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Published in the Russian Federation
European Journal of Medicine
Has been issued since 2013.
ISSN: 2308-6513
E-ISSN: 2310-3434
Vol. 6, No. 4, pp. 215-225, 2014

DOI: 10.13187/ejm.2014.6.215
www.ejournal5.com

UDC 61

Premature birth: An Enigma for the Society?

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Abstract

Infants born preterm are at greater risk than infants born at term for mortality and a variety of health and developmental problems. Complications include acute respiratory, gastrointestinal, immunologic, central nervous system, hearing, and vision problems, as well as longer-term motor, cognitive, visual, hearing, behavioral, social-emotional, health, and growth problems. The birth of a preterm infant can also bring considerable emotional and economic costs to families and have implications for public-sector services, such as health insurance, educational, and other social support systems. The greatest risk of mortality and morbidity is for those infants born at the earliest gestational ages. However, those infants born nearer to term represent the greatest number of infants born preterm and also experience more complications than infants born at term. Preterm birth is a complex cluster of problems with a set of overlapping factors of influence. Its causes may include individual-level behavioral and psychosocial factors, neighborhood characteristics, environmental exposures, medical conditions, infertility treatments, biological factors and genetics. Many of these factors occur in combination, particularly in those who are socioeconomically disadvantaged or who are members of racial and ethnic minority groups. The empirical investigation was carried out to draw correlation between preterm birth and eventuality. This paper deals with various issues related to the premature deliveries from socio-biological perspectives.

Keywords: maternity; pregnancy; septicemia; prenatal mortality; prematurity.

Introduction

In the era of modern Obstetrics, where there has been a rapid advancement in all specialties, preterm labour still remains an enigma for the obstetrician today and is the leading cause of neonatal morbidity and mortality. The magnitude of the problem is evident from the fact that after exclusion of genetic and anatomic defects, it accounts for 75-80% of prenatal mortality and morbidity. Prenatal mortality among Indian babies has been reported to be 2-7 times higher than term babies.

With the advent of newborn special care units, there have been dramatic improvement in neonatal survival rates of preterm babies (>90%) but neonatal intensive care is very expensive, so preterm labour is not only a medical and social problem, but also an economic one.

Real reduction of preterm delivery will only take place through improved understanding of the physiology of preterm labour, identification of patients at risk of preterm labour, prediction and prevention of its occurrence, early detection of its onset and effective to colysis. When prolongation of pregnancy is not hazardous to the mother or fetus, the best place for immature fetus is still inside the uterus. The rationale behind keeping the otherwise healthy fetus in uterus is based on the fact that prenatal mortality and morbidity decrease markedly from 24 to 26 weeks of gestation. Interventions such as antenatal corticosteroid treatment and postnatal surfactant treatment for infants with respiratory distress syndrome and gentle ventilation strategies maximize fetal adaptation to the abnormal fetal environment and improve outcomes. Preterm birth is defined as a fetus delivered earlier than 37 weeks or less than 259 days from the first day of last menstrual period (WHO, 1972).

Preterm labour complicates approximately 5-10% of pregnancies and accounts for about 75% of prenatal deaths (Fuch, 1976). Bhargava *et al* (1990) reported prenatal mortality in preterm Indian babies to be 2-7 times higher than term births. Premature labour is an age old entity which poses a problem to the obstetrician as well as to the neonatologist. The obstetrician has to decide whether to try and conserve the pregnancy a little longer so as to improve the chances of health survival of the baby or to resign to the inevitability of premature delivery. The neonatologist on the other hand has to look after the preterm neonate and to see it through the turbulent period when the baby tries to attain maturity (Trivedi *et al*, 1995).

Preterm labour is associated with poor prenatal outcome and the surviving preterm babies have an increased incidence of neurological and respiratory disabilities and suffer from recurrent illnesses during childhood (Patwardhan *et al,* 2001).

Over the last 50 years, extensive research has been conducted with the objective of preventing, predicting and optimizing the outcome of patients with preterm labour. Currently, the therapeutic foundation for treating preterm labour involves the use of tocolytic agents (Goldenberg, 2002).

The precise etiology of preterm labour is still unknown. Many factors like preterm premature rupture of membranes, over-distension of the uterus, medical diseases like chronic nephritis, and obstetrical complications like pre-eclampsia and ante-partum hemorrhage are thought to be mainly responsible for onset of preterm labour (Dutta 2004).

