

**A SURVEY ON KNOWLEDGE, ATTITUDE AND PRACTICE REGARDING
CARDIOPULMONARY RESUSCITATION OF PREGNANT WOMEN
AMONG ANESTHESIOLOGY AND OBSTETRICS REGISTRARS IN
KENYATTA NATIONAL HOSPITAL**

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**A DISSERTATION PRESENTED IN PART FULFILLMENT OF THE
REQUIREMENTS FOR THE AWARD OF A MASTERS DEGREE IN
ANESTHESIOLOGY, UNIVERSITY OF NAIROBI.**

2012



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DECLARATION

I declare that this research thesis is my original work, and to my knowledge, has not been submitted for a degree award in this university.

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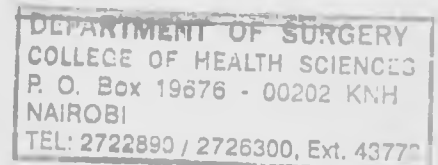
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DEDICATION

This thesis is dedicated to my parents Mr. Davis Kivungi and Mrs. Ruth Kivungi who have inspired, encouraged and walked with me right from childhood.

My husband and friends for their continued support during the training period.

ACKNOWLEDGEMENT

Sincere appreciation goes to my supervisor Dr Mark V Gacii and Dr C. Mwangi for their guidance in the formulation of my thesis, Dr Chokwe for his tireless effort to ensure that we all succeed and to my post graduate colleagues.

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ABBREVIATIONS

A-B-C	Airway Breathing and Circulation
ACLS	Advanced Cardiac Life Support
AHA	American Heart Association
BLS	Basic Life Support
C-A-B	Circulation, Airway and Breathing
CPR	Cardiopulmonary Resuscitation
C/S	Cesarean section
CEMACH	Confidential Enquiry into Maternal and Child Health
ECG	Electrocardiogram
KNH	Kenyatta National Hospital
Obs/Gyn	Obstetrics & Gynecology
UON	University Of Nairobi

1.0 SUMMARY

Background

Kenyatta National Hospital is the largest of the two main level 6 (National Referral Hospital) health facilities in Kenya. It has one labour ward, with a bed capacity of twenty six. Though it is supposed to handle referrals mainly from public and sometimes private hospitals, it handles more walk in patients than referrals. Most of the times the hospital is not forewarned of the referrals so as to get prepared. Some of these mothers may require CPR (Cardiopulmonary Resuscitation) at some point during their management. Resuscitation of these mothers is done by a team consisting of obstetrics and gynaecology registrars (postgraduate students undertaking their masters degree) nurses and sometimes the anesthesiology registrars.

Objective

The objective of the study was to assess knowledge, attitude and practice of CPR of pregnant women among anesthesiology and obstetrics registrars.

Methods

It was a cross-sectional descriptive study was to assess knowledge, attitude and practice of CPR of pregnant women among anesthesiology and obstetrics gynaecology registrars. The target population was all anesthesiology registrars (n=26) and all Obstetrics Gynaecology (n=59). A pretested questionnaire was used to collect data which was then be analyzed using Statistical Package for Social scientists (version 11.0; SPSS, Chicago, IL)

Results

78 (97.5%) felt training on resuscitation of pregnant woman was important. More than 51.2% of the registrars felt they were more than 50% knowledgeable. It was observed that resuscitation of pregnant women in KNH was done by obstetrics registrars covering the floor with the help of nurses and sometimes requested for assistance from the anesthesiology registrar on call. Majority of the anesthesiology registrars 20 (80%) felt that the team leader should be the Obstetrics registrar while majority of the Obstetrics registrars 51 (93%) felt that the anesthesiology registrar should be the team leader. 13 (15%) of the registrars felt that resuscitation was not necessary in some conditions. Majority (6) felt that resuscitation was not necessary in cases of prolonged cardiac arrest. Lack of equipment 62 (77.5%), lack of knowledge 52 (65%) and lack of team work 45 (55%), were graded as the major factors affecting CPR respectively. Anesthesiology registrars felt supine position was inappropriate for a pregnant woman and should instead be placed in the left lateral position to avoid aortocaval compression by the gravid uterus.

More than half of the obstetrics registrars (58.2%) practice was in keeping with what the first responder should do according to the 2010 Algorithm on maternal cardiac arrest CPR. Anesthesiology registrars consider defibrillation to be an important part of resuscitation compared to the obstetrics registrars. 3 (5.5%) of obstetrics registrars would not defibrillate due to concerns about effect of the shock on the foetus. Despite the willingness to perform defibrillation on pregnant women by the registrars, very few of them actually adhere to the modified CPR protocol of removal of foetal monitors before defibrillation. 2 (3.6%) of the obstetrics registrars had ever performed a perimortem c/s (Procedure of cesarean delivery concurrent with maternal C.P.R).

99% of the anesthesiology registrars were conversant with anatomical changes in the airway compared to obstetrics registrars 89.1%.

Conclusion:

Obstetrics and anaesthesiology registrars are more likely to encounter cardiac arrest in pregnancy. Although the incidence of this is small, this is not a reason for these cadres of doctors not to have knowledge on resuscitation of parturients and not to have the right attitude. Therefore these doctors should receive regular trainings on resuscitation focusing on parturients.

2.0 LITERATURE REVIEW

Maternal health indicators in Kenya have not improved significantly over the years. The 1998 and 2003 Kenya Demographic and Health Surveys (KDHS) recorded a national maternal mortality ratio of 590 and 414 deaths per 100,000 live births respectively.¹ In 2005 the World Health Organization (WHO), United Nations Children's Fund (UNICEF), United Nations Population Fund (UNFPA) & the World Bank estimated the mortality rate at 560 maternal deaths per 100,000 live births in the developing world.² Overall maternal mortality rate in the United Kingdom as per Confidential Enquiries into Maternal and Child Health (CEMACH) is reported as at 13.95 deaths per 100 000 maternities.³

Kenyatta National Hospital is the largest of the two main level 6 (National Referral Hospital) health facilities in Kenya. It handles about eleven thousand five hundred inpatient obstetric cases annually. 57% of these cases are walk in patients who are not booked at the hospital's antenatal clinic. Cases of maternal mortality are approximately 103 out of eleven thousand eight hundred live births annually .⁴ This is much higher than the overall rate by Confidential Enquiries into Maternal and Child Health (CEMACH).³ A survey conducted in Korongocho and Viwandani slums on maternal mortality showed a mortality rate of 706 per 100,000 live births which is way higher than the national estimate of 560 per100, 000 live births.⁵

The true incidence of cardiac arrest during pregnancy is unknown but has been estimated at 1: 30,000 pregnancies.⁶ The change in the obstetric population due to delay of pregnancy to late and an increase in obesity has led to increased likelihood of morbidity among parturients who may require CPR.³

Optimal maternal and foetal outcomes are dependent on the underlying cause of the arrest, the speed of intervention by the response team and an understanding of the

principles of resuscitation during pregnancy. It is therefore important for medical personnel to be aware of how to conduct effective resuscitation in pregnant patients so as to obtain optimal maternal and foetal outcomes.⁷

Physiological and anatomical changes in pregnancy and their relevance to CPR

There are unique physiological and anatomical changes which occur in pregnancy and this have an impact on CPR. Physicians dealing with obstetric patients should have a thorough knowledge of these changes to be able to institute timely intervention and perform appropriate cardiopulmonary resuscitation when needed.⁷

There are no randomized controlled trials evaluating the effect of specialized obstetric resuscitation in pregnant patients in cardiac arrest but there are reports in the literature of patients not in arrest that describe the science behind important physiological changes that occur in pregnancy that may influence treatment recommendations and guidelines for resuscitation.

