrastructure accessible by all healthcare providers and practitioners.
2. Recording, segmentation and provision of verifiable data on the various levels of participants so as to enable proper permissions and consumption of confidential data in the right direction.
3. Design a prototype that should include identity and authentication of all these healthcare players.
4. Creation/building of a consistent representation of authorization to access the confidential mother electronic health information, and several other confidentiality requirements.



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