HIGH RISK PREGNANCIES AND THEIR CLINICAL OUTCOMES

A PROSPECTIVE DESCRIPTIVE STUDY OF THE CLINICAL OUTCOMES OF HIGH RISK PREGNANCIES AT A PUBLIC SECTOR TERTIARY CARE CENTRE, KERALA

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CERTIFICATE

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DEDICATION

This work is dedicated to my beloved parents who have inspired me all throughout my studies.

CONTENTS

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Dr. Aysha Beegom. A.

HIGH RISK PREGNANCIES AND THEIR CLINICAL OUTCOMES.

ABSTRACT

Background

A 'high risk' pregnancy (HRP) state has been associated with an adverse maternal and foetal outcome. There is a dearth of data on the occurrence of HRP in Kerala state. Such information is critical for planning interventions in the state to reduce the maternal mortality rate, infant mortality rate and the incidence of low birth weight babies.

Objective

The objectives of the study were to investigate the incidence of HRP at a tertiary care referral hospital, and to study the short term 'in - hospital' outcomes of these HRP, using the '*normal risk*' pregnancies as a comparison group. We also examined the relations of select predictor variables to maternal and foetal outcomes.

Setting

The SAT Hospital located in Trivandrum, the state capital, is a public sector tertiary care centre for maternal and child health (MCH) care. It is the chief referral centre for MCH services in this region. There were 15,752 deliveries in the hospital during 1997.

Sampling Strategy

From 1 January to 14 February, 1998 (a period of 45 days), 2002 patients were admitted to the labour room with active labour pain. The data of surgical interventions were collected from the post-operative wards. From this group of

2002 cases, 1672 patients (83.7%) were included in the study which formed the study sample.

Material and Methods

All the patients who were admitted in the labour room from 8 A.M. to 5 P.M. were personally interviewed by the investigator. Both the mother and the new-born were followed up for a period of 7 - 10 days and their health outcomes were recorded. The health outcomes included were :-

a) Maternal mortality & morbidity (abnormal types of deliveries)

b) perinatal mortality & the incidence of low birth weight babies.

The pregnancies were classified according to the risk criteria based on the *Coopland's* (modified) scoring system. A pre-tested, structured close-ended questionnaire was used to collect the data.

Analysis

The analysis was done using SPSS PC+ statistical software. The non-parametric *Chi-square* test and *Chi-square trend* tests were used to study the association of select predictor variables with the health outcomes of interest in relation to the HRP cases. Multiple logistic regression with stepwise forward selection of variables was done to assess the independent contribution of predictor variables to the adverse maternal and foetal outcomes.

Results

Of the 1672 pregnant women, 1513 (90.5%) were from rural area and two thirds belonged to the lower socio-economic group. The primigravida were 752 (45%). Among the multigravida, the use of contraceptives were very low(12.5%). In our study sample, 93% of the women had regular antenatal visits. According to Coopland's criteria, 691 (41.3%) pregnancies were of low risk, 892

(53.3%) were of high risk and 89 (5.3%) were of severe risk group ratings.

Two maternal deaths occurred during the study period; both were among the HRP group and were related to caesarean section. The caesarean section rate was found to be greater (25.1%) in the high risk group, compared to the low risk (14.4%) group (P= < 0.001). An increase in caesarean section rate was noted as the maternal age(P = < 0.001) and parity (P =<0.01) increased. Perinatal mortality and low birth weight were associated with high risk pregnancies (P = < 0.001); Manual labour and reduced food intake during pregnancy were also associated with adverse outcomes(P = < 0.001). Low birth weight was associated with a low maternal education status (P = < 0.02) and a low family income (P = <0.001). Multivariable logistic regression analysis showed that high risk pregnancy score and socio-economic status of the patients were the principal factors influencing the maternal and foetal outcomes.

Conclusion

We have used the Coopland modified criteria for identifying high risk pregnancies in a sample of Indian women at a tertiary care hospital. The study suggests that risk stratification of pregnant women according to these criteria, aids in the prediction of pregnancies that are likely to have adverse outcomes. Targeting such high risk pregnancies for special care may further reduce the rates of maternal mortality, infant mortality and low birth weight babies in the state of Kerala.

Chapter .1.

INTRODUCTION

Women form the centre of the family and their health is of prime importance to the well-being of the whole family. With the emergence of nuclear family type, health of the women has increased in its relevance. Moreover, women's health is of cardinal importance to the health of the society. In the last decade, considerable attention has been paid to the health of women in their reproductive age by the health care providers and public health experts. The World Health Day, 7 April ,1998 was observed this year, with these objectives in mind and the slogan " Pregnancy is special; Let's keep it safe" was perpetuated.

Millions of women in the developing countries face health hazards related to procreation, child-bearing and the post-partum after-effects of ill-health every year. These problems constitute a vicious cycle which takes its toll on their everyday life. The health situation in India is the same as in the other developing countries in this aspect. It is estimated that for every 1000 live births, 4 - 5 mothers die for want of better health care in India and the situation is worse in some other developing countries.

Given this background of a high magnitude of reproductive morbidity and mortality of the women in the developing countries, the world health authorities convened a conference in Geneva during 1985, calling for urgent health measures to this hitherto neglected area. Twenty-five countries were represented. The rates of maternal death in the developing countries attributable to child-bearing were almost 200 times the rates in developed countries, thereby demonstrating considerable inequity in the heath status of women across the world (WHO 1985)[1].

It is estimated that for every maternal death, 10 -15 residual morbid conditions occur among women in the developing world[2]. This morbidity includes urinary tract fistulae, urinary incontinence and prolapse of uterus. The burden of reproductive morbidity and consequent chronic ill health can result in disruption of family / marital life. A world program was formulated by the WHO, UNDP and the World Bank on 'Safe Motherhood' in 1987 at Nairobi, Kenya. Efforts were made to undertake immediate and concerted measures for addressing this major health problem.

The WHO aims to reduce this high maternal mortality by half, by the end of the year of 2000 AD and subsequently, the remaining half by the year 2015 AD. With this in view the WHO stipulated that the maternal mortality rate (MMR) should be used as a monitor for the 'Health for All by 2000 AD' program. The International Co-operation for Population Development (ICPD) stated that the countries with the highest levels of MMR should aim to achieve a rate below 125 per 100,000 live births by the year 2005, and a rate below 75 per 100,000 by the year 2015. Countries with intermediate levels of MMR should aim to achieve their rates below 100 per 100,000 live births by the year 2005 and a rate below 60 by the year 2015 (ICPD 1994)[3].

There has been a rapid growth of the global population as a result of increased life expectancy and reduced death rate of human beings. In the '70s governments and social scientists gave importance to family planning to control this population growth world over. Since it was widely accepted that contraceptive technology alone could not achieve this goal, in the '80s the focus was shifted to mother and child health(MCH) and this was integrated into the family planning. In 1987, the 'Safe Motherhood' initiative was

commenced to reduce maternal mortality. This incorporates primary health care, family planning, comprehensive prenatal care, help of trained delivery personnel for all women during child birth, and effective access to maternity hospital services in high risk pregnancies and other emergencies.

1.1. Maternal Mortality - A Global Perspective

A recent study conducted jointly by the WHO and the UNICEF revealed that around 5,85,000 pregnancy related maternal deaths occur every year globally. For every maternal death 2 or more children are left motherless. Many deaths are unreported. About 99% of these deaths occur in the developing countries of which 55% occur in Asia (which accounts for 60% of the world's births), and 40% in Africa (which has 20% of the world's births) while only less than 1% of maternal deaths occur in the developed countries (which contribute about 12% of births in the world)[4]. Presently 60% of the women in the world live in nations were their status is low. This contributes the maternal deaths indirectly.

Table 1. Maternal Mortality Ratio in Selected Countries- 1990

Countries	MMR/ 100,000
India	460
Sri Lanka	80
Bangladesh	600
Nepal	830
Pakistan	500
Thailand	50
Chine	95
Japan	11
Singapore	10
UK	8
USA	8
Switzerland	5

Source:- WHO/ UNICEFF revised 1990 estimation of maternal mortality April 1996 (Park &Park 1997).

1.2. Pregnancy - Related Mortality and Morbidity

In the developing world one in every 200 pregnancies results in the

death of the mother. Africa has the highest MMR of 640 per 100,000. The developed world has a MMR of less than 20 per 100,000. Maternal deaths constitute 20 - 45% all deaths in women of the reproductive age group in most Asian countries while they account for fewer deaths - less than 1% in Japan, Sweden and Singapore[5]. Pregnancy associated morbidity is an important cause of chronic ill health among young mothers. Pelvic inflammatory disease is a major sequel following septic abortion. About 70% of the pregnancy related morbidity and mortality is preventable with adequate antenatal , natal, and post-natal obstetric care. Traditional damaging obstetric practices have to be eliminated by giving basic health care training to the *Dais* (locum pregnancy care attendants). All these can reduce most of the maternal deaths.