The airway during pregnancy is altered by anatomic and physiologic factors which place the parturient at risk of difficult airway management. Increases in oestrogen levels during pregnancy increases interstitial water resulting in oedema of the respiratory tract connective tissues. Nasal mucosal oedema decreases the area of the nasal passage and this predisposes the patient to increased risk of epistaxis with the passage of a nasogastric or nasotracheal tube. Tongue enlargement and immobility of the floor of mouth can result in difficult mask ventilation and laryngoscopy. Oedema of the respiratory tract tissues decreases the area of airway opening. This hinders the

passage of an endotracheal tube through the vocal cords that would pass easily in a non-pregnant female hence a smaller sized endotracheal tube is used.⁷

The functional residual capacity in a parturient decrease as the enlarging gravid uterus pushes the diaphragm more cephalad. In addition there is a 15-20% increase in maternal oxygen requirements during pregnancy. This results in an increased likelihood of hypoxia when cardiopulmonary arrest occurs in a parturient compared to non gravid patient.^{8,9} Cheun et al found that during apnea desaturation in pregnant patients is significantly faster than in nonpregnant patients due to the physiological changes in the respiratory system.¹⁰

By 20 weeks' gestation, the gravid uterus has reached the level of the inferior venacava. In the supine position, the gravid uterus can cause compression of the venacava resulting in decreased venous return and hypotension hence affecting perfusion to vital organs such as the kidneys and the brain during CPR. The compression of pelvic veins by the enlarging uterus can cause an increase in venous pressure below the uterus. Due to the increased pressure and poor venous return to the heart, intravenous lines in the lower extremities should be avoided when doing CPR because any medication administered through that route will have a limited return to the heart and arterial circulation.¹¹

Aspiration occurs easily in a pregnant woman because of decreased gastrointestinal motility, relaxation of the lower esophageal sphincter and an increase in intra-gastric pressure due to the expanding uterus and therefore securing of the airway should be done quickly by any experienced person available.¹²

Patient position has emerged as an important strategy to improve the quality of CPR.¹³ Studies in non cardiac arrest parturients indicate that left-lateral tilt results in improved maternal hemodynamics blood pressure, cardiac output, and stroke volume which increases by at least 25% and improved fetal parameters: oxygenation, and fetal heart rate due to the release of aortocaval compression.¹⁴

The left lateral tilt position can be achieved by: The Cardiff wedge, which is made of hard laminated wood on casters, a “human wedge” which is done by tilting the patient on the bent knees of a kneeling rescuer,¹⁵ using rolled up blankets to tilt the right hip¹⁶ and by manual left uterine displacement in supine position technique. Studies in pregnant women not in arrest by Kinsella et al & Amaro et al found that manual left uterine displacement, which is done with the patient supine, is as good as effective as lateral tilt in relieving aortocaval compression as assessed by the incidence of hypotension and use of ephedrine.^{17,18}

The 2010 American Heart Association (AHA) guidelines recommend manual left uterine displacement in the supine position first .Chest compressions should be performed slightly higher on the sternum than normally recommended to adjust for the displacement of the heart by the elevation of the diaphragm by abdominal contents due to the gravid uterus.¹³

Defibrillation and drugs management guidelines of resuscitating a parturient are the same as those used in non pregnant patients. Defibrillation and cardioversion are considered safe at all stages of pregnancy.¹³ However there is a small risk of inducing

fetal arrhythmias.²⁰ During defibrillation Internal or external fetal monitors attached in a pregnant woman should be removed according to the 2010 AHA guidelines.¹³

Reversible causes of cardiac arrest that occur in nonpregnant women can occur during pregnancy and should be identified during resuscitation attempts. In addition, providers should also be familiar with pregnancy-specific diseases and procedural complications and manage them accordingly.³

During attempted resuscitation of a pregnant woman, providers have two potential patients: the foetus and the mother. The best hope of the foetus survival is maternal survival. Initially, the Romans had decreed that unborn infants should be excised from the womb if the mother died in late pregnancy. This was a religious ritual rather than an attempt at saving the newborn.²¹ However, some infants did survive and several ancient historical figures were reported to have been born in this fashion, including the Greek physician Asklepios, "*from the womb of dead Koronis.*"²² During the late 19th and early 20th centuries, case reports began to appear of postmortem cesarean deliveries in which the fetus was rescued, and the procedure began to be considered as a legitimate medical intervention. However, neonatal survival rate was very low and therefore conventional wisdom dictated that all possible attempts were made to save the mother.²³

During the early 1980s, several authors reported unexpected maternal recovery after postmortem cesarean delivery.^{24,25} An immediate restoration of maternal circulation after emergency cesarean delivery was demonstrated in a pregnant patient undergoing cardiac arrest.²⁴ In 1982, Marx suggested that prolonged cardiopulmonary

resuscitation without prompt cesarean delivery in patients with cardiac arrest was associated with worsened maternal outcome; this led to consideration of the possibility that immediate cesarean delivery during maternal cardiac arrest might improve the parturient's survival.²⁵

In a review of 61 peri-mortem Cesarean sections published between 1985 & 2005, Katz et al noted that 70% of all fetal survivors were delivered within five minutes of maternal arrest, all of them neurologically intact. In no case was there deterioration of the maternal condition. After 15 minutes of maternal arrest, there was a 5% survival rate, most with negative neurologic sequelae. These findings prompted the development of the "*four -minute rule*" (i.e., a cesarean section should be performed within four minutes of maternal cardiac arrest and the infant delivered by the fifth minute).²⁶

The ideal location to perform a c/s is in the operating room. However a simulation study by Lipman S et al suggests that even in an optimal setting, delivery within 5 minutes cannot be achieved if the patient is moved to the operating room. This study suggests that delivery must be performed in the patient's room to achieve the best outcome.²⁷ McDonnell NJ emphasizes the need for '*perimortem cesarean section packs*' in labour wards.²⁸

Knowledge, practice and attitude on CPR

Obstetricians, anesthesiologists and nurses in antenatal wards will encounter maternal cardiac arrests because they work more closely with pregnant women. Resuscitation of a pregnant woman in KNH wards is usually done by the obstetrics and gynaecology registrars covering the floor with help of the nurses and will sometimes request for the assistance of the anesthesiology registrar on call. No data is available to show whether this is done according to the AHA guidelines and no protocol is available on who plays what role.

Cohen SE et al carried out a study to evaluate knowledge about resuscitation of parturients among anesthesiologists, obstetricians and emergency physicians. They were tested on need for left uterine displacement, Advanced Cardiac Life Support (ACLS), physiologic changes of pregnancy and the importance of cesarean delivery in parturients after unsuccessful resuscitation. Knowledge in these areas was found to be lacking.²⁹

A survey conducted by Einav et al on knowledge on maternal cardiac arrest and resuscitation amongst Obstetricians, midwives and anaesthetists found that 43% claimed broad experience, 50% claimed some experience and 6.7% claimed no experience in adult resuscitation.³⁰

Research in Lagos university teaching hospital by Desalu I et al showed that anaesthetists did not adhere to existing guidelines during peri-operative cardiac arrest as shown by how they conducted A-B-C, use of resuscitation drugs and defibrillation.³¹

Ibironke D et al carried out a study to establish how confident anaesthesia trainees who had attended a revision course prior to postgraduate examinations are in implementing CPR guidelines. It was shown that there was low confidence among junior anaesthetists as only 30.6% of the study group were confident in their ability to perform CPR according to 2005 AHA resuscitation guidelines.³²

Most studies on practice are performed via simulated situations. A study done by Sharon Maslovitz et al on recurrent obstetric management mistakes identified by simulation found out that poor CPR techniques contributed to 80% of the common management errors and concluded that a curriculum based on simulation of obstetric emergencies(Advanced Obstetric Life Support) could identify the pitfalls in management in the delivery room.³³

Limpman SS et al carried out a study on the deficits in the provision of CPR during simulated obstetric crises among obstetricians, labour and delivery nurses and anesthesiologists. They were tested on removal of foetal/uterine monitors before defibrillation, placing a firm back support, Left uterine displacement, ventilation, chest compression, communication to the neonatal team, correct hand position on the sternum and delivery of the fetus in five minutes or less. No team performed all the tested areas appropriately.³⁴

Smith J et al assessed the CPR skills in thirty Non Consultant Hospital Doctors of a university associated teaching hospital. It was found that none of the candidates followed the recognized A-B-C sequence which was recommended then by the AHA and only one provided effective CPR.³⁵

Data on survival rate after resuscitation of pregnant women is lacking though a study done by Dr. Waringo in 2009 on knowledge, attitude and practice of CPR amongst Kenyan ICU nurses in Nairobi hospitals concluded that the barriers of effective CPR are lack of adequate knowledge and exposure, lack of coordinated teamwork and availability of equipment.³⁶

3.0 JUSTIFICATION OF THE STUDY

Kenyatta National Hospital being the largest of the two level 6 health facilities in Kenya handles many obstetric cases. Some of these cases are associated with pregnancy associated complications and may require CPR.

Obstetrics and anesthesiology registrars cover their units all the time hence are always the first responders when cardiopulmonary arrest occurs. In this situation the resident assumes the role of team leader and must ensure that CPR is effective.

It is therefore important for this cadre of doctors to have adequate knowledge on the physiological and anatomical changes in these patients in order to be able to provide effective CPR.

There is no local data available on this subject and this study aims to provide baseline data that would help identifying training needs for staff involved in maternal CPR. With improved training, survival rate of mother and child is expected to rise and the confidence of doctors handling these patients is also expected to rise.

4.0 OBJECTIVES OF THE STUDY

4.1 Broad objective

To assess knowledge, attitude and practice of CPR of pregnant women amongst anaesthesiology and obstetrics/Gynaecology registrars

4.2 Specific objectives

- To assess knowledge on physiological and anatomical changes in pregnancy relevant to CPR amongst anaesthesiology and obstetrics/Gynaecology registrars
- To assess practice of the modifications in the CPR protocol when dealing with pregnant women amongst anaesthesiology and obstetrics/Gynaecology registrars.
- To assess anaesthesiology and obstetrics registrars' attitude with regard to CPR of pregnant women.

5.0 METHODOLOGY

5.1 Study design

The study was a cross-sectional descriptive study that involved the administration of questionnaires to anesthesiology and obstetrics registrars in KNH.

5.2 Study site

Kenyatta National Hospital anesthesiology and obstetrics / gynaecology departments

5.3 Study population

All anesthesiology (n= 26) and all obstetrics (n=59) registrars in KNH.

5.4 Inclusion criteria

- Registrars who gave consent undertaking their Master of Medicine degree in anesthesiology
- Registrars who gave consent undertaking their Master of Medicine degree in Obstetrics and gynaecology

5.5 Exclusion criteria

- Those declining to give consent.
- Those not available and could not be reached during the study period.

5.6 Data storage and management

Data was collected by the principal investigator using a pre-tested questionnaire which was hand delivered and collected within one sitting. The hardcopies were filed after transcription of the information into a Microsoft database. The hardcopies and the database were treated with strict confidentiality. Data was then analyzed using statistical software, Statistical Package for Social Scientists (version 11.0; SPSS, Chicago, IL)

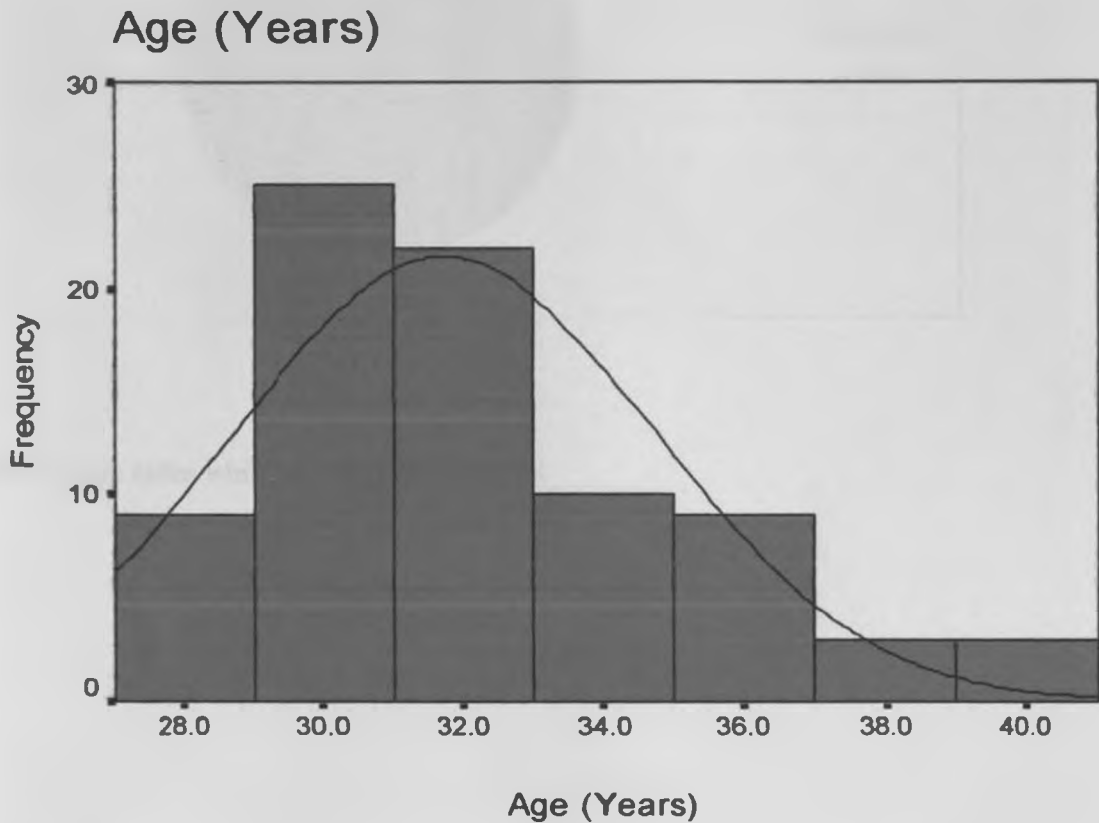
6.0 ETHICAL CONSIDERATIONS

1. The nature and purpose of the study was explained to the participants and consent obtained.
2. The study had no harmful effects on the participants, patients or the hospital in general.
3. Confidentiality was maintained at all stages of the exercise.
4. Approval for the study was sought from Kenyatta National Hospital-University of Nairobi, Ethics and Research Committee prior to the whole exercise.
5. Findings from the study were availed to the Ethics Committee of KNH, the University of Nairobi and the participants.

7.0 RESULTS

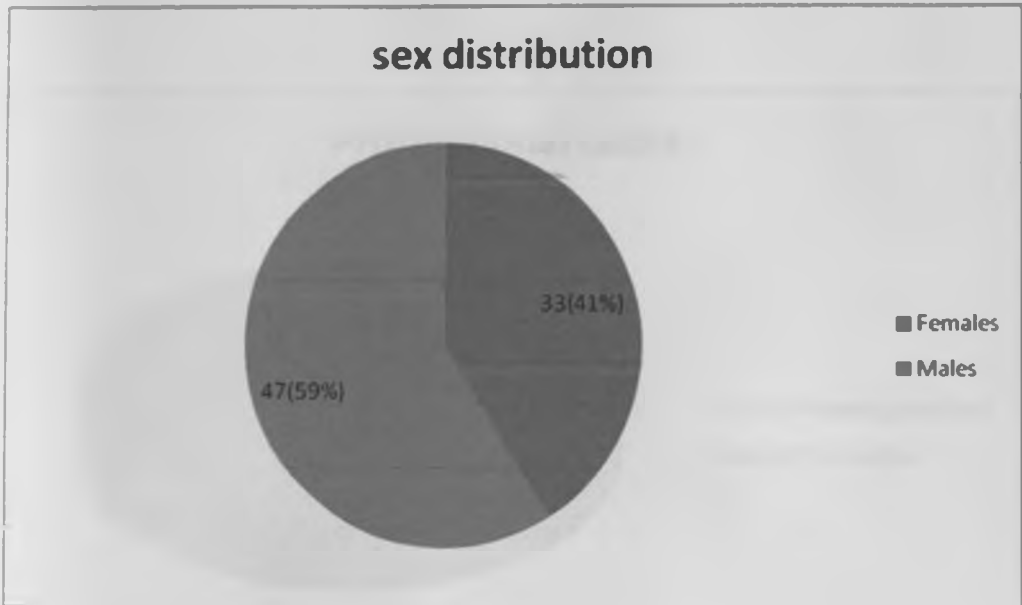
The study was carried out in Kenyatta National hospital Obstetrics and Gynaecology department. Data was collected from consenting anesthesiology and obstetrics registrars between June 2010 and July 2010.

Figure 1: Age of participants in years



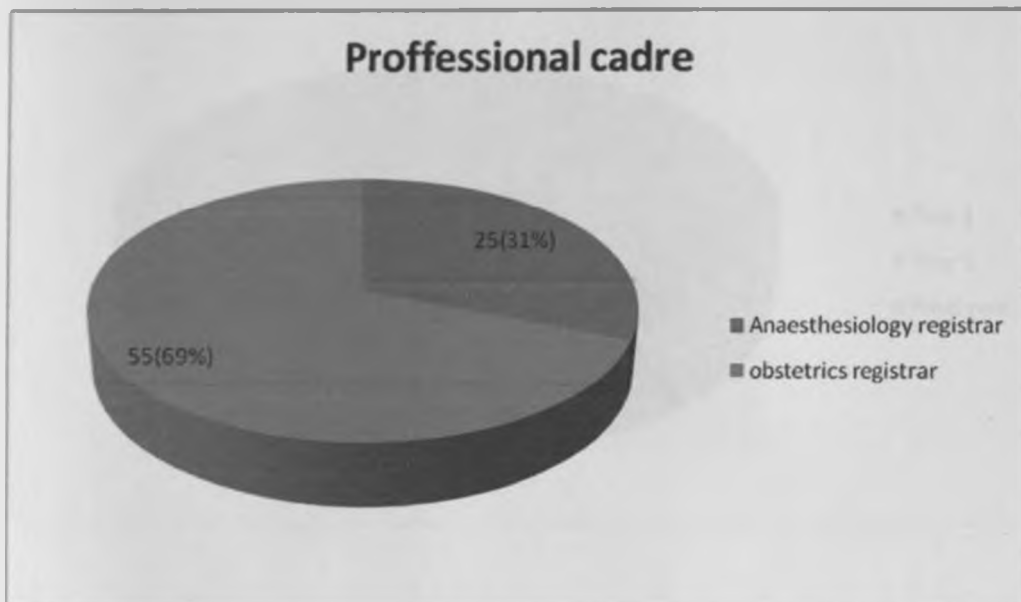
Eighty out of the total eighty six registrars responded to the questionnaire (94% response rate). The age range was 27 to 40 years. The age distribution was Gaussian with a left skew. The age range was 27 to 40 years mean age of 31.7 years.

Figure 2: Pie chart of Sex distribution



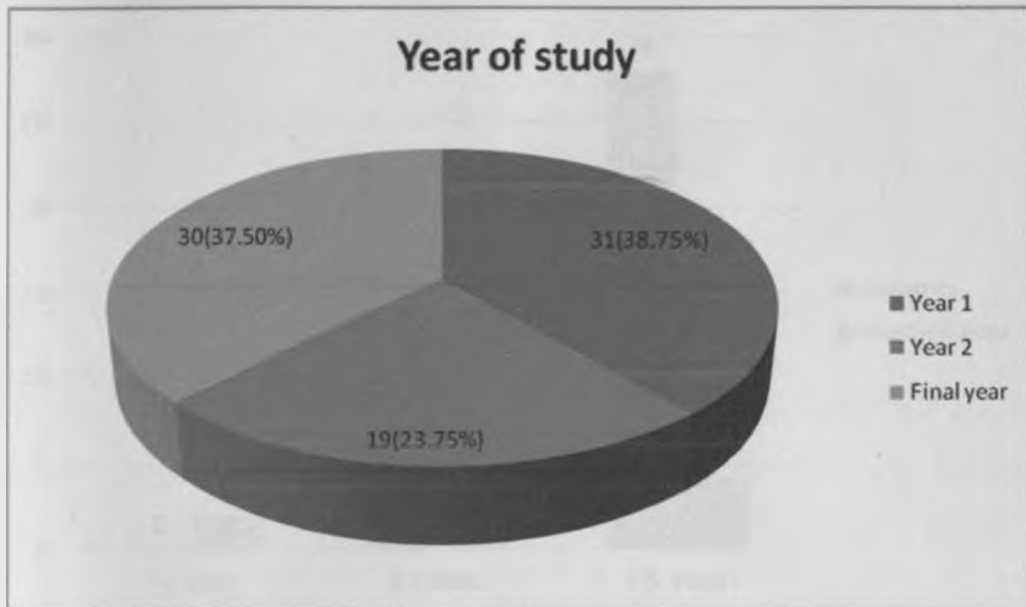
47(59%) were males while 33(41%) were females.

Figure 3: Pie chart of Professional cadre



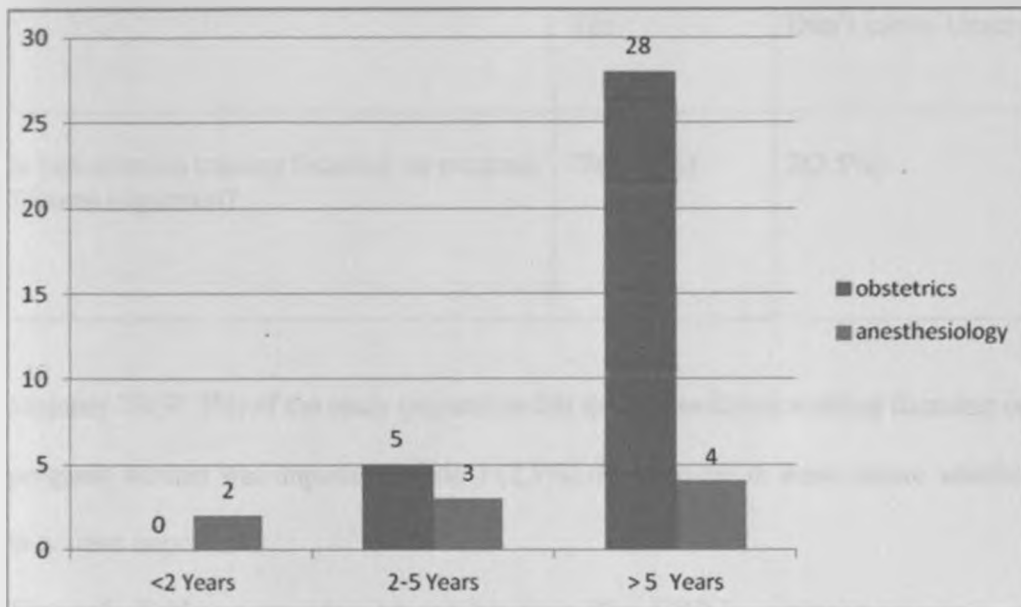
25(31%) of the respondents were anesthesiology registrars while 55(69%) were obstetrics gynecology registrars.

Figure 4: Pie chart of year of study of the registrars



31(38.75%) of the respondents were in year one 19(23.75%) in year 2 and 30 (37.5%) in their final year.

Figure 5: Number of obstetrics and anesthesiology registrars who have attended resuscitation trainings.



A total of 42(52.5%) registrars had ever attended resuscitation trainings.2 anesthesiology registrars had attended this trainings less than 2 years ago, 3 between 3-5 years ago and 4 more than 5 years ago.5 obstetrics registrars had attended the trainings 2-5 years ago and 28 had attended this trainings more than 5 years ago.

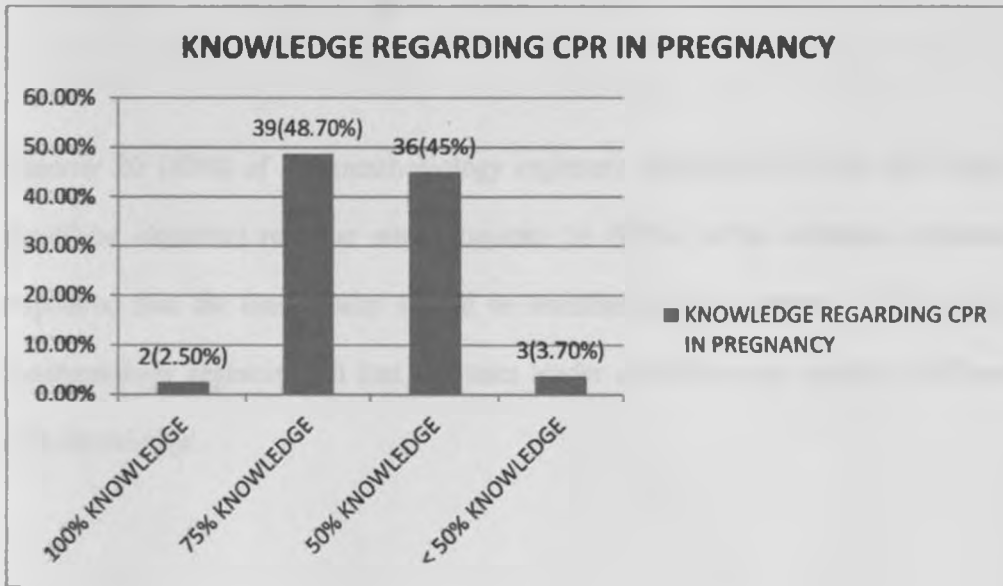
Of all this registrars, only 8 obstetrics registrars had attended training courses focusing on CPR in pregnant women.

Table 1: Importance of resuscitation trainings in pregnancy

	Yes	Don't know/ Unsure
Is resuscitation training focusing on pregnant Women important?	78(97.5%)	2(2.5%)

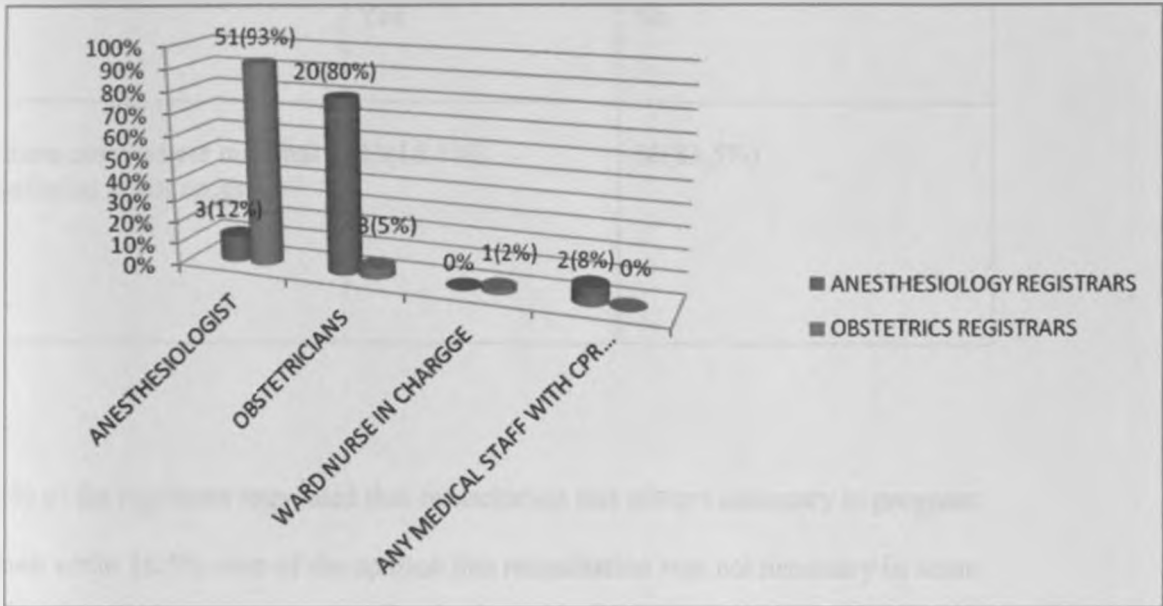
Majority 78(97.5%) of the study population felt that resuscitation training focusing on pregnant women was important while 2 (2.5%) didn't know or were unsure whether they were important.

Figure 6: Self assessment on knowledge regarding CPR in pregnant women



2(2.5%) of the registrars felt that they were 100% knowledgeable while 39(48.7%) felt they were 75% knowledgeable.36 (45%) of the registrars felt they were 50% knowledgeable and only 3(3.7%) felt they were less than 50% knowledgeable on cardiopulmonary resuscitation of pregnant women.

Figure 7: Response on who should be the team leader by the two departments



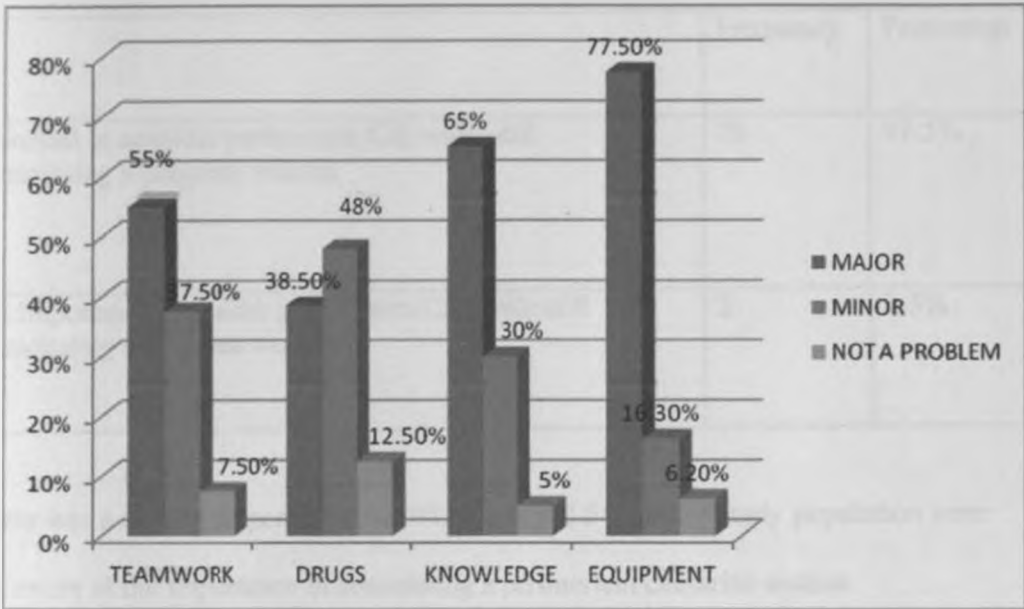
Majority 20 (80%) of the anesthesiology registrars responded that the team leader should be obstetrics registrar while majority 51 (93%) of the obstetrics registrars responded that the team leader should be anesthesiology registrars. 2 (8%) of the anesthesiology registrars felt that the team leader should be any medical staff with CPR knowledge.

Table 2: Opinions on whether there are cases where maternal resuscitation is not necessary

	Yes	No
Are there cases where maternal resuscitation is not necessary?	13(16.5%)	66(83.5%)

83.5% of the registrars responded that resuscitation was always necessary in pregnant women while 16.5% were of the opinion that resuscitation was not necessary in some cases. Some of the cases where CPR was not necessary were specified as amniotic fluid embolism by one registrar, Brainstem death by two registrars, prolonged cardiac arrest > 20 minutes by six registrars and terminal illness by four registrars.

Figure 8: Challenges faced during resuscitation of pregnant women in KNH



Lack of equipment 62 (77.5%), lack of knowledge 52 (65%) and lack of team work 45 (55%), were graded as the major factors affecting CPR respectively.

Table 3: Knowledge on importance of perimortem caesarian section

	Frequency	Percentage
Important to consider perimortem C/S while still resuscitating a pregnant woman	78	97.5%
Not Important to consider perimortem C/S while still resuscitating a pregnant woman	2	2.5%

There was a correct response rate of 97.5%. Only 2.5 % of the study population were not aware of the importance of considering a perimortem caesarian section.

In practice, only 2(3.6%) of the obstetrics registrars had performed a perimortem caesarian section while 53(96.4%) had not.

Table 4: Duration of time within which the perimortem caesarian section was performed and Immediate outcome after perimorterm C/S

Duration	Outcome
5-10 minutes	Mother survived
>30 minutes	Non survived

One perimortem C/S was done within 5-10 minutes and only the mother survived. The other perimortem C/S was done after 30 minutes and neither the mother nor the foetus survived.

Table 5: Ideal location to perform a perimortem cesarean delivery

	Frequency	Percentage
Maternity theatre	17	20.2%
Labor and delivery room	12	14.3%
In the location where maternal cardiac arrest occurs	55	65.5%

Majority of the registrars 55 (65.5%) said that the ideal location to perform a perimortem c/s was in the location where maternal cardiac arrest occurs.

Practises by registrars as first responders in maternal cardiac arrest

Figure 9: Anesthesiology Registrars

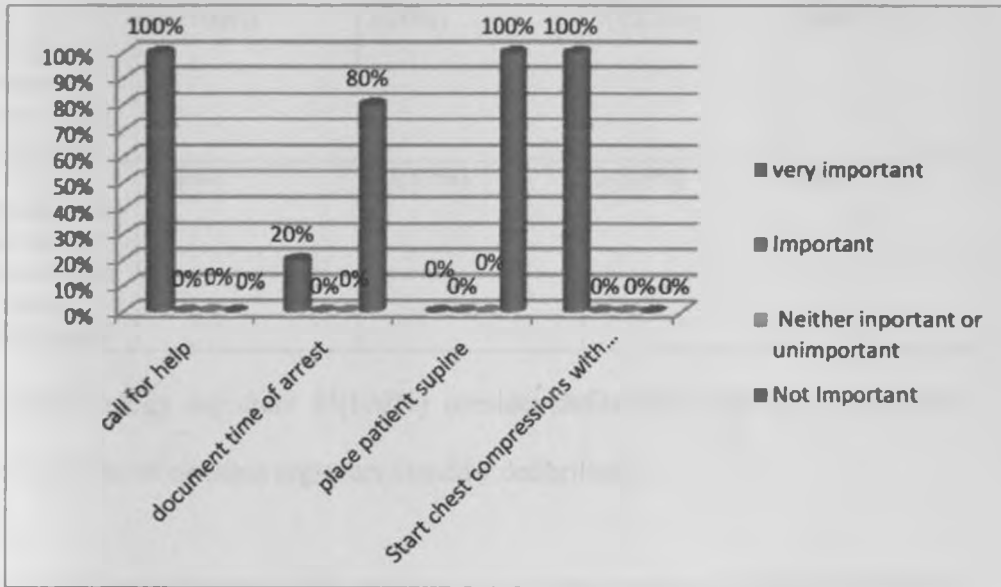
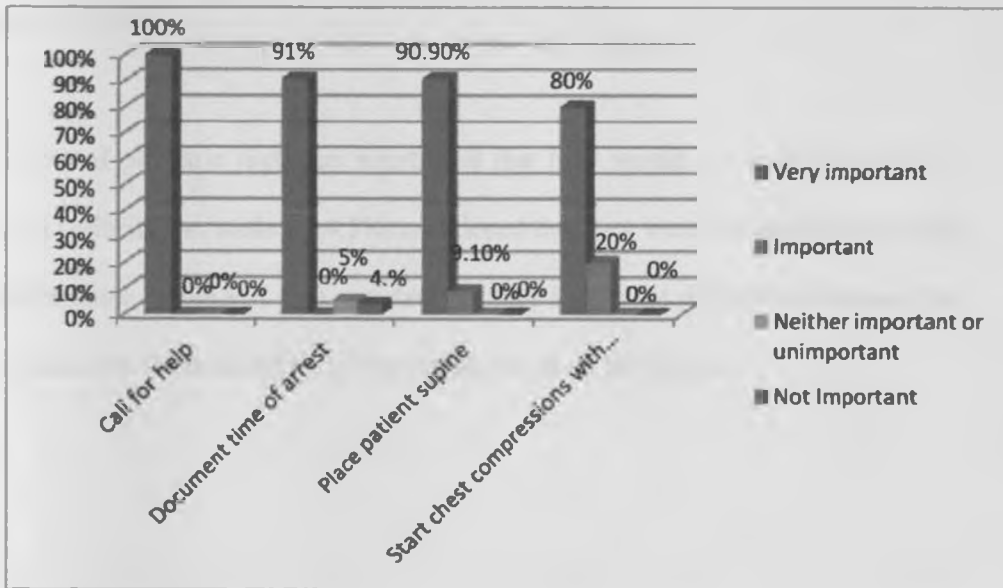


Figure 10: Obstetrics Registrars



Average correct response rate was 79.4%.

Anesthesiology registrars correct response rate was 55% while the obstetrics registrars correct response rate was 90.4%

Table 6: Defibrillation of a pregnant woman during CPR

	Anesthesiology registrars who answered yes	Anesthesiology registrars who answered no	Obstetrics registrars who answered yes	Obstetric registrars who answered no
Do you defibrillate pregnant women during resuscitation	25(100%)	0 (0%)	7(12.7%)	48(87.3%)
If you defibrillate, do you remove foetal monitors before defibrillation?	2(8%)	23(92%)	3(5.5%)	(0%)

All anesthesiology registrars 25(100%) consider defibrillation during resuscitation while 7(12.7%) of obstetric registrars consider defibrillation.

The average correct response rate for removal of foetal monitors during resuscitation was 10.37%, with anesthesiologist registrars accounting for 8% and obstetric registrars 12.7%.

37(61.3%) of obstetric registrars mentioned that they would not defibrillate due to lack of a defibrillator, while 8(14.5%) mentioned that they were not comfortable using the defibrillator, while 3 (5.5%) reported that they would not defibrillate because they were concerned about the effect of the defibrillation on the foetus.

Table 7: Use of defibrillation energies

	Anesthesiology Registrars	Obstetrics Registrars
The same defibrillation energy in non-pregnant patient	21(91.3%)	12(28.6%)
Reduce defibrillation energy in the pregnant patient	2(8.7%)	17(40.48%)
Change energy levels depending on the stage of pregnancy	0	10(23.8%)

The overall response rate for this question was 65 (81.25%).

The correct response rate for this question was 50.77% of which majority were anesthesiology registrars 21 (91.3%) and 12 (28.6) were obstetrics registrars.

Table 8: Practice regarding use of epinephrine during maternal resuscitation

	Frequency	Percentage
Avoided, decreases uterine blood flow	18	22.25%
Avoided, causes foetal tachycardia	3	3.8%
Indicated in full ACLS doses	57	71.25%

Correct response rate was 71.2%.

71.2% of the respondents were aware that epinephrine is indicated in full ACLS doses while 26.3% said that it should be avoided because it decreases uterine blood flow and causes foetal tachycardia.

Table 9: Knowledge on the most appropriate position when performing chest compressions in pregnancy

Position	Anesthesiology registrars	obstetrics registrars
Supine	0	30(54.5%)
Reverse Trendelenburg	0	0
Supine with manual leftward displacement of the uterus	6(24%)	1(1.8%)
Lateral tilt with a wedge	19(76%)	24(43.6%)

The average correct response was 7(12.7%).

6 anesthesiology registrars were aware that Supine with manual leftward displacement of the uterus was the best position while only one obstetrics gynecology registrar was aware.

Table 10: Knowledge on physiologic changes during pregnancy that affect resuscitation measures in a parturient in cardiac arrest

	Anesthesiology Correct response	Obstetrics Correct response
Decreased circulating blood volume (The answer to this question was false)	25(100%)	55(100%)
Decreased pulmonary reserve due to decreased functional residual capacity	25(100%)	48(87.3%)
The gravid uterus compresses iliac vessels and inferior venacava causing increased venous resistance and hypertension	20(80%)	43(78.2%)

The average correct response rate was 90.91%.

Anesthesiology registrars had a correct response rate of 93.33% while obstetrics registrars had an 88.5% correct response rate.

Table 11: Conditions that make intubating a pregnant woman difficult

	Anesthesiology registrars correct response	Obstetrics registrars correct response
Marked airway oedema may be present	25(100%)	55(100%)
Gravid abdomen may displace adipose/breast tissue superiorly	25(100%)	43(78.2%)
High risk of aspiration of stomach contents necessitates rapid sequence intubation	25(100%)	55(100%)
Most women after approximately 20 weeks of gestation have smaller glottis.	24(96%)	43(78.2%)

The overall correct response rate by anesthesiology registrars was 99% and that of obstetrics registrars was 89.1%.

The correct response rate for airway oedema and aspiration of stomach contents was 100% for both anesthesiology and obstetrics registrars.

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8.0 DISCUSSION

Cardiac arrest during pregnancy is a rare event, most of us fortunate enough never to encounter it in practice. Despite rarity of the event, the knowledge on how to manage it should not be substandard.

This survey achieved a 94% response rate, the 6 % non response was due to refusal to participate in the study by some of the participants.

42(52.5%) of the residents had ever attended resuscitation a resuscitation training.³² of this residents had attended this training more than five years ago and only eight obstetric residents had attended resuscitation training focusing on parturients. This numbers are much higher than those seen in a study in south Nigeria where only 1.19% of the study population had formal training in cardiopulmonary resuscitation tr. However this study included obstetrics consultants, registrars and house officers and did not include the anesthesiologists.³⁷

Majority of the anesthesiology and obstetric registrars 78 (97.5%) felt training on resuscitation of pregnant women was important as was recommended by Hishman Farag and Mohammed Naguib, in a review report on CPR. The recommendation stated basic & advanced life support training should be given to all medical personnel.³⁸

More than 51.2% of the registrars felt they were more than 50% knowledgeable as regards resuscitation of pregnant women.

This is contrary to the survey of labour ward clinicians done by Einav et al in 2008, which found that 43% of the study population claimed broad experience while 50%

claimed some experience. However this study was broader in that it included midwives.³⁰

It was observed that resuscitation of pregnant women in KNH was done by obstetrics registrars covering the floor with the help of nurses and sometimes requested for assistance from the anesthesiology registrar on call. No data was available to show whether this was done according to AHA guidelines and no protocol is available on who plays what role. However majority of the anesthesiology registrars 20(80%) felt that the team leader during maternal resuscitation should be the Obstetrics registrar while majority of the Obstetrics registrars 51(93%) felt that the anesthesiology registrar should be the team leader. Suresh M.S in 2010 recommended that there should be quick and timely intervention for optimal maternal and foetal outcomes hence the need for any medical personnel in contact with pregnant woman who arrests to have effective resuscitation skills and therefore be able to be a team leader.⁷

13 (15%) of the registrars felt that CPR in pregnant women was not necessary in some conditions. Majority of these registrars (6) felt that resuscitation was not necessary in cases of prolonged cardiac arrest. However a review by Marx FG in 1982 revealed that cardiopulmonary resuscitation and perimortem C/S had unexpected incidences of maternal recovery and foetal survival even in cases of prolonged arrest and was therefore justified .However it should be noted that the outcomes are much better if the perimortem C/S is performed immediately.²⁵

Weber CE in a review of postmortem C/S in 1982 emphasized that the pregnant woman represented two potential patients and hence resuscitation should be

performed if the foetus is viable even in some conditions mentioned by the registrars such as Brain stem death and terminal illness if the foetus is viable.²³

Factors affecting CPR in pregnancy among pregnant women were assessed. Lack of equipment 62(77.5%), lack of knowledge 52(65%) and lack of team work 45(55%), were graded as the major factors affecting CPR respectively.

Lack of knowledge was said to be a major challenge hindering resuscitation of pregnant women in KNH, this was found to be contrary to how the registrars graded themselves on knowledge about resuscitation of pregnant women were most of them 55(96.3%) said they were more than 50% knowledgeable. After seeking further clarification it emerged that the registrars were referring to lack of knowledge by the other members of the team. However according to a study by Cohen SE et al in 2008 on knowledge of resuscitation of pregnant women, there was evident lack of knowledge among anesthesiologists, obstetricians and emergency physicians on resuscitations of parturients.²⁹

Registrars were assessed on their practice of CPR in pregnant women as first responders and whether it follows the recent 2010 maternal cardiac arrest CPR algorithm. The areas assessed included calling for help, documentation of the time of arrest, positioning of the patient and at what level of the chest to perform chest compressions.

The average correct response rate was 79.4% of which 32(58.2%) obstetrics registrars had a 100% correct response in all the areas assessed while none of the anesthesiology registrars had a 100% correct response. This was mainly because anesthesiology registrars felt supine position was inappropriate for a pregnant woman and should

instead be placed in the left lateral tilt position to avoid aortocaval compression by the gravid uterus.

More than half of the obstetrics registrars (58.2%) practice was in keeping with what the first responder should do according to the 2010 Algorithm on maternal CPR.¹³

On registrars' assessment on defibrillation, all anaesthesiology registrars said they defibrillate a pregnant woman during resuscitation if the situation warrants, while only 7(12.7%) of obstetrics registrars defibrillate. This shows that anaesthesiology registrars consider defibrillation to be an important part of resuscitation compared to the obstetrics registrars. However a study done in Lagos by Desalu I et al showed that anaesthetists did not adhere to existing guidelines during peri-operative cardiac arrest as shown by how they conducted A-B-C, their use of resuscitation drugs and defibrillation.³¹

3 (5.5%) of obstetrics registrars would not defibrillate due to concerns about effect of the shock on the foetus. However, this has been shown not to be a deterrent for defibrillation as it only poses a small risk of arrhythmias in the foetus as was shown by Gorman RD in 2003.³⁹ On the contrary rapid defibrillation is the major determinant of survival in cardiac arrest due to ventricular fibrillation.⁴⁰

When asked whether they would remove foetal monitors before defibrillation, only 8% of the anaesthesiology registrars said that they would and none of the obstetrics registrars considered removal of foetal monitors important. Majority felt that continuous foetal monitoring was important despite the cardiac arrest. This shows that despite the willingness to perform defibrillation on pregnant women by the registrars,

very few of them actually adhere to the modified CPR protocol of removal of foetal monitors before defibrillation.¹³

Majority of the anesthesiology registrars 21(91.3%) were aware about the defibrillation energy requirements during maternal CPR and only 12(28.6%) of obstetrics were aware .15 (18.75%) of residents did not respond to this question. this further emphasizes the lack of familiarity with the defibrillation among obstetric residents as was earlier seen.

Majority of the registrars 57 (71.25%) were aware that drugs such as epinephrine need not be contraindicated or dose adjusted during CPR of pregnant women as is recommended by American Heart Association guidelines in 2010. ¹³ However Varga et al in 2000 revealed that there was an increase in Glomerular Filtration Rate and Plasma Volume in parturients suggesting that drugs excreted renally are eliminated faster.⁴¹

Majority of the registrars 78 (97.5%) reported that they would consider doing a perimortem c/s during resuscitation. This shows that Obstetrics and Anesthesiology residents do consider perimortem c/s an important entity of the resuscitation process. Most of the residents 55 (65.5%) felt that the perimortem c/s should be done where the maternal cardiac arrest occurred. This further emphasizes findings in a simulation study by Lipmans and Carvalho in the Journal of American Society of Anesthesiologists in 2008 that suggested that perimortem c/s should be done at the location of arrest to hasten the speed of the procedure.²⁷ Only 2 (3.6%) of the obstetrics residents had performed a perimortem c/s. One perimortem c/s was done

within 5-10 minutes, and the mother survived but the infant did not. However, neither mother nor infant survived during the second perimortem c/s which was done 30 minutes after cardiac arrest. This closely resembles the observation made by Katz et al in 2005 that there was 70% survival if perimortem c/s was done within 5 minutes but only 5% survival if done after 15 minutes prompting the 4 minute rule.²⁶ However the number of perimortem c/s reported to have been done by registrars was too small to draw a conclusion and more studies will have to be done in this regard. It was not clear whether this small number was due to delayed decision making or not.

Assessment of knowledge on aortocaval compression caused by the gravid uterus had a correct response rate of 7 (12.7%). This was in regard to supine position with manual left forward displacement of the uterus as is recommended by the AHA guidelines¹³ and a study done by Kundra P and Khannas in 2007 that recommended that manual displacement of the uterus to the left may be better than the lateral tilt with a wedge.¹⁷ 30 (54.5%) of obstetrics registrars believe that supine position is the most appropriate position during resuscitation of a pregnant woman. This is a reflection that they lack knowledge on aortocaval compression by the gravid uterus, or they believe that supine position offers the best position for chest compressions as was suggested by Rees G.A in his study on resuscitation in late pregnancy which also involved lateral tilt.⁴²

83.3% of the registrars of whom majority 19 (78%) were anesthesiology registrars were aware of aortocaval compression and considered lateral tilt with a wedge, but did not consider the difficulty in giving good forceful chest compressions in the left lateral tilt position as was suggested by Rees.⁴²

Assessment of the anatomical changes in the airway that affect airway management of a parturient during resuscitation revealed that 99% of the anesthesiology registrars were conversant with anatomical changes of the airway compared to obstetrics registrars. Assessment of knowledge on the physiological changes in pregnancy among registrars revealed that anesthesiology registrars had a correct response rate of 93.3% while obstetrics registrars had a 88.5% correct response rate. Overall, registrars demonstrated that they are conversant with anatomical and physiological changes in pregnancy.

9.0 CONCLUSION

- Deficits in resuscitation of pregnant women among both the anesthesiology and obstetrics registrars were evident as shown by their response on positioning, use of epinephrine and defibrillation.
- The barriers that hinder effective CPR of pregnant women in KNH were found to be lack of equipment, lack of knowledge and lack of team work.
- Some(13) registrars indicated that there are some cases where resuscitation of a pregnant woman was not necessary like pulmonary embolism, terminal illness, prolonged cardiac arrest and brainstem death and did not seem to consider the viability of the foetus.
- Knowledge on the physiological and anatomical changes during pregnancy relevant to CPR was generally good.
- 42(52.5%) of the registrars had attended cardiopulmonary resuscitation trainings of which majority (40%) had attended this trainings > 5 years ago.
- Only 2 obstetrics registrars had performed a perimortem cesarean section and none had been done within the recommended 5 minutes.

10.0 RECOMMENDATIONS

- 1. All anesthesiology and obstetrics registrars should have regular trainings focusing on CPR in pregnancy.**
- 2. The hospital should provide equipment necessary for resuscitation in labour ward and antenatal wards i.e. laryngoscopes, E.T tubes and defibrillators.**
- 3. Cardiac arrest teams should be formed in KNH and these teams should practice maternal cardiac arrest drills to ensure that appropriate care is provided in a timely fashion.**
- 4. A single recognized protocol on CPR in pregnancy should be taught.**

11.0 LIMITATIONS OF STUDY

1. Not all Obstetrics and gynaecology practitioners were included in the survey and therefore their views were not included in the analysis, but effort was made to make the sample as representative as possible.
2. Several omissions were present in certain sections of the questionnaire due to inability to provide answers by respondents concerned. This was noted and conclusions and analysis made on those valid entries alone. Confidentiality was assured in the course of data collection.
3. Not all aspects of Resuscitation in pregnancy were considered in the study because registrars were not assessed on other their handling of other obstetric emergencies other than cardiac arrest (ALSO-Advanced Life Support in Obstetrics)

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APPENDIX 1: MATERNAL CARDIAC ARREST CPR ALGORITHM

Maternal Cardiac Arrest

First Responder
<ul style="list-style-type: none"> • Activate maternal cardiac arrest team • Document time of onset of maternal cardiac arrest • Place the patient supine • Start chest compressions as per BLS algorithm; place hands slightly higher on sternum than usual

Subsequent Responders	
<p style="text-align: center;">Maternal Interventions</p> <p style="text-align: center;"><i>Treat per BLS and ACLS Algorithms</i></p> <ul style="list-style-type: none"> • Do not delay defibrillation • Give typical ACLS drugs and doses • Ventilate with 100% oxygen • Monitor waveform capnography and CPR quality • Provide post-cardiac arrest care as appropriate <p style="text-align: center;">Maternal Modifications</p> <ul style="list-style-type: none"> • Start IV above the diaphragm • Assess for hypovolemia and give fluid bolus when required • Anticipate difficult airway; experienced provider preferred for advanced airway placement • If patient receiving IV/IO magnesium prearrest, stop magnesium and give IV/IO calcium chloride 10 mL in 10% solution, or calcium gluconate 30 mL in 10% solution • Continue all maternal resuscitative interventions (CPR, positioning, defibrillation, drugs, and fluids) during and after cesarean section 	<p style="text-align: center;">Obstetric Interventions for Patient With an Obviously Gravid Uterus*</p> <ul style="list-style-type: none"> • Perform manual left uterine displacement (LUD)—displace uterus to the patient's left to relieve aortocaval compression • Remove both internal and external fetal monitors if present <p style="text-align: center;"><i>Obstetric and neonatal teams should immediately prepare for possible emergency cesarean section</i></p> <ul style="list-style-type: none"> • If no ROSC by 4 minutes of resuscitative efforts, consider performing immediate emergency cesarean section • Aim for delivery within 5 minutes of onset of resuscitative efforts <p>*An obviously gravid uterus is a uterus that is deemed clinically to be sufficiently large to cause aortocaval compression</p>

Search for and Treat Possible Contributing Factors (BEAU-CHOPS)

- B**leeding/DIC
- E**mbolism: coronary/pulmonary/amniotic fluid embolism
- A**nesthetic complications
- U**terine atony
- C**ardiac disease (MI/ischemia/aortic dissection/cardiomyopathy)
- H**ypertension/preeclampsia/eclampsia
- O**ther: differential diagnosis of standard ACLS guidelines
- P**lacenta abruptio/previa
- S**epsis

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APPENDIX 2:2010 AHA GUIDELINES FOR CPR

COMPARISON CHART OF KEY CHANGES

2010 RECOMMENDATION	2005 RECOMMENDATION	EXPLANATION
BLS		
A change in the BLS sequence of steps for trained rescuers from ABC to CAB for adults and paediatric patients excluding new borns Also applies for BLS for health care providers	Use of ABC BLS sequence	In the majority of cardiac arrests, the initial element of CPR are chest compressions and defibrillation In the CAB sequence, chest compressions will be initiated sooner and ventilation minimally delayed until completion of the first cycle of chest compressions The ABC protocol could be the reason why fewer than a third of cardiac arrest receive bystander CPR ABC starts with most difficult procedures: opening airway and delivering rescue breaths
Look, listen and feel has been removed from the BLS algorithm	Included	Performing look ,listen and feel is inconsistent and time consuming
A compression rate of at least 100/min	A compression rate of approximately 100/min	The number of chest compressions per minute is an important determinant of return of spontaneous circulation and survival with good neurologic function. In most studies, delivery of more compressions during resuscitation is associated with better survival and vice versa
The new recommendation	Depress adult breast bone	Compressions generate critical blood

<p>For chest compression depth push down on the adult breast bone at least 2 inches (5cm)</p>	<p>approximately 1 1/2 -2 inches</p>	<p>flow and oxygen and energy delivery to the heart and brain Rescuers often do not push hard enough</p>
<p>If a bystander is not trained in CPR, they should provide Hands only CPR “compression only” CPR for the adult who suddenly collapses with emphasis to push hard</p>	<p>The 2005 AHA guidelines for CPR did not provide different recommendations for trained versus untrained rescuers</p>	<p>Hand only (compression only) CPR is easier for an untrained rescuer to perform and can be more readily guided by discharges from the telephone.</p>

APPENDIX 3: INFORMED CONSENT FORM

A SURVEY ON KNOWLEDGE, ATTITUDE AND PRACTISE REGARDING CPR OF PREGNANT WOMEN AMONG ANESTHESIOLOGY AND OBSTETRICS RESIDENTS IN KNH

This Informed Consent Form is for anesthesiology and obstetrics registrars in Kenyatta National Hospital. You are hereby invited to participate in the above mentioned study

PART I: Information Sheet

Introduction

I am Dr. Kivungi Patience Koka, a third year resident in the MMed Anesthesiology program. I am conducting a survey on knowledge, attitude and practice of CPR in pregnant women amongst obstetrics and anaesthesia registrars in Kenyatta National Hospital in part fulfillment of my post-graduate program requirements. I will to the best of my knowledge answer any queries that may arise before and during the course of the intended study.

The objective of this survey is to assess knowledge; attitude and practice regarding CPR of pregnant women among the above mentioned specialists with an aim highlight any inadequacies.

Your participation in this research is entirely voluntary. You are free to withdraw from the study.

The information that I collect from this research project will be kept confidential.

Who to Contact

If you have any questions you may ask them now or later, even after the study has started. If you wish to ask questions later, please use the contacts below:

Dr.Kivungi Koka (Researcher) – 0722709396

PART II: Certificate of Consent

I have read the foregoing information. I understand the study and hereby consent to participate in this research.

Name of Participant.....

Signature: Date:

Statement by the researcher

I confirm that I have explained the nature of the study and assured the participant of their confidentiality and the voluntary nature of the study.

Name of Researcher:

Signature: Date:

APPENDIX 4: BUDGET ESTIMATES

Item	Total cost (KShs)
Biostatistician Fee	15,000
Stationary & Related printing costs	10,000
Internet hours	5000
KNH/UoN Ethics & Research Committee fee	1000
Phone call costs	3000
Miscellaneous	1000
<i>SUBTOTAL</i>	35,000
<i>10% Contingency</i>	3,500
GRAND TOTAL	38,500

APPENDIX5: WORKPLAN

	Dec 2011	Jan 2011	April 2011	June 2011	July 2011	Aug 2011	Sept 2011	Oct 2011	Nov 2011
Proposal Development	v	v							
Proposal presentation			v						
Data collection				v	v				
Data Analysis						v	v		
Dissertation Writing								v	
Dissertation presentation									v

APPENDIX 6: QUESTIONNAIRE

SECTION A: DEMOGRAPHIC DATA

Serial Number:

Date:

1) Sex F M

2) Age in years _____

3) Current professional cadre.

A) Obstetrics Registrar

B) Anaesthesia Registrar

4) Year of study _____.

5a) Have you attended any resuscitation course

b) When

< 2 years ago 2-5 years ago > 5 years ago

c) Did the course have any focus on CPR in pregnant women?

Yes

No

SECTION B

6) Are resuscitation trainings focusing on pregnant women important?

Yes

No

Don't know /unsure

7) How would you grade your knowledge on CPR in pregnant women?

a) 100 knowledgeable

b) 75% knowledgeable

c) 50% knowledgeable

d) < 50% knowledgeable

8) When resuscitating a pregnant woman who in your opinion should be team leader?

- A) Anesthetist
- b) Obstetrician
- c) Ward nurse in charge
- d) Other _____

9) Are there cases of cardiac arrest in pregnant women where you feel resuscitation is not necessary?

Yes No If yes
 specify _____

10) The table below shows some of the challenges faced when performing CPR in pregnant patients in KNH? Rate each based on the score format below:

1-Major 2-Minor 3-Not a problem

	1	2	3
Lack of teamwork			
Lack of drugs			
Lack of knowledge			
Lack of equipment			

11a) Do you consider perimortem C/S while still resuscitating a pregnant woman?

Yes No

b) What would be your ideal location to perform perimortem cesarean delivery?

- a) Main theatre
- b) Maternity theatre
- c) Labor and delivery room
- d) In the location where maternal cardiac arrest occurs

No.12 to 14 to be answered by the obstetricians only

12) Have you ever performed a perimortem c/s in KNH? Yes No

13) If yes above, within what duration of time was it done?

- a) 1-4 minutes
- b) 5-10 minutes
- c) >30 minutes
- d) 11-20 minutes

14) What was the immediate outcome?

- a) Mother survived
- b) Both mother and foetus survived
- c) Foetus survived
- d) None survived

15) If you are the first responder in cardiac arrest of a pregnant woman, what do you do? 1-Very important 2-Important 3-Equivocal 4-Not important

	1	2	3	4	
Call for help					
Document time of onset of the arrest					
Place patient supine					
Start chest compression with hands slightly higher on the sternum					

16a) Do you defibrillate a pregnant woman who has suffered a cardiac arrest?

Yes No

b) If yes is it necessary to remove foetal monitors before defibrillation.

Yes No

c) What dose adjustments do you make?

- a) Applying the same defibrillation energy as in the non pregnant patient
- b) Reducing defibrillation energy in the pregnant patient

- c) Changing the energy levels depending on the stage of pregnancy
- d) Increasing energy levels at all stages of pregnancy

d) If no specify why you don't defibrillate-----

17) Regarding your use of epinephrine in a parturient experiencing cardiac arrest:

- a) Epinephrine is avoided, as it will cause decreased uterine blood flow
- b) Epinephrine is avoided, as it will cause fetal tachycardia
- c) Epinephrine is indicated in full ACLS doses.

18) The most appropriate position for performing chest compressions in a patient more than 30 weeks pregnant is:

- a) Supine
- b) Reverse Trendelenburg
- c) Supine with manual leftward displacement of the uterus
- d) Lateral tilt with a wedge

19) Physiologic changes during pregnancy that affect resuscitation measures in a parturient in cardiac arrest include: Use True or False

- a) Decreased circulating blood volume
- b) Decreased pulmonary reserve, due to decreased functional residual capacity
- c) The gravid uterus, after 20 weeks gestation, compresses the iliac vessels and inferior vena cava causing increased systemic venous resistance and hypertension

20) All of these conditions may make intubating a pregnant patient difficult. T/F

- a) Marked airway edema may be present
- b) The gravid abdomen may displace adipose tissue and breast tissue superiorly, making positioning for intubation difficult
- c) A high risk of aspiration of stomach contents necessitates rapid sequence induction and intubation
- d) Most women after approximately 20 weeks of gestation have smaller glottis openings.