

**THE EFFECTIVENESS OF
ANTENATAL RISK SCREENING SERVICE
IN THE
FOUR REFERRAL HOSPITALS
OF ADDIS ABABA**

A thesis presented in partial fulfilment of
academic requirement for the Degree of Masters
in Public Health.

Community Health Department
Facility of Medicine
School of Graduate studies
Addis Ababa University

Addis Ababa

Ethiopia

May 1994



MEKONNEN ADMASSU MD.

ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES

**The Effectiveness of Antenatal Risk Screening
Service in the Four Referral Hospitals
of Addis Ababa**

By

Mekonnen Admassu, MD

Department of Community Health
Faculty of Medicine, Addis Ababa University

Approved by the Examining Board

Dr. Derege Kebede

Chairman, Department
Graduate Committee



Dr. Jim Farrow

Advisor



Dr. Pierre Duplessis

Examiner



Dr. MelakeBerhan Dagneu

Examiner



Dr. Sally Stansfield

Examiner



DEDICATED

**To my wife Saba Haile and
my daughter Yokabeth Mekonnen.
Because you are so special to me.**

ACKNOWLEDGMENTS

I am greatly indebted to my advisors Dr. James Farrow and Dr. Derege Kebede, for their diligent and indefatigable effort, beginning from the inception up to the completion, in the process of making this study the best as possible.

I acknowledge to the Heads of Departments of Obstetrics and Gynaecology of the four hospitals, Dr. Tadesse Kitella, Dr. Esayas Muleta, Dr. Molla Tsega and Dr. Hailemichial for their good will and permission in order to conduct the study in the ANC - clinics and maternity wards.

My thank also goes to the Head nurses and staffs working in the ANC clinics and maternity wards to which the actual work was posed on their shoulders, besides their other responsibilities, did this work effectively, in the recording of outcomes and follow up of mothers.

I thank also Ato Abate Gudunfa, Dr. Tesfanesh and Ato Yohannes, of the Family Health Department, Ministry of Health for their assistance in providing me medical instruments, different formats and teaching materials as well as reference materials.

I wish to acknowledge my debt to Emebet Haile for her intensive revision and editing of this manuscript.

I wish to acknowledge the staffs of NCDDP, particularly Dr. Renato Corregia for his valuable comments.

I must thank Wt. Eleni, Wt. Tsige, Wt. Yemeserach Ashenafi, Ato Kidanu for the data entry and typing.

I would like to thank the MCGILL-Ethiopia Community Health Project for the funding of this study.

Finally, I am grateful to the important role played by my families, colleagues, friends, for their contribution in the making of this study possible.

ACKNOWLEDGEMENTS

I wish to acknowledge the staffs of NCDDP, particularly Dr. Renato Corregia for his valuable comments.

I must thank Wt. Eleni, Wt. Tsige, Wt. Yemeserach Ashenafi, Ato Kidanu for the data entry and typing.

I would like to thank the MCGILL-Ethiopia Community Health Project for the funding of this study.

Finally, I am grateful to the important role played by my families, colleagues, friends, for their contribution in the making of this study possible.

ABBREVIATIONS

ANC	-	Antenatal care
APH	-	Antepartum haemorrhage
BP	-	Blood Pressure
BMJ	-	British Medical Journal
C/S	-	Cesarean section
D/C	-	Developing Countries
FHD	-	Family Health Department
F/P	-	Family Planning
FNR	-	False Negative Rate
FPR	-	False Positive Rate
GDM	-	Gestational diabetes
HPD	-	Hypertensive pregnancy diseases
IUFD	-	Intrauterine fetal death
IUFGF	-	Intrauterine fetal growth retardation
LB	-	Live Births
LR+	-	Positive Likely-hood Ratio
LR-	-	Negative Likely-hood Ratio
MCH	-	Maternal and Child Health
MCH-COO	-	Maternal and Child Health Coordination Office (the current FHD)
MMR	-	Maternal Mortality Ratio
MOH	-	Ministry of Health of Ethiopia
NCDDP	-	National Control of Diarrhoeal Diseases Programme
NND	-	Neonatal death
PPH	-	Post partum haemorrhage
PVP	-	Positive Predictive Value
PVN	-	Negative Predictive Value
R	-	Rate (prevalence)
SVD	-	Spontaneous vaginal delivery
TNR	-	True Negative Rate (Specificity)
TPR	-	True Positive Rate (Sensitivity)
WHO	-	World Health Organization

TABLE OF CONTENT

	PAGE
Acknowledgments	iv
Abbreviations	vi
Abstract	iiiiv
 Introduction	
1.1. Background	1
1.2. The risk approach and risk screening	5
1.3. Implementation of risk approach	7
1.4. Evaluation studies of ANC programme	8
1.5. The challenge to ANC	10
1.5.1. Identification of risk factors	11
1.5.2. Identification of the population at risk	14
1.5.3. Provision and quality of care	15
2. Objectives	
2.1 General	18
2.2 Specific	18
3. Materials and methods	
3.1. Study design	19
3.2. Study period	19
3.3. Hospitals involve in the study	19
3.4. Population	
3.4.1. Source population	20
3.4.2. Entry criteria	20
3.5. Study population	
3.5.1. Sampling procedure	21
3.5.2. Enrolment procedure	21
3.6. Variables and methods of measurement	
3.6.1. Operational definition	21
3.6.2. Methods of measurement	21
3.6.3. Category of variables	21
3.7. Data collection	23
3.8. Data analysis	25
3.8.1. Descriptive statics	25
3.8.2. Analytic statistics	25
3.9. Ethical considerations	27

4. Result	
4.1. Description of the study population	29
4.2. Identified risk factors	30
4.3. Pregnancy outcomes	30
4.4. Test performance	
4.4.1. Test performances of each factor	31
5. Discussion	39
6. Conclusion	46
7. Recommendation	47
8. Annex (appendix)	
1. ANC - card	48
2. Questionnaire	50
3. Statistics used in the test performance analysis	62
4. Consent form	66
9. Reference	67

LIST OF TABLES AND FIGURES

	PAGES
Figure 1. Sampling frame of the study population, Addis Ababa, 1993-94.	28
Table 1 . Numbers of mothers who completed the study in terms of parity and risk status (Oct 1993 - Mar 94)	33
Table 2. Common risk factors identified in "high" risk pregnancy, Addis Ababa 1993-94	34
Table 3. Pregnancy outcomes according to parity and risk, Addis Ababa, 1993-94	35
Table 4. The distribution of " bad" outcomes among high and low risk mothers as identified by the ANC screening card, Addis Ababa, 1993-94	36
Table 5. The identified risks with outcomes and the test performances as identified by the ANC screening card, Addis Ababa, 193-94.	37
Table 6. Pregnancy outcomes according to parity and the test performance as identified by the ANC screening Addis Ababa 1993-94.	38

ABSTRACT

A prospective hospital based study was designed to evaluate the effectiveness of ANC - risk screening in the four referral hospitals of Addis Ababa.

The assessment of the effectiveness of the risk screening was performed by employing ANC - card developed by the Family Health Department, MOH.

A total of 758 mothers completed the study. 385 were high - risks and 373 were low risks.

Among the 385 high risk mother, 232 were parous and 153 were nulliparous. Among the 385 high risk mothers; pregnancy related diseases 42%, malpresentation and malposition 30.6% and age 18.7% and non - pregnancy related diseases 9.6% were the main risk factors identified. Fifty six percent were having only one type of risk factor, 13.3% two and 30.4% three or more risk factor.

318 (42%) developed bad outcomes. Among these, 225 (71%) were identified as high risks during antenatal visit.

Among the listed risk factors, current pregnancy related diseases (LR+6.89, PVP 77.8%), non-pregnancy related diseases (LR+ 5.53, PVP 73.5%), and malposition (LR + 4.76, PVP 71.2%) were found to have better discriminator and predictive powers of bad outcomes both in parous and nulliparous women.

Height in nulliparous (LR + 3.20, PVP 70.3%) and age in both groups (LR+ 2.80, PVP 67.1%) were found to be fairly discriminant and predictive of bad outcome. Bad obstetrics history (LR+ 1.60, PVP 58.7%) and grand parity (LR+ 2.0, PVP 67.1%) were found to have less discriminating and productive capacity.

Presence of 3 or more risk factor (LR + 22.3, PVP 92.3) followed by two factors (LR + 3.35, PVP 76.5%) were also found to have high discrimination and predictive capacity.

The test performance of the ANC card was sensitivity 63.6%, specificity 70.8% LR + 1.95, PVP 58.4%). This instrument showed better performance in parous than in nulliparous.

" APPEARANCES IN THE MIND ARE OF FOUR KINDS.
THINGS EITHER ARE WHAT THEY APPEAR TO BE;
OR THEY NEITHER ARE, NOR APPEAR TO BE;
OR THEY ARE, AND DO NOT APPEAR TO BE;
OR THEY ARE NOT, YET APPEAR TO BE.
RIGHTLY TO AIM IN ALL THESE CASES
IS THE WISE MAN'S TASK. " --
EPICTETUS 2nd CENTURY AD

1. INTRODUCTION

1.1 Background information

At least half a million maternal deaths take place in the world each year. Ninety-nine percent of these deaths occur in developing countries. The life-time risk of a woman dying from pregnancy and its related complication is one in twenty one in Africa, compared only one in ten thousand in developed countries. This is the widest disparity in human development indicators yet reported (1,2).

About 62 million pregnant women in developing countries develop acute and chronic complications such as fistula and uterine prolapse (3). In addition, about 20 million pregnant women contract malaria, hepatitis, anaemia and/or malnutrition, all of which are conditions that are aggravated by pregnancy (3).

One cannot look at maternal morbidity and mortality alone. Pregnancy involves a dyad: the mother, and the fetus/newborn. It is estimated that in developing countries, seven million perinatal deaths occur annually that are associated with maternal complications and poor delivery care (3).

Analysis of obstetric factors shows that the causes of maternal deaths are haemorrhage, infections, toxæmia,

obstructed labour and illicit induced abortion while the rest are due to indirect obstetric causes. However, the factors responsible for the development of complications are multifactorial, complex and not fully understood (4).

Maternal health in Ethiopia, a sub-Saharan and least developed country, is characterized by high total fertility (5,6), high mortality, and serious morbidity. In addition coverage with antenatal services (16%) and institutional delivery (5%) are very low. Each year, about 5% of the population is expected to be pregnant (5).

The Ministry of Health of Ethiopia currently estimates the Maternal Mortality Ratio (MMR) as 600-1000 per 100,000 live births (LB) (5,6), and it can therefore be estimated that between 15,000 and 25,000 women in Ethiopia die due to complications associated with pregnancy and child birth

each year. The life-time risk of dying as a result of pregnancy and child birth is estimated to be 6-7% or one in sixteen women.