1.3. Maternal Mortality and Morbidity in India

Several surveys in India have demonstrated a substantial reduction in MMR over the last six decades . MMR has declined sequentially from 2000 per 100,000 in 1938 - to 1000 per 100,000 in 1954 - to 453 per100,000 in 1992 Sample registration system (SRS). According to this, the major causes of maternal mortality in India are haemorrhage(23%), anaemia(20%), eclampsia(14%), puerperal sepsis(12%), obstructed labour(6%), abortion(12%), and unclassified(14%)[6]. This high MMR of 453 per 100,000 indicates a very high rate of about 55 per 100,000 maternal deaths among the women of their reproductive age group. Maternal deaths account for 15% of all deaths among women in the child bearing age[7]. According to SRS estimates, 1.1% of all deaths in the country in 1991 were due to maternal causes. In comparison, it is found that the maternal mortality in Europe is at less than 10 per 100,000 while it is 50 times higher in India. So the average Indian woman is almost 50

times more likely to die of pregnancy-related causes than the women in the developed world.

There is a wide variation in the maternal mortality in the different regions of India. Social scientists and policy makers have to see the problem with regional perspectives in order to identify their appropriate solutions. The MMR varies from less than 100 to 700 per 100,000 in India for the different regions. This is due to the existing social and regional disparities, i.e., people of the same country live in entirely different conditions in terms of their health and socio-economic status. In states where the MMR is high, most of the deliveries are domiciliary, viz., attended to by traditional, untrained *Dais* (pregnancy care attendant).

Reliable community-based estimates of maternal morbidity are presently unavailable in India, though some data are available from referral hospitals. The pregnancy-related morbidity described was around 10 to 15 times more than the maternal mortality[4]. Such morbidity contributes substantially to the poor health sector performance of the states of Bihar, Madhya Pradesh, Rajaststhan and Uttar Pradesh - the *BIMARU* states of India (*Bimaru* in Hindi language = sick & unhealthy). In 1984, these states had only 20% of their deliveries attended by trained birth attendants (TBA) while the corresponding figures were 82% in Kerala, 76% in Punjab & Haryana and in the remaining states around 50 percent[8]. The major reproductive morbidities are vesico-vaginal fistula, uterine prolapse and urinary incontinence.

1.4. Maternal Mortality in Kerala

In comparison to other states of India, Kerala has the lowest MMR of 87per 100,000 population while Orissa has the highest with a MMR of 738 per lakh in India[6]. The achievements of Kerala in the health care sector are highly

commendable. The high female literacy rate, a higher age of female at marriage, improved basic standards of living, a greater awareness and access to health care, all contribute to the low MMR in the state. Hospitals are accessible to the rural population and there is less inequity in this matter. Another factor contributing to the low MMR in Kerala is that over 90% the deliveries and most of the domiciliary births are attended by the trained professionals. T.N. Krishnan[9] reported that, in Kerala institutional and domiciliary births attended by trained professionals are around 90%(1992) of all the births while deliveries attended by trained professionals were 46% in 1958; 57% in 1973 and 82% in 1984 in Kerala according to the SRS.

1.5. Prevention of Maternal Mortality

In 1993, on examining the causes of MMR, experts were of the opinion that 72% of them are preventable. A third of maternal mortality can be prevented with proper antenatal care and two thirds can be prevented with adequate referral to higher health care facility. A good primary monitory health care facility at the periphery can tackle the problem in an efficient way. It is widely believed that most of the maternal deaths in India and other developing countries are preventable. One step towards reducing pregnancy related morbidity and mortality in India is to target the high risk pregnancy patients for due interventions by ensuring primary antenatal health care facilities.

1.6. High Risk Pregnancy (HRP)

The term " **high risk pregnancy (HRP)**" refers to any pregnancy associated with an increased risk for adverse outcomes. This can be maternal or foetal. The incidence of high risk pregnancies varies from place to place. According to WHO estimates (1972), over 30% of all pregnancies in South

East Asia, Africa and Latin America may be categorised as 'high risk' . High risk pregnancies are associated with a higher incidence of low birth weight babies (LBW), a high perinatal mortality (PNM), and an increased pregnancy-related maternal morbidity and mortality.

The maternal and perinatal mortality reflects the quality of health of a community. Perinatal mortality in the best indicator to measure the quality of maternal and child health (MCH) care in a community. The high perinatal mortality in India reflects the composite effect of malnutrition, infection and high fertility. The lack of adequate obstetrics care and poor transportation in rural settings further aggravates the problem.

1.7. Motherhood is Safe or Not ?

The outcome of a pregnancy can be said to be good only when it results in a normal delivery, with a healthy mother and baby without any health complications. The outcome of pregnancy can be unpredictable in the sense that even a low risk pregnancy can result in a poor outcome.

1.8. Study of HRP - Relevance in Kerala

Kerala's health care achievements are quoted as a model to the other states of India and also to the rest of the developing world, it being one of the states with a low per capita income; with 30% of its people living below the poverty line. These health achievements are praise-worthy in this perspective. A study of HRP is important in Kerala as the outcomes of HRP determine the other important health indicators like -maternal mortality rate, the life expectancy, infant mortality rate(IMR) and perinatal mortality(PNM). An investigation of HRP profile is relevant to Kerala as, such data is very few in the state. This could serve as a prelude to interventions targeted to lower the MMR, IMR, & the incidence of low birth weight babies further. It can also help in effective health policy measures for better utilisation of the available health resources. Such a study of HRP would also be timely, given the current global interest in reproductive health.

Chapter . 2.

LITERATURE REVIEW

Motherhood is a natural phenomenon, but safe motherhood is fraught with many complications related to of pregnancy and child birth. Every pregnancy should culminate in a healthy mother and baby. This should be the objective of all good obstetric health care .

2.1. Evolution of Antenatal care

From the advent of time man has cared for his perpetuation. He had wanted offspring and the tenets of kith, kin, clan and tribes were established from ancient civilisations onwards. The need for a healthy offspring laid the foundations of maternity and obstetric health care.

No	Period	Source/ Place	Subject
1	Hellenic Period	Hebrew, Bible, Talmud Principles	Pregnancy Care
2	II Century	Soranus of Ephesus	Pregnancy & infant care
3	1781	Alexander, Hamilton	Midwifery Practices
4	1837	Thomas Bull	Antenatal Care concepts
5	1877	Thomas Parker	Revised AN care
6	1901	In Boston, America	Instructive nursing association.
7	1902	England	Midwifery Act
8	1909	America	Assoc. for prevention of infant mortality
9	1915	Edinburgh	First Antenatal clinic
10	1932	England	Report on maternal mortality & morbidity
11	1936	England	Domiciliary midwifery
12	1940	Drs Weymuller &Beck	Perinatal Medicine
13	1948	England	Socio-economic survey on pregnancy
14	1966	America	Birth control & voluntary sterilisation

The above table summarises the evolution of antenatal care around the world[10].

2.2. Mother and Child Health Services in India

The MCH services in India started with the aim of reducing the prevailing high maternal mortality rates. With the arrival of British in India , allopathic

hospitals were started as pa part of their missionary work. There were programmes for the training of indigenous *dais* to enable them to practice safer midwifery in the rural community.

No	Year	Place	Particulars and Committees
1	1886	British India	Women's hospitals
2	1918	Delhi	Lady Harding Health School
3	1931	Madras	Maternal & Child Welfare Centre
4	1937	India	Special Health Committee
5	1946	"	Health Survey & Development committee
6	1947	"	Mother & child health more attention
7	1962	"	Mudaliyar Committee
8	1963	"	FPP included in MCH
9	1965	"	Mukherji Committee - separate staff for FPP
10	1973	"	Kartar Singh Committee - Mobile Service Units for FPP
11	1981	"	Health for All by 2000 AD
12	1987	"	Safe Motherhood initiative

FPP = Family Planning Program; MCH = Mother & Child Health

2.3. Recent Studies

Several national and international studies have evaluated ***International Studies***[11-18].

No	Year of Study	Number	Findings
1	Johnson et al - '81.	PROM	Crevice vaginal infection in 30%
2	Rayburn - '81	PROM	Intercourse during late pregnancy
3	DeBono- 1990	38,000	75% still births after 31 wks of gestation, half were preventable
4	Sadosky E et al -1990	-	Establishment of HRP units reduced IUDS& PNM significantly
5	Phelen JP- '90	2081 HRP	Polyhydramnios in 3.5% with increased PNM
6	MacFarland et al - '90	Age group of HRP	Better perinatal outcome in Aspirin treated cases of hypertension
7	Malik SJ et al - '92	1107 HRP	PNM 40/1000. 2/3 were preventable
8	Fortmey JA et al - '96.	Morbidity survey	Risk factor & socio-cultural barrier elimination-improve the situation

IUD = Intra uterine deaths PNM = Perinatal mortality

pregnancy-related morbidity and mortality. Early detection of high-risk pregnancies is needed for their special management in order to improve their outcomes. During the last fifteen years there has been no significant reduction of the maternal mortality in India. This is due to the vast disparity in maternal care among the different regional states of India.

2. Indian Studies[19-28]

The studies tabulated in the table below suggest that maternal and perinatal mortality are high in India. A substantial proportion of new-borns are also having low birth weight. The low birth weight was having significant association with lower socio-economic status, physical labour, maternal diseases like hypertension during pregnancy etc.

