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Editors

1. Dr Christopher Maghanga

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Foreword

Dear Authors, esteemed readers,

It is with deep satisfaction that I write this foreword to the Proceedings of the Kabarak University 8th Annual International Research Conference held between 22nd and 26th October at the Kabarak University Main Campus in Nakuru, Kenya. This conference focused on the thematic areas of computer, education, health, business and music and attracted a great number of paper and poster publications. The conference also featured workshops in the areas of blockchain and digital skills for business. The participation of developing academics, undergraduate students and graduate students was particularly encouraged in this conference.

In addition to the contributed papers, the conference featured a number of invited keynote and guest speaker presentations as follows;

- Mr John Walubengo, Dean Faculty of Computing at the Multimedia University of Kenya and a member of the Artificial Intelligence and Blockchain Taskforce.
- Mr Derrick Rono, Senior Systems Developer with Andela Ltd and our Kabarak University Computer Science alumni
- Mr John Karanja, Chief Executive Officer, Bithub Africa
- Ms Roselyne Wanjiru, Education Program Coordinator EOS Nairobi, representing Mr Daniel Kimotho, Community Lead EOS Nairobi
- Ms Rosemary Koech-Kimwantu, Legal and Regulatory Specialist at Oxygene Marketing
- Dr Julius Jwan, the CEO Kenya Institute of Curriculum Development
- Prof Ruth Otunga, Deputy Vice Chancellor, Academic Affairs, University of Eldoret.
- Dr Edward Nzinga, Senior Lecturer, Instruction and Curriculum Design Scientist, Pan Africa Christian University.
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- Prof Michael Kiptoo, CEO, Kenya Medical Training College.
- Dr Geoffrey Wechuli, Head, Department of Family Medicine, Kabarak University
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- Prof. Kimberly Carballo: Coordinating Opera Coach and Collaborative Piano, Jacobs School of Music, Indiana University
- Dr Evelyne Mushira. Deputy Director, Permanent Presidential Music Commission
- Mr Reuben Kigame; Renowned Gospel Artist and Founder of Sifa Voices International
- Ms Caroline Wanjiku, A renowned Comedian aka "Teacher Wanjiku"

I trust that these proceedings will provide researchers with an excellent source of new and relevant knowledge in their respective disciplines. We thank all authors and participants for their contributions.

Dr Moses M Thiga

Director, Research, Innovation and Outreach

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A Blood Pressure Monitoring Prototype for Preeclampsia Management in Antenatal Care in Kenya

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Abstract
Women health is a public health concern as it impacts the personal well-being and societal development. Globally, a significant number of women die as a direct result of pregnancy complications such as preeclampsia, among others. The condition is managed in developed countries where healthcare system complemented by advanced technology aids in blood pressure fluctuations. However, the situation in developing countries is not as supportive due to poor health systems and lack of affordable technology. The study sought to develop a blood pressure monitoring prototype for preeclampsia management in a developing country setting. A mobile application was developed and integrated with a smart wrist band to read real time data and send alerts to caregiver in case of an emergency and where data can be stored for analysis. Functional decomposition and rapid prototyping approaches were adopted during implementation, and prototype was taken through alpha test. This paper documents the features of the prototype and their potential in addressing preeclampsia in developing countries.
Keywords: Preeclampsia, Smart Wrist Band, Ante-natal Care, Mobile Application

Introduction
Women health is considered a big public health issue, impacting personal well-being, family reproduction, and society's development . Studies have shown that many women die yearly due to pregnancy cases as reported by , who showed in a year, nearly 350,000 women die worldwide as a direct result of pregnancy and childbirth, and for those who die, approximately 20 others suffer from pregnancy-related consequences. Another study showed that in India, out of the 28 million pregnancies that take place every year, around 67,000 women die of complications related to pregnancy and childbirth, about one million women are left with chronic ill health and about one million neo natal deaths happen showing similar situations persist in many other developing countries . This indicates that maternal health is a global healthcare problem affecting developing and developed countries alike. Pregnancy complications increase the risk of maternal and infant death, and are associated with adverse outcomes such as miscarriage, stillbirth, and preterm birth . Maternal health is a positive experience, however it involves suffering, ill-health and at some level death in large numbers. The major direct causes of maternal morbidity and mortality include haemorrhage, infection, high blood pressure, unsafe abortion, and obstructed labour.

Currently, there are maternal challenges that cause long term effects if not controlled such as preeclampsia that is caused by blood pressure. Preeclampsia conditions represent one in three cases of severe obstetric morbidity, while hypertension is the leading single identifiable risk factor in pregnancy associated with stillbirth. Preeclampsia is strongly associated with foetal growth restriction, low birth weight, preterm delivery, respiratory distress syndrome, and admission to neonatal intensive care . Mostly, blood pressure challenge doesn't cause signs or symptoms and pregnant mother should go to all prenatal care visits for check-up. To manage blood pressure levels, a pregnant mother should go for prenatal care check-ups even if she is feeling fine.

The burden of preeclampsia has been a major concern worldwide both in developed and developing countries making its prevention and management a major concern. Currently, there is no well-established measure for prevention of preeclampsia in the general population . In developed countries, preeclampsia community guideline, has been laid down, which involves: mothers to be offered referral before 20 weeks gestation for specialist input to their ANC plan if they have high risk, women with no risk of preeclampsia visit ANC care 7 times, while mothers with high risk are reviewed in the community at least once every three weeks before 32 weeks and at least once every two weeks until delivery for check-up of any symptoms of preeclampsia. Recommendations have been made for improving accuracy of blood pressure measurement . In addition, technology has brought great improvement of preeclampsia cause (blood pressure) detection.

In a study carried out in Kenya found out that maternal deaths due to preeclampsia are incredibly high with 14% of maternal mortality worldwide being due to hypertensive disorders of pregnancy with sub-Saharan Africa (Kenya) at 16% while United States, death due to preeclampsia is as low as 4.8%. This points out that there is a huge difference in the rates of maternal mortality and preeclampsia which is caused by different diagnosis and management of preeclampsia in Kenya and United States. When preeclampsia is left unmanaged it is likely to progress into eclampsia hence respiratory issues, acute renal failure, obstetric embolism, or maternal death occur.