Preterm onset of labour is a heterogeneous condition with multi-factorial etiology. Clinical suspicion from the past obstetrical history, early detection and correction of risk factors (Medical, Obstetrical) like control of blood pressure in pre-eclampsia, correction of anemia, treatment of cervico-vaginal infections and asymptomatic bacteriuria, avoidance of coitus in late pregnancy, use of tocolytics in over distended uterus, cervical encerclage in proven cases of cervical incompetence.

Tocolytic agents can significantly prolong pregnancy in the hope of avoiding or ameliorating the sequelae of preterm labour. Alternatively, these agents can delay delivery for time sufficient enough to allow administration of steroids and in-utero transfer of mother, thereby enabling preterm infants to be delivered in obstetric units experienced in the care of high risk pregnancies along with their supportive neonatal intensive care facilities (Simhan *et al*, 2005).

Due to continued innovation in neonatal intensive care facilities and obstetric interventions, fetal survival is now possible even at 20 weeks gestation in developed countries. However, even the best setups in developing countries, salvage is rare below 28 weeks of gestation (Singh *et al,* 2007).

Use of injectable progesterone in idiopathic threatened preterm labour can reduce the incidence of preterm labour. Maternal betamethasone in preterm labour helps in enhancing fetal pulmonary maturity and reduces the incidence of respiratory distress syndrome in newborn babies. Deliveries in the institution having facilities for neonatal care will improve the prenatal outcome in preterm labour (Bangal *et al*, 2012).

The incidence of preterm births is raising world over because of increased frequency of multiple births due to assisted reproductive techniques (ART), more working mothers, increasing psychological stress and medically induced prematurity. Hence, it is a time felt need to ascertain the causes and outcome of preterm labour and delivery and also the neonatal care resources available in most Indian nurseries. So, we have chosen this subject for the study.

Methodology

The present prospective study on prematurity at Jawaharlal Nehru Hospital and Research Centre was conducted in the Department of Obstetrics and Gynecology, Jawaharlal Nehru (JLN) Hospital and Research Centre, Sector-9, Bhilai, Chhattisgarh, India.

JLN Hospital and Research Centre, Bhilai is 860 bedded multidisciplinary tertiary and referral hospital in the state of Chhattisgarh. The hospital caters free medical care to employees of Bhilai Steel Plant and their dependents. It also looks after referred employees of other associated industries, referred cases from local nursing homes, private practitioners, district hospitals, health centers and nearby rural areas on payment basis. Obstetrics and Gynecology Department has total of 117 beds with 2 maternity and one gynecology ward.12 beds in labour room, 70 beds in obstetric ward and 35 beds in gynecology ward.

The present study is hospital-based observational (analytical) cohort study of prospective (longitudinal)-type. The study was conducted over a period of 18 months from September 2009 to February 2011.

The study comprised of 343 cases of preterm births, who presented in the department of Obstetrics and Gynecology with preterm labour. The cases during emergency hours were admitted through casualty to labour room and were screened immediately. The other group came through Out Patient Department (OPD), where the high risk cases were admitted for planning of termination, observation and monitoring.

Cases coming through OPD or through casualty to labour room, with 28-37 weeks of gestation from last date of menstrual period were taken into study. Cases having regular 28 days cycle were taken into study.

All women with preterm labour were investigated for presence of infection by complete haemogram and urine and vaginal swab culture. Antibiotics were provided to those with ruptured membranes or significant pathogen count on urine or vaginal culture .Women in active phase of labour (>4 cm dilatation), those with signs and symptoms of chorioamnionitis and those with antepartum haemorrhage ,those with fetal distress due to any reason and those with any medical contraindication to tocolytics were not given tocolysis. Tocolytics were given to the other group of women in either of two forms Isoxsuprine orally or parenterally as per treating obstetrician's choice. The aim of using tocolytics was to delay delivery for at least 48 hours in women with ruptured membranes and through 36 completed weeks of gestation in those whose membranes were intact.

Results and discussions

The societal costs of prematurity associated with illness are conventionally broken down into direct and indirect costs. Direct costs include the value of the resources used to treat the condition, such as medical care, special education, and developmental services. Indirect costs include the value of resources lost to society, such as the reduced labor market productivity or the reduced level of household productivity due to heightened morbidity or premature mortality. Costs are incremental relative to referent or counterfactual assumptions. Except where otherwise stated, the estimates of the societal costs of preterm birth provided here use term birth (37 weeks of gestation or greater) as the referent.