No.	Author & year	Findings
1	Misra J - '81.	HRP study in Patna, 1/3 - toxaemia, 1/5 haemorrhage and 1/6 had IUGR.
2	Sachar RK - '94.	Significant relationship between taking rest & birth weight
3	Sachar RK - '94.	Pre pregnancy body weight, height & BMI - +'ve correlation in Birth weight
4	Gupta KB et al - '94	140 PIH cases; PNM 140/ 1000; LBW - 74%
5	Bhatia JC - '95.	Among 3600 Pregnant women, maternal morbidity in 500 cases
6	Anjana Devi & Reddy Rani - '96.	Significant association between PROM & cervico-vaginitis.
7	Sangita et al - '96.	Study in rural MC, showed that 90% of maternal deaths were preventable.
8	Tivari S et al - '96.	Case control study - of cervical infection & pre-term delivery- significant association
9	Das Gupta et al - '97.	In a Tertiary Care centre, PNM-67.7/1000 (India-42.3/1000)
10	Singla P.N et al - '97.	Anaemia in pregnancy- increased risk of pre-term delivery, PNM & LBW

These studies underscore the fact that a majority of these maternal and foetal deaths can be prevented.

3. Kerala Studies[29-32]

There are very few studies in the state on HRP. Many of the studies available are based on hospital records.

No	Authors	Findings
1	RS Kurup et al - '74.	Study in 2 major public sector hospitals, LBW was 17% & 12.2%
2	Girija Leela - '77.	HRP Study at MCH
3	Bai NS et al-1991 Study at MCH	PNM was42.75/1000. National average-55.3/1000
4	Pradeep M. et al-1992.Study at MCH	Most PNM in LBW& pre-term babies, in 90% 0f PNM -mother had high risk factors.

Only the study by Girija Leela mentioned above was prospective. It was based on direct patient evaluation at this tertiary care setting in the state of Kerala (unpublished) 20 years back. In that study the Nesbit & Aubrey score system was used to stratify the risks of pregnancy. It had 27% of high risk group. The present study when compared to the above shows the different time trends of the HRP as of today. The malnutrition which was prevalent earlier was not present in this study. Maternal and perinatal mortality and morbidity were high in the high risk group. Some of the findings of these studies were also similar to the present study results.

Chapter .3.

STUDY OBJECTIVES

The objectives of this study were :-

1. to assess the frequency of HRP, and their significant outcomes, at a tertiary care referral hospital. It looks into the short term outcomes using the "normal risk or low risk" pregnancies as a comparison group.

2. to evaluate the Coopland's criteria for HRP in predicting adverse maternal and foetal outcome in our study sample.

3. to investigate the impact of medical and select socio-demographic variables on the outcome of pregnancies.

Chapter .4.

MATERIALS AND METHODS

4.1. Setting

Sri Avittam Tirunal Women & Children's Hospital is a tertiary care centre for maternal and child health care. It is in the public health care sector located in Trivandrum, the capital city of the state of Kerala. HRP cases are referred here from the neighbouring districts and from outside the state for tertiary level management. Being a public sector institution, a greater proportion of people from the lower economic strata attend this hospital. It is attached to the premier medical college hospital in the state of Kerala. During 1997, there were 15,752 deliveries in this hospital. The hospital has good paediatric care services which includes first-line neo-natology services as well. Thus, the hospital is a referral centre for the management of high risk pregnancies.

4.2. Methods

All the cases admitted with labour pain in the 'labour' rooms from 8 A.M to 5 P.M. were taken for the study starting from 1 January, 1998. During this 45 day period, 2002 deliveries were conducted in this hospital. Out of this, 1672 cases were included in the present study (83.7%) in this time frame. This study sample approximates 10.5% of the total deliveries conducted in a year at the hospital. The mother and baby were followed up for a period of 7 - 10 days to investigate their mortality or morbidity if any. All of the 1672 cases were interviewed personally by the investigator. All the pregnancy cases who were admitted for labour were stratified for their risk ratings for the present study with the Coopland's risk scoring system (modified). There were three strata by this.

4.3. Instrument

A pre-tested close-ended structured questionnaire was used to collect the data *(Appendix B)*. This questionnaire sought information regarding the medical conditions, antenatal practices, socio-demographic characteristics and other relevant factors.

4.4 Data Entry

The data was entered into a spread-sheet in D base III plus format.

4.5. Statistical analysis

The analysis was done using SPSS PC+ statistical software.

1. *Univariate analysis* - The non-parametric *Chi-square* test and *Chi-square trend* tests were used to study the association of select variables with the health outcomes of interest in relation to the HRP cases.

2. *Multivariate analysis* - Multivariable logistic regression with stepwise forward selection of variables was performed to study the independent influence of various predictor variables on the health outcome of interest.

3. *Correlation Matrix* - A Correlation Matrix was used to assess the correlation of the predictor variables.

4.6. Outcomes

For each pregnancy, the outcome was dichotomised as 'good' or 'adverse'. The outcome of a pregnancy was coded as adverse if there was either an adverse maternal outcome or an adverse foetal outcome.

The outcomes of pregnancy studied are:-

1.Maternal outcomes	- Mortality	
	- Morbidity	Abnormal type of delivery-i.e., Caesarean section etc.
2.Neonatal outcomes	- Mortality	Perinatal mortality,
	- Morbidity.	Low birth weight

4.7. Maternal mortality

According to WHO, maternal death is defined as "the death of a women while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of pregnancy, from any cause related to or aggravated by pregnancy, or its management, but not from accidental or incidental causes". This definition is used in the present study with the limitation that postpartum follow-up was restricted to the *in-hospital* period of 7 - 10 days.

In developed countries the MMR has declined so significantly that the use of the denominator 100,000 (instead of 1000) is recommended there to avoid fractions of deaths in calculating MMR.

Causes of maternal deaths can be grouped into:-

1. *Direct or obstetric causes* - These are due to the complications of pregnancy, labour and puerperium, like eclampsia,, haemorrhage and obstructed labour which constitute around 75%.

2. *Indirect causes* - These are medical disorders associated with the pregnancy, like anaemia, hepatitis and sepsis.

4.8. Type of delivery

Among the abnormal type of deliveries, caesarean section was taken as the measure of morbidity among the pregnant women. Caesarean Section is the operative procedure whereby the foetus is delivered surgically, approaching through an incision on the abdomen and uterus. There is a trend, towards increasing rates of caesarean sections during the last two decades[33]. Caesarean section is used as a measure of morbidity because the mother and the baby have to undergo the risks of surgery and anaesthesia. The duration of hospitalisation is

also more for the women who undergo caesarean section, compared to those who have a normal delivery.

The major reasons for caesarean sections are cephalo-pelvic disproportion, abnormal foetal presentations, low lying placenta, uncontrollable hypertension and elderly primigravida. Generally speaking, caesarean sections constitute around 10% of all hospital deliveries in the published literature.

4.9. Perinatal Mortality

The term *"perinatal mortality"* (PNM) includes both intrauterine foetal deaths (stillbirth) and early neonatal deaths(within 7 days of birth). The International Classification of Diseases (ICD) defined "the perinatal period as the duration lasting from 28th week of gestation to the 7th day after birth" . The Ninth Revision (1975) of ICD added that :-

i. Babies chosen for inclusion in perinatal statistics (this means late foetal deaths, live births and early neonatal deaths) should be those above a minimum birth weight, i.e., 1000 gm at birth (A birth weight of 1000 grams is considered equivalent to gestational age of 28 weeks). This method is used for calculating the PNM in this study.

ii. If the birth weight is not available, a gestation period of at least 28 weeks should be used.

iii. When (i) and (ii) are not available, body length (crown to heel) of at least 35 cm should be considered.

WHO defines "the perinatal mortality rate is the ratio of perinatal deaths in a given year to the total number of live births in that year; it is usually expressed as a rate per 1000 live births". It is a baseline indicator of the health of a community and the country.

The perinatal mortality (PNM) rates of a few countries (1990) are listed below :-

India	_	46 per 1000 live births.
USA	_	10 "
Japan	_	5 "
Bangladesh	_	85 "

With the decline of infant mortality in many countries, the PNM has assumed the greater significance as an indicator of obstetric & paediatric care before and around the time of birth. The major causes of PNM are intrauterine and birth asphyxia, LBW, birth trauma and intrauterine or neonatal infections.

4.10. Low Birth Weight

A low birth weight (LBW) baby has been defined by WHO as " a birth weight less than 2500 grams (upto and including 2499 grams) the measurement being taken preferably within the first few hours of life, before significant postnatal weight-loss has occurred ".

There are two types of LBW babies. (i). Pre-term babies (ii). intra-uterine growth retardation(small-for-date babies). Approximately two-third of all LBW babies in the developed countries are estimated to be pre-term. The causes for LBW are multiple births, acute infections, physical labour and reduced nutrition, hypertensive disorders of pregnancy, etc. It is often preventable by good prenatal care; by discouraging adolescent pregnancies and by adequate management of the hypertensive disorders of pregnancy. The frequency of LBW in 1990 in some countries is listed below[4].

India	_	33%
USA	_	7%
Netherlands	_	4%
Bangladesh	_	50%

4.11. Identification of HRP

The incidence of HRPs varies from place to place and from country to country, depending on the socio-economic conditions. The identification of HRP and their timely referral is essential for proper management. The high risk pregnancies need specialised investigations and intensive management for the better outcome of the mother and the baby.

There are several types of scoring systems designed to identify the HRPs. None are satisfactory in all respects. Each scoring system consists of a list of conditions known to be poor prognostic indicators in the pregnancy. Most of these systems give different numerical values to the high risk factors ,depending on the severity of their effects on the pregnancy and produce a numerical score that is designated to indicate the seriousness of the anticipated and potential problem.