To achieve the Millennium Development Goals (MDGs) and maintain better maternal health beyond 2030, researchers have critically examined new ways of using existing resources in the world to create improvements. Mobile technology infrastructure is one of the unprecedented technologies that are being adopted to increase access to health care and save lives of pregnant mothers. The growth of mHealth solutions to improve health outcomes is largely embraced due to its convenience, user friendliness, and relatively low cost of mHealth applications . In recent moments, sensor technology is an advanced technology that is being used to monitor maternal data. In addition, Internet of Things (IoT) technology in conjunction with modern sensor technologies such as RFID and ZigBee are currently being implemented for the success of automated tracking systems for patients, assets and records in a smart hospital environment .

The Problem
Kenyan government has greatly embraced Ante-natal care (ANC) in pregnant mothers through the beyond zero health care project in reducing pregnancy complications and foetus risks. However, major pregnancy complications are still being experienced such as preeclampsia among them which is caused by hypertensive disorder. When mothers attend ANC a blood pressure measurement is taken and minimum recommended number of ANC visits are four, which for many women is never a reality. Even for those who manage, it may never be feasible to closely detect hypertensive disorders within those four visits. Therefore, there is need of a

health care provider to receive timely and effective data about the pregnant mother. Globally, wearable devices have been developed that sense any danger from the mother and save the data for self-management. This real time data does not reach a caregiver who can analyse the situation at hand for the pregnant mother Therefore, there is need of a prototype that will send timely blood pressure measurement to the caregiver as well as an alert message when the measurement is over 140/90mmHg.

Literature Review

3.1   Preeclampsia in Pregnant Mothers

Maternal health refers to the health of women during pregnancy period, childbirth and the postpartum period. Although motherhood is a positive and fulfilling experience in the society, it is associated with suffering, ill-health and even death in some women leading to maternal morbidity and mortality.

The importance of maternal health care is very vital factor in human aspect in the world since a healthy child needs a healthy mother. Studies have also shown that at least 20% of the disease burden in children under 5 is related to problems in maternal health during pregnancy. Moreover, according to , a baby whose mother dies during childbirth is less likely to survive, and children who lost their mothers are 10 times more likely to die within two years of the death of their mothers. This shows how critical is the matter of maternal health.

The World Health Organization (WHO) recommends a minimum of four antenatal care (ANC) visits . The WHO pictures a world where every pregnant woman receives quality care throughout the pregnancy period. Antenatal care in the period of positive pregnancy, it provides a platform for important health-care functions, such as health promotion, screening and diagnosis, and disease prevention which with effective implementation of ANC visits can save and improve lives. The ANC practice also, provides the opportunity to communicate with and support women, families and communities at a critical time in the course of a woman's life. However, global estimates indicate that only about half of all pregnant women receive this recommended amount of care .

According to WHO's report , the major direct causes of maternal morbidity and mortality are: haemorrhage, infection, high blood pressure, unsafe abortion, and obstructed labour. In a report by , in the year 2015, it was estimated that 303 000 women died from complications related to pregnancy or childbirth due to haemorrhage, infection, unsafe abortion, and eclampsia (very high blood pressure leading to seizures), or from health complications worsened in pregnancy in low-resource settings. The report showed that in all these cases, unavailable, inaccessible, unaffordable, or poor quality care is fundamentally responsible.

According to , the primary causes for the high maternal and neo natal deaths have been identified as delays such as: delay in recognizing the problem and seeking care take place due to the lack of awareness of danger signs, inaccessible health facility or lack of resources to pay for services and medicines; delay in reaching the health facility due to unavailability of transport or lack of awareness of appropriate referral facility in the region and; delay in receiving treatment once a woman has arrived at the health centre due to inadequate health facility, lack of trained personnel or emergency services. These are the same delays that will probably occur to a woman with blood pressure issue especially for those in semi settlement areas. The two authors found out that requirement for elimination of delays are a combined approach of data collection, data correlation and data presentation to assist caregivers in delivering high levels of patient care, and

also to empower individuals and their families for self-care and health management thus presented a low cost mobile handheld based decision support system.

According to a study by , worldwide, half a million women die each year as a result of pregnancy or childbirth and 99% in developing countries. Huge number of these pregnant women experience pregnant-related morbidity hence causing severe consequences that can be avoided through information and better monitoring. Clinicians report that the main cause of death for pregnant women is linked to nonattendance or late arrival in a health service due to distance, lack of transport, poor quality of primary health care services, poverty, lack of information or education, and women's social status.

Hypertensive disorder being one of the causes of maternal mortality in pregnant mothers, during ANC visits, a mother is checked on blood pressure level fluctuation. According to a study by, hypertensive disorders represent major causes of pregnancy related maternal mortality worldwide which was estimated to occur in about 6–8% of pregnancies. Moreover, in low-income and middle-income countries, preeclampsia and its convulsive form, eclampsia, are associated with 10–15% of direct maternal deaths. Preeclampsia is being a pregnancy-specific disorder is characterized by hypertension of greater than or equal to 140/90 mm Hg .

In Kenya, the case is not different from other developing countries. According to a report , the maternal mortality ratio, the number of women dying of pregnancy-related causes, stands at 488 deaths per 100,000 live births which ranks Kenya among the 10 most dangerous countries for a woman to give birth in the world. UNPF reported that maternal mortality is caused by challenges such as: limited use of skilled care, inadequate skills among health care providers and low health facility coverage. In a study carried out in Kenya showed that late presentation by pregnant woman in the event of a complication, combined with poor quality care, contributes to high levels of maternal and perinatal mortality and severs morbidity . This study found out that awareness is a major structural variable that could influence decision of women to get health care services thus affecting quality of free maternal health services in Kenya. A study carried out in Central Kenya showed that, the direct causes contributed to the majority deaths included haemorrhage, infection and pre-eclampsia/eclampsia showing preeclampsia/eclampsia caused 12% of maternal deaths in the period between 2008 and 2012 .

