

ST. PAUL'S HOSPITAL MILLENNIUM MEDICAL COLLEGE



Clinical use of combined first-trimester screening test for aneuploidy at Saint Pauls Hospital Millennium Medical College: retrospective institutional study

A Research thesis to be submitted to SPHMMC department of gynecology and obstetrics in partial fulfilment of sub-speciality certificate in maternal fetal medicine.

Clinical use of combined first-trimester screening test for aneuploidy at Saint Pauls Hospital Millennium Medical College: retrospective institutional study

Principal Investigator:

Tesfaye Diress, MD

Maternal-fetal medicine fellow

Department of Obstetrics and Gynecology,

St. Paul's Hospital Millennium Medical College

Addis Ababa, Ethiopia

Email: tdm.opth4@gmail.com

Tel: +251922556557

Advisors

1. Dr. Abdulfetah Abdulkadir, M.D

Assistant Professor of obstetrics and gynecology, Department of Obstetrics and Gynecology, St. Paul's Hospital Millennium Medical College

Addis Ababa, Ethiopia

Email: chechera8@gmail.com

Tel: +251911205760

2. Wondimu Gudu, MD, MPH

Associate professor of Obstetrics and Gynecology, MFM and Gynecology Oncologist, Department of Obstetrics and Gynecology, SPHMMC

Email: wondgu@yahoo.com

ABSTRACT

BACKGROUND: Multiple studies show that combined first-trimester screening is effective to detect major fetal aneuploidies. In Ethiopia, these screening tests are practiced in some centres, mainly in centres with maternal-fetal medicine sub-specialist. However; there is no single study on the performance of this important prenatal screening tests in Ethiopia.

OBJECTIVES: To describe clinical use of combined first trimester prenatal screening tests and clinical characteristics of cases with positive screening result at Saint Pauls Hospital Millennium Medical College, Ethiopia.

METHODOLOGY: This retrospective study was conducted from July 2016 to July 2023 at SPHMMC. Data on nuchal translucency, maternal age, weight, gestational age provided by obstetrician. Determination of β -human Chorionic Gonadotropin (β -hCG) and pregnancy associated plasma protein A(PAPP-A) was done at LABCO advanced laboratory. Risk assessment was done with Snibe 2000 software by using maternal age, nuchal translucency, PAPP-A, β -hCG and other maternal characteristics. Genetic test for high risk cases was done at MRC-ET diagnostic laboratory. Statistical analysis was done using SPSS version 22, Fishers exact and Man Whitney U test done to see association between dependent and independent variables with p-value less than 0.05 considered statistically significant.

Result: Overall high risk cases for aneuploidy are 24.8%. High risk cases who tested positive for aneuploidy have significant association with increased nuchal translucency, low PAPP-A values in MoM and modest association with pre-gestational diabetes.

Conclusion: This study shows significant association of aneuploidy with increased nuchal translucency, low levels of pregnancy associated plasma protein A in MoM and presence of diabetes. Risk of having aneuploidy like trisomy 21 and 18 is not limited to women older than 35 years, which may necessitate the need for universal screening in the future.

Key words: Aneuploidy, combined first trimester screening, multiples of median, nuchal translucency, PAPP-A, free β -hCG.

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ABBREVIATIONS

cFTS	Combined first trimester screening
cfDNA	Cell free DNA
DS	Down syndrome
FBR	False positive rate
hCG	Human chorionic gonadotropin
NIPT	Non-invasive prenatal testing
NT	Nuchal translucency
PAPP-A	Pregnancy associated plasma protein- A

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Table 1: Frequency table shows maternal sociodemographic and reproductive characteristics

Table 2: Maternal and screening characteristics

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1. INTRODUCTION

1.1 BACKGROUND

The worldwide incidence of aneuploidy particularly down syndrome is between 1 in 1000 to 1 in 100 live births. Each year, 3000 to 5000 babies will have born with this chromosomal disorder. Down syndrome is caused by trisomy of chromosome 21 and commonest genetic cause of intellectual disability. Life time prevalence of down syndrome increases with growing global population, as shown by the doubling of cases in USA population from 3.3 to 6.7 cases per 10,000 from 1950 to 2013.

UN General Assembly in 2011, declared March 21 as world down syndrome day in order to create public awareness, improve quality of life of people with down syndrome fulfilling educational and health care needs. A detailed second trimester anatomic scan only detect 50% of Down syndrome cases.

Aneuploidy poses significant morbidity and mortality to the child and social and economic constraints to the family¹. NIPT with cffDNA has a high sensitivity and specificity for detection of aneuploidy. Its applicability is limited particularly in developing nations due to the significant cost incurred². First trimester screening for aneuploidy and structural abnormalities is shown to be effective in most settings³. Isolated increment in nuchal translucency (3-3.5mm) mandates chromosomal microarray analysis⁴. Combination maternal serum markers of free β subunit of hCG, pregnancy-associated plasma protein A and maternal age uniformly demonstrate a sensitivity for Down syndrome of approximately 60% with a 5% false positive rate⁵. These first trimester serum markers are largely independent of nuchal translucency, which has resulted in the development of a combined serum and sonographic screening protocol that would be more effective for screening than either component alone. Combined first trimester screening helps to detect 90%, 97%, 92% of trisomy 21, 18 and 13 respectively⁶.

First trimester screening should be integrated in local prenatal care guidelines. Population based studies including the four risk parameters(maternal age, NT, PAPP-A, B-hCG) shown to increase detection of aneuploidy from 4.4% to 4.8%⁷.

Currently, first trimester combined screening test is being done only in a single private laboratory in Addis Ababa, Ethiopia. Although, it has been practiced for the past 5 years, there is no study conducted to describe the experience of this screening tests in our setup. The aim of this study is to assess this experience at Saint Pauls Millennium Medical College.

1.2 STATEMENT OF THE PROBLEM

First trimester screening with NT and serum biochemical markers continues to be the main first-line and cost effective Down syndrome screening method offered to general obstetric patients with singleton and multiple pregnancies⁶⁸. A study done in UK, combined first trimester screening shown to detect 90% of trisomy 21 and other major aneuploidies with false positive rate of 5%⁹. A population based study in Denmark to examine efficacy of combined first trimester screening identified 87% T21, 80% T13, 75% T18 and 79% of sex chromosome aberrations⁷. In another study done in resource limited setting of main land China to evaluate feasibility and cost effectiveness, combined first trimester screening is regarded as cost effective¹⁰.

To the authors knowledge, there is no study done in our country to describe the experience and clinical use of combined first trimester prenatal screening.

2. LITERATURE REVIEW

2.1 MATERNAL AGE AND GESTATIONAL AGE

Incidence of chromosomal abnormalities increase proportionately with maternal age and decrease with increase in gestational age¹¹¹². Combining maternal age with nuchal translucency significantly improves the detection ability of pregnancies at high risk of aneuploidy¹³. Detection rate of aneuploidy using combined serum anaylates decreases with gestational age from 78% at 9 weeks to 70% at 13 weeks¹⁴.

2.2 NUCHAL TRANSLUCENCY

A first trimester genetic sonogram including NT, presence of nasal bone and ductus venosus waveform is invaluable for detection of aneuploidy in a setting like ours where serum screening lacking. A prospective study done in UK shows that nuchal translucency(NT) measurement of 3-8 mm is associated with chromosomal abnormalities in 35% of the cases¹⁵. Increased nuchal thickening (>3.5 mm) in the absence of aneuploidy is associated with higher risk of fetal malformations, disruptions and genetic syndromes¹⁶. Combining NT with other sonographic markers of aneuploidy (nasal bone, Ductus venosus) improves the detection of aneuploidy in a setting where serum marker testing not easily available¹⁷¹⁸. A study done in Thailand to evaluate the effectiveness of first trimester genetic sonogram(NT) for detection of aneuploidy showed 55% detection with false positive rate of 5%¹⁹.

2.3 COMBINED NT, PAPP-A AND SERUM B-HCG

Traditionally, first trimester screening used maternal age and NT alone and in combination for screening fetal aneuploidy¹²¹³¹⁵. First trimester screening using maternal serum markers (PAPP-A, serum B-hCG) allows to identify 88% of cases with false positive rate of 13%²⁰. Combining NT with serum maternal makers increased detection rate by decreasing false positive rate. In a study done in Kings hospital, UK demonstrates detection rate of 95% with FPR of 3% for major aneuploidies with the use of combined first trimester screening tests⁹. FPR of combined first trimester screening will increase in pregnancies from IVF and ICSI regardless of fetal number. Patients undergoing ART should be advised on the drawback of this tests²¹. A low serum level of PAPP-A in the first trimester of pregnancy is associated with increased risk of aneuploidy, preterm delivery and stillbirth²².

Combined first trimester aneuploidy screening is being widely adopted in developed nations. Its use in low resource settings like ours is limited due to lack of laboratory setup to determine the serum markers of aneuploidy.

3. SIGNIFICANCE OF THE STUDY

Multiple studies show that first trimester screening for aneuploidy is effective and offers substantial benefits to clinicians and patients. Although these first trimester combined screening has been practiced inconsistently in centres with maternal fetal medicine sub-speciality, little is known about this experience and screening ability in our setting.

This study intends to present the first evidence regarding this essential prenatal intervention. Results of this study will have a national implication on expanding availability of this prenatal screening tests across tertiary obstetric centres in Ethiopia. At regional level, it will lend a new information on the scale and characteristic of this practice among obstetric centres which could be relevant in improving the quality of prenatal care across Sub-Saharan Africa.

4. OBJECTIVES

4.1 GENERAL OBJECTIVE

To describe the percentage of positive cases among women who undergone combined first trimester screening for aneuploidy and clinical characteristics of cases with positive screening test result at Saint Pauls Hospital Millennium Medical College.

4.2 SPECIFIC OBJECTIVES

1. To describe the percentage of positive cases among women who undergone combined first trimester screening at Saint Pauls Hospital Millennium Medical College from July 2016 to July 2023.
2. To describe clinical characteristics of cases with positive test result at Saint Pauls Hospital Millennium Medical College from July 2016 to July 2023.

5. MATERIALS AND METHODS

This retrospective study was conducted on 141 pregnant women who undergone the combined first trimester screening test from July 2016 to July 2023 at SPHMMC. Cases with incomplete documentation were excluded.

5.1. STUDY SETTING

The research was conducted at Saint Paul Hospital Millennium Medical College, which is located in Addis Ababa, Ethiopia's capital city.

Undergraduate, specialty and subspecialty programs are available at the college. The Obstetrics and Gynecology department of the SPHMMC is one of the pioneers to launch residency program in the college. It was established in 2012-13G.c and the first seven residents were admitted. The program's capacity has gradually risen and the average number of admissions each year is now 28. Maternal-Fetal Medicine, Family Planning, Gynaecologic Oncology, Reproductive Endocrinology, Infertility and Urogynecology are among the subspecialties offered by the department.

Maternal fetal medicine unit offers a wide variety of services including ANC follow up for high risk mothers in collaboration with different units of internal medicine. We also provide comprehensive first and second trimester anatomic scanning, diagnostic procedures like amniocentesis and therapeutic procedures like intrauterine transfusion.

5.2. STUDY PERIOD

Retrospective data was collected from July 2016 to July 2023.