COOPLAND'S High Risk Evaluation Form

Name ----------Age ------ Para ----- Gravida-------LMP----------EDC-----

Reproductive history	Medical / surgical conditions	Present pregnancy
Age < 16 years. =1 16-35 =0 > 35 =2 Parity 0 = 1 1-4 = 0 >5 = 2 Two or more abortions/ history of infertility = 1 Postpartum bleeding/manual removal of placenta = 1 Prior child wt<5 lb./ >9 lb. =1 Toxaemia or hypertension =2 Previous cesarean section=2 Abnormal / difficult labour =2 COLUMN TOTALS Total Score ------ **Low risk 0-2**	Previous gynaec. surgery = 1 Chronic renal decease = 1 Gestational diabetes(A) =1 Class B/ greater diabetes = 3 Heart disease = 3 Other significant medical disorders (score 1 to 3 according to severity) **High risk 3-6**	Bleeding < 20 wks. = 1 > 20 wks. = 3 Anaemia <10 g% = 1 Postmaturity = 1 Hypertension = 2 Premature rupture of membranes = 2 Ployhydramnios = 2 IUGR = 3 Multi.pregnancy = 3 Breech / Malpresentation =3 Rh mismatch = 3 **Severe risk ≥ 7**

Some of these scoring systems are - Nesbit and Aubry's "Maternity and child health care index system" (1969), Goodwin et al's scoring system (1969) and the grading system of Coopland et al (1976). In this study we used the modified Coopland scoring system (proposed by Coopland et al in Manitoba, Canada, 1977). The validity of this scoring system has hitherto not been examined in Indian women previously and this scoring system is widely used in the developed countries.

4.12. Predictor Variables

The predictor variables considered in this study are

- *Place of residence* - urban / rural
- *Region* - home district, other districts or other states.
- *Age* - of the mother was stratified into five groups, with class intervals of 5 starting from 20 - 35 years ..
- *Education of the couple* -The couple were mainly grouped into two for the purpose of analysis, i.e.,(1)education upto standard X and (2)education above that.
- *Occupation of the couple* -This was stratified into six. In the first stratum there were three unemployed men - one was having psychiatric disorder and other two were physically handicapped. The second group is formed by unskilled labourers and the third group comprised of semi-skilled labourers - like masons, tappers, electricians, plumbers, petty shop-keepers etc. The fourth group constituted office workers and small time businessmen. The fifth group is formed by professionals and higher income groups. The Gulf employees formed the sixth group.

- *Family income* - This was stratified into four, depending on the number of earning members in the family (subjective data). They are the lower income group(less than Rs 2000 per mensem), lower middle(Rs 2000 - 4000), upper middle (Rs 4000 - 6000)and the higher income groups (more than Rs 6000).
- *socio-economic status* - determined by considering the composite variables like income, ownership of property(own house), education status and occupation.
- *Nutritional status* - categorised into three strata (subjective), more food intake (relative to pre -pregnancy state), normal food intake and less food intake. Each study participant was asked to indicate her food consumption during pregnancy compared to her pre-pregnancy state.
- *physical exertion* - categorised into three subjective strata. Each pregnant woman was asked to describe her level of physical activity during the index pregnancy like light physical exertion, moderate physical exertion and heavy manual labour.
- *Number of living children* - nil ; 1 child ; more than 1 child.

Chapter .5.

RESULTS

During this 45 day study period, the SAT Hospital had a total delivery of 2002 deliveries, out of which 1672 were included in our study sample. This constituted 83.7% of the total deliveries during this period.. The remaining 330 deliveries could not be enrolled in this single investigator study, because they had occurred after 5 P.M, outside the chosen time-frame. They could not be followed up in the wards as they were shifted there before the next morning . The SAT Hospital is a tertiary care centre, and not purely a referral centre. In our sample 35.2% cases were referred to this centre for due treatment, and the rest were directly admitted for the same.

High risk cases who were cared for in their previous deliveries at the SAT hospital, preferred to return to the same hospital for their next delivery. For their very first delivery, women prefer the well equipped hospitals. The primigravida constitutes 45% of the sample. People who need sterilisation (wishing to complete their family) also come to this institution directly. So the proportion of non-referred cases (65%) were found to be more in our sample. Majority of the women in our study sample belonged to the lower socio-economic group, this being a government health care centre.

5.1. Reasons for Referral

The various reasons for the referral are listed in Table 2. They were categorised into nine groups. Some cases were without any reason for referral as many peripheral hospitals do not have facilities for conducting the deliveries there and hence these patients were referred.

Table 2. Reasons for Referral

Reasons	Number	%
No reason	42	2.5
Foetal reasons	110	6.6
Pre-term/Bad Obstetric History	57	3.4
Past date	55	3.4
Premature Rupture of Membranes	76	4.5
Previous Caesarean / Cephalo--Pelvic Disproportion	43	2.6
High Blood Pressure/Eclampsia	111	6.6
Ante Partum Haemorrhage/ Post partum Haemorrhage	37	2.2
Infections-STD/Hepatitis & others	17	1.0
Heart Disease/Diabetes Mellitus	41	2.5
TOTAL	**589**	**35.2**

The major reasons for referral were pregnancy-induced hypertension, foetal complications and premature rupture of membranes.

5.2. Socio-demographic features

The various demographic features of our study participants are described below and summarised in Table 3.

1. Place of Residence

More than 90% of the women were from the rural areas while and the rest were from the urban areas. According to 1991 census, only 26.4% of the population of Kerala resides in urban areas. In this study sample, the urban representation is 9.5%. This may be due to the availability of many other well equipped private hospitals in the urban areas. Likewise, the increased rural representation in our study sample may be related to a paucity of duly

equipped public care hospitals in the rural settings and may also be due to the high cost of health care in the local private hospitals.

Table No .3. Demographic characteristics.

Variables	Type	Number & %
Place	Rural	1513 (90.5)
	Urban	159 (9.5)
District	Trivandrum	1364 (81.6)
	Other districts	282 (16.9)
	Other states	26 (1.6)
Caste	Hindu	1160 (69.4)
	Muslim	273 (16.3)
	Christian	239 (14.3)
Family	Nuclear	592 (35.4)
	Joint	1080 (64.6)
Monthly income (Rupees)	< 2000	402 (24.0)
	2000-4000	729 (43.6)
	4000-6000	381 (22.8)
	> 6000	160 (9.6)
Age of the mother	20 years	132 (7.9)
	20 - 25 years	753 (45.0)
	25 - 30 years	563 (33.7)
	30 - 35 years	181 (10.8)
	35 years	43 (2.6)

2. District

More than 80% of the women were from the home district of Trivandrum and 1.6% were from outside the state. People from the neighbouring districts were also utilising the services at the SAT Hospital and constituted 16.9% of the study sample. The majority of the patients hailing from outside Trivandrum district and from outside the state, were referred from the secondary level health care facilities for seeking further specialised care for their pregnancy related health problems.

3. Caste

A majority of the women in our study sample were Hindus, the major community, as expected . The relative proportion of other religions corresponds

to that of the general population of Kerala.

4. Marital Status

Most of the women in our study sample were married. Three women were unmarried; while five were separated from their husbands. All the latter eight women belonged to the lower socio-economic group.

5. Family Type

Two third of the women in the study sample were from joint families . Forty five percent were primigravida and lived along with their parents.

6. Monthly Family Income

There were four groups according to their family income. Two-thirds of them belonged to the low and lower middle income groups. This shows that the hospital services were utilised more by the lower income groups. Only one-tenth belonged to the upper and middle classes. Very high income groups were not represented in our study sample.

7. Age of the Mother

A majority of the subjects (78.7%) in the sample were between the ages of 20 and 30 years. The patients who belonged to the teenage group constituted 7.9%, and the youngest was 17 years old. About 3% of the women were over the age of 35 years, the age end cut-point defining the high risk group; the oldest one was 41 years old.

5.3. Education & Occupation

Table .4 illustrates the details of the education status & occupation of the spouses. With regard to the education of the spouses, only 2.7% of the men were illiterate. Over 60% had school education and 24.5% had college level education. Among the women, 2% were illiterate, 62.4% had school education and

35.6% had college education. Among the women 91.1% were housewives. 3.2% were manual labourers and the other women (5.7%) had different occupations. Among the men, the manual labourers constituted 39.2%, while 28.9% of the husbands were semi-skilled workers.

Table 4.Education & Occupation

Variable	Type	Number (%)
Education of wife	Illiterate	33 (2)
	upto 7th	254 (15.2)
	upto 10th	789 (47.2)
	PDC	365 (21.8)
	Degree	151 (9)
	Professionals	80 (4.8)
Education of husband	Illiterate	45 (2.7)
	upto 7th	301 (18)
	upto 10th	910 (54.4)
	PDC	230 (13.8)
	Degree	116 (6.9)
	Professionals	63 (3.8)
Occupation of wife	Housewives	1524 (91.1)
	Manual labourer	53 (3.2)
	Semi-skilled	36 (2.2)
	Office work	48 (2.9)
	Professional	10 (0.6)
	Gulf employed	1 (0.1)
Occupation of husband	No occupation	2 (0.2)
	Manual labourer	655 (39.2)
	Semi skilled	483 (28.9)
	Office work	363 (21.7)
	Professional	34 (2.1)
	Gulf employed	127 (7.6)

5.4. Nutrition and Physical Activity

Table 5. displays the nutritional intake and level of physical activity of the women in our study sample. The information obtained on nutrition was subjective. Two- third of the women reported an increase in food intake (including milk and other supplementary food items) during pregnancy. One- fourth had a reduced food intake (compared to their pre pregnancy level) and the rest reported a normal

food intake. During pregnancy more food is essential for the well being of the mother and foetus, and for the proper intrauterine growth of the baby.