There have been strategies that have been laid to detect blood pressure fluctuation. Blood pressure measurement can be possible with the help of two different techniques which are Auscultatory technique and Oscillometric technique. In Auscultatory technique is listening of korotkoff sound which gets created by body during the blood pressure measurement with the help of stethoscope while the correct measurement depends on cuff size, wrapping technique and release of the pressure. The oscillometric technique depends on measuring oscillation signals in the cuff which is quite easy and automated technique, and more accurate than that of oscillometric technique (Holey &Bhosale, 2016).

Another study carried out on arm-band wearable device for blood pressure in pregnant mother recommended that ongoing researches on patient monitoring system should focus on ensuring systems are more compact and easily available at affordable price. New technologies could also enhance the performance the new systems. This indicates that less has been done on wearable device acceptability due to compatibility and affordability issues.

In recent times, there have been technological improvements that make IoT a reality such as wireless communications, low power processors, and electronic devices. With visualization of IoT, every single entity on Earth can be identified, addressable, controlled, and monitored via Internet. The wide dissemination of IoT paradigm has shown its potential to produce a

considerable impact in the daily lives of human beings which has been increasingly employed in applications from several real-world domains, such as domotics, ambient assisted living (AAL), energy, transportation, and environmental and urban monitoring .

In health sector, remote monitoring to patients incorporates digital mobile applications that involve provision of care to patients in terms of medical conditions that can be supervised, frequency to be supervised and whether they should be supervised real-time or periodically. Remote supervision is the supervision of a medical task from a remote setting, giving diagnosis to the patient without the patient being present physically. When medical monitoring is complete, a guidance on whether the patient requires immediate attention by the doctor is released through a monitoring device. According to , remote patient monitoring technologies are safer, more effective monitoring of health and safety among older adults, control visits to hospitals with an objective of addressing cost, decongestion issues, geographic challenges, geriatric conditions and lack of mobility.

Methodology

This study used experimental design that was carried out in six steps: conception: which researcher decided what to learn and define goals, design: which involved translating of identified objective into formal question, preparation: which involved readying the subjects for application of the treatment, execution: where the experiment was executed. Analysis stage: which involved review of measurements to ensure were valid and useful and also analysis of data to tell if research questions are answered. Lastly, dissemination and decision-making stage: which involved documentation of conclusion and any other key aspects of research .

Functional decomposition approach for system analysis and design was also used to help in development for guiding the application. Functional decomposition focuses on the functions and sub-functions that a system needs to perform and the interfaces between them.

Results

5.1 Implementation of Blood Pressure Monitoring Prototype

Blood pressure monitoring prototype for preeclampsia management was implemented in the following components.

Pregnant Mother: This is the pregnant mother who was the subject of the study.

Smart wrist band: It consists of an integrated chip for sensing, recording, and displaying real time data on the screen.

Cloud Transceiver and simulator: after the smart wrist band reads the real time data, the data is then send to transceiver device which is a smart phone that is connected to smart band via Bluetooth connectivity. The smartphone is installed a Blood pressure monitoring mobile application that was developed specifically for pregnant mothers.

Blood Pressure Monitoring Mobile Application: This mobile application consists of two modules: Pregnant Mother and Care Giver modules. Pregnant mother module stores details which are: Mother Name, Identification number, Mother image Date of Birth, Height in centimetres, Weight in kilograms, Pregnancy start date, expected delivery date, gestation stage in weeks, and Blood Pressure History.Care giver module consists of Care giver name, medical Identification number, Gender, care giver image, view list of pregnant mothers, Search new pregnant mothers, and alerts history.

Cloud Data center: The mobile application is synchronized with a firebase database that keeps all records. Data is shared thiscentralized database in which it is properly analyzed for statistics and in-depth knowledge of the level of blood pressure of the pregnant mother. It has the function to

check if the records of blood pressure exceeds normal, if so an alert message is sent to care giver's smartphone for further action.

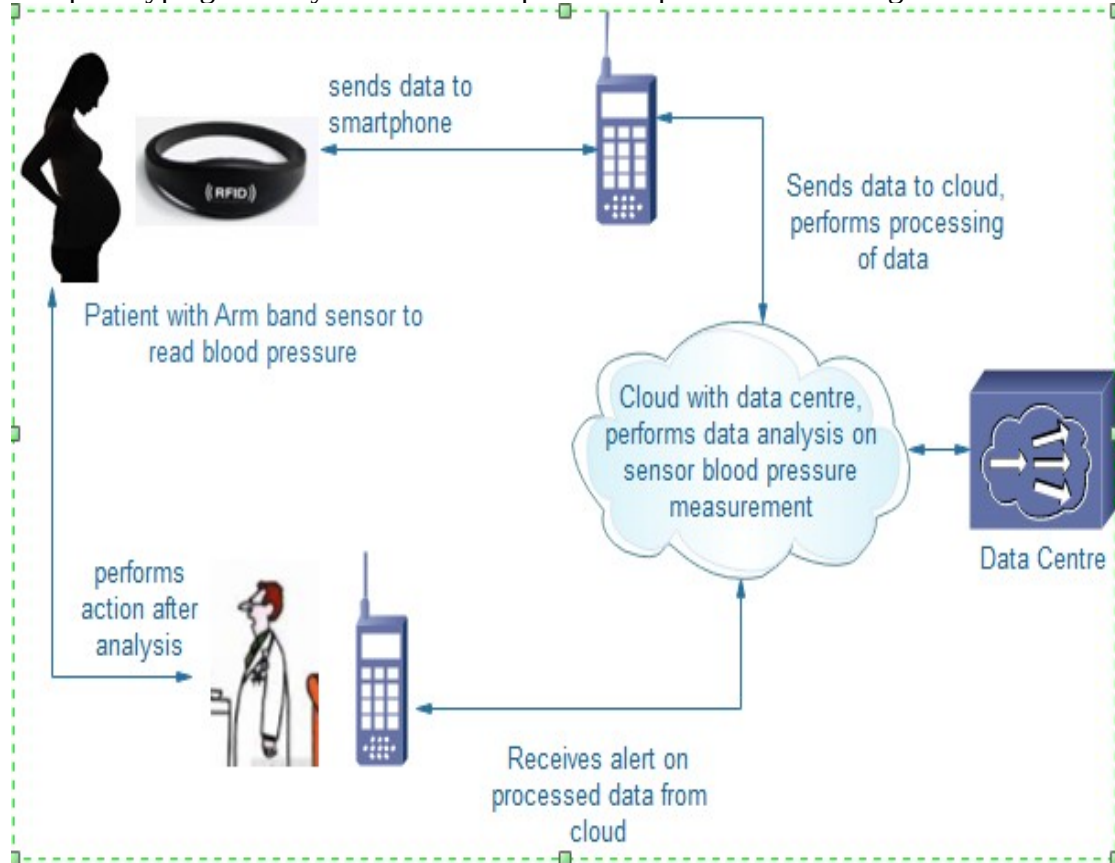The prototype guided by the above components is presented in the figure shown below:

Figure 1: A Blood Pressure monitoring architecture for preeclampsia management

5.2 Blood Pressure Monitoring Mobile Application

The proposed blood pressure monitoring mobile application was implemented to provide solution to preeclampsia management during antenatal care. The following are design modules that were adopted during implementation.

User authentication and security

The prototype has ensured that all users are registered before allowing them to access any of the system functionality. The login details are username/email and password as shown in the interface shown in figure 2.
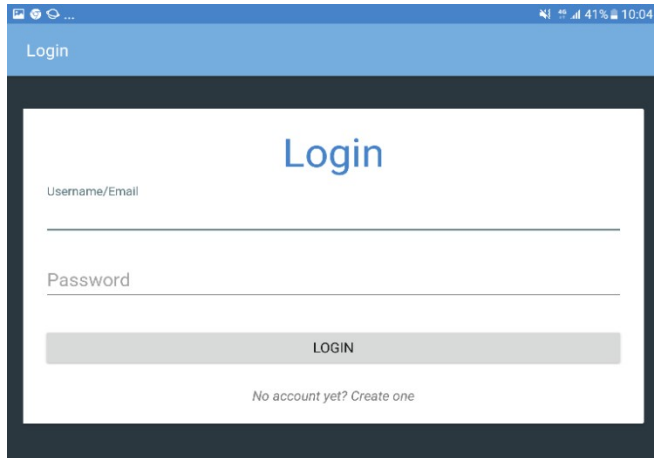
Figure 2: A Login interface of BP monitor app

User registration

All users will be required to register prior to accessing any of the system functionality as shown in figure 3 below. For pregnant mother the details include: name, Medical ID, Date of Birth, Height in centimetres, weight in kilograms, pregnancy start date, expected delivery date. The system automatically updates the gestation weeks of the pregnant mother. For Caregiver the details include: name, Medical ID, and Gender.
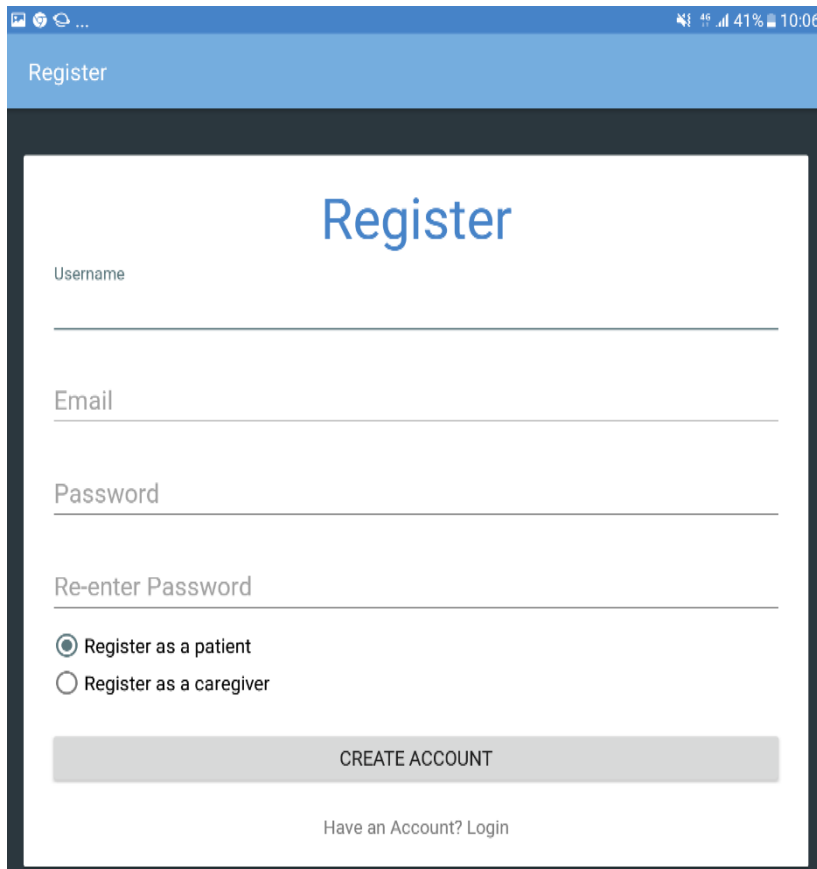

Figure 3: A Registration interface of BP monitor app

Pregnant mother as a user

Once the smart wrist band is connected to a mobile application using Bluetooth connection, then a pregnant mother can take a reading when the smart wrist band is fixed at handby clicking take a reading from the BP monitor app. The data will be displayed on both the smart wrist band and on mobile application interface. The mother can also access history of readings of blood pressure measurements taken, manage the device, and view the caregiver details as shown in figure 4 shown below.
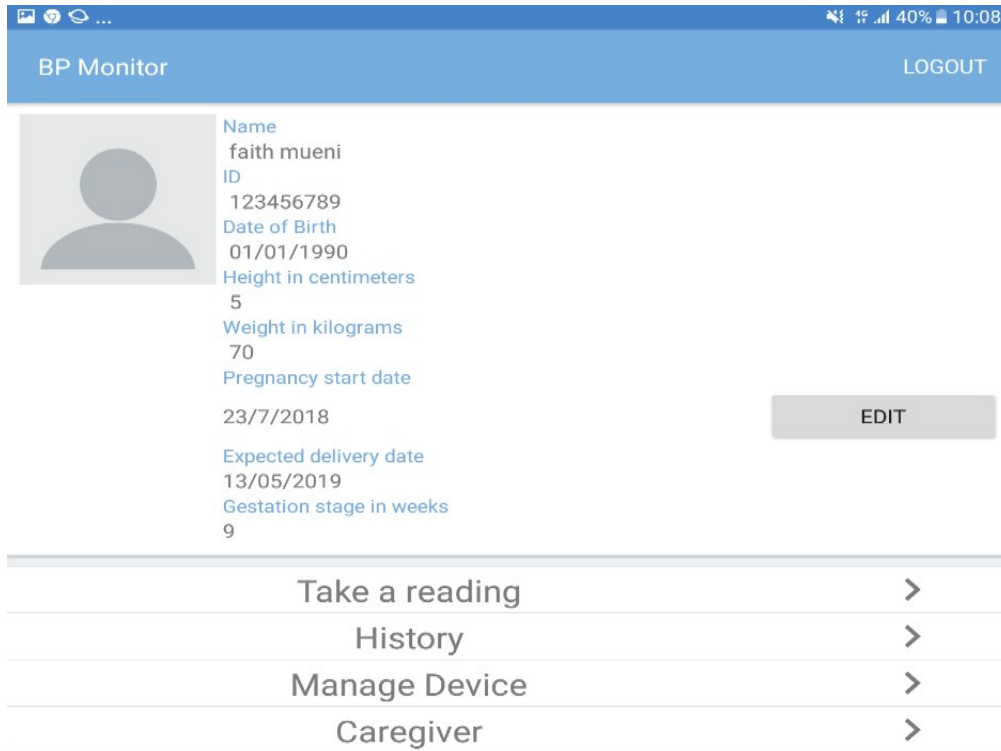

Figure 4: A Pregnant mother interface of BP monitor app

Caregiver as a user

Once the caregiver has registered to the application, there are several functions that he/she canwhich include: Finding the patient; where the application displays the pregnant mothers who are registered and are not attached to the caregivers. My patients; where caregiver can view all pregnant mothers is connected to and can also remove them from the list as shown in figure 5 below. Alerts; which allows caregiver to view any sent alert when the patient's blood pressure exceeds normal.
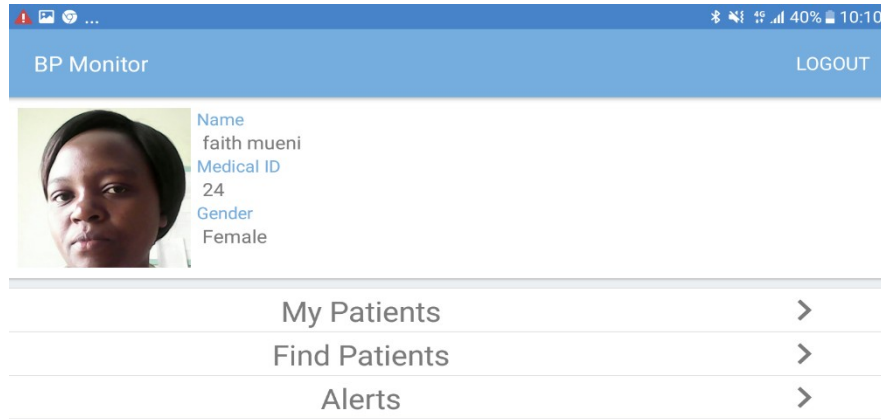
Figure 5: A Caregiver interface of BP monitor app

Discussion

In Kenya, little has been implemented in Health sector concerning mobile application and internet of things technologies which the proposed prototype is focusing on in order to bridge the gap. Currently, a pregnant mother who is in rural settlement, mostly attends ANC clinic four times during her gestation period which is then difficult for a caregiver to know her blood pressure fluctuation that leads to preeclampsia. With the help of this proposed prototype, it will be easier for a caregiver to know real time blood pressure readings for the pregnant mother at any given time and take an action when the caregiver receives an alert showing high blood pressure readings. Therefore, the proposed prototype will help enhance in managing of high blood pressure condition in pregnant mothers in Kenya. There are challenges that might be faced during the adoption of the system in Kenya, such as the affordability of the smartphone and smart band and creation of systems awareness to the pregnant mothers from rural settlement in Kenya.

Recommendations

The paper recommends the following to enhance knowledge in the field of Health informatics. An evaluation should be carried out to ensure acceptance of the prototype by the pregnant mothers and their family members. There should be a creation of awareness for the proposed prototype in preeclampsia management.

Conclusion

The prototype presented in this paper manages preeclampsia condition by use of a smart wrist band and a blood pressure monitor mobile application. The system keep vital information concerning the pregnant mother and caregiver. It has gone further to send an alert message to care giver when the blood pressure measurement exceeds 140/90mmHg for an action to be taken.