The relevant costs included are not conceptually restricted to those associated with the affected individual. Maternal, caregiver, and family costs are also relevant. Maternal costs include the incremental costs of prenatal care and delivery services, the costs of any extended care associated with maternal morbidity arising from the pregnancy, and the costs of added precautionary care in subsequent pregnancies, even if the subsequent birth goes to term. Caregiver costs appropriately include travel expenses for extended care of the preterm infant, in addition to the incremental value of time devoted to caring for the infant or child born preterm.

Insufficient information was available to estimate reliably the national burden for all of the cost categories listed above. However, estimates were made for a portion of the lifetime costs for medical care, special education services, and household and work productivity losses for the affected individual. A national estimate of early intervention services was also made, based on the extent and cost of such services provided in Massachusetts. Among the family costs, only an estimate of maternal delivery costs was included. The details of findings are discussed bellow.

Table 1: Incidence of Preterm Births

Total number of deliveries	Total number of preterm deliveries	Incidence of preterm deliveries
5664	343	6.05%

The incidence of preterm births is 6.05 % at our hospital.

Table 2: Distribution of Cases according to Antenatal Care (n=343)

S. No.	Booked/ Unbooked	Gestational Age (in completed weeks)				Total	Percentage
		Very Preterm (28-32 weeks)		Moderately Preterm (33-36 weeks)			
		No.	%	No.	%		
1.	Booked	9	15.25%	110	38.73%	119	34.69%
2.	Unbooked	50	84.75%	174	61.27%	224	65.31%
	Total	59	100%	284	100%	343	100%

The patients who had 3 or more antenatal visits were taken as booked cases and the rest were taken as unbooked cases. Out of 343 cases, 119 (34.69 %) were booked cases and 224 (65.31 %) were unbooked cases. The difference between both groups is significant (p value 0.001, CC 0.175).

Table 3: Distribution of Patients according to Residence

Sl No	Rural/Urban	No. of Patients	Percentage
1.	Rural	96	27.99%
2.	Urban	247	72.01%
	Total	343	100%

The above table shows that out of 343 patients studied, maximum 247 (72.01 %) patients resided in urban area and 96 (27.99 %) patients resided in rural area.

Table 4: Distribution of Patients according to Socioeconomic Status

Sl No	Socio-Economic Class	Gestational Age (in completed weeks)				Total	Percentage
		Very Preterm (28-32 weeks)		Moderately Preterm (33-36 weeks)			
		No.	%	No.	%		
1.	Class I	2	3.39%	24	8.45%	26	7.58%
2.	Class II	6	10.17%	29	10.21%	35	10.21%
3.	Class III	10	16.95%	74	26.05%	84	24.49%

4.	Class IV	36	61.02%	140	49.3%	176	51.31%
5.	Class V	5	8.47%	17	5.99%	22	6.41%
	Total	59	100%	284	100%	343	100%

The above table shows that out of 343 patients studied, maximum 198 (57.72 %) patients belonged to lower socioeconomic class (Class IV and V) of Modified Kuppuswamy Scale (2007).The difference between both groups is not statistically significant.(p value 0.4050,CC 0.107).

Table 5: Distribution of Patients According to Age

Sl No	**Age-group (in years)**	**Gestational Age (in completed weeks)**				**Total**	**Percentage**
		Very Preterm (28-32 weeks)		**Moderately Preterm (33-36 weeks)**			
		No.	**%**	**No.**	**%**		
1.	≤ 20	8	13.56%	49	17.25 %	57	16.62%
2.	21-25	24	40.68%	96	33.80 %	120	34.99%
3.	26-30	20	33.9%	61	21.48%	81	23.62%
4.	31-35	6	10.17%	52	18.31%	58	16.91%
5.	> 35	1	1.69%	26	9.15 %	27	7.87%
	Total	59	100%	284	100%	343	100%

The above table shows that out of 343 cases studied, highest number of patients (120) was present in the age group 21-25 years (34.99 %) and out of 59 patients of very preterm group, 40.68 % patients were in the age group of 21-25 years. The difference between both groups is statistically significant (p value 0.0473, CC 0.165) (S).