Table 5. Nutrition And Activity

Variable	Number	%
Nutrition		
More food intake	1118	67.5
Normal food intake	130	7.8
Less food intake	410	24.7
Activity		
Light work	212	12.7
Moderate work	1429	85.5
Hard work	31	1.9

Most women reported moderate physical exertion during pregnancy. A few women(3.2%) were manual labourers, and were engaged in hard physical work during pregnancy. Studies show that physical exertion in pregnancy is associated with an increased incidence of low birth weight babies[20].

5.5. Parity and Contraceptive Use

Table 6. displays the information on the parity, prior living children and contraceptive use among the women in our study.

Table 6. Parity and Contraceptive Use.

Variable	Type	Number(%)
Gravida	Primi	752(45)
	Multi	920(55)
Number of live children	0	918(55)
	1	666(39.8)
	2	77(4.6)
	>2	11(0.6)
Contraceptive use in multipara	Condoms	23(2.5)
	Oral pills	8(0.9)
	IUCD	84(9.1)

In the sample, 45% of the women were primigravida while the remaining 55% were multigravida. This shows that people prefer tertiary care hospitals for

the first delivery. Women with one living child constituted 39.8% of the study sample. This may reflect the reduced number of children preferred in a family, the current trend.

Among the multigravida, contraceptive use was found to be very low at 12..5%; condom use was 2.5%, oral pills 0.9%, while intrauterine contraceptive devices were used by 9.1% of the women.

5.6. Health Care Seeking Behaviour

Details of health care seeking behaviour of the sample are given in Table 7. Majority of the women(93%) had regular antenatal check-ups and 99.5% had more than 3 antenatal check-ups in the index pregnancy. Only 0.2 % had no antenatal visits and another 0.2% had only one antenatal visit. This illustrates the health care seeking behaviour of the Kerala women. Most women had received the recommended doses of injection tetanus toxoid and were on iron supplements.

About the consultation practices, more than half of the women were attending the government hospitals while a small proportion (6.3%) were utilising both private and public services. About 44% of the women underwent exclusive private consultation .

Table 7. Health Care Seeking Behaviour

Variable	Number	%
Antenatal Visit		
Regular visits	1557	9.3
Irregular and >3 visits	110	6.5
One visit	3	.2
No visit	3	.2
Consultation		
Private consultation	734	43.9
Government consultation	830	49.6
Both	105	6.3
No consultation	3	.2

5.7. High Risk Characteristics of the Present Pregnancy

Table .8 displays the high risk characteristics of present pregnancy among the women of our study.

FEVER - High fever during the antenatal period is dangerous, and may cause sudden foetal death. It is seen that only 4.8% of patients had a history of fever due to viral fever or a respiratory tract infection.

URINARY TRACT INFECTION (UTI) was reported in 8.6% of the women in our study sample. Non-symptomatic UTI is more present during pregnancy. The sample showed a higher prevalence of UTI.

ANAEMIA (defined as haemoglobin<10gms) was present only in 7.6%. The prevalence of anaemia among the pregnant women is 40-80% in India. In the developed countries, it is only 10 - 20 %[33]. In this institution the incidence is less than 10% due to the better health care seeking behaviour of the people of the state.

Table 8. Characteristics Of Present Pregnancy

Conditions	Number	%
Fever	81	4.8
Urinary tract infection	144	8.6
Anaemia	125	7.6
PIH	314	18.8
PROM	456	27.3
Infections- STDs	5	0.3
Hepatitis	9	0.5
Hyperemesis	20	1.2
Heart disease	59	3.5
Diabetes mellitus	84	5.0
Antenatal haemorrhage	105	6.3
Surgical History		
Previous caesarean / multi	231	25.1
Previous gynaec. surgery	11	0.7
Previous h/o abortion	301	18.0

There was only one case of severe anaemia with a haemoglobin level of less than 6.5gm%. Severe anaemia may cause pregnancy induced hypertension (PIH), eclampsia, pre-term labour and stillbirth. About 17% of the maternal deaths are due to anaemia in India.

PREGNANCY INDUCED HYPERTENSION (PIH)- Incidence of PIH in India is 8 - 10 %. In this sample it was found to be very high at 18.9%. PIH occurs among the low socio-economic group, in teenagers and in the elderly as reported in the literature. More than two third of the PIH occur among the primigravida.

ECLAMPSIA (Severe grade of PIH with convulsions) - In the newborn it is a major cause of intrauterine death, IUGR and pre-maturity. Eclampsia is a major cause of maternal death. There were 9 cases of eclampsia in our study. One of the two maternal deaths occurred in this group. The caesarean section and PNM were high in this group.

PRE-MATURE RUPTURE OF MEMBRANES (PROM)- Spontaneous rupture of chorio-amniotic membranes at any time beyond 38 weeks of pregnancy and before the onset of labour is designated as PROM. Infection is a major contributing factor here. The frequency of PROM varies from 2.6 - 14% in this study . Here 27.3% of the women had premature rupture of membranes. There was a large proportion of LBW babies due to pre-term deliveries and most of the perinatal deaths also occurred in this group. So the identification and the treatment of reproductive tract infection in pregnancy is essential for the better outcomes of new born.

HYPEREMESIS - A small number (1.2%) of women needed hospital admission and treatment for hyperemesis. Most of them were primigravida.

INFECTIONS - There were five VDRL positive and seven HBsAg positive

cases. In both diseases, the outcomes of pregnancy were poor.

HEART DISEASE- 3.5% of cases(59) had heart diseases. Rheumatic heart disease was the most common ailment present in our study sample. Two cases developed heart failure in their post delivery period.

GESTATIONAL DIABETES MELLITUS- The women with diabetes mellitus about 5%(89). In diabetes, foetal outcomes are poor if proper blood glucose control is not established throughout the pregnancy. The babies were over-weight in 18 such cases.

PREVIOUS SURGERY - One-fourth of the multigravida had undergone a previous caesarean section previously. About a fifth had history of a previous abortion.

OTHER CONDITIONS - Antenatal haemorrhage was present in 105 cases(6.3%) while 28 cases had multiple (twin) pregnancies.

5.8. Hospital Admissions

There were 304 patients(19.1%) who had undergone hospital admissions and treatment during their antenatal period. The major reasons for hospitalisation were hypertension, fever, urinary tract infections, haemorrhage, premature rupture of membranes, anaemia, intrauterine growth retardation and decreased foetal movements.

5.9. Grading of Pregnancy Risks

The use of a high risk scoring system should help the obstetrician to identify the HRP cases and to elaborate a prognosis for the outcome of the pregnancy. The second objective is not easily accomplished as the HRP indicators are not very sensitive enough. There are many scoring

systems for categorising the high risk pregnancies . In this study , we used the widely used Coopland's high risk scoring system (modified). According to this the study subjects were classified into three " low risk ,high risk and severe risk groups " adding the risk scores assigned . In the low risk group, there were 691 (41.3%) women; 892 (53.3%) women were categorised as high risk group.and the remaining 89 (5.3%) constituted the severe risk group.

Table 9. Coopland's High Risk Pregnancy Grouping

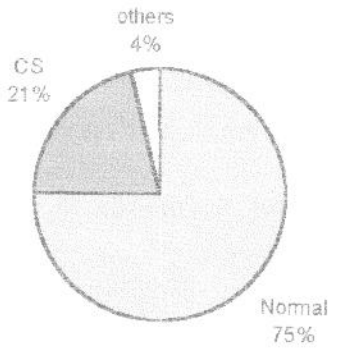
Types	Score	Number & %
Low Risk	0-2	691 (41.3)
High Risk	3-6	892 (53.3)
Severe Risk	>6	89 (5.3)
Total		1672 (100)

5.10. Outcome of Pregnancies - (I)Maternal

Type of Delivery

Normal delivery was possible in about 75% of women; 20.7% had caesarean sections and the remaining (4.5%) had other forms of assisted deliveries(assisted breech deliveries, vacuum and forceps deliveries).

Distribution of type of deliveries



CS - caesarean section; Others - other types of deliveries;

Maternal Deaths.

There were two maternal deaths in the hospital during the study period. Both cases were in the high risk group and belonged to the lower socio-economic class. One was a primigravida who died due to post partum eclampsia. The second case succumbed to postpartum sepsis. Both died after emergency caesarean section.

Type of Delivery and Risk Groups

Table .10 illustrates the association of risk categories (Coopland's classification) and type of deliveries.

Table 10. Type of delivery and risk groups

Risk groups	Normal delivery	Caesarean section	Other types	Total
1. No risk	571 (82.6%)	99 (14.3%)	21 (3%)	691 (41.3%)
2. High risk	621 (69.6%)	224 (25.1%)	47(5.3%)	892 (53.3%)
3. Severe	59 (66.3%)	23 (25.8%)	7(7.9%)	89 (5.3%)
Total	1251 (74.8%)	346 (20.7%)	75(4.5%)	1672 (100%)

χ^2 t rend test p=<0.001

As the risk grading of the pregnancy increased, the chances of occurrence of normal delivery decreased. The proportion of normal deliveries in the three groups showed a decrease as the risk score increased, 82.6%, 69.6% and 66.3% respectively. Three quarters of the women had a normal vaginal delivery.

Among the women in our sample, 346 (20.7%) underwent caesarean section. All cases were given trial labour as protocol, unless contraindicated otherwise. The frequency of caesarean section was found to be higher in the 'high risk' group and very high among the 'severe risk ' group (caesarean section rates of 14.3% in the low risk group, the high risk group with 25.1%, and severe risk group with 25.8% respectively).

Other types of deliveries including assisted breech deliveries,

vacuum extraction and forceps deliveries also showed an increasing trend , 3%, 5.3%, 7.9% respectively, as the risk score increased.

Type of Delivery and Age group

Table .11 lists the type of delivery underwent in relation to the maternal age. With the increasing age of the mother, the chances of normal delivery get decreased. Among the women who were less than 30 years of age, the proportion of normal deliveries varied from 74 to 84%, while in patients who were more than thirty years of age, the proportion of normal deliveries reduced to 51 - 55.5% .

The caesarean section showed an increasing rate as the age of the mother increased . It varied from 9.1% to 41.9% in our sample. The highest rate was observed among the women who were more than 35 years old (41.9%).

Table 11. Age group and type of delivery

Age groups	Normal	C. Section	Other types	Total
< 20 years	111 (84.1%)	12 (9.1%)	9 (6.8%)	132 (7.9%)
20-25 ,,	598 (79.4%)	124 (16.5%)	31 (4.1%)	753 (45%)
25-30 ,,	416 (73.9%)	128(22.7%)	19 (3.4%)	563 (33.7%)
30-35 ,,	104 (57.5%)	64(35.4%)	13(7.2%)	181(10.8%)
>35 ,,	22 (51.2%)	19 (41.9%)	3 (7%)	43 (2.6%)
Total	1251 (74.8%)	346 (20.7%)	75 (4.5%)	1672(100%)

χ^2 trend test p = <0.001

Parity And Caesarean Section

Parity denotes the state of previous pregnancy beyond the period of viability i.e. above 28 weeks. *Para* refers to pregnancy and not to babies. A woman who delivers twins in her first pregnancy is still a gravida one and para one. Table .12 displays the association of parity and frequency of caesarean section. A large proportion of the primipara - 214 (23.7%) underwent caesarean section. As the parity increased the caesarean section rate also

increased. Women with a single child had a rate of 16.8%(126) while multipara had this rate at 26.7%.

Table 12. Parity And Caesarean Section

Parity	Caesarean Section
1	214 (23.7)
2	126 (16.8)
3	4 (26.7)
> 3	2 (100)
Total	346 (20.7)

χ^2 trend test p = <0.01

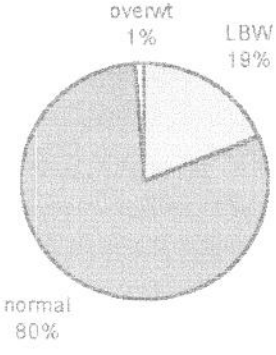
Postnatal complications

There were 20 patients (1.3%) who developed postpartum haemorrhage requiring blood transfusion. Five women had a retained placenta, for whom manual removal of the same was performed under anaesthesia. Eleven patients (0.7%) had a second degree perineal tear which required repair.

(II)Foetal outcomes

Among the study subjects of 1672 cases there were 854 (51.0%) male babies and 815 (48.8%) female babies in our study sample. Three babies had ambiguous genitalia. In twin pregnancies only the first baby is counted for the

Distribution of newborns by birth weight



Low birth-weight babies in the study sample were 15.9%

study outcome since 80% of the twins had similar characteristics. There were 28

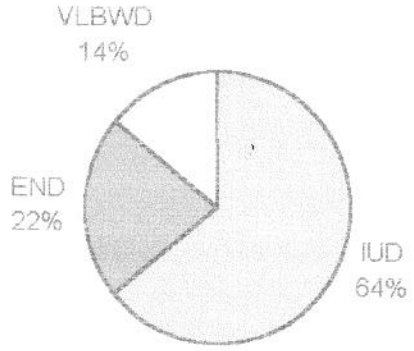
twin pregnancies in this group.

Low birth-weight - was found in 312 (18.7%) babies (less than 2500gm).

Among these 254 were live-born (15.9%). Birth weight was normal in 1342(80%) babies; 18(1.1%) babies were over-weight (>4000gm). There were 181 (10.9%) pre-term babies and 1491(89.1%) full-term babies in the study sample.

The National Family Health Survey - NFHS (92 -93), gives the rate of low-birth weight of Kerala as 17 - 20%. (India 26%). Our study here shows this rate at 16% among the hospital based sample. So the same at the community level may be lower than the estimates given above.

Distribution of newborn deaths



VLBWD - very LBW deaths (<1000 gms)
END - early neonatal deaths (first 7 days of life)
IUD - intra-uterine death

Perinatal Mortality.

There were 103 deaths among the babies; of these 66(64%) were intrauterine deaths and 23(22%) were early neonatal deaths (death within first 7 days of birth). So there were 89 perinatal deaths. Babies with a birth weight less than 1000gm (14 cases) were excluded from the calculations of

perinatal mortality.

Perinatal Mortality Rate is 54 per 1000 live births in this study

5.11. Admissions of Sick New-borns

During the study period 258 babies required treatment in the new-born nursery. Major causes for the nursery admissions were birth asphyxia, neonatal jaundice, neonatal sepsis, pre-term LBW and congenital abnormalities. The major causes of birth asphyxia were pre-term deliveries and respiratory distress syndrome of the new-born. Among the new-born with jaundice, ABO incompatibility was found to be more common compared to Rh incompatibility. Neural tube defects were the commonest congenital abnormalities, of which meningo-coele and anencephaly formed the majority. Among the infections, umbilical sepsis was the major cause.

There were 23 infant deaths within the first week of birth. Among these 14 were pre-term LBW babies with birth asphyxia and secondary infection; one had intra-uterine growth retardation; 4 had birth asphyxia; one had hypoglycaemia and 3 deaths were due to congenital anomalies.

5.12. Association of Foetal Outcomes and High Risk Groups.

Table No.13 displays the association of foetal outcomes and high risk groups. It is noted that the higher Coopland risk categories were associated with increased perinatal mortality and an increased frequency of low birth weight babies .

Table13. High Risk Pregnancy And Foetal Outcomes

Risk Groups	Perinatal Deaths	Low Birth Weight
Low Risk	15 (2.2)	74 (11.0)
High Risk	58 (6.5)	155 (18.1)
Severe Risk	16 (19.5)	25 (35.2)
TOTAL	89 (5.4)	254 (15.9)
x^2 trend test	p = < . 001	p = < . 001

The perinatal deaths among the new-borns were 89 and the frequency of

PNM was found to increase from 2.2% to 6.5% and 18.5% as the risk rating increased. There were 254 LBW babies in the study sample and most of them were pre-term. The LBW frequency was found to increase from 11% to 18% and 35% as the risk score increased, showing a strong association between these two variables.

5.12. Socio-Demographic Variables and Foetal Outcomes

Table 14. displays the association of select socio-demographic variables

Table 14. Select Variables and foetal outcomes

Variable	Number(%)	Number(%)
	PNM 89 (5.4)	**LBW 254 (15.9)**
Income (Rs.)		
<2000	23 (5.8)	75 (19.5)
2000-4000	39 (5.4)	115 (16.6)
4000-6000	20 (5.3)	48 (13.0)
>6000	7 (4.4)	16 (10.4)
	p = .94	*p = < .001*
Nutrition		
Less food intake	38 (9.3)	86 (22.6)
Normal food intake	6 (4.6)	11 (8.8)
More food intake	45 (4.0)	157(14.4)
	p= <.001	*p=<.001*
Education (H)		
No husband	3 (100)	1 (20.0)
Illiterate	1 (2.2)	8 (18.2)
<7th standard	20 (6.7)	62 (21.6)
8-10	49 (5.4)	139 (16.1)
Pre -degree	8 (3.6)	22 (10.0)
Degree	6 (5.2)	15 (13.2)
Higher education	3 (4.8)	7 (11.3)
	p= .09	*p =<.002*
Occupation		
Housewife	76 (5.0)	223 (15.3)
Employed	13 (8.8)	31 (22.1)
	p = .053	*p = <.03*
Activity		
Light work	14 (6.8)	46 (23.1)
Moderate work	69 (4.9)	200 (14.6)
Hard work	6 (19.4)	8 (29.6)
	p = <.001	*p = <.001*

(Analysis by χ^2 trend test)

with foetal outcomes in the study group. It displays the association of the foetal outcomes with maternal nutrition and physical activity during pregnancy.

5.13. Family Income & Foetal outcome

Perinatal mortality was found to be similar in low income, middle and high income groups in our sample (no significant association was found between PNM and these variables ($P = 0.94$). But ***Low birth weight*** was found to be high among the low income group and the frequency of LBW increased as the income decreased; a significant inverse association was noted between the two ($P =<0.001$) .

5.14. Nutrition & Foetal outcome

PNM was also associated with the amount of food intake during pregnancy. The assessment of amount of the food consumption during pregnancy was, however, subjective. LBW was also found to be high among the women with a reduced food intake during pregnancy. PNM and LBW displayed a strong inverse association with the amount of food intake during pregnancy ($P=<0.001$).