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Prevalence of Postpartum Depression among Mothers Attending Nakuru Level 5 Hospital, Nakuru County Kenya

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Abstract

Postpartum depression (PPD) is a non–psychotic mood disorder that can affect women during perinatal period. The World health organization has identified major depression as the fourth leading cause of burden of disease and years lived with disability which has currently been identified as an international public health concern. Globally, the statistics of postpartum depression is at 10-20%, however, this prevalence varies depending on the demographic regions from 0% in Singapore to 57% in Brazil. Despite postpartum depression being categorized as the fourth leading cause of burden of disease, not so many research has been conducted to determine the burden in our region, moreover little emphasis has been placed in mental health, hence not meeting health care needs as defined by the WHO in order to reduce maternal morbidity and mortality thus this research sought to identify the prevalence of postpartum depression among mothers attending Nakuru level five hospital. The research study design was a descriptive study design that was carried out among mothers seeking perinatal clinic services inNL5H. The study participant were identified using systematic random sampling in order to identify 381 study participants, where data was collected through researcher administered questionnaire which comprised of a screening tool. The mothers who scored above 13 points on the scale were considered to have postpartum depression. 381 study participants were recruited for the study where 43 study participants were screened positive for postpartum depression at a prevalence of 11.3% where only 32% were aware of PPD and 2% were ever screened previously of PPD. Conclusion this study shows that the prevalence obtained in Nakuru Level 5 hospital is 11.3% which is comparable to the prevalence found in Kenyatta National hospital at 10.6%, the researchers noted that there was low level of awareness on PPD regarding the condition and the different screening tools and very few participants were screened.

Key words: Postpartum depression (PPD), Edinburgh Postnatal Screening Tool (EDPS)

Introduction

Postpartum depression is a non-psychotic mood disorder that occurs after childbirth, it affects one in eight women. Women who experience PPD have intense depression with the following symptoms: feelings of anger, cry more than usual, withdraw from their family, distressed and detached from baby, worry that they may injure their baby and feel guilty about not being a good mother (CDC, 2016). The WHO has classified postpartum depression in ICD-10 under the category of mental and behavioural disorders associated with puerperium as depression with postpartum onset that occurs within 6 weeks of delivery (Epocrates 2016).

The prevalence of PPD is estimated to be at 10 - 15% globally, (WHO, 2017), however the prevalence ranges from 0% in Singapore to about 57% in Brazil, (Lanes, *et al.* 2011). Current

literature suggest that the perinatal mental disorders which includes postpartum depression, is high in low and middle income countries and is estimated to range at 18.6%, this prevalence was reported after a systematic review of 47 studies in 18 countries, (Upadhyay, 2017). In Africa, the prevalence is estimated to between 10% to 28% , however this varies depending on the regions. In Kenya a research done by Mwikali in 2013 indicated a prevalence of postpartum depression at 10.6% among mothers at six weeks attending Kenyatta National Hospital.

This study sought to determine the prevalence of post-partum depression among mothers seeking health care at Nakuru County Level Five Hospital through screening, which provided the burden of postpartum depression of Nakuru County and the level of awareness of postpartum depression.

1.1 Statement of the Problem

The Government has linked up with various partners with the aim of reducing maternal mortality rate by focusing on maternal health care. This has led to the standardization of health care practices in all the health care facilities, however, little emphasis has been placed on the emotional and the psychological aspect of the mother, whereby, many cases of PPD go undetected and if they are detected they remain untreated, therefore, the health needs as defined by the WHO are not met. Hence this study has assessed the prevalence of postpartum depression and identified the level of awareness on PPD among postpartum mothers attending NL5H.

1.2 Objectives of the Study

To determine the prevalence of post-partum depression among postpartum mothers attending perinatal clinic services at Nakuru level five hospital.

To determine level of awareness on postpartum depression among postpartum mothers attending perinatal clinic services at Nakuru level five hospital.

Literature Review

2.1 Introduction

PPD is a chronic, debilitating psychological condition that affects women during postpartum period to one year after childbirth. It is characterized by reduced quality of life, costly treatment and management with increased risk of numerous life threatening events and complications, (Dennis &Dowswell, 2013). The World Health Organization has identified major depression as the leading cause of years lived with disability and has ranked it as the fourth leading cause of burden of disease, currently identified as an international public health concern, (WHO, 2012).

2.2 Prevalence of PPD

PPD is rated as one of the most increasing epidemics globally with current statistics at 10 –20 %; it is estimated to affect a minimum of 1 among 8 mothers in a year (WHO, 2016). The World Health Organization indicates that globally 10% of pregnant women experience PPD while 13% experience PPD after child birth, (Fisher*et al.,* 2013), however, figures are greater in developing countries where 15.6% of women suffer from PPD during the antenatal period while 19.8% experience PPD after childbirth, (Rahman*et al.,* 2013). In Africa, prevalence rate ranges between 10% to 28% , however higher prevalence as high as 60% has been reported in other regions (Fitelson*et al.,* 2011). The variation of prevalence in Africa has been reported as follows: In Nigeria, prevalence of 22% (Tungchama et al., 2018), Cameroon prevalence of 23.4% (Adama*et al.* 2015), South Africa prevalence of 27% and 50% was reported (Stellenberg& Abrahams, 2016). Sudan reported a lower prevalence of 9.2% (Khalifa et al., 2016) and Tanzania reported a prevalence of 12% . In Kenya prevalence of 10.6 (Mwikali, 2013) and 13.5% has been reported.

The variability of the prevalence rate in the region has been attributed to: different socioeconomic status and the determinants of health care, (Stuart-Parrigon*et al.*, 2014), cross cultural variables, different reporting styles, difference in perception of mental health and its stigma, biological vulnerability factors and different in social economic environments i.e. poverty, levels of social support nutrition and stress, (Rahman*et al.,* 2013). The National Institute of Mental Health has indicated that the disease burden is greater in mothers who had already experienced PPD in their previous pregnancy with a likelihood of 20% to 25%, (Field, 2010) which concurs with consistent evidence by most researchers, (Robertson *et al*., 2004). Statistics have also shown that 40-67% of PPD cases begin during the first 12 weeks postpartum, 30-70% of the affected mothers may suffer from PPD for more than a year, (Thurgood, 2009).

