Design and implementation of a smart card based healthcare information system to improve maternal reproductive health in Kenya

An estimated 7,000 women in Kenya die annually from pregnancy-related complications due to inability to access medical care. Another 52 out of 1,000 children die at birth.

Globally, maternal mortality remains a big public health problem. Kenya is one of the African countries with high maternal mortality with current estimates being as high as 488 deaths per 100,000 live births\(^1\). Although the Kenya government is making efforts to reverse maternal mortality trends, challenges related to a supportive legal environment, access to services and general rights awareness among women still hinder realization of improved health for Kenyan women.

The new constitution provides the much needed opportunity in reversing maternal mortality trends and improving the general welfare of women in Kenya. Article 43/1(a) provides an entitlement to the highest standards of health including the broad range of reproductive health information and services. Article 43/2 further stipulates that no one will be denied emergency treatment including all pregnancy related complications.

Most explicit is the platform provided under the bill of rights to promote and enhance the health of women in Kenya. Article 26/4 outlines conditions for provision of safe abortion services by trained medical providers.

While these provisions are generous in expanding health care space for women and addressing maternal mortality, millions of women do not have access to affordable, accessible, and acceptable maternal health care services.

Going through pregnancy and childbirth safely is what every woman should expect. We know that even though complications of pregnancy cannot always be prevented, deaths from these complications can be averted. Close to 80 percent of all maternal deaths can be averted if women received timely and appropriate medical care. We have the knowledge of the causes of these deaths and how they

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can be prevented; we know what works and what does not work. It is now
generally accepted that lack of skilled assistance during childbirth is the most
important determinant of maternal mortality.

Also is lacking is the commitment, at all levels, to act; to make the reduction of
maternal mortality a high priority; and to reflect this in resource allocations to
health services, especially for reproductive health care.

Our clients both men and women need to be educated on the fact that skilled
attendance at birth is one of the ways to improve these statistics. Policy makers
need to improve infrastructure so enable our clients access these facilities
otherwise we will be preaching to people to deliver at unreachable facilities.

Unlike in the developed world where a woman’s risk of dying during or following
pregnancy is 1 in 4,300, the risk of maternal death in Sub Saharan Africa is very
high at 1 in 31. According to the Kenya Demographic Health Survey (KDHS)
2008/9, 53 per cent of births are delivered at home with only 43 per cent at a health
facility. Maternal deaths are currently estimated at an average of 560 per 100,000
live births. Another 760 in 100,000 mothers in slums die during delivery. This
compares unfavourably against the 147 target set under the Millennium
Development Goals by 2015. This grim picture has leveraged the role of
technology in the provision of quality healthcare.

Immediate areas of intervention that can reverse maternal mortality and improve
women welfare in Kenya include policy engagement with the government and
improved legal environment that promotes the aspiration of the new Kenyan
constitution. There is a also a need to increase demand and utilization of health
facilities and as well as for skilled attendance for deliveries.

Roughly about 60% of the private and 40% of public institutions are using
electronic medical records. Unfortunately, these institutions do not communicate
with each other and this therefore is a disadvantage both to the physicians and the
clients as their records remain in the parent institutions. Even medical records at
the highest referral level the Kenyatta National Hospital is not 100% computerized
and also not integrated.
Professor Japheth Mati in a paper extracted from the Kenya Demographic and Health Survey of 2008/2009 showed that poverty was a major contributor to the wide disparities in maternal health outcomes in Kenya. He further was of the opinion that the attainment of Millennium Development Goals 5 will ultimately depend on the progress made in other social and economic goals is clear from data from selected maternal health indicators by household wealth status in Kenya. Poverty reduction measures, equitable resource allocation and especially empowerment of women, all came out as critical strategies and necessary preconditions for attainment of improved maternal health in Kenya.

The level of a woman’s education, a poverty related variable was also a proximate determinant of the poor maternal health outcomes in Kenya. Taking the example of skilled attendance at childbirth, the 2008-9 KDHS showed that the percentage of deliveries that were attended by a skilled attendant (doctor or nurse/midwife) was lowest among mothers with no education at all (19%) and it was slightly above the national average of 44% for women who had completed primary education (49%), and highest among those with secondary education and above (73%).

It will now be easier for pregnant women to deliver in hospitals without the pains of carrying hard cash, thanks to the introduction of mobile money transfer technology. Through a partnership programme with some hospitals, mothers in low-income areas who have no access to medical schemes and insurance can save money on the Changamka Smart Card, associated with a local firm Changamka MicroHealth Ltd.

In the convergence of the 3Ms (Mobile), — M-technology, M-money and M-health, expectant mothers can now top up prepaid cards with small amounts of money using M-Pesa technology a product of one of the leading mobile phone operators Safaricom. The system, also known as m-health, allows users to transfer money via M-Pesa to a prepaid smart card. The prepaid electronic smart card, known as Changamka (Swahili for "Get a life" or "Cheer Up"), enables the bearer to save and receive outpatient primary health care treatment at a pre-contracted price.

The initiative hopes to ride the deep mobile phone penetration estimated at 51 per cent to provide healthcare to underserved sections of the population. Out of 38 million Kenyans, mobile phone handsets are said to be in the region 19 million. So far, Changamka has distributed more than 10,000 smart cards specifically targeted at pregnant women. Through the programme, 1,000 women have received health
education in the country. The use of technology to improve access to affordable healthcare to millions of the working poor, is gaining momentum an needs to be scaled up fast to improve our statistics.

The introduction of a new smart card payment platform is a novel idea that has been embraced the world over.

Using two counties across the country like Siaya in Nyanza province and Kwale at the Coast provinces as pilots. I would do a baseline survey to get the actual numbers of women in the reproductive age-group served by the facilities in their area, the number of facilities that are using electronic medical records as well as those that need capacity building so as to move to electronic records use.

The official definition of smart card is "an integrated circuit card with memory capable of making decisions."

It is therefore a plastic card about the size of a credit card, with an embedded microchip that can be loaded with data, used for telephone calling, electronic cash payments, and other applications, and then periodically refreshed for additional use. It can describe chip card or integrated circuit card. Smart cards in addition have an Integrated Circuit (IC) Chip embedded in it. Smart cards are also known as IC cards and ICC cards. The amount of information can be stored in smart cards is much greater compared to magnetic stripe cards. Some of them can also be reprogrammed to add, delete or rearrange data.

In health care, smart cards are used in many high income countries toward generalized healthcare coverage and to support more government's laws to protect individual data privacy. The mobile nature of today's healthcare administration necessitates immediate information access and total flexibility. Smart cards technology can help to optimize portable solution for information access, management and improved communication among a variety of professionals involved in the healthcare administrations. Smart cards allow the information for a patient's history to be reliably and safely stored. Health care professionals can instantaneously access such information when needed, and update the content. Instant patient verification allows immediate insurance processing and refund. Doctors and nurses themselves can carry smart card-based IDs that allow secure, multi-level access to private information.
The first step is to equip the facilities with the bare minimum of hard and software and to build the capacity of the users in all points of service. Edutainment and public awareness campaigns will need to be conducted to inform the communities of the smart card availability, cost as well as use.

For areas where internet access is available, the facilities may even install a card reader that is web based.

The advantages of a Web based card system is as follows:-

- It records all transactions with the details of client
- List of care givers, health facility, contributions also entered here, types of treatment, who gave it and what drugs are dispensed at the pharmacy
- How much they were charged and how much is remaining in card
- An automated short message system will be sent to remind them the date for reviews
- For pregnant woman at high risk i.e. with high blood pressure, the system will reminds one to go into the facility at intervals for Blood pressure checks

Then it will need a lot of advocacy using health care workers as well as the provincial or county administration to spread the word to the community as well as involve men in the effort to enroll as many women.

Some of the messages that can be used are as follows:

- They can be readily purchased at a small fee and top up done with time
- They are reusable
- They allow for secure transactions off-line, reducing the cost for inline networks
- They give more security, thus reducing the risk of transaction fraud
- They are much more durable and reliable
- They allow multiple applications to be stored in one card.

The introduction of a 'true' smart card would be my proposal. This contains microprocessor which is implanted in the card along with memory. It has the capability to store information as well as make decisions about the data stored. The card is independent on the unit it is plugged in to so that it can work. The contact version of card would be useful as it has to be inserted into a smart card reader. This produces physical contact. The user then established identification via Personal Identification Number (PIN) or biometrics (using finger, eye, etc). He
chooses mode from a menu of options. Some minimal data entry may be provided. He confirms the action, and thus the task is complete.

The Ministries of Medical and of Public Health Services are currently analyzing the ways of scaling up the Social Health Insurance scheme after successfully piloting it in three rural districts namely Kitui, Kiambu and Kisumu as well as in two Nairobi informal settlements. The objective of the program is to provide subsidized high quality health care to a population of at least three million poor people. The initial three main target areas of the program are Safe Motherhood, Clinical Family Planning and Gender Violence Recovery Services. Termed the Output Based Aid (OBA) voucher system has not yet been scaled up but in the few areas that it is used there are threats of abuse by a few who can actually afford to use the private institutions.

**The smart card Technology program**

**Goal of Program**
To improve the overall maternal and infant morbidity and mortality rates in Kenya.

**Specific Objectives**

- Increase access to reproductive health services especially skilled attendance at birth for women in Kenya.
- Reduce maternal mortality in vulnerable groups in the two counties-Siaya and Kwale as the initial pilot centres.
- Develop and test the effectiveness and acceptability of new smart card for followup of antenatal mothers upto their delivery at the health facilities.

The initial investments may be high but the cost benefit analysis will make this program worth every coin.

The community will be informed of the disadvantages a few of which are user dependant i.e. :-

- Fees applied with the use of a card
- It gives liability issues if stolen or lost
- The accuracy of information is small
- Lack of technology to support users
• It is potential for too much data on one card if lost or stolen
• Security - It is a potential area for computer hackers and computer viruses as well as individual users perceptions of security
• Card readers are costly. Companies are creating new pocket readers and others are considering adding readers to keyboards

The outcome of the intervention is that more mothers lives will be saved. This directly translates to healthier infants and more children living beyond their 5th birthday as compared to orphaned children. The family is the basic unit of the society and the mother is crucial to achieve this.

In Kenya, progress has been inadequate in almost all other indicators. As stated above, the causes of maternal deaths, and how they can be prevented are not new. We know what interventions work and which do not; what appears to be the main barrier is the lack of commitment to act; to prioritize reduction of maternal mortality, and to reflect this in resource allocations to the health sector, and to maternal health services, in particular. From available evidence it is obvious that MDG5 cannot be achieved without emphasis on equitable expansion of access to basic services for all.

Standardization in smart cards technologies are required to make sure that cards and card-accepting devices are made to identical specifications. This ensured that cards manufactured in one part of the world can be acknowledged by a device in another part of the world.

1 Gok/Measure/ Macro (2008/9) Kenya demographic health survey
2 Africa Health Dialogue- What’s in the way of achieving improved maternal health in Kenya?
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