5.15. Education Of Husband & Foetal outcome

PNM did not vary according to the educational status of the husband or the mother ($P = 0.09$ and 0.13, respectively). But LBW showed a significant association with the educational status of the husband and the mother . As the education status increased of the husband and the mother increased, the proportion of low birth weight babies decreased($P=<0.002$ and 0.022 respectively). This may reflect the health seeking behaviour of the subjects studied.

5.16. Occupation of Mother & Foetal outcome

Among the women 1524 (91.1%) were housewives and less than one-tenth of the women only were employed. PNM was found to be more among the employed women than in housewives (*P = 0.05*). LBW was also found to be more among the employed women compared to housewives (*P = 0.03*).

5.17. Physical activity & Foetal outcome

PNM was found to be very high among the women who were engaged in manual labour (19.4%), compared to women doing moderate work (04.9%) and women doing light work (06.8%; *P= 0.001*). LBW was also found to be more frequent among the women performing manual labour(29.6%) compared to women engaging in moderate work (14.6%; *P=0.001*).

5.18. Type of Family and Foetal Outcomes

When adverse foetal outcome(PNM and LBW) were considered for their association with the type of families like nuclear and traditional, it was insignificant (*P = 0.12* and *P = 0.69* respectively).

5.19. Maternal Medical Conditions and Foetal Outcomes

Table .15 illustrates the association of high blood pressure and anaemia during pregnancy with adverse foetal outcomes.

Table 15. Select Diseases And Foetal Outcomes

VARIABLE	PNM - 89 (5.4 %)	LBW- 254 (5.9%)
Blood pressure		
Normal	56 (4.2)	183(14.0)
High Blood Pressure	33 (10.5)	71(24.6)
P value	P = <.001	p = <.001
Haemoglobin		
>10 Grams	81 (5.3)	233(15.7)
<10 Grams	8 (6.4)	21(17.8)
P value	p = < 0.6	p = < 0.5

5.20. High Blood Pressure

PNM was high when associated with hypertension. Pregnancy induced hypertension and adverse foetal outcomes were found to be highly significant in this study group. LBW was also more among the women with high B.P compared to women with normal BP.

5.21. Haemoglobin Level

Foetal outcome and anaemia were found to have no significant association in this study. PNM and LBW were found to be almost equal among women with haemoglobin >10 gm% and haemoglobin <10 gm% .

5.22. Multivariable .Analysis

Results reported earlier examined bivariate associations. We performed the multiple logistic regression to study the independent and combined effects of important predictor variables on the study outcomes; (maternal mortality, PNM, LBW and caesarean section).

The predictor variables used were

1. High risk score (Continuous variable)
2. Education status of husband and wife (Categorical variable)
3. Socio-economic status (Categorical variable)
4. Nutritional status (Categorical variable)
5. Activity in terms of physical work ((Categorical variable)

The outcome variable was dichotomised i.e. the presence or absence of an adverse maternal or foetal outcome . Table .16 presents the results of multivariable logistic regression of pregnancy outcomes on select predictor variables.

Table 16. *a.* Multivariable logistic regression of pregnancy outcomes.

Variable	β Beta	Odds ratio	P value
Risk score	0.3134	1.37	<0.001
Education (H)	-0.2907	0.75	0.02
Education (W)	0.0402	_	0.84
Socio-economic	0.7478	_	0.38
status	0.4724	_	0.49
Nutrition	1.806	_	0.84
Activity.			

(a) In these analyses , the Coopland's high risk score and education status of the husband were significantly associated with the pregnancy outcomes. An increase in Coopland's score was associated with a 1.37 fold elevated risk of an adverse outcome, while an increase in husband's education was associated with a reduced risk of an adverse outcome.

(b) Since educational status was closely related and collinear to socio economic status, the educational status of both husband and wife was excluded from the analysis and the results were studied. These results are presented in the table 17.

Table 17. (b). Multivariable logistic regression of pregnancy outcome on selected predictor variables.

Variable	β Beta	Odds ratio	P value
High risk score	0.3104	1.36	<0.001
S E S	-0.123	0.88	0.037
Nutrition	0.4858	_	0.48
Activity	1.509	_	0.22

In these analyses, a high risk score and a low socio-economic status were highly significant factors influencing the outcome of pregnancy adversely.

5.23. Correlation Matrix

Regression method tells us something about the nature of the relation between two variables and how one changes with the other. It does not tell us how close the relation is. To get this, one has to estimate the correlation coefficient. When the correlation is positive it shows that as one increases the other also increases likewise. It is negative when, as one variable increases the other decreases as expressed by a negative correlation coefficient.

Table18. Correlation of Demographic variables

	Edn(H)	Edn(W)	SES	Nutrition	Activity
Edn(H)	1	.6443**	.6047**	.2851**	-.0876*
Edn(W)	.6443**	1	.5575**	.2914**	*
SES	.6047**	.5575**	1	.3326**	.0920**
Nutrition	.2851**	.2914**	.3326**	1	-.0732*
Activity	-.0876**	-.0920**	-.0732*	-0345	-0345
					1

(2 tailed test n =1672 * = .01 * * = .001)

Table .18 shows the correlation of the predictor variables studied. The findings in this correlation matrix show that all the variables are positively correlated to each other, except for the level of physical activity and nutrition which are negatively correlated.

Chapter .6.

DISCUSSION

Pregnancy and childbirth constitute a set of important and specific risks to women's health. In developing countries the poorly monitored pregnancies greatly jeopardise the health of the mother and the baby.

6.I. Profile of Pregnant Patients in a Tertiary Care Facility

In the study sample, there were only a third of the patients were referred. More than 90% of the patients were from the rural areas, possibly because of a lack of adequately equipped hospitals in the public sector at the periphery. The smaller proportion of patients coming from the urban areas may be because they seek care in the other city hospitals in these areas.

Teenage pregnancies were few (8%) when compared to other states which show high proportion of the same. This may be due to the higher age at marriage of the females in the state (22.9 years). Women in the age group 20 - 30 years constituted the majority of our study sample(79%) .

More than 97% of the couples were literate. Women (35.6%) were having more education than men (24.5%) especially with regard to college level education, yet their employment rates were very low, (<9%). Most of the women (91%) were housewives and a minority (3.2%) were engaged in manual labour .

About 75% of the sample belonged to the lower and lower-middle income groups. This shows that the hospital is more utilised by the lower socio-economic groups.

A majority of women were taking adequate nutrition during pregnancy (75%). This may indicate the health awareness regarding the importance of adequate nutrition in pregnancy and the availability of food even to the low

income group in the state. They tend to take less food during their pregnancy to reduce the fullness of stomach and related discomfort. It was not due to any food scarcity. They reported a feeling of abdominal discomfort when they took more food during pregnancy.

Nearly half of the women in our study were primigravida. Pregnant women with more than one living child constituted only 5% of our sample. These figures are corroborative of the declining trend in fertility in the state. The use of contraceptives among the multigravida was low (12.5%) - may be related to the reported lesser acceptance of the temporary methods of contraception among the rural women, who formed the majority of our study group. The contraceptive practices saves maternal lives by reducing the hazards on unintended pregnancy and dangerous abortions[34].

Several studies in other states of India relate that the maternal mortality can be due to the low availability of antenatal care . Most pregnant women (99%) were getting adequate antenatal care in our study. This reflects the availability, access and effective utilisation of health care facilities by the women in Kerala.

Antenatal morbidity measured in terms of prior hospitalisation before delivery was reported at 19%. The government health care facility was utilised by 50%; exclusive private consultation was sought by 44% of the women, while the remaining 6% utilised both the public and private sectors.

The occurrence of premature (PROM) rupture of membranes was high (27.3%) in our sample and this probably contributed much to the adverse foetal outcomes. The reasons attributed for this in the literature are cervico-vaginal infection and sexual contact during the last months of pregnancy[11,12]. The frequency of pregnancy induced hypertension(PIH) was also high

(19%) in our study and this probably contributed to the adverse outcomes. This condition was found to be more often present among the lower socio-economic group.

6.2. Coopland's Criteria & Pregnancy Outcomes

(i) Maternal outcomes: When the Coopland's criteria were applied, 58% of the study sample were grouped as high risk group category. This suggests that the criteria are not sufficiently wholesome or specific. Any set of criteria that identify 50% of pregnant women as being at high risk are unlikely to have be sufficiently discriminatory value. They then tend to have a low positive predictor value in identifying the association of adverse outcomes to risks during pregnancy.

Normal delivery occurred in 75% of the cases; 21% had caesarean section and the rest were other types of assisted deliveries. The number of multigravida with previous caesarean section was high (25%) in the study group. This had resulted in a high caesarean section rate in the study sample. The performance of caesarean section was higher among the ' high risk ' group of pregnancy compared to the normal risk group and this association was highly significant ($p =< 0.001$). The chances of a normal vaginal delivery in the high risk group were less when compared to the low risk group. The caesarean section rate increased as the maternal age increased ($p =< 0.001$). It was also high in the primigravida; the rate also increased as the parity increased. This may be due composite effect of an increase in the age, the parity, the weight of the baby and the maternal medical complications.

The post-natal complications were less; they were more predictable in this tertiary care setting and could be managed better with the facilities in this hospital. This was also due to the earlier antenatal care of good quality.

received by the patients in the study.

Two maternal deaths occurred in the hospital during the study period. Both deaths were after caesarean section. These women were in the ' high risk ' group and belonged to the low socio-economic group as well. Maternal mortality rate in this institution according to this study is at 125 per 100,000. The previous year's MMR was also of near-about the same rate as shown by the medical records of SAT hospital. This rate is high compared when compared to that of the state (87 per 100,000 in 1993)which may be due to the study sample being hospital based and referral in nature.