Table 6: Grades of Prematurity in association with Obstetric Score

Sl No	**Gravida**	**Gestational Age (in completed weeks)**				**Total**	**Percentage**
		Very Preterm (28-32 weeks)		**Moderately Preterm (33-36 weeks)**			
		No.	**%**	**No.**	**%**		
1.	Gravida 1	35	59.32%	157	55.28%	192	55.98%
2.	Gravida 2	13	22.03%	65	22.89%	78	22.74%
3.	Gravida 3	6	10.17%	42	14.79%	48	13.99%
4.	Gravida 4 and above	5	8.48%	20	7.04%	25	7.29%
	Total	59	100%	284	100%	343	100%

The above table shows that out of 343 patients, maximum number of patients were Gravida 1 i.e. 192 (55.98 %) patients. Out of 59 patients of very preterm group,35 (59.32 %) patients were

Gravida 1.Out of 343 patients,78 (22.74 %) patients were Gravida 2,48 (13.99 %) patients were Gravida 3 and 25 (7.29 %) patients were Gravida 4 and above. The difference between both groups is not statistically significant (p value 0.7915, CC 0.0550) (NS).

Table 7: Distribution of Patients According to Parity

Sl No	Parity	Gestational Age (in completed weeks)				Total	Percentage
		Very Preterm (28-32 weeks)		Moderately Preterm (33-36 weeks)			
		No.	%	No.	%		
1.	Para 0	39	66.10%	167	58.80%	206	60.06%
2.	Para 1	15	25.42%	83	29.23%	98	28.57%
3.	Para 2	4	6.78%	29	10.21%	33	9.62%
4.	Para 3 and above	1	1.7%	5	1.76%	6	1.75%
	Total	59	100%	284	100%	343	100%

The above table shows that out of 343 patients, maximum number of patients were nulliparous i.e. 206 (60.06 %).Out of 59 patients of very preterm group,39 (66.10 %) were nulliparous as compared to patients in the moderately preterm group (58.80 %).The difference between both groups is not statistically significant. (P value 0.7340, CC 0.0610) (NS).

Table 8: Basic Parameters of Study Group

Basic Parameter	Mean	Standard deviation	Min	Max
Maternal age (in years)	26.24	5.34	18	41
Gestational age (in weeks)	34.52	1.72	29.1(29w+1d)	36.6(36w+6d)

The above table shows that the mean maternal age in our study was 26.24 (±5.34) years and the mean gestational age was 34.52 (±1.72) weeks.

Table 9: Predisposing Factors Associated With Prematurity

SL No.	Risk Factor	Gestational Age (in completed weeks)				Total	Percentage
		Very Preterm (28-32 weeks)		Moderately Preterm (33-36 weeks)			
		No.	%	No.	%		
1.	Lack of antenatal check-ups	50	84.75%	174	61.27%	224	65.31%

2.	Low-socioeconomic status	40	67.8%	158	55.63%	198	57.73%
3.	Extremes of age ≤ 20 years > 35 years	9 8 1	15.25%	29 17 12	10.21%	38	11.08%
4.	H/o previous preterm births: a)One preterm b)Two or more preterm	11 8 3	18.64%	24 15 9	8.45%	35	10.20%
5.	H/o previous 2 or more abortions	2	3.39%	15	5.28%	17	4.96%
5.	Family H/o preterm births	6	10.17%	9	3.17%	15	4.37%

The above table shows various predisposing (risk) factors identified in the study.224 (65.31 %) patients did not have essential antenatal check-ups,198 (57.72 %) patients belonged to low socioeconomic class,38 (11.08 %) patients had extremes of age (≤ 20 years or >35 years),35 (10.20 %) patients had history of prior preterm births,17 (4.96 %) patients had history of previous 2 or more abortions and 15 (4.37 %) patients had family history of preterm births.

Table 10: Analysis of various Predisposing Factors for Preterm Births

Risk Factor	**Odds Ratio**	**95 % Confidence Interval**	**p value**	**Inference**
Lack of antenatal check ups	3.51	1.66 – 7.42	0.001	Highly significant
Low Socioeconomic Class	1.84	1.01-3.36	0.046	Significant
Extremes of Age	1.58	0.70 – 3.54	0.2647	Not significant
H/o Previous Preterm Births	2.48	1.14 – 5.40	0.0218	Significant
H/o Previous 2 or more Abortions	0.62	0.14 – 2.82	0.5457	Not significant
Family H/o Previous Preterm Births	3.45	1.18 – 10.12	0.0235	Significant

The above table analyzes the relationship between predisposing (risk) factors and preterm births. Lack of antenatal checkups (OR 3.51,95 % CI 1.66-7.42,p value 0.001),low socioeconomic class (OR 1.84,95 % CI 1.01-3.36,p value 0.046),history of previous preterm births (OR 2.48,95 % CI 1.14-5.40,p value 0.0218) and family history of preterm births (OR 3.45,95 % CI 1.18-10.12,p value 0.0235) were found to be statistically significant.