5.3. STUDY DESIGN

Retrospective descriptive study

5.4. POPULATIONS

5.4.1. SOURCE POPULATION

All pregnant women who had ANC follow up in Addis Ababa during the study period

5.4.2. STUDY POPULATION

All women who undergone combined first trimester screening test in the study period

5.4.3. INCLUSION AND EXCLUSION CRITERIA

Inclusion criteria

All women who undergone the screening test during study period between gestational age of 11 to 13+6 weeks

Exclusion criteria: incomplete documentation, second trimester Quad or triple tests

5.5. SAMPLE SIZE AND SAMPLING PROCEDURE

All consecutive samples based on inclusion and exclusion criteria during study period were included in the study

5.6. STUDY VARIABLES

Study variables

Sociodemographic factors

Maternal age

Weight

Obstetric factors

Gestational age, mode of conception, number of gestation

Screening tests

NT, PAPP-A, free serum B-hCG

Maternal medical conditions

Diabetes

5.7. DATA COLLECTION PROCEDURE

Data on socio-demographic characteristics, obstetric factors and screening parameters was collected retrospectively using data extraction sheet. The questionnaire forms were checked for completeness and consistency by the principal investigator before data entered to SPSS version 22. Cases for screening were selected based high risk status for aneuploidy like women having increased nuchal translucency, older age greater than 35 years, IVF pregnancy and previous bad obstetric performance. Ultrasound assessment of nuchal translucency done between gestational age of 11 to 13+6 weeks. Biochemical markers like pregnancy associated plasma protein- A(PAPP-A) and β -human chorionic gonadotropin(β -hCG) was performed from maternal blood between gestational age of 11 to 13+6 weeks at LABCO advanced laboratory. Risk of aneuploidy was calculated using SNIBE 2000 software by entering dual serum markers (PAPP-A and β -hCG), NT and maternal characteristics with a cut-off point of 1:300. Around 10ml of amniotic fluid sample was taken and subjected for cytogenetic analysis. Genetic test was performed at MRC-ET advanced diagnostic laboratory for those cases considered high risk.

5.8. DATA PROCESSING AND ANALYSIS

The data was entered into SPSS version 22 software packages for analysis. Simple descriptive analysis of baseline characteristics was done. Fishers exact test for categorical variables and Man- Whitney U test for continuous variables was used to see association of dependent and independent variables with p-value <0.5 is considered significant.

5.9. OPERATIONAL DEFINITIONS

First-trimester combined screening: measurement of nuchal translucency, pregnancy-associated plasma protein A [PAPP-A] and the free beta subunit of human chorionic gonadotropin at 10 weeks 1 day through 13 weeks 6 days of gestation.

High risk cases: cases with software generated likelihood ratio greater than 1 in 300.

Low risk cases: cases with likelihood ratio of less than 1 in 300.

Positive cases: high risk cases who tested trisomy 21, 18 and 13 on genetic testing

5.10. ETHICAL CLEARANCE

Ethical clearance was received from IRB of SPHMMC. Confidentiality was maintained. Initials, phone number of clients was not included.

6. RESULT

6.1. Maternal demographic and reproductive characteristics

□ Of the 141 pregnant mothers who undergone combined first trimester screening for aneuploidy, 35(24.8%) cases were found to be high risk for aneuploidy. Among 35 high risk cases, 30 cases had diagnostic genetic test from amniotic fluid, with 9(25.71%) cases found to be positive for trisomy 18 and 21. The mean age of women is 31.5 years with range of 20 to 45 years with SD of 4.891 years. The screening was done at gestational age of 11 to 11+6 weeks in 27.7%, 12 to 12+6 weeks in 39% and 13 to 13+6 weeks in 33.3% of pregnant women who had the combined first trimester screening. Of the 9 positive cases of aneuploidy, 66.7% of them are between gestational ages of 11 to 11+6 weeks. Among those women who screened high risk for aneuploidy, 55% are above the age of 35 years. 7.8% of cases were conceived by IVF among all mothers who undergone the screening.

Table1: Frequency and percentage of maternal characteristics

Variables	Number	Percentage
Age in years		
20-34	100	70.9%
>=35	41	29.1%
Weight in KG		
<45	3	2.1%
45-70	104	73.8%
>70	34	24.1%
Mode of conception		
Natural	130	92.2%
ART/IVF	11	7.8%
Gestational age in weeks		
11 – 11+6	39	27.7%
12 – 12+6	55	39%
13 – 13+6	47	33.3%
History of diabetes		
Yes	11	7.8%
No	130	92.2%

6.2. First trimester screening characteristics (NT, PAPP-A, free β -hCG)

Only 33.3% of cases who tested positive for trisomy 21 and 18 demonstrate a free B-hCG level >1.5 , 55.6% have PAPP-A level < 0.5 MoM. Those cases who tested positive for aneuploidy have increased nuchal translucency with median of 2.9mm (2.4,2.9) as compared to high-risk cases who tested negative with median of 2.1mm (1.7,2.5).

Fishers exact test for categorical variables and Man Whitney U test for continuous variables done to see the association of dependent variable with independent variables of maternal age, weight, gestational age, mode of conception, diabetic status, nuchal translucency and dual serum biomarkers. The result showed statistically significant association of positive test for aneuploidy with nuchal translucency, low PAPP-A level in MoM, and modest association with diabetes (Table 2).

This study didn't show statistically significant association between outcome variable with maternal age and serum free β -hCG level in MoM in contrast to similar studies which can be possibly explained by small sample size of our study. We showed also that nuchal translucency, PAPP-A and free B-hCG are independent of the each other in the prediction of risk for aneuploidy as demonstrated in statistical association. This study also shows that the use of first trimester (between 11 and 13+6weeks) PAPP-A and nuchal translucency measurement are invaluable for aneuploidy screening.

Factor	Negative	Positive	p-value
N	21	9	
Age of the woman			1.00
20-34 years	8 (38%)	4 (44%)	
>=35 years	13 (62%)	5 (56%)	
Weight of the woman in kg, median (IQR)	65.0 (55.0, 70.0)	63.0 (59.0, 67.0)	0.60
History of pre-gestational diabetes			0.049
Yes	2 (10%)	4 (44%)	
No	19 (90%)	5 (56%)	
Gestational age in weeks			0.35
11- 11+6	7 (33%)	6 (67%)	
12-12+6	6 (29%)	1 (11%)	
13- 13+6	8 (38%)	2 (22%)	
Nuchal translucency in mm, median (IQR)	2.1 (1.7, 2.5)	2.9 (2.4, 2.9)	0.021
Mode of conception			0.53
Natural	18 (86%)	9 (100%)	
ART	3 (14%)	0 (0%)	
PAPPA in MOM			0.005
<=0.5 MOM	1 (5%)	5 (56%)	
>0.5 MOM	20 (95%)	4 (44%)	
Free B-hCG in MOM			1.00
<=1.5MOM	7 (33%)	3 (33%)	
>1.5MOM	14 (67%)	6 (67%)	

Table 2: Maternal and screening characteristics

*p-value s for categorical variables were calculated using Fisher's exact test

**IQR = Interquartile range

***p-value for continuous variables was calculated using the Man-Whitney U test of two independent samples

7. DISCUSSION

Studies in developed nations showed that combined first trimester screening methods using maternal serum markers (B-hCG and PAPP-A) and sonographic marker of nuchal translucency(NT) enables to identify 90% of aneuploidies with a false positive rate of 5%²³⁶²⁴. But, there is scarce literature on this aspect in developing nations particularly in sub-Saharan Africa. First trimester aneuploidy screening will help us for early counselling and invasive diagnosis to provide the options of earlier pregnancy termination as it incurs little risk of complications to the mother²⁵.

In our study, 141 pregnant women who had combined first trimester aneuploidy screening were found from data retrieved from July 2016 to July 2023. Among this, 35 cases (24.8%) were found to be high risk for aneuploidy with the cut-off value of 1:300. The overall positive screening result of 35(24.8%) is much higher than in a similar 3 years retrospective study done in India which is 2.58% which can be explained by selective screening of high-risk mothers in our setting²⁶. Of the 35 high risk cases, 30 had the diagnostic amniocentesis for aneuploidy and 9 cases (25.7%) tested positive for trisomy (8 cases of trisomy 21 and a case of trisomy 18).

In this retrospective study, there is statistically significant association between trisomy's 21 and 18 with nuchal translucency, pregnancy associated plasma protein A and modest association with diabetes. There is no statistically significant association found between positive aneuploidy test with either maternal age, weight, mode of conception, gestational age, previous history of aneuploidy or free serum B-hCG in our study.

A similar retrospective study with larger sample size of 86118 pregnant women showed significant association between aneuploidy with increasing maternal age unlike our study finding, which can possibly be explained by the small sample size and selective provision of first trimester screening for elderly pregnant women in our setup²⁶. Another prospective study done in Poland involving 251 pregnant women showed no statistically significant association between cytogenetic abnormality and increased maternal age²⁷.

The significant low levels of PAPP-A in cases high risk cases for trisomy 21 and 18 can be in part explained by reductions of serum biomarkers in women with pre-gestational diabetes²⁸²⁹. But, retrospective study done in UK to see whether pre-gestational diabetes alters levels first trimester serum biomarkers and nuchal translucency showed no significant difference in medians of this

markers among the groups³⁰. A 3-year retrospective study conducted in India, involving 86118 cases showed significant association between aneuploidy and insulin dependent diabetes²⁶. A retrospective analysis done in a university hospital in London, UK to see the impact of diabetes on the median MoM of maternal free b-hCG, PAPP-A and fetal NT necessitates the need for risk-specific adjustment of PAPP-A for type 2 diabetic women³⁰.

Present study demonstrates significant association of low PAPP-A in MoM (0.51 ± 0.126) and increasing nuchal translucency ($2.9 \text{ mm} \pm 0.716$) among cases who tested positive for trisomy 21 and 18 which is consistent with other studies²². A retrospective study done in a university hospital, Finland involving 961 pregnant women showed significant association of low levels of PAPP-A with cytogenetically confirmed aneuploidy and still births²². Retrospective multicentre study done in Israel involving 1588 cases, showed association of increased nuchal translucency measurement with cytogenetic abnormality for aneuploidy⁴.

In our centre, we are practicing measurement of nuchal translucency as first trimester screening strategy. The screening ability of first trimester nuchal translucency measurement can be increased from 64% to 81% with combined use of maternal first trimester biomarkers as it is demonstrated by prospective study done in France³¹. Combining NT with evaluation of nasal bone and ductus venosus improved significantly the performance of genetic sonogram for aneuploidy screening in a setting with limited resource for serum biomarker screening¹⁹³²¹⁷.

8. CONCLUSION AND RECOMMENDATION

8.1. CONCLUSION

This study shows significant association of aneuploidy with increased nuchal translucency, low levels of pregnancy associated plasma protein A in MoM and presence of diabetes. Risk of having aneuploidy like trisomy 21 and 18 is not limited to women older than 35 years, which may necessitate the need for universal screening in the future. It will lend new information at institutional, national level. It will also act as reference for future research in this area.

8.2. RECOMMENDATION

Based on the finding of our study

1. Combined use of NT and biochemical markers are invaluable for first trimester aneuploidy screening
2. Large prospective studies needed to validate the sensitivity and specificity of the screening test in our setting.

9. STRENGTH AND LIMITATION OF THE STUDY

9.1. STRENGTH OF THE STUDY

1. It will be the first paper at national and regional level
2. It will lend new information and serve as reference for future research work in this area

9.2. LIMITATION OF THE STUDY

1. Retrospective nature of the research with lack of data on neonatal evaluation for those screened low-risk
2. Lack of confirmatory testing for outcome variable to make validation and assess sensitivity and specificity of the test

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11. ANNEXES

11.1 ASSURANCE OF INVESTIGATOR

I the undersigned fellow agree to accept all responsibilities for the scientific, ethical and conduct of the research project and for provision of required progress reports as per terms and conditions of the research and publication directorate of St Pauls Hospital Millennium Medical College.

Name of principal investigator: Dr Tesfaye Diress

Signature: _____

Date: _____

Name of advisors

1. Dr Abdulfetah Abdulkadir

Signature: _____

Date: _____

2. Dr Wondimu Gudu

Signature: _____

Date: _____

11.2 PI's Resume

Dr. Tesfaye Diress Mamuye

Gulele Sub-city, St. Paul's Hospital, Addis Ababa(ET)

tdm.optha4@gmail.com

[+251922556557](tel:+251922556557)

PROFESSIONAL SUMMARY

- Dedicated, passionate and credible obstetrician and gynaecologist with over 3 years of experience in the field of expertise
- Certified in basic leadership training with good attitude and communications skills

EMPLOYMENT HISTORY

Assistant professor of Obstetrics and Gynaecology, Debre Markos university, college of medicine and health sciences from January 2020 to October 2021GC, Maternal fetal medicine fellow at St. Paul's Hospital Millennium Medical College, Ethiopia

November 2021 till now

- Teaching undergraduate and postgraduate students
- Served as head of department of obstetrics and gynaecology and performed activities pertaining to the department
- Attending elective gynaecology surgeries and caesarean deliveries
- Mentoring undergraduate and post-graduate students
- Research advisor for undergraduate and postgraduate students

Obstetrician and Gynaecologist, Debre markos specialized hospital, Ethiopia

January 2020 to October 2021

- Responsible gynaecologist in charge of managing OPD consultations and doing elective gynaecologic procedures
- Responsible obstetrician in charge of labor ward and maternity ward
- Doing major ward rounds and teaching students
- Provide consultation and surgical assistance to other physicians and surgeons.

- Manage surgery services including planning, scheduling, coordination and decision of procedures.

Maternal fetal medicine Fellowship, St. Paul's Hospital Millennium Medical College (SPHMMC) Addis Ababa, Ethiopia (October 2021 till now)

- Provide comprehensive care for high risk pregnant mothers
- Teach post-graduate students
- Attend different scientific conferences and seminars

Residency training in Obstetrics and gynaecology, Bahir Dar university college of medicine and health sciences, Bahir Dar, Ethiopia

June 2014 – December 2019

- Four years' residency training in obstetrics and gynaecology which included diagnosis and management of complicated obstetric and gynaecologic cases
- Yearly one-month attachment in remote areas in Ethiopia where complicated cases were managed with the limited resource available
- Prescribe preoperative and postoperative treatments and procedures.
- Provide consultation and surgical assistance to other physicians and surgeons.
- Direct and coordinate activities of residents and other medical staff.
- Doing different presentations- case presentation, seminars, perinatal mortality audit and maternal death reviews

General practitioner, Debre markos university college of medicine and health science, Debre Markos, Ethiopia.

September 2012 – June 2014

- Responsible physician to lead teaching activities
- Established and lead department of obstetrics and gynaecology department before joining residency program

Mekelle university, Ayder college of health sciences, Mekelle, Ethiopia

November 2006 – September 2012

- Attended 6 years of undergraduate study in medicine
- Participated in community health services in rural Tigray
- Practiced diagnosis and management of patients in obstetrics and gynaecology, paediatrics, internal medicine and surgery 3 month for each for one year under supervision of consultants

EDUCATION

Bahir Dar university college of medicine and health sciences, Bahir Dar, Ethiopia

Specialty Certificate Postgraduate Study-Obstetrics and gynaecology, Dece. 2019

Mekelle university college of medicine and health sciences, Mekelle, Ethiopia, M.D.,
Medicine, Sept. 2012