The overwhelming majority of maternal deaths are preventable. The interventions most effective in reducing the risk of maternal mortality and morbidity are the reduction of fertility and provision of improved and accessible health care (7,8,9).

Antenatal care (ANC) was introduced to the modern health care system in the mid 19th century in the United Kingdom, and its use since that time has become widespread. Its original objective was to reduce morbidity and mortality due to pregnancy and childbearing (7,8). As an essential component of MCH/FP, ANC is composite of a variety of services including patients education, treatment of existing conditions and complications, and screening for risk factors.

It is not known when ANC was introduced in Ethiopia. A community based ANC system as part of a home visiting service was started by health teams trained by the Gondar Public Health College in the early of 1950s (10).

In the sixties and seventies, certain health facilities, both public and private, had antenatal programs, but the introduction of a standardized ANC service had to await the founding of the Maternal & Child Health Coordinating Office (MCH-COO) of the MOH in the late 1970s (11). At present MCH/ANC is delivered by the majority of health units (65% of 2122 facilities). Sixty hospitals (83%), 140 health centres (93%) and 1,160 health stations (59%) offer ANC services (11).

The objectives and schedule of the service provided in Ethiopia, being based on the program developed by the British Ministry of Health in 1929 is the same as that provided in other countries.

This includes monthly visits following the first 30 weeks, with fortnightly visits after 30 weeks gestation and weekly visits during the last 6 weeks (5,11).

According to ANC guidelines, at the first visit the mother's health and prognosis is assessed by enquiring into her previous medical and obstetric history, and by performing general, abdominal and pelvic examination. In subsequent visits, uterine growth, weight gain, blood pressure and fetal heart are assessed.

Determination of haemoglobin, blood grouping, syphilis serology, and urine tests for glucose and albumin are done. Tetanus Toxoid, iron and folate tablets, (and malaria prophylaxis when necessary) are included in the program. This information is recorded on the ANC card developed by the Family Health Department of the MOH and distributed to all health facilities throughout the country. This card is used as a guide to the health worker in the risk screening, and is kept in the health units. The card is printed only in English. It contains demographic information as well as current and past obstetric history (Annex 1).

While this is the program that is supposed to be offered to all women in Ethiopia, the reality is significantly different.

About 21% of the population, are women in the reproductive age group (15-49 years of age), and it is estimated that 20% of these women become pregnant each year (5,6). Of these, only 16% register for ANC care, and only 5% deliver in the health units. In addition, the quality of services offered to this small percentage of pregnant women is generally poor. Lack of trained personnel, lack of adequate supplies, and poor transportation services are some of the factors that have been implicated in the poor performance of the ANC program in Ethiopia (5,6,12).

1.2 The risk approach and risk screening

The faith in ANC rests on the presumed efficacy of the risk screening in reducing maternal mortality and morbidity by facilitating early intervention before complications occur ie the "risk approach".

The notion of "risk" is widely expressed in various ways and is frequently applied in everyday life. "Risk is a measurement of statistical chance", the probability of future occurrence of an event or outcome (13). In the context of medicine, "risk" implies "a condition, physical characteristic, or behaviour that increases the probability (i.e risk) that a currently healthy individual will develop a particular disease..." (14).

"Risk factor" is defined as "an ascertainable characteristic or circumstance of a person or a group of persons that is known to be associated with abnormal risk of developing or being especially adversely affected by a morbid process" (15). In other words "a risk factor is one link in a chain of associations leading to an illness" or an indicator of a link (13).

The "risk approach" gives special attention to vulnerable groups, and within those groups, to those at higher risk. It targets care for those who need it most, and where possible, in proportion to that need (13).

Decisions made based on the risk approach, depend on risk ascertainment, risk scoring or quantifying of the measured risks. The existing resources will be rationally allocated based on the measured risks that reflect the need rather than according to "access" or "demand" (13).

The task of implementation of the risk approach begins with the process of identification of risks, that is screening or surveillance of the population whose health problems are to be the target of the risk strategy. The risk approach should be supported by valid "risk data", including frequencies or magnitudes of the risk factors and their association with the outcome.

The "risk data" are then used to predict the outcome and to identify appropriate measures to be taken to avert that bad outcome or to promote the good outcome.

Therefore the risk approach is said to be effective as a public health strategy if the following conditions are met:

- The whole population must be included in the primary screening.
- Conditions screened must include the important causes of mortality and morbidity.
- When increased risk is detected, appropriate action must be taken.
- The screening must have the ability to discriminate those at high risk from those at no risk or low risk. It should have high sensitivity, specificity and positive predictive values as well as reliability (7).

1.3 Implementation of risk approach in ANC

Pregnancy and parturition, a natural process, still carries a risk to both the mother and the infant. The vulnerability to the risk of death or disability is not equally distributed among all pregnant women and their babies.

Although all pregnant women have the risk, only a certain proportion of pregnant women and infants develop serious complications while the majority of women have uneventful pregnancies and deliveries.

Unfortunately, those who face the greatest risks often receive the least medical care (16).

These high risk mothers share common risk factors that are related to their biological make up (age, birth order, parity, height, presence of pregnancy-related or other diseases) or social/ environmental factors (status of women, health care services) or both. The theory behind ANC is that these risk factors can be identified, their effects can be predicted, and thus, the unwanted outcomes can be averted.

All antenatal care programmes through out the world are based on risk ascertainment in that they attempt to screen the whole pregnant population and provide surveillance and treatment to individual women or groups according to their levels of needs.

1.4 Evaluation studies of ANC programme

Although ANC was first introduced to the modern health care system at the beginning of this century, and its benefits are widely accepted, its true capacity to improve maternal and perinatal health has not been properly assessed.

In developing countries, for instance, there is a general consensus that the risk of maternal death and morbidity processes is up to 15 times (17-20) and perinatal mortality 4-11 times (21-23) higher for women

who do not receive ANC care than it is for those who do.

Whether ANC actually contributes to this reduction is difficult to determine from the studies that are reported (7). Significant methodological weaknesses are common to the published studies. All are observational: trend studies, geographical comparisons and qualitative assessments of ANC care (24). Evaluation of ANC, so far has not been subjected to randomized clinical trials (7,24).

The majority of studies have been conducted in the developed world where adverse maternal outcomes are rare. Therefore, most evaluations of ANC programs have considered only perinatal and neonatal outcome, but not maternal outcome. A few have provided information of both maternal and perinatal outcomes, but only for high risk pregnancies; there has been no comparison group.

There are few studies in Africa that were designed to evaluate ANC in terms of detection of complications and intervention in relation to pregnancy outcomes. A prospective study of ANC in rural Tanzania from 1983 to 1985 concluded that despite full coverage and good attendance rates at ANC, maternal and perinatal morbidity and mortality remain high (25).

The Kasongo project in Zaire found "bad obstetric history" to be the most important risk factor for the development of obstructed labour in multiparous mothers. It was found that women with a bad obstetric history were nine times more likely to develop obstructed labour than women without such a history (Relative Risk 9.2). However, the sensitivity of this predictor was found to be only 29%, ie. more than two-thirds of the obstructions were not predicted. Neither was the test specific, as 90% of the predicted cases had uneventful deliveries (26).

Therefore, despite the general consensus that ANC is worthwhile, reservations remain about the extent of its true effectiveness for several reasons (7).

1.5 The challenges to ANC

For 60 years, since the appearance of an article in the BMJ in 1934 (27), the effectiveness in reducing maternal and perinatal loss has been questioned (28).

The challenges made regarding ANC, particularly risk screening components can be summarized as follows:

1.5.1 Identification of Risk factors

ANC risk screening lacks sufficient information on maternal and perinatal risk factors (7,29). The list of known risk factors is neither complete nor is there general consensus about their appropriateness (30). There are "big unknowns" such as genetic factors that are neither predictable nor preventable and that can have major influence on pregnancy outcome (30).

Non medical risk factors are not included in the standardized check list of ANC risk factors. It is important to recognize that socio-economic, cultural, and psychological variables must be taken into account, "because their predictive value is at least equal to that of laboratory data or clinical observations" (30,31).

Individual risk factors are poor predictors as they are only markers or signals rather than direct causes for poor outcome (7).

The known risk factors are not even sensitive enough to detect the common chronic conditions as anaemia, HPD, IUFGF and infections in pregnancy, not to mention the major acute conditions such as haemorrhage or obstructed labour, which emerge close to the time of delivery (7,28,32).

Many risk factors lack sensitivity. In the Aberdeen study (7,28), only 44% of low birth weight, 88% of breech presentation, 70% of eclampsia/ pre-eclampsia, and 49% of total admissions were predicted antenatally. In a study in Tanzania, only 64% of twin and 47% of breech presentation were correctly predicted (25).

Risk assessment has proven most useful in the prediction of obstructed labour based on height and previous poor obstetric history (7). However, as mentioned above, the Kasongo project team found that those who have a bad obstetric history were 10 times more at risk to have obstructed labour, but the sensitivity and positive predictive value were 29% and 10% respectively (27).

Studies of maternal height, age, and foot size have shown a correlation with cephalo-pelvic disproportion and rate of caesarian section (C/S), but they are poor discriminating tools (7,32). In Aberdeen, Scotland, 17% of women less than 152 cms were delivered by C/S and 11% by forceps and vacuum compared with 8 and 5% respectively of taller women, giving a positive predictive value of 28%. It is not possible to obtain estimates of sensitivity or specificity from this report (3,7). A height of 150 cms is often quoted as a "cut off" point to define high risk.

However, as there is considerable variation among populations, each population needs a preliminary study to establish its own "cut off" point (3,7).

Clinical pelvic assessment by manual examination is part of routine ANC. This practice was investigated in a study of the risk approach in SIRRUR, India, but insufficient outcome data is provided to assess its effectiveness (SIRRUR Project 1985) (7). Severely contracted pelvis may be diagnosed by an experienced obstetrician, however, there is no data to assess its reliability in identifying high risk for obstructed labour, or its effectiveness as part of ANC (7).

The finding of a non-engaged or non-descended head near term was found to be significant with "life threatening fetopelvic dystocia" (7,26), but the data were few and did not show any increased risk of either C/S or forceps delivery rate. In addition to this, there was no information on the estimates of predictive power, sensitivity, or specificity (7).

Finally, even the reliability of X-ray and ultrasound pelvimetry to predict cephalo-pelvic disproportion (CPD) and obstruction remains in doubt (7). That risk assessment has proved most useful for predicting obstruction, therefore, does not bode well for its usefulness in predicting other negative outcomes.

1.5.2 Identification of the Population at Risk

If the screening service is to be used as a public health strategy the whole pregnant population should be included in the primary screening services. However, in a country such as Ethiopia, with a huge rural population, more than 50% of which has no geographical access to services, ensuring that the whole pregnant population will be screened is an impossibility.

In addition to geographic barriers, cultural and social barriers to the use of ANC have also been found. This was demonstrated in recent study in India which found that women with most risk factors are less receptive to proffered antenatal services (7). Therefore, the risk screening has failed to screen those at "high risk".

An individual low risk pregnant mother is less likely than a high risk woman to develop complication. However, low risk women, generally considered to be about 90% of the population (30) develop complications, although at a lower rate than do high risk women. As a result of this, most of the women who develop complications are low risk women. Therefore, prenatal screening does not identify all (even most) of the women who will develop complications (7.8 31).

1.5.3 Provision and Quality of Care

Even if the risk factors identified in the ANC program are appropriate, and the whole population has access to the service, the quality of care provided may be inadequate.

There is evidence of frequent failure to identify or elicit important information on risk factors when increased risk was evident. In regular ANC clinics, for instance in Java, Burkina-Faso and the UK, important risk factors, particularly those of past obstetric and medical history, such as stillbirth (25%), low birth weight (68%) and PPH (85%) were not noted by the medical staff(7).

Medical equipment such as thermometer, BP apparatus, weight and height scales, gloves, fetoscope, specula, and laboratory procedures such as haemoglobin determination, blood groupings and VDRL, are not available in all ANC clinics. Therefore, risk screening is often conducted in a setting of poor quality.

While a wide variety of check lists and ANC cards have been designed to improve identification of risk factors they have rarely been evaluated, and their efficacy is, for the most part, unknown (7,27, 28,29, 32).

Women in developing countries (especially those in the rural areas) have difficulties in following the advice that is given during screening (33).

In Kenya, of women who were advised to deliver in the hospitals, only 27% did so (34). In Maputo, Mozambique, it was found that though many women were successfully assessed and referred, less than half of those in the high risk groups were actually seen at the referral centres (7). In a study in Sierra Leone, it was found to be very difficult to persuade women who were referred to be delivered in the hospital (7).

Treatment of existing health problems such as malaria and anaemia during pregnancy is found to be helpful during pregnancy. However, often ANC clinics do not have the capacity to treat such diseases or, indeed, pregnancy-related problems such as ante partum haemorrhage, gestational diabetes mellitus or hypertensive disease of pregnancy.

In addition, there are diseases such as viral hepatitis which significantly contribute to maternal mortality in developing countries for which there is no effective treatment (30).

In developing countries many pregnant mothers are anaemic, stunted, and have low body weight even before pregnancy. The additional demand from the current pregnancy worsens the deficit, which is very difficult to correct to any significant degree even with efficient antenatal care (16).

In general, then, the risk screening that is currently provided often fails to meet the criteria of an appropriate public health strategy described above.

2. OBJECTIVES

2.1 General objective

To determine the effectiveness of ANC risk screening in the regular ANC clinics of referral hospitals in Addis Ababa.

2.2 Specific objectives

a. To evaluate the test performance of the ANC screening mechanisms (ANC card) as used in referral hospitals in Addis Ababa.

b. To generate a potentially valid list of risk factors which included in the currently used ANC screening card.

3. MATERIALS AND METHODS

3.1 Study design

A prospective hospital based cohort study was designed to select pregnant women to be enrolled in the study.

Two cohorts of 400 "high" and "low" risk mothers were selected and a follow up observation was carried out to record their delivery.

The pregnancy outcome of each cohort in terms of mode of delivery, and postnatal condition of the mothers and the newborns was observed. Both institutional and home deliveries were recorded. The outcome was compared with their antenatal risk status as determined by the ANC check list used in the routine ANC clinics of the four referral hospitals in Addis Ababa.

3.2 Study period

The study covers a period of 5 months from the 15th of October 1993 until the 20th of March 1994.

3.3 Hospitals involved in the study

1. Tikur Anbesa teaching hospital
2. Saint Paul's hospital
3. Ghandi Memorial hospital
4. Zewditu Memorial hospital

The first two are central referral hospitals and the others are Region 14 (Addis Ababa) referral hospitals. All are located in Addis Ababa.

3.4 Population

3.4.1 Source population: All pregnant women who attended ANC in those hospitals during October 1993 to March 1994 (Figure 1).

3.4.2 Entry criteria:

- Gestational age > 24 Weeks as determined by the physicians.
- Residence in Addis Ababa, as varified by the respondents.
- Those who sign consent to be enrolled in the study.

3.5 Study population

3.5.1 Sampling procedure

All pregnant women who fulfilled the entry criteria were included in the study. Pregnant women from every session were all taken as a study population until one hundred (60 parous and 40 nulliparous) from each risk category is attained. Thus the total number of women included in the study numbered 800.

3.5.2 Enrolment procedure

The purpose of the study was presented to the source population in the waiting area prior to their ANC visit. Consent to participate was solicited from those who fulfilled the criteria prior to their being included in the study.

A list was kept of all of those entered in the study according to the date for their next visit. Those who missed 2 consecutive appointments were considered to have dropped out of ANC attendance, and they were therefore traced.

For those women who could not be found (n=16), others were selected using the same sampling procedure.

Any woman who missed an appointment after 40 weeks of gestation was considered to have been delivered, and was immediately traced.

3.6 Variables and methods of measurement

3.6.1 Operational definitions

Risk:- The probability, the likely hood that people who are symptomless, but are exposed to certain factors (Risk factors), will develop untoward outcomes (14).

Risk factors:-Factors that are associated with an increased risk of developing the untoward outcome (14).

Risk factors are the factors that are listed on the ANC card (section VIII - Annex 1).

Permanent risk factors: are risk factors such as age, height, parity or bad obstetric history that can not be changed during intra- partum or during delivery. Other risk factors as pregnancy and non pregnancy related diseases, malpresentation and/or obstructed labour can be observed at any during labour, although the mother was not diagnosed antenatally, therefore, are not considered as permanent risk factors in the analyses.

High risk: A mother that has any of the risk factors that are listed on the ANC card and or diagnosed as high risk by the physicians.

Low risk: A mother who does not have any of the factors listed on Antenatal card and or diagnosed as high risk by the physicians.

Antenatal care or Prenatal care. Every aspect of care serving, treating, educating or others which routinely provided for all pregnant women by a trained person in the referral hospitals. The care will continue up to delivery.

ANC - card - (annex 1) A check list developed by the FHD-MOH and used by the health facilities during giving ANC.

Bad obstetric history:- Any pregnancy related disease, intervention made at delivery, still birth, low birth weight, premature or post mature delivery, perinatal or neonatal loss in the previous pregnancies.

Mode of delivery:- the type of delivery either in the current or previous pregnancies.

Bad outcome: Referred to current pregnancy outcome is considered if the mode of delivery is abnormal (high forceps or C/S or destructive delivery);

and/or maternal outcomes (as operation, prolonged or abnormal or obstructed labour and its complication, APH, PPH, third degree tear, fistulae etc including death); and/or newborn outcome (SGA, pre and post maturity, stillbirths, prenatal and neonatal deaths, malformation, delivery injuries, etc.) are considered as bad outcomes (annex 3).

Total outcome (OTCM)-. The summary of the current pregnancy outcome in terms of the mode (type) of delivery or the conditions of mothers and newborns.

3.6.2 Methods of measurement

All mothers were interviewed by a trained nursing student or a health assistant, and an antenatal card was distributed to them during the first day of interviewing. They were instructed to bring the card on every subsequent visit.

On the first visit, the ANC card was completed. On subsequent visits the ANC card was completed. Any change in diagnosis or risk status was duly noted.

All admissions during the study period, except delivery, were followed and recorded.

Outcomes of home deliveries were checked by trained nursing students and health assistants. Outcomes of deliveries in health units were verified from delivery summaries.

Measurement of the newborn (length and weight) were taken. For those admitted to the neonatology unit, information was extracted from hospital records.

In the case of illness, congenital anomalies, pre- or post- maturity, or operative deliveries, follow-up was conducted a minimum of seven days following delivery to ensure that the outcome was correctly recorded.

3.6.3 Categories of variables

The study population was divided into two groups based on parity as nulliparous and parous women. Thirty seven variables for nulliparous and 41 variables for parous women were analyzed see annex 2 for details.

3.7 Data collection

Data were collected using questionnaires, the ANC card, and different forms developed by the investigator (Annex 2).

Interviews were conducted by 13 female student nurses and health assistants (8 & 5 respectively), who were trained for one and a half days by the investigator and his assistants.

Mothers who were coming to ANC for follow up according to their schedule were checked by the 4 head nurses working in their respective hospitals. The information was recorded by the student nurse or health assistant on the card.

Outcome data was collected using the ANC card, forms and questionnaires for both hospital deliveries and home-births.

BP apparatus, thermometer, measuring tape and baby scale were used to measure the newborns. The information was recorded on the delivery summary of the ANC card and on the questionnaires and forms.

3.8 Data analysis

All the data were entered using EPI-INFO 5 and analyzed using EPI-INFO and SAS Statistical packages.

3.8.1. Descriptive Statistics: Description of the study population by age, parity, risk status and outcomes has

been carried out. The frequency of the identified risk factors in high risk women, both parous and nulliparous, and the type of outcomes in relation to parity and risk status have been shown.

3.8.2. Analytic Statistics: Test performance for each risk factor, the ANC - card (as tested instrument) has been analyzed in terms of:

- Sensitivity (expressed in percentages)
- Specificity (expressed in percentages)
- Positive likely hood ratio (LR+) (A value of 1 denoting a useless test)
- Positive predictive value (PVP): Is calculated at rate of 42% and 34% of bad outcomes to good outcomes.
- Kappa statistics - (20% agreement corrected for chance agreement.)

For the details see annex 5: Statistics used in the test performance analyses.

The "Gold Standard" was the pregnancy outcome, which was dichotomized as bad or good, depending on the type of delivery, post delivery conditions of the mother and the newborn.

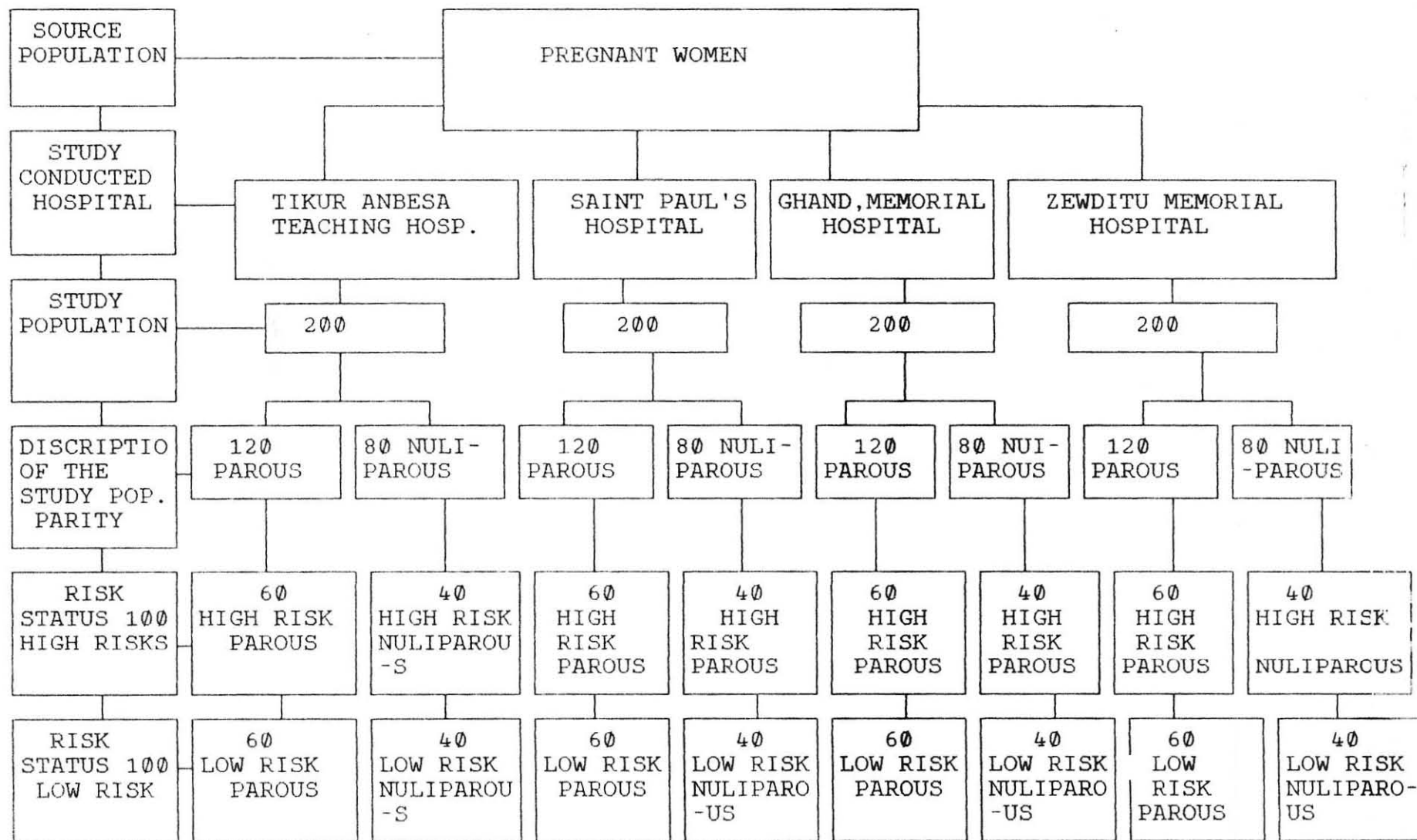
Individual risk factors:

1. Permanent risk factors: the test performances were calculated at the rate of 42% of bad outcomes (n = 758).

2. Other risk factors: The LR+, PVP were calculated at the rate of 34% of bad outcomes (n= 665).

3.9 Ethical considerations.

The study was approved by both Departmental and Faculty scientific and ethical review committees before initiation of the study.



4. RESULTS

4.1. Description of the study population

The number of mothers who were completed followed were 758. In both parous and nulliparous groups, the drop out rate (lost to follow up) was the same (5%). The drop out rates in the high and low risk groups were 4% and 7% respectively (Table 1). The mean age of the population was found to be 26.8 ± 6.4 years; the mean age of parous women being $29.6 (\pm 5.2)$, and of nulliparous women, $22.5 (\pm 4.5)$ years of age.

4.2 Identified Risk Factors

Height (42%) and age (41%) were the main risk factors identified in nulliparous women, while "bad obstetric history" (65%) and grand multiparity (41%) were the most common factors in parous women (Table 2).

Current pregnancy related diseases (toxaemia, APH, HPD without toxaemia and GDM) constituted 39% and 47% of the causes of high risk diagnosis in parous and nulliparous women respectively.

The frequency of other risk factors is also shown in the table.

About 56.4% (217) of all high risk women (nulliparous and parous) had only one risk factor, 13.3% (51) had two factors, and 30.4% (117), three or more.

Fifty-six percent (86) high risk nulliparous mothers were found to have more than one factor, compared to 35% (82) in high risk parous mothers.

4.3. Pregnancy Outcomes

Pregnancy outcomes were determined in terms of both in risk status and parity. Among women who completed the study, 42% (318) have been recorded as "bad" outcomes. Seventy-one percent (225) who had "bad" outcomes were high risk mothers; 29% (93) were low risks (Table 3).

Among the 385 high risk mothers, 225 (58%) had a bad outcome. (Table 4). Bad outcomes included more than one reason for being considered "bad" such that there were 148 bad newborn outcomes, 147 bad maternal outcomes and 130 delivered by other than spontaneous vaginal delivery. Nearly 30% had only one type of bad outcome, while 52% and 18% had two and three types respectively.

Ninety-three (25%) low risk women had a bad outcome. This included 72 bad newborn outcomes, 57 bad maternal outcomes and 37 abnormal deliveries.

No maternal deaths were reported.

4.4 Test performance analysis

4.4.1 Test performance of each risk factor

Discriminatory power: Pregnancy related diseases have the highest: LR+ 6.89 followed by non-pregnancy related diseases:LR+ 5.53 (Table 5).

Malpresentation and IUFG/ IUFD were found to be good discriminators (LR+4.76 & 4.52). Height (in nulliparous) and age were also have high positive likely-hood ratio (LR+ 3.2 & 2.8). Bad obstetrics history and grand parity have less positive likely- hood ratio (LR+ 2 & 1.6 respectively).

Among the laboratory data, only haemoglobin < 8.5 have higher LR+ (4.76) than VDRL and Rh factor (LR+ 0.92 & 0.33). Multiple pregnancy as a factor has the least LR+ (0.42).

Presence of three or more risk factors has more discriminatory capacity in detecting bad outcomes (LR+ 22.32) than presence of two factors (LR+ 6.50) and one factor (LR+ 1.09).

Predictive power: Current pregnancy related diseases have been found to have the highest positive predictive power (PVP 78%). Non pregnancy-related diseases, malpresentation, IUFG/ IUFD were also found to be good predictors (PVP 74%, 71% & 71%) respectively.

The positive predictive capacity of height (nulliparous) and age were 70% and 67%. Bad obstetric history and grand multiparity have PVPs of only 59%, 54% respectively. The presence of three or more risk factors was found to be more predictive than two factors or a single factor (PVP 92%, 77% & 36% respectively).

4.4.2. ANC Card

The sensitivity of this instrument was high (71%, LR+ 1.95) but less specific (64%). The kappa of the test was 48%. The proportion of bad outcomes to good outcomes was 42%. Predictive value positive of the test was 58% (Table 6).

Parous mothers: 42% of these had bad outcomes. Sensitivity was 73%, specificity 65% and LR+ 2.02. The kappa the test was 50%. The positive predictive value of the test was 60%.

Nulliparous mothers: 43% of these had bad outcomes. The sensitivity was 66%, specificity 61% and LR+ 1.7. The kappa of the test was 44%. The predictive power was also low (PVP 57%).

TABLE 1 . Numbers of Mothers who completed the study in terms of parity and risk status, Addis Ababa, 1993-94

HOSPITALS	PAROUS n = 480 (%)	NULLIPAROUS n = 320 (%)	TOTAL n = 800 (%)
According to parity			
TIKUR ANBESA	113 (23.5)	74 (23.1)	187 (23.4)
ST. PAUL'S	115 (24.0)	78 (24.4)	193 (24.1)
GHANDI	113 (23.5)	73 (22.8)	186 (23.3)
ZEWDITU	114 (23.8)	78 (24.4)	192 (24.0)
TOTAL	455 (94.8)	303 (94.7)	758 (94.8)
	LOW RISK n = 400 (%)	HIGH RISK n = 400 (%)	TOTAL n = 800 (%)
According to Risk Status;			
TIKUR ANBESA	91 (22.8)	96 (24.0)	187 (23.4)
ST. PAUL	95 (23.8)	98 (24.5)	193 (24.1)
GHANDI	92 (23.0)	94 (23.5)	186 (23.3)
ZEWDITU	95 (23.8)	97 (24.3)	192 (24.0)
TOTAL	373 (93.4)	385 (96.3)	758 (94.8)

TABLE 2. Common risk factors identified in "high" risk pregnancy, Addis Ababa, 1993-94.

Identified risk factors	High risk Parous # (%)	High risk Nulliparous # (%)	Total high risk # (%)
Age*	20 (8.60)	62 (40.5)	82 (18.7)
Height <150 Cms**		64 (41.8)	-
Grand multiparity***	77 (33.1)	-	77
Bad obstetric hist***	150 (64.7)	-	150
Current pregnancy related diseases			
Toxaemia	6 (14.3)	18 (40.0)	24 (6.2)
HDP	63 (70.0)	32 (44.4)	95 (58.6)
APH	12 (13.3)	12 (16.7)	24 (14.8)
Diabetes M.	9 (10.0)	10 (13.9)	19 (11.7)
Sub total	90 (38.8)	72 (47.1)	162 (42.1)
Non-pregnancy related diseases			
	29 (12.5)	5 (3.3)	34 (8.8)
IUGR/IUFD	22 (9.5)	15 (10.0)	37 (9.6)
Malpresentations	71 (30.6)	47 (30.7)	118 (30.6)
Multiple pregnancy	5 (2.2)	8 (5.3)	13 (3.4)
HGB. < 8.5G/L	6 (2.6)	4 (2.6)	10 (2.6)
RH factor	15 (6.5)	17 (11.0)	32 (8.3)
VDRL	13 (5.6)	7 (4.6)	20 (5.2)
Number of risks factors			
1 factor	150 (64.7)	67 (43.8)	217 (56.4)
2 factors	25 (10.8)	26 (17.0)	51 (13.3)
3 or more	57 (24.6)	60 (39.6)	117 (30.4)
Total	232 (100)	153 (100)	385 (100)

* Age. <18 or >35 Nulliparous and ≥45 parous.

** Height is only for nulliparous, denominator = 153.

*** Grand parity and bad obstetric history for parous mother only, denominator = 232.



TABLE 3. Pregnancy outcomes according to parity and risk status,
Addis Ababa, 1993-94.

RISK STATUS	BAD OUTCOME N (%)	GOOD OUTCOME N (%)	TOTAL
Parous women*			
High	140 (74)	92 (35)	232
Low	49 (26)	174 (65)	223
Sub-total	189 (100)	266 (100)	455
Nulliparous women**			
High	85 (66)	68 (39)	153
Low	44 (34)	106 (61)	150
Sub-total	129 (100)	174 (100)	303
Both groups***			
High	225 (71)	160 (36)	385
Low	93 (29)	280 (64)	373
Total	318 (100)	440 (100)	758

* Rate = 42%. Kappa statistics = 50%.

** Rate = 43%. Kappa statistics = 44%.

*** Rate = 42%. Kappa statistics = 48%.

TABLE 4. The distribution of 'bad' and 'good' outcomes among 'high' and 'low' risk mothers as identified by the ANC screening card, Addis Ababa, 1993-94.

TYPE OF OUTCOMES	High Risk 385 (%)	Low Risk 373 (%)	Total 758 (%)
Mode of delivery			
Good Outcome	255 (66.5)	336 (90.0)	591 (78.0)
Bad outcome	130 (33.5)	37 (10.0)	167 (22.0)
Maternal outcome			
Good outcome	238 (61.8)	316 (84.7)	554 (73.1)
Bad outcome	147 (38.2)	57 (15.3)	204 (26.9)
Newborn outcome			
Good outcome	237 (61.5)	301 (79.7)	538 (71.0)
Bad outcome	148 (38.5)	72 (19.3)	220 (29.0)
Number of outcomes.			
One type of bad outcomes			
A. Mode of delivery			
	8 (3.6)	2 (2.2)	10 (3.1)
B. Maternal	7 (3.1)	7 (7.5)	14 (4.4)
C. Newborn	52 (29.8)	26 (30.0)	88 (27.7)
Sub total	67 (29.8)	35 (37.6)	112 (35.2)
Two bad outcomes.			
A + B	62 (27.6)	12 (12.9)	74 (23.3)
A + C	18 (8.0)	8 (8.6)	26 (8.2)
B + C	36 (16.0)	23 (24.7)	59 (18.6)
Sub total	116 (51.6)	43 (46.2)	159 (50.0)
Three types of bad outcomes			
A + B + C	42 (18.7)	15 (16.1)	57 (17.9)
Sub total	225 (100)	93 (100)	318 (100)

TABLE 5: The identified risks with outcomes and the test performances as identified by the ANC screening card, Addis Ababa, 1993-94.

Identified factors	Bad outcome n=225)%	Good outcome (n=160)%	Total n=385 %	Test per. PVP(%) LR+
Age+	55 (24.4)	27 (16.9)	82 (21.3)	67.1 2.80
Height**+	45 (52.9)	19 (27.9)	64 (41.8)	70.3 3.20
Grand parity**+	42 (30.0)	35 (38.0)	77 (33.2)	54.1 1.60
Bad obst.Hist.**+	88 (62.9)	62 (67.4)	150 (64.7)	58.7 2.00
Current pregnancy related diseases++	126 (56.0)	36 (11.9)	162 (42.1)	77.8 6.89
Non pregnancy related diseases++	25 (11.1)	9 (5.6)	34 (8.8)	73.5 5.53
IUGR/IUFD++	26 (11.6)	11 (6.9)	37 (9.6)	70.3 4.52
Malpresentation++	84 (37.3)	34 (21.3)	118 (30.6)	71.2 4.76
Multiple pregnancy+	3 (1.3)	10 (6.3)	13 (3.3)	23.1 0.42
Hgb <8.5gm/l++	20 (8.9)	8 (5.0)	28 (7.3)	71.4 4.76
Rh factor+	8 (3.6)	24 (15.0)	32 (8.3)	25.0 0.46
VDRL+	10 (4.4)	11 (6.9)	20 (5.2)	50.0 1.30
Number of risk factors++				
1 factor	78 (34.7)	139 (86.9)	217 (56.4)	36.0 1.09
2 factors	39 (9.7)	12 (7.5)	51 (13.3)	76.5 6.50
≥ 3 factors	108 (48.0)	9 (5.6)	117 (30.4)	92 22.32

* Height is only for nulliparous.

** Bad obstetrics history and grand parity are for the parous mothers.

+ Rate 42% bad outcomes to good outcomes 318/758

++ Rate 34% bad outcomes to good outcomes 225/665 (93 were subtracted from the numerator and denominator)

TABLE 6 Pregnancy outcomes according to parity and the test performances as identified by the ANC screening card, Addis Ababa, 1993-94.

RISK STATUS PVP	Specificity	Sensitivity	LR+
Parous 60.3	65.4	73.3	2.12
Nulliparous 55.6	61.0	66.0	1.70
Total 58.4	63.6	70.8	1.95

5. DISCUSSION

Current pregnancy related diseases, height, age and malpresentation or malposition were the leading causes of diagnosis of high-risk pregnancy in nulliparous women. Bad obstetric history, presence of pregnancy related diseases, grand multiparity, and malpresentation and malposition were the major reasons identified in high risk pregnancy in parous mothers. About 56% of the mothers had only one risk factor, 13% had two, and 30% three factors. Of the total 42% developed bad outcome and 58% did not. Among those who developed bad outcomes, 71% were high risk mothers and 29% were low risk mothers. Among those who were diagnosed high-risk antenatally, 60% of parous and 52% of nulliparous women developed bad outcomes.

Among the listed risk factors, current pregnancy related diseases, followed by non pregnancy related diseases, and malpresentation, were found to be better discriminators and predictors of bad outcomes both in parous and nulliparous women. Height in nulliparous women and age in both groups were also fair discriminators of bad outcomes. Grand parity was found to have less discriminatory and predictive power. Presence of more risk factors was found to be more predictive than a single factor.

The drop out rate in this study was very low (6%); and there was no difference between parous and nulliparous, but high risks had fewer drop outs compared to low risks (3.7% & 6.4% respectively). The reason could be that many mothers have delivered in these hospitals, hence could be easily followed up and their pregnancy outcomes easily recorded. As it should be expected, high risks were delivered more frequently in hospitals than the low risks.

There are no data in Ethiopia on the relative frequency of risk factors during pregnancy. The rate of occurrence of risk factors may not reflect the prevalence of risk factors in the general pregnant population. As the high risk mothers were selected from the referral hospitals, they were referred because many of them could not be managed in the primary or secondary facilities. However, the variety of risk factors and their rate in this study were comparable to those found in studies conducted in Scotland, Cameroon and Tanzania (7,18,25).

The sensitivity analysis of selected factors showed that the presence of current pregnancy diseases, non pregnancy related diseases, malpresentation including IUFGP/IUFD were better discriminators and predictors than the others.

Unlike the study in Aberdeen (7,32) where height was found to be poor predictor (PVP 29%), height and age were found to be good discriminators and predictors in this study. This may be because 152 centimetres was taken as a cut off point for height in the Aberdeen study. Marriage and parturition starts early in many developing countries when compared to developed countries (11, 47). Therefore, age could have strong discriminator and predictive power in this study.

Bad obstetric history has better predictive power (PVP 59%) compared with the Kasongo study (PVP 29%) (27). However, the PVP was high in this study because of the high rate bad outcomes (42%) when compared to the population based Kasongo Project study. Nevertheless, compared with other risk factors, both grand parity and bad obstetric history have the lowest predictive capacity in this study.

It is expected that when more than one risk factors were detected the risk of developing of bad outcome will be high.

This was observed in this study, presence of more than one factor having more discrimination and predictive power than a single factor (PVP 36% for one factor, while 88% for two or more factors).

The test performance of the ANC card in detecting of bad outcomes sensitivity 64%, specificity 71%, LR+ 1.95 were satisfactory. Nevertheless, the predictive capacity is not as good as the discriminatory power. More than two-fifths (42%) who were predicted to develop bad outcomes did not develop the outcomes (PVP 58%) and 25% of low risks developed bad outcomes. The lower sensitivity and specificity of some listed risk factors on one hand and the patient misclassification or missing some of the risk factors on the other could, explain this findings.

The test performance of the ANC card was relatively better in parous than nulliparous. The possible reason could be that more listed risk factors on the ANC card was referred to the parous mothers than the nulliparous.

It is standard to compare the performance of tests in a number of patients known to have the disease (high risk) with an equal number of patients with out the disease (low risk) (47). The test performances analysis in both groups of mothers showed high performances.

However, these results should not be taken literally for the following reasons:

1. Prevalence of the disease or the risk factors: In theory, sensitivity and specificity are independent of prevalence.

In practice, however, not only prevalence, but also several characteristics of the study populations may affect the validity either positively or negatively. For instance, if most of the high risk mothers are very young in age, or very short in stature (height) or if many of them are grand multiparas or have pregnancy related diseases and/or those who have known medical problems; then the rate of bad outcomes will be high and the sensitivity and LR+ will be high.

On the other hand, if the low risk prevalence is high, the specificity will be high. As a result of this the sensitivity will be low. This type of paradox was well documented in the Kasongo Project study (there were about more than 22 times as many as low risk mothers) thus inflated the specificity 99% (8,26).

2. These patients were selected from referral facilities. The diagnosis of high risk was therefore relatively certain. However, tests are most useful when the disease (diagnosis) is neither very likely nor very unlikely. The test performance is therefore higher than it might otherwise be.

3. The outcome or the dependent variable used: The mode of delivery, maternal and perinatal outcomes were considered at the same time.

This increases the statistical power of discrimination but does not define the strength of the association of the risk factors to a particular outcome of interest.

On a practical note, the ANC card presented as Annex 1 has some problems. The risk factors listed on the card are complete except for such factors such as IUFD/IUFGR, birth intervals, abortions, pre & post term deliveries, gynaecological histories such as PID, and relevant family history such.

There are no guidelines for use of the card. For instance the boxes drawn in front of each risk factor vary in their appearance.

Some boxes are shaded differently, but there is no mention of the reasons for this. In addition to this, there is no definition of high risk given.

Issue of validity and reliability.

The "Gold standard" considered here is the outcome of the pregnancy; and thus compared with the instrument i.e the ANC card, the ad-hoc base and the data base score. Various test performance analyses were employed. The measure of validity (sensitivity, specificity and LR+) was taken as a measure of test performances.

Strength of the study: Since it is a prospective study on one hand and all the listed factors, ANC card as instrument was compared with outcome on the other makes the findings more valid.

Limitations of the study: As a hospital based study the inherent problems of the selection bias can never be ruled out. Although selection of all mothers can certainly minimize the bias.

Outcome is influenced by the intra- partum risk factors however, the study did not consider these factors due to the lack of information on the home deliveries that were recorded as bad outcomes.

6. CONCLUSIONS

The effectiveness of the ANC risk screening services in four referral hospitals was determined by evaluating the test performance of the ANC card. Determination of the known risk factors as listed on the instrument (ANC) card comparing with the outcome, and its test performance analysys has been done. The listed risk factors, particularly pregnancy and non pregnancy related diseases, malpresentation, age and height have been found to be good discriminators and predictors.

From this study it can be concluded that:

- The existing ANC card can be a good instrument if additional risk factors are added.

A single study can never be conclusive in such initiatives; therefore, additional studies are necessary. However we believe that this study gives comprehensive information to help resolve the dispute regarding the effectiveness of ANC risk screening and its methodological issues of how to do evaluation. It is an issue with no end.

7. RECOMMENDATION

7.1. Launching of multi center prospective studies about the effectiveness of ANC-risk screening at different levels and establish its effectiveness of the test performances should be undertaken.

7.2. Improve the design of the current ANC-card. and definition of high risk will be helpful in the screening of high risk mothers and for the better discrimination and predictive of bad outcomes. The following additional risk factors should be added to the ANC card:

- IUFD/IUFUR
- Primigravdity
- Previous pregnancy related diseases
- Pre-term and post-term or prolonged gestation
- Laboratory data - RH and VDRL
- Proper definition of high risk and low risk and moderate risk.

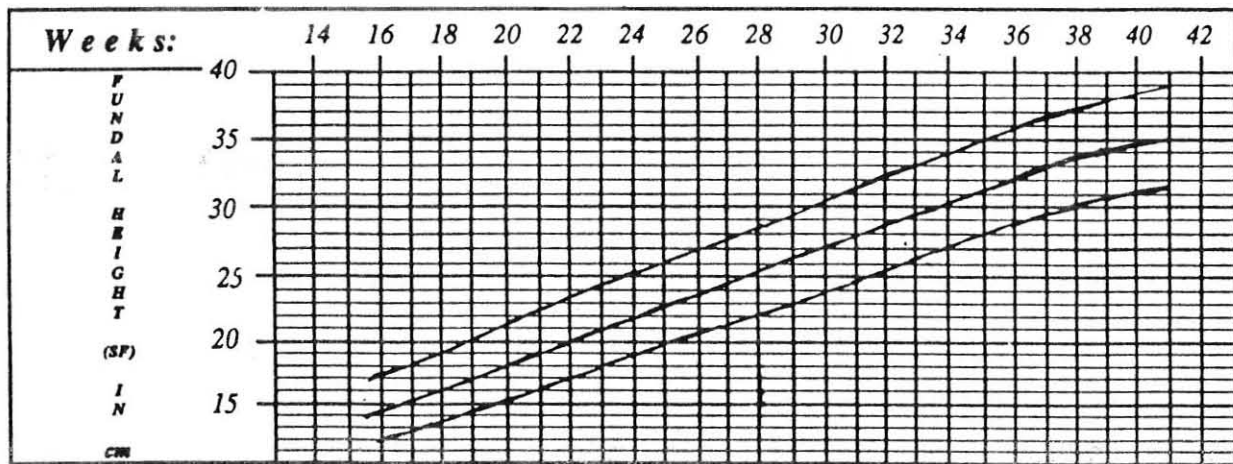
7.3. Further test performances studies on the following risk factors should be conducted:

- medical risk factors
 - History of frequent abortion
 - Birth inter-space less than two years
 - Family history
 - The known risk factors that occurred in any of the previous pregnancies other than the index pregnancies
- Non medical risk factors
 - Psycho- social factors
 - Socio- economic and cultural risk factors

PRESENT PREGNANCY

Date									
Name									
Signature									
Gest. age (w)									
Weight (kg)									
BP									
Anaemia (Hb)									
Urine									
SF (cm)									
FHB/min.									
Oedema									
Presentation									
TT									
Iron									
Chloroquine									
Next Appointment									

Date: | **Notes:** _____

[illegible]

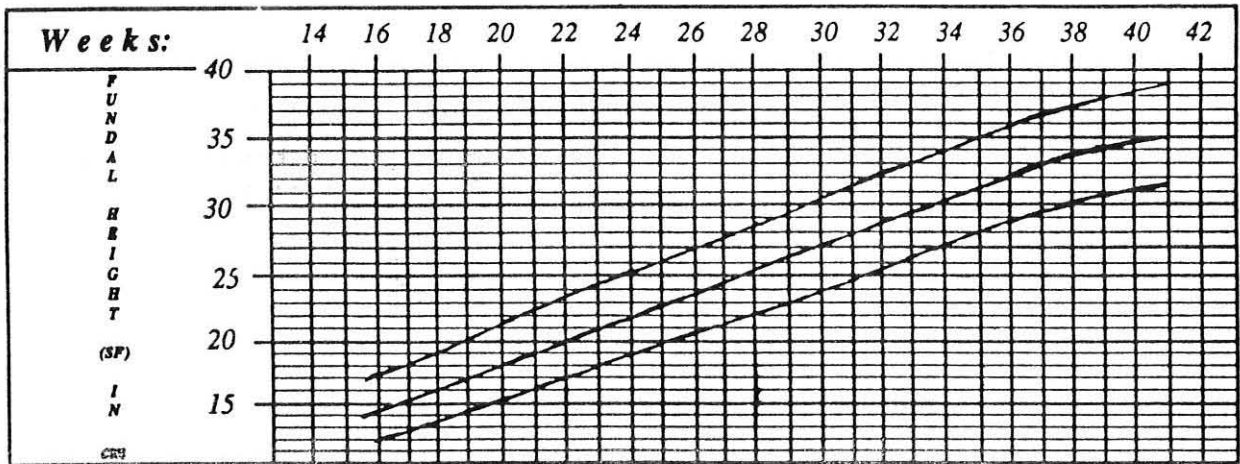
Risk factors for identification during pregnancy (check at each visit)

☒ Anemia Hb < 10	☒ Malpresentation	☒ BP > 140/90	☒ Tolerant
☒ APH	☒ Oedema	☐ Other	☐ APH

PRESENT PREGNANCY

Date
Name
Signature
Gest. age (w)
Weight (kg)
BP
Anaemia (Hb)
Urine
SF (cm)
FHB/min.
Oedema
Presentation
TT
Iron
Chloroquine
Next Appointment

Date: | **Notes:** _____

[illegible]

Risk factors for identification during pregnancy (check at each visit)

- ☒ Anemia Hb < 8.5 ☒ Malpresentation ☒ BP > 140/90 ☒ Twins
☒ A & P & V ☒ Oedema ☐ Other

Annex 2

THE EFFECTIVENESS OF RISK SCREENING OF ANC IN THE REFERRAL HOSPITALS OF ADDIS ABABA.

This is a hospital based study that will be conducted in the following hospitals of Addis Ababa.

1. TIKUR ANBESA TEACHING HOSPITAL.
2. SAINT PAUL HOSPITAL.
3. GHANDI MEMORIAL HOSPITAL.
4. ZEWDITU MEMORIAL HOSPITAL.

Patients will be selected from the regular ANC clinic and follow up will be carried out at the regular clinics and at home.

THE ORGANIZATION OF THE QUESTIONNAIRE.

Part 1. General.

- 1.1. Hospital at which the mother is following ANC care.
- 1.2. Name and address
- 1.3. Marital status, Occupation, education and family income.

Part 2. Reproductive history.

Age, Gravidity, parity and birth space.

Part 3. Previous obstetrics history

- 3.1. History of previous pregnancy related diseases.
- 3.2. Pregnancy Outcomes
 - Fetal conditions
 - maternal conditions
 - Newborn conditions

Part 4. History of Gynaecological and/or medical diseases

Part 5. Present pregnancy

- 5.1. Date of delivery
- 5.2. Physical examination
- 5.3. Laboratory investigation
- 5.4. Diagnosis

Part 6. Treatment given

Part 7 pregnancy outcome

- 7.1. Mode of delivery
- 7.2. Maternal and Newborn conditions.

All information is strictly confidential. Please make every effort to each applicable question as honestly as possible.

Instruction.

Please show the responses by circling or underline the answers or write the reply in the space provided. Use the back space if the provided space is not enough.

SERIAL No. _____.

PART 1. GENERAL.

1. Name of the hospital.

- | | |
|---------------------------|------------------------|
| 1. Tikur Anbesa hospital. | 2. Saint Paul hospital |
| 3. Ghandi hospital | 4. Zewditu hospital. |

2. Name of the mother (Full name including grand father name)

3. Hospital registration
No. _____

4. ANC card No. _____

5. Patient serial No. _____

6. Address _____ Town. _____

wereda / Kefetegna/. _____

kebele. _____

House No. _____

Telephone No. Home. _____

or office (hers or husband or close person). _____

neighbour. _____

a n y s p e c i a l
locations. _____

7. Current marital status.

- | | |
|-------------------------|---------------|
| 1. married. | 4. divorced. |
| 2. single. | 5. separated. |
| 3. single stable union. | 6. widowed. |

8. If married or stable union:

Name of the husband (full name including grandfather).

occupation /working place/. _____

Tel. No. _____

9. Any close person in case of contact.

Name: _____

Address: _____

Working place: _____

Tel No. _____

PART 2 OBSTETRIC HISTORY

10. Age (Years).

- | | |
|----------|--------------|
| 1. 18-35 | 2. 16-17 |
| 3. 35-39 | 4. < 16 |
| 5. 40-44 | 6. $\geq$ 45 |

11. Height (cms)

- | | |
|----------|------------|
| 1. > 150 | 2. 145-150 |
| 3. < 145 | |

12. Gravidity.

- | | |
|--------|-------------|
| 1. 1 | 2. 2 to 4 |
| 3. 5-6 | 4. $\geq$ 6 |

13. Parity.

- | | |
|--------|-------------|
| 1. 0 | 2. 1 to 3 |
| 3. 4-5 | 4. $\geq$ 6 |

14. Birth space (years)/ Date of last delivery/.

- | | |
|---------------|--------------------|
| 1. < 2 years. | 2. $\geq$ 2 years. |
|---------------|--------------------|

PART 3 PREVIOUS PREGNANCY HISTORY.

3.1 HISTORY OF PREVIOUS PREGNANCIES

15. Did you have any of the following pregnancy related diseases in your previous pregnancies?

- | | |
|-----------------------|--------------------------|
| 1. None | 2. APH. |
| 3. High BP (Toxaemia) | 4. Gestational Diabetes. |
| 5. 2 & 3 | 6. 2 & 4 |
| 7. 3 & 4 | 8. |
- Others/specify/_____
-
-

3.2 PREGNANCY OUTCOMES

16. Did you give birth at the expected date of delivery?

- | | |
|---------|--------|
| 1. Yes. | 2. No. |
|---------|--------|

17. How did you deliver?

- | | |
|------------------|--------------------------|
| 1. SVD /Normal/. | 2. Instrumental Delivery |
| 3. C/S | |

3.3 MATERNAL CONDITIONS.

18. Did you have the following problems during or after delivery?

- | | |
|---------|-----------|
| 1. None | 2. PPH |
| 3. VVF | 4. Others |
- /specify/_____
-
-

3.4. CONDITIONS OF THE NEWBORN.

19. What was the condition of the Newborn?

- | | |
|----------------------|---------------------|
| 1. Normal live birth | 2. Normal twin live |
| | births. |
| 3. Malformation | 4. Stillbirth |
| 5. NND | 6. Others |
- /specify/_____
-
-

PART 5 PREVIOUS GYNAECOLOGICAL AND/OR MEDICAL HISTORY

20. Do/did you have any known medical disease/s/ or

operation/s/ at present or before ?
 1.No 2. Yes

21. If yes, which of the flowing problem(s) do/did you have ?

- | | |
|-------------------------------------|---------------------------|
| 1. gynaecological operation | 2. stable diabetes |
| 3. Cardio vascular diseases | 4. chronic renal diseases |
| 5. 1 & 2 | 6. 1 & 3 |
| 7. 1 & 4 | 8. 2 & 3 |
| 9. 2 & 4 | 10. 3 & 4 |
| 11. 2 - 4 | 12. 1 - 4 |
| 1 3 . O t h e r s (s p e c i f y) | |
-

PART 4 PRESENT PREGNANCY

4.1 DATE OF DELIVERY

22. Last menstrual period _____
 Expected date of delivery _____

4.2 PHYSICAL EXAMINATION

23 What is the blood pressure (Diastolic pressure)?
 1. < 90 mm Hg 2. Between 90-95 mm Hg
 3. between 95-100 mm Hg 4. $\geq$ 100 mm Hg

24. Fundal height in centimetres or in weeks of gestation _____

25. Presentation:-

- | | |
|------------------------|---------------------------|
| 1. Cephalic | 2. Breech |
| 3. Mentum presentation | 4. Difficult to determine |

26. Lie:

- | | |
|-----------------|---------------|
| 1. Longitudinal | 2. Transverse |
| 3. Oblique | |

27. Malpresentation:

- | | |
|-------------|---------|
| 1. No | 2. brow |
| 3. shoulder | 4. face |

5. undetermined
28. Position.
- | | |
|---|----------------|
| 1. normal | 2. abnormal |
| 3. difficult to determine examination not | 4. pelvic done |
29. Fetal heart beat :
- | | |
|------------------------------|-----------------|
| 1. Between 140 & 160/minute. | 2. < 140/minute |
| 3. > 160/minute | 4. Irregular/ |
- regular or irregular/
30. Antepartum haemorrhage
- | | |
|----------------------------|-------------|
| 1. No | 2. Yes, but |
| scanty | bleeding |
| 3. Yes, and heavy bleeding | |
31. Pelvic assessment.
- | | |
|--------------------|---------------|
| 1. adequate pelvis | 2. Inadequate |
|--------------------|---------------|
- (contracted) pelvis.
- | | |
|--|-----------|
| 3. difficult to determine assessment is/was not done | 4. Pelvic |
|--|-----------|
32. Oedema
- | | |
|---|-----------------|
| 1. No | 2. Yes but only |
| trace | |
| 3. Yes, gross including trunk and face. | |
- 33 Other signs and symptoms
1. No other signs and symptoms
 2. Frequent nausea and vomiting?
 3. persistent headache
 4. blurring of vision & light headiness
 5. seizure.
 6. 2 & 3
 7. 2 & 4
 8. 2 & 5
 9. 2 - 5
 10. 3 & 4
 11. 3 & 5
 12. 3 - 5
 13. 4 & 5
 14. others specify _____
-
-

34. What other non pregnancy related problems (medical and surgical) do you have at present ?
- | | |
|----------------------|------------|
| 1. No, I do not have | 2. malaria |
|----------------------|------------|

3. Infectious hepatitis
4. others _____

4.3 LABORATORY INVESTIGATION

35. Haemoglobin determination
1. > 10 gm/litre
2. 8.5-10 gm/litre
3. < 8.5 gm/litre
4. not done.
36. Albumin
1. absent
2. trace
3. present
4. Not done
37. Glucose : (urine)
1. absent
2. trace
3. present
4. not done
38. VDRL status
1. Non reactive
2. weakly reactive
3. reactive
4. not done
39. RH factor
1. positive
2. negative
3. not done
40. What other laboratory investigation are done.
1. Blood glucose determination (oral glucose tolerance curve/OGTT). _____
2. T₃ and T₄ determination) _____
3. Blood film
/AFI/ _____
4. Serology or blood chemistry other than _____

VDRL _____
5. Blood morphology _____
6. chest X-ray _____
7. Ultrasound examination _____
8. others _____
specify _____

4.4 DIAGNOSIS

41. Diagnosis

1. low risk mother

2. high risk mother

42. Type of risk

1. Bad obstetric history_____
2. Antepartum haemorrhage_____
3. Toxaemia (preeclampsia & eclampsia)_____
4. Hypertension_____
5. Intrauterine growth retardation (IUGR)_____
6. Multiple pregnancy_____
7. Short stature (contracted pelvis)_____
8. Primigravida Age <18 yrs or >35 yrs._____
9. grand multiparity_____
10. diabetes mellitus_____
11. malaria_____
12. infectious hepatitis_____
13. any combination _____
14. others specify _____

PART 5 TREATMENT GIVEN

43. Is the mother treated for the problems mentioned choice or for others ?

1. No, she does not have any problems and not treated.
2. Yes, she was having a problem but not treated.
3. Yes, she was having problem/s/ and treated.

44. If Yes, she is/ was/ getting treatment as :-

1. In patient admitted to hospital
2. An out patient only taking medicines
3. Advice and reassurance only.

PART 7 OUTCOME OF THE CURRENT PREGNANCY & DELIVERY PLACE

47. Where did she deliver ?

1. Hospital (skip to Q 69)
2. Health centres
3. Home

48. If the delivery is/was made at home who helped you to deliver (attendant(s))?

1. Health workers
 2. Trained tradition birth attendants
 3. Mother or other relatives
 4. Neighbours
- 5 . 0 t h e r s

PART 7 OUTCOME OF THE CURRENT PREGNANCY & DELIVERY PLACE

47. Where did she deliver ?

1. Hospital (skip to Q 69) 2. Health centres
3. Home

48. If the delivery is/was made at home who helped you to deliver (attendant(s))?

1. Health workers 2. Trained
tradition
birth attendants
3. Mother or other relatives 4. Neighbours
5 . 0 t h e r s
(specify) _____

49. Was the delivery complicated?

1. No, there was no complication (SVD)
2. Yes, the labour was long but could be completed at home.
3. Yes, there was complications and the delivery was completed in the hospital.

50. If there was complication, what was or were the problem or problems.

1. Cephalo pelvic disproportion 2.
malpresentation
3. malposition 4. total distress
5. maternal examination 6. multiple
pregnancy
7. eclampsia or preeclampsia 8. delayed 3rd
stage of labour or difficult
to remove placenta.
9. Heavy bleeding 10. any
combination _____
11. Death 12.
other(specify) _____

/ Skip to Q. 69 /

59. What type of C/S was it ?

- | | |
|-------------|--------------|
| 1. Elective | 2. Emergency |
|-------------|--------------|

60. what was/were the main indication(s) of the C/S

- | | |
|----------------------------|---------------------|
| 1. Contracted pelvis | 2. CPD |
| 3. Placenta Pervia | 4. failed induction |
| 5. Severe pre or eclampsia | 6. Malposition |
| 7. cord prolapse | 8. fetal distress |
| 9. any combination | 10. others |

specify _____

61. Is/was this a first c/s

- | | |
|--------|-------|
| 1. Yes | 2. No |
|--------|-------|

62. If it was a repeated c/s, what was the indication of the previous c/s.

- | | |
|-----------------------------|---------------------|
| 1. Contracted pelvis | 2. CPD |
| 3. Placenta Previa | 4. failed induction |
| 5. Severe pre- or eclampsia | 6. malposition |
| 7. cord prolapse | 8. fetal distress |
| 9. any combination | 10. others |

specify _____

63. What were/are the intra-operative findings?

- | | |
|----------------------|---------------------|
| 1. malpresentation | 2. Placenta previa |
| 3. abruptio-placenta | 4. Ruptured uterus |
| 5. impending rupture | 6. any combinations |

7. others specify _____

64. Is/was there complication during the operation?

- | | |
|---------------------------------|-----------------------|
| 1. No | 2. haemorrhage |
| 3. c/s hysterectomy | 4. Haemorrhagic shock |
| 5. Bladder &/or ureteral damage | 6. Bowel damage |
| 7. combination | 8. others |

specify _____

65. What is/was post operative condition of the mother

- | | |
|---------------------------------|-----------------------------|
| 1. Good | 2. Post operative infection |
| 3. complication with disability | 4. death |

66. Condition of mother on discharge

- | | |
|-------------------------|-------------------------|
| 1. good | 2. Temporary disability |
| 3. Permanent disability | 4. death |

67. Duration of stay in the hospital ?

68. Cause of maternal death

- | | |
|-------------------------|---------------|
| 1. Haemorrhage | 2. septicemia |
| 3. Emboli | |
| 4. others specify _____ | |
-

NEWBORN CONDITION

69. What was the fetal outcome ?

- | | |
|------------------------------|--------------------|
| 1. live birth (skip to Q 71) | 2. stillbirth |
| 3. neonatal death | 4. twin live birth |
| 5. twin one live birth | |
| 6. others (specify) _____ | |

70. If there was NND (Neonatal Death) with in how many hours after birth (state in hours) ? _____

71. Apgar score at one minute

72. Apgar score at five minutes

73. What is/was the weight of the newborn in grams ?

74. Physical assessment of the fetus

- | | |
|---------------------------|-------------------|
| 1. Term neonate | 2. Premature |
| 3. Congenital abnormality | 4. Others specify |
-

75. Is/was there any neonatal complication ?

- | | |
|---------------------|--------|
| 1. No | 2. Yes |
| State the reason(s) | |
-

76. Causes of NND

- | | |
|-------------------------|-------------------------|
| 1. haemorrhage | 2. sepsis |
| 3. prematurity | 4. congenital anomalies |
| 5. others specify _____ | |
-

Annex 3

STATISTICS USED IN THE TEST PERFORMANCE ANALYSES

Descriptive Statistics: Description of the study population by age, parity, risk status and outcomes has been carried out. The frequency of the identified risk factors in high risk women, both parous and nulliparous, and the type of outcomes in relation to parity and risk status have been shown.

Analytic Statistics: Test performance for each risk factor, the ANC - card (as tested instrument), has been analyzed in terms of:

Rates (Proportions) Used to Analyses Test Performances.
OUTCOME

Risk Status	Bad	Good	Total
High	a	b	a + b
Low	c	d	c + d
Total	a + c	b + d	a + b + c + d

- Sensitivity or true positive rate (TRR) = $a/a+c$
- Specificity or true negative rate (TNR) = $d/b+d$
- False negative rate /FNR) = $c/a+c$ or $1 - \text{TPR}$
- False positive rate (FPR) = $b/b+d$ or $1 - \text{TNR}$
- Positive predicative value/PVP) = $a/a+b$
- Negative predictive value (PUN) = $d/c+d$
- Positive likely hood ratio (LR+) =

$$\frac{a/a+c}{b/b+d}$$

or TPR / FPR

- Negative likely hood ratio (LR-) =

$$\frac{c/a+c}{d/b+d}$$

or FNR / TNR

- Rate (prevalence) = $a+c/a+b+c+d$
- Accuracy = $a + d/a+b+c+d$
- Kappa (Agreement correlated for chance)

$$= \frac{\text{Observed agreement} - \text{Agreement by Chance}}{1.0 - \text{Agreement by chance}}$$

■ Risk ratio /rate ratio/ = RR =

$$\frac{a/a+b}{c/c+d}$$

PUP / 1 - PVN

The test performance of each risk factor was analyzed in terms of LR+ but not sensitivity or specificity, after changing the rate (R) and the predictive value (PVP) to an odds ratio using the following formula: (47)

Pre test odds x Likelihood ratio = Post test odds

$$ODDS = \frac{\text{Probability}}{1 - \text{Probability}} : \text{Probability} = \frac{\text{Odds}}{1 + \text{Odds}}$$

Test performance of the ANC card for the total, parous and nulliparous were calculated.

SAMPLE SIZE

The data from the "KASONGO PROJECT TEAM" KASONGO, ZAIRE, (1971-75) has been used as the base for calculating the sample size. Taking bad obstetrics history as the screening test for prediction of obstructed labour, the following result for test performances were found:

Sensitivity = 15/51 = 0.29 or 29%

false positive = 141/156 = 0.90 or 90%

Positive prediction = 15/156 = 0.01 or 10%

Considering, this study was conducted before 20 years in the rural set up compared with the condition with the referral hospitals in the capital, the availability of diagnostic aids and the qualification of personnel; in addition to this only one risk factor and only parous mothers were studied; the following assumptions were made:-

Sensitivity = increasing to about 2.5 times;

PVP = increasing to about 6 times;

FPR = decreasing to approximate 3 times;

Based on this following test performance results were assumed:-

Sensitivity = 65% (0.65) (60-70%);

FNR = 35% (1-sensitivity);

FPR = 35%;

Specificity = 65% (1-FPR) (60-70%);

Therefore, assuming that the sensitivity of ANC risk screening 60-70% (65%) the one tailed 95% confidence interval of "P" shall have 10% width then applying a single proportion sample size formula; the sample size will be as follows:-

$$N = \frac{4.P (1 - P). Z^2}{W^2} = \frac{4 \times 0.65 \times 0.35 \times (1.96)^2}{(0.02)^2}$$

= 400 HIGH Risk Mothers.

Assuming 10-15% (12.5%) loss to follow up, then $350 \times 0.125 = 394$ or 400 mothers of high risks and 400 mothers of low risks total 800 mothers have been selected as a study population.

ቀን _____

የፌዴሬሽን-ግሪግ

ለዚህ ጥናት ፌዴሬሽን ማህበረ ባለሙያዎች ፊርማዎችን አረጋግጣለሁ፡፡

ፊርማ _____

REFERENCE.

1. PEOPLE "SAFER MOTHERHOOD" IPPF review of population and development, volume 14, November 13, 1987. PP 1-9.
2. Ann Starrs PREVENTING THE TRAGEDY OF MATERNAL DEATHS A report on the "International Safe motherhood Conference", Nairobi, KENYA February 1987. PP6:
3. Tinker, A., Koblinsky, MA., Patrecia, D., Rooney, C., Leighton C. The WORLD BANK, "Making Motherhood Safe" Population and Human Resources Department The WORLD BANK, September 17, 1992. PP 1-11.
4. Safe motherhood, A newsletter of World wide activity Issue 11 March - JUNE 1993.2
5. MINISTRY OF HEALTH :Hand book any Guide-lines on integrated MCH/FP Services, 1992, Addis Ababa.
6. MOH, " National MCH/FP Services Guideline in Ethiopia. Maternal and child health coordinating office, 1985.
7. C. Rooney "Antenatal care and maternal health; How effective is it? WHO/MSM/92.4
8. M. DEBORAH, "SAFE MOTHER HOOD PROGRAMS: Options and issues.
Center for population and family health school of Public health,
Faculty of medicine Columbia University, New York.
9. Koblinsky, A.M, Judith I, and Gay I. Women's health at the crossroads, excerpts from The health of Women: A Global perspective. July 1992 Wester View Press.
10. Gebreamanuel Teka. The Public Health college & Training Center Gondar. Review Of Its Orgin And Development in Twenty Years Of National Services. 1975; p111.
11. MOH, Background information and proposal for action. FHD, 1991 (unpublished data).

12. Ministry of Health; Family Health Department. **Maternal and Child Health Care Module 3, High Risk Women and Infants.**- 2nd edition; Addis Ababa.
13. Backel, EM, Davies, AM and Petros Baruoian A. The risk approach in health care, with special reference to maternal and child health, including family planning WHO, Public health papers No. 76 Geneva 1984.
14. Rebecca G, Knapp and M. Clinton Miller III. **Clinical Epidemiology and Biostatistics.** Williams and Wilkins, Baltimore, Maryland, 1992.
15. WHO Regional office for EUROPE, **Symposium on the identification of high risk persons and population groups,** Windsor, 1972, Copenhagen, 1973 (unpublished documents EURO 4911).
16. HELEN MW., KANTI G., **Health care of Women and children in developing countries** Third Party Publishing Company, 1990 California, USA.
17. Kwast, B., **Maternal Mortality in Addis Ababa, Eth. Med. J.**1986.
18. Leke, R. 1991 " THE RISK APPROACH IN CAMEROON" presentation at the workshop on guidelines for Safe Motherhood Programming. **THE WORLD BANK/MOTHER CARE. WASHINGTON, D.C., NOVEMBER 17 -21/ 1991.**
- 19 PIA POOUAN, FESEHATSION KIFLE, & BARBARA E. KWAST. A Maternity waiting Homes reduce Obestetrics Catestrophy. **WORLD HEALTH FORUM VOL 11/1990**
20. Nasah, B.T., R.J. Leke, A.s, DOH, J. Kamdom Moyo, et, al, 1991 "The risk approach for reducing maternal mortality : the Younde expenance" **Int. j. Gynecol Obstet, 36: 195 - 201.**
21. Barros, FC., CG, Victoria and J, P Vaughan, et a 1.**Perinatal mortality in S. Brazil. Bulletin WHO 65: 95-104, 1987.**

22. Martin, B.H., and Y.S. Kim. Progress through antenatal care in Korea. Proc of 6th Asian Congress Obst. Gynaecology. Kuala Lumpur, 1974, P 139.
23. Perera, T., and K.M. Lwin, Perinatal mortality including low birth weight. A South East Asia Regional profile.
- SEARO Regional health papers No. 3 Geneva: WHO.**
24. Leiv S.Bakketeig - Methodological problems and possible end points in the Evaluation of Antenatal care. **International journal of Technology Assessment in health care**, 8: Suppl 1 (1992), 33-39, Cambridge University Press.
25. Moller, B., Lushino, O., Gebremedhin, M., and Lindmark, G. A study of Antenatal care at Village level in rural Tanzania. **INT. J. Gyneacol, obstet.**, 1989, 30: 123 - 131. **International Federation Gynaecology and Obstetrics.**
26. kasongo Project Team. "Antenatal Screening for fetapelvic dystocias. **Journal of Tropical medicine and Hygiene**, Aug 1984, 87(4): 173-183.
27. peggy Anne Field "Effectiveness and Efficiency of Antenatal care. **Midwifery** (1990) 6, 215 - 223
28. GAUIN YOUNG " RE thinking Antenatal Care" **The Practitioner**, March 1992 Volume 236.
29. Debora8h Maine, Allan Rsenfield, Marlyn Wallace, et.al. **Prevention Of Maternity Deaths in Developing Countries: PROGRAMME OPTIONS AND DRACTICAL CONSIDERATIONS: ' A BACK GROUND PAPER PREPARED FOR THE INTERNATIONAL "SAFE MOTHERHOOD" CONFERANCE, NAIROBI. FEBRURY 10-13. 1987.**
30. JOHN LESINSKI " HIGH RISK PREGNANCY Unsolved Problems of Screening Management and Prognosis" **Obstetric and Gynaecology** Volume 46 No.5 November 1975 PP. 599 - 603.

31. Gunilla Lindmark " Assessing The scientific basis of Antenatal care - The case of Sweden. **International Journal of Technology Assessment in Health Care & : Suppl. 1(1992), 2-7.** Cambridge University.
32. Safe motherhood : **ACTION Kit, Family Care International NEW YORK USA.**
PP. 2.
33. Thaddeus , S, and Maine, D. Too far to walk: **Maternal Mortality in Context: Columbia University, Center for population and Family Health, 1990.**
34. VoorHoeve, A.M, kars, C., Van Ginneken, JK, " Modern and Traditional Antenatal and delivery care" in modern and Traditional obstetrics edited by j.K Van Ginneken and A.S Muller, London: **Croom Helm, 1984, PP 309 - 322.**
35. Flecher HR., Flecher WS., Wagner HW. **Clinical Epidemiology,**
The essentials. 2nd edition.
36. Kloos H., Zein Ahmed Zein. **The Ecology of Health and Disease in Ethiopia.** 2 Westview Westview Press, Oxford,1992. p 295-306

DECLARATION

I, the undersigned declare this thesis is my original work and was not been presented for a degree in this or any other University and that all sources of materials used for this thesis have been dully acknowledged.

Name MELCOMANU ABASSU

Signature 

Place Addis ABABA

Date of submission 20/07/94

This thesis has been submitted with our approval as university advisors

Dr. James Farrow _____
Advisor.