2.3 Screening tool

There are several diagnostic tools that have been developed to diagnose post-partum depression, the commonly used tools include: Edinburgh Postnatal Depression Scale (EPDS), (Cox *et al.,* 1987), the Nine-item Physician's Health Questionnaire (PHQ-9), (Hunusa, 2008), and the Postpartum Depression Screening Scale (PDSS), (Beck *et al.,* 2001), however the most widely used epidemiologic screening tool is the Edinburgh Postnatal Depression Scale (EPDS) due to its extensive validation, simplicity with good validity and reliability, moreover, this tool is highly recommended due to the inclusion of anxiety symptoms which is a prominent feature of perinatal mood disorder hence increases its specificity for perinatal depression (American College of Obstetricians and Gynecologists 2015). The latest scale validation of the EDPS tool was done by Connor et al, 2016 who reported that the tool has a high sensitivity of 67 – 100%% and specificity of 87-99%%, (O'Connor et al 2016).

Methodology

The study design was a cross-sectional descriptive study design that sought to determine the burden and level of awareness of postpartum depression among mothers attending clinic services at NL5H. The target population were all postpartum mothers seeking postnatal and child welfare clinic services in NL5H. The entry point for the study participantswassix to eight weeks. The study population was drawn from the accessible population from the mothers seeking perinatal clinic health services in the hospital. All mothers who were within six to eight weeks postpartum, those who were 18 years and those who gave written consents were included in the study whereas those below eighteen years, consent was sought from their guardian, however, mothers with previous mental illness, non-consenting mothers, ill mothers, and mothers who were not within the six weeks postpartum period were excluded from the study. A systematic random sampling was done among the accessible population to identify 381 study participants.

The data collection technique was a researcher administered semi-structured questionnaire with both closed ended and open ended questions. The tool incorporated questions that sought to identify the sociodemographic data factors, the level of awareness and an EDPS screening tool to screen the postpartum mothers on PPD. The screening tool consisted of 10 items where the response categories were scored as 0, 1, 2 and 3 this was dependent on the severity of symptoms. The total score was obtained by adding the scores on each item and mothers who scored 13 or more on the EDPS were screened as positive tests for PPD. Focus group discussion guide was used on the respondents to elucidate some information that might have been left out in the questionnaire. Key Informant Guide was used to get information from the health care providers on the awareness of PPD and familiarity to the screening tool. A pre-test was done on the data collection tool in a similar population in order to identify the overlooked constraints in the applicability and the validity and reliabilityof the tool. The pre-test was done at Kabarak Health

Centre using 10% of the study population, 40 mothers, where the comments and suggestions concerning instructions, clarity of the tool and were taken into consideration to improve the tool before the actual study.

Ethical approval was sought from Kenyatta university Ethical review Committee, a research permit was obtained from National Commission for Science, Technology and Innovation (NACOSTI), and permission to conduct the study was sought from Nakuru County Health and Education administrators and the medical superintendent of NL5H. Participation by the study participants was voluntary for those who met the eligible criteria; the eligible mothers were be informed about the research, and were reassured of their anonymity and confidentiality through coding rather than the use of the participants name and those who gave consent were provided with a written consent form to sign whereas those under 18 years permission was sought from their guardian. All research assistants were required to adhere to the required code of conduct regarding the study.

Results

Sociodemographic Characteristics

A total of 381 subjects aged between 10 to 49 years were interviewed. Even though the inclusion criteria included patients above 50 years, the researcher did not find any subject in this age bracket during the study period. The mean age of the respondents was 23.8 years whilst the median age was 24.0 years. Of the total respondents, (N=381), majority were married (78.7%) while 2.4% were divorced, most of the study participants had achieved secondary education whilst only 3.7% had no education, (see Table 1).

Table 1: Sociodemographic Characteristics

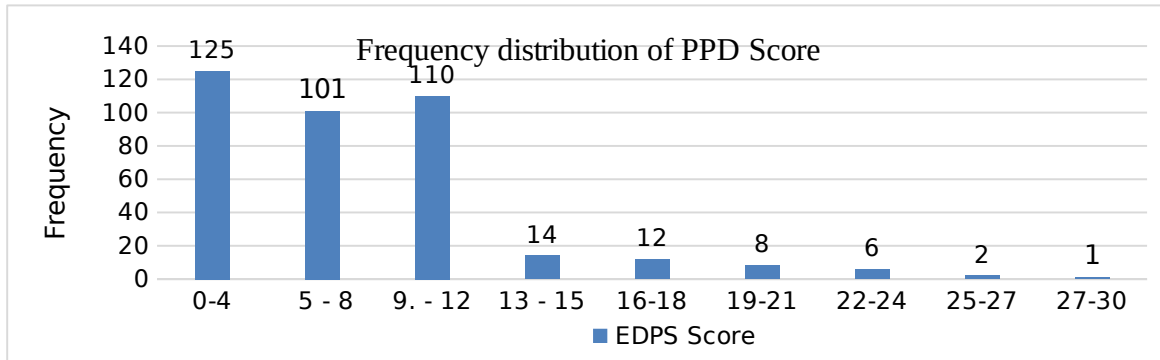| Demographic variables	Frequency (n=381)	Percentage (%)
10-19	29	7.6
20-29	226	59.3
30-39	119	31.2
40-49	7	1.8
50-59	0	0.0
60-69	0	0.0
Marital Status	Frequency (n=381)	Percentage (%)
Single	72	18.9
Married	300	78.7
Divorced	9	2.4
Education status	Frequency (n=381)	Percentage (%)
None	14	3.7
Primary	110	28.9
Secondary	155	40.7
Tertiary	102	26.8

Prevalence of Post-partum depression

Figure 1: Prevalence of Postpartum depression

Using the Edinburgh Postnatal Depression Scale, A patient who scores 13 or more is considered to have PPD. In the current study 43 (11.3%) of the respondents, scored above 13.

Level of awareness and Screening of Post-Partum Depression (PPD)4
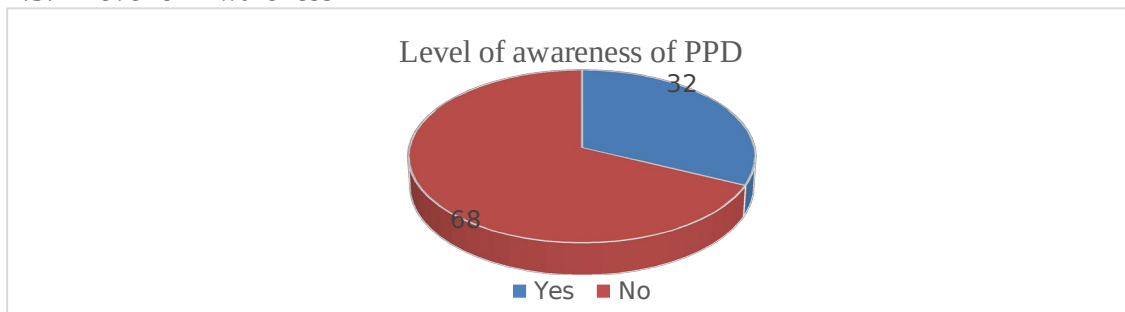
4.3.1 Level of Awareness

Figure.2 Level of awareness of PPD

Thirty two percent (122) of the mothers responded that they were aware of PPD whereas sixty eight percent (259) did not know what PPD is.
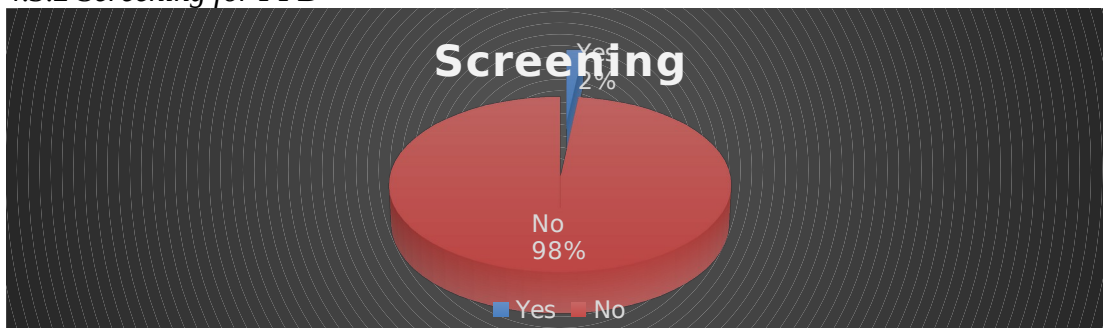
4.3.2 Screening for PPD

Figure 3: Screening for PPD

It was noted that only 2% (7) of the respondents have ever been screened for PPD whilst 98% (374) of the mothers were never screened for PPD.

Discussion

A total of 381 mothers were identified, of the respondents reviewed (59.3%) were young mothers aged between 20-29 years with a median age of 24.5, who all had a minimum of secondary level education, and thus, this indicates a well-received health education as young mothers are attending perinatal clinics (Table 1).

The prevalence of PPD is estimated to be at 10 - 20% globally, (WHO, 2016), however, the prevalence rate in developing countries is estimated to be higher than that in developed

countries, majorly due to the little emphasis placed on post-natal care and mental health issues. In Africa, the current literature places the average prevalence of PPD between 10% to 28% . In the present study 11.3% of the respondents were found to have postpartum depression. This was after they scored 13 points and above in Edinburg Postpartum depression scale. These results concurs with the previous studies done at Kenyatta National hospital which reported a score of 10.6% and in Kariobangi, Nairobi at 13.5% . Variations in the prevalence of Post-natal depression from different countries has been well documented in literature as presented in Table 1.

Table 1: Global Prevalence of Post-partum Depression

Country	Author	Prevalence
Nigeria		22%
Sudan		9.2%
South Africa		27%
Tanzania		12%
India		20%
United states		11.5%
Kenya (Current study)	**(Tuitoek*et al.* 2018)**	**11.3%**

These variations in the prevalence of Postpartum depression may have been attributed several variables such as cultural practices may also have a significant influence in the mental health of the mother. For instance, some tribes insist on the mother and the new born keeping inside the house exclusively for three months postpartum without contact with outside world, this may lead to PPD . The different use of postpartum screening tools and post-partum period which the study was done may also give varying results as screenings done 2 weeks post-delivery would give different results compared to screenings done 7 weeks postpartum . For instance in the current study, PPD screening was done at 6 – 8 weeks postpartum whilst studies done in Nigeria and South Africa was done between 3 to 12 months Post-partum.

The apparent positive influence on education among young mothers was observed as the respondents aged 20-29 had secondary level of education and above. However, majority (68%) of the current respondents were not aware of post-partum depression (Figure 2). This may be attributed to the confusion between PPD and postpartum psychosis. Some mothers specifically had not heard of PPD but were able to explain the symptoms consistent with post-partum psychosis which includes anxiety, irritability, delusions paranoia and loss of inhibitions immediately after birth . There was no statistically significant correlation between the lack of awareness of PPD among expectant mothers and the level of education (p=0.13).

Despite 32% being aware of postpartum depression, only 2% (7) were ever screened for PPD in their previous pregnancy at a different hospital (Figure 3), however, none of the screened respondents were found to have postpartum depression. The minimum uptake of PPD screening, may be attributed to the lack of availability of screening tools in facilities, the increased workload of health care workers in the perinatal clinics and also because of the little emphasis being placed on mental health where all focus shifts to physical health and the health of the new-born.

Conclusion

This study shows that the prevalence obtained in Nakuru Level 5 hospital is 11.3% which is comparable to the prevalence found in Kenyatta National hospital at 10.6%, the researchers noted that there was low level of awareness on PPD regarding the condition and the different

screening tools and very few participants were screened.This research recommends more focus on mental health, raise mental health awareness and introduction of postpartum depression screening tools in perioperative clinics. Further research should be done on early detection of PPD.

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