(ii) Foetal outcomes

Among the new-born 51% were male. Nearly a fifth of the new-born had a low birth-weight . The study comprised of more HRP cases and hence, the occurrence of pre-term babies (10.9%) and the LBW babies (15.9%) were high. These results corroborate the findings from various other investigations conducted in Kerala[29, 32]. There were 103 new-born deaths, of which 89 (5.4%) were peri-natal deaths. Of these, 66 (64%) were stillborn, 23 (22%) were early neonatal deaths and 14 (14%) were pre-term LBWs weighing less than 1000 grams.

Majority of the peri-natal deaths were the result of maternal complications. So prevention of maternal high risk factors and special care of HRP cases can help in reducing the PNM and LBW substantially. Fifteen percent of the new-borns were sick due to birth asphyxia, perinatal infections, neonatal jaundice and pre-term status. About 60% the early neonatal deaths occurred among the pre-term LBW babies. PNM and LBW were significantly associated with the HRP status by the Coopland criteria ($p =<0.001$).

About the association of the select predictor variables with the outcomes, high risk groups showed significant positive association with caesarean section, peri-natal deaths and low birth-weight (χ^2 trend test, p = < 0.001).

PNM in this study is 54 per 1000 live-births. It showed no significant association with family income or education of the husband. This is understandable as it is more related to maternal medical complications rather than to poverty. Poor nutrition was significantly associated inversely with the PNM while the and hard physical labour was directly related to it. (χ^2 trend test, p = < 0.001).

LBW was significantly associated with low income, reduced nutrition during pregnancy and hard physical labour (χ^2 trend test, p = < 0.001). This may reflect the stress of the work with inadequate food intake. LBW is also significantly associated with the low education status of the husband and with the occupation of the mother. Education of the husband may influence the health care seeking behaviour in the family.

PNM and LBW were more in hypertensive patients (p =< 0.001)[22]. So the foetal outcomes may improve when special attention is extended to this group. Maternal anaemia had no influence on any of the pregnancy studied , possibly because, only a mild degree of anaemia was prevalent in our study sample.

6.3. Univariate and Multivariate Analysis

Multivariate analyses suggest that a high Coopland risk score and the socio-economic status were the principal determinants of adverse outcomes in pregnancy. This would emphasise the need to incorporate measures of socio-economic status along with variables related to the medical conditions to develop a scoring system for identifying high risk pregnancies in India.

These data also suggest that risk stratification by the Coopland score coupled with the socio-economic status of the women, may be more preferable than, to use the Coopland score alone. Pregnant women who have a high risk score and who belong to the lower socio-economic groups should be targeted for specialised medical attention. This forms the chief message of this study.

One pre-requisite to reduce the MMR is to identify the high risk group by a scoring system considering the local conditions and customs as well. The most needy are the poorer women living in disadvantaged regions with poor health care access[35].

6.4. Limitations of the Study

- This is a hospital sample, and hence is not truly representative of the community at large, since there is a significant referral bias.
- Height and weight of the patients were not available; it is very difficult measure the same in patients who are supine and in active labour pain. So the nutritional status assessment could not be done by anthropo-metric measures.
- Follow-up of the patients was difficult since they are admitted in different parts of this big hospital complex. So for collecting information about morbidity, case records were examined at times, in a few patients, when they were unavailable for the same.
- There was only one investigator and hence time and manpower were major constraints for visiting all the care- stations spread throughout the large hospital building complex.

6.5. Strengths of the Study

- Our study sample includes the majority of the HRPs that occurred in a setting of a government tertiary care centre.

- The data were collected by in-depth personal interviews, which were prospective and cross-sectional in nature, by a single investigator with background knowledge in obstetrics.
- a similar study was not available in the published literature for the state.

6.6. Public Health Importance of the Study

Scoring system suitable for the Indian situation can be developed from the data, which can be used by the field staff at the grass root level of Mother and child health care. Further analysis is also envisaged with this study. Given the low predictive value of the Coopland scoring system, It is intended to examine the relations of select medical and socio-demographic variables taken together to the pregnancy outcomes in our data set (training set). After developing a risk prediction rule from this training set it we be tested prospectively in other groups of patients in different hospital settings(validation sets) to see how the prediction rule will perform as a clinical tool.

- Outcomes are poor in high risk groups and the complications can be anticipated in these groups for their due interventions, if identified earlier.
- Nutrition and manual work has adverse outcome in HRPs and timely intervention can improve the outcome of mother and the new born.
- Adequate rest during third trimester of pregnancy shall improve the birth weight of the new-born.
- Maternity care providers should be trained in the use of Coopland's criteria for risk stratification based on the study results.
- the peripheral health care centres should be adequately equipped to facilitate to monitor and care the HRPs before being referred to the higher centres.

Chapter . 7.

CONCLUSION

We have used and validated prospectively the Coopland's modified criteria for identifying high risk pregnancies in a sample of Indian women in a tertiary care setting in the public sector in the state of Kerala. The study showed that the maternal deaths and abnormal types of deliveries were greater in the high risk pregnancy group. With increase in maternal age, parity and maternal diseases, the chances of a safe outcome of pregnancy are lessened. The foetal outcomes like perinatal mortality and low birth weight babies were more in the high risk pregnancy group.

On studying the various socio-demographic factors to their association with outcomes of pregnancy it has been found that they also play important roles in the occurrence of high risk pregnancies. Poor nutrition and heavy physical work adversely affect a safe outcome. The incidence of HRP was more in the lower socio-economic status group. The state of a lower family income is associated with low birth weight while it has no relation to the perinatal mortality. Medical conditions during pregnancy like hypertension, eclampsia etc. also affect the outcome adversely.

The study suggests that risk stratification of pregnant women will be useful in the prediction of pregnancies with an adverse outcome. Targeting high risk pregnancy for special care may further reduce maternal mortality rate, infant mortality rate and low birth weight babies in the state.

Appendix A

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Appendix B

PROFORMA

HIGH RISK PREGNANCIES AT THE S. A. T HOSPITAL, TRIVANDRUM

A Cross-sectional study (January - February 1998).

Primary Investigator : Dr. Aysha Beegom. A., MBBS, DGO, DPH.

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PROFORMA Date of Exam :-

A: General Data:-

ID No: LR No: Referred Y / N

Date of Admission: Date of Delivery: Date of discharge:

Name: Age: Place: Rural / Urban Dist:

SES: Education : Occupation: Family Income: Contraception:

Husband --

Wife --

Gravida: Para: LMP: EDC: LCB:

B: Obstetric Data: Coopland Score - HRP (Modified)

(i) Reproductive History

1. Age - >35 = 2 . 2. Parity- < 0 = 1; > 5 = 2

3. Abortions - 2 or more : Induced / Spontaneous : H/o of Infertility = 1.

4. PPH / ROM -manual = 1 . 5. Baby - < 5 lb. / > 9 lb. = 1.

6. Toxaemia / HBP = 2 . 7. Previous CS = 2 .

8. Labour-difficult /abnormal = 2.

(ii) Medical / Surgical co-morbidity:-

1. Previous gynaec. surgery = 1. 2. Renal Disease = 1.

3. Gestational DM (A) = 1. 4. Class B or > DM = 3.

5. Heart Diseases = 3. 6. Others if any = 1 to 3.

(iii) Present Pregnancy :

1. Bleeding :- < 20 weeks = 1. 2. > 20 weeks = 3.

3. Anaemia :- < 10 gms = 1. 4. Post-maturity = 1.

5. High BP :- = 2. 6. PROM = 2.

7. Polyhydramnios = 2. 8. IUGR = 3.

9. Multiple Pregnancies = 3. 10. Abnormal lie = 3.

11. Rh iso-immunisation = 3.

(iv)RISK :- ***Low*** : 0 - 2. ***High*** : 3 - 6. ***Severe*** : 7 + .

AN Care - Visit I - By :JPHN / PHC/ GP/ GH Inj. TT / Fe BOH:

Hospital Admission in AN Period - Y / N Why ?

Ht: Wt gain > 5Kg: Nutrition: more / less

Activity : sedentary / moderate / severe

Obstetric Morbidity :

1. Hyperemesis - .2. Fever / Infections -

a. Antepartum - 3. APH - .4. UTI

5. Convulsions - .6. DM / HBP / HD

b. Intrapartum :- 1. Prolonged labour -.2. Tear - Perineal / cervical

3. Excessive bleeding - .4. Retained placenta -

5. Delivery - CS / Assisted / Forceps / Vacuum

6. Convulsions -

c. Postpartum : 1. PPH - 2. Convulsions - .3. Shock - 4. Sepsis -

5. Br.abscess - .6. Depression - .7. Others -

Sterilisation - Y / N Desire by Husband / Wife - Reasons -

Maternal Mortality : Dt. of death : AP / PP

Cause of death :

NEW-BORN Data :

1. Sex : .2. Birth order : .3. Weight .4. Term - Pre / Post- .5. Apgar :

New-born Morbidity :

.1. LBW - .2. RDS - .3. Icterus - .4. Infections - .5. Congenital abnormalities - .6. Convulsions - .7. Hypoglycaemia -

.8. Rh incompatibility - .9. Others -

Mortality - Date of death - .Cause :