Table 11: Association of Birth Weight (in kilograms) with Prematurity

SL No	Birth weight (in kg)	Gestational Age (in completed weeks)				Total	Percentage
		Very Preterm (28-32 weeks)		Moderately Preterm (33-36 weeks)			
		No.	%	No.	%		
1.	1.00-1.49	23	40.35%	15	5.43%	38	11.41%
2.	1.50-1.99	24	42.11%	86	31.16%	110	33.03%
3.	2.00-2.49	9	15.79%	146	52.9%	155	46.55%
4.	≥ 2.50	1	1.75%	29	10.51%	30	9.01%
	Total	57	100%	276	100%	333	100%

The above table shows that out of 333 live births, maximum number of preterm babies 155 (46.55 %) had birth weight in the range of 2.00- 2.49 kg at birth, followed by 110 (33.03 %) babies who weighed 1.50- 1.99 kg at birth..98.25 % of very preterm babies were associated with low birth-weight (LBW) as compared to moderately preterm babies (89.49 %).The difference between both the groups is statistically significant.(p value < 0.0001,CC 0.41) (HS).

Parameter	Mean	Standard deviation	Min	Max
Birth weight (in kg)	1.99 kg	0.39	1kg	3 kg

The Mean birth weight in our study was 1.99 (± 0.39) kg.

Table 12: Association of Birth Weight (according to Growth Chart) with Prematurity (n=333)

SL No	Location in Growth Chart	Gestational Age (in completed weeks)				Total	Percentage
		Very Preterm (28-32 weeks)		Moderately Preterm (33-36 weeks)			
		No.	%	No.	%		
1.	SGA	6	10.53%	118	42.75%	124	37.24%
2.	AGA	48	84.21%	157	56.89%	205	61.56%
3.	LGA	3	5.26%	1	0.36%	4	1.20%
	Total	57	100%	276	100%	333	100%

SGA-Small-for-gestational age, AGA-Average-for-gestational age
LGA-Large-for-gestational age

The above table shows that out of 333 live born babies, 205 (61.56 %) preterm babies were average-for-gestational age, 124 (37.24 %) preterm babies were small-for-gestational age and only 4 (1.20 %) preterm babies were large-for-gestational age. The difference between two the groups is statistically significant. (P value < 0.0001, CC 0.280) (HS)

Table 13: Maternal Morbidity associated with Preterm Deliveries

SL No	Maternal Morbidity	Gestational Age (in completed weeks)				Total	Percentage
		Very Preterm (28-32 weeks)		Moderately Preterm (33-36 weeks)			
		No.	%	No.	%		
1.	Postpartum haemorrhage	12	20.34%	8	2.82%	20	5.83%
2.	Puerperal pyrexia	6	10.17%	11	3.87%	17	4.96%
3.	Wound infection	2	3.39%	7	2.46%	9	2.62%
4.	Retained placenta	4	6.78%	3	1.06%	7	2.04%
5.	Chorio-amnionitis	4	6.78%	3	1.06%	7	2.04%
6.	Perineal tear	0	-	4	1.41%	4	1.17%

The above table shows that the most common cause of maternal morbidity in preterm deliveries was post partum haemorrhage i. e. 20 (5.83 %) cases, followed by puerperal pyrexia in 17 (4.96 %) cases, wound infection in 9 (2.62 %) cases, retained placenta in 7 (2.04 %), chorioamnionitis in 7 (2.04 %) cases and perineal tear in 4 (1.17 %) cases (p value 0.1323,CC 0.34).

Conclusion

Preterm births account for 70 % of neonatal morbidity and mortality. Preterm labour, in spite of its incidence of around 10 %, contributes disproportionately to prenatal mortality. Preterm labour is not a single entity, but it is a cascade of events culminating in delivery at an early gestation, thereby decreasing the survival potential of the neonate and exposing it to wide spectrum of risk of death and future handicaps. Even if the preterm delivery rate comes down by a quarter, a significant decrease in prenatal mortality will result.

The prevention of preterm labour is one of the greatest challenges to the obstetricians and much of it also depends on social and economic factors that have also to be addressed at. Preterm births constitute an enormous medical, social and financial problem. There are multiple determinants of preterm labour. Therefore, intervention programs should target multiple determinants. Adequate support from the pre-conception period, including monitoring for identified causes of previous adverse outcome, adequate nutrition, pregnancy spacing, avoidance of harmful substances/strenuous working conditions/chronic stress, screening and treatment of infections/ medical disorders/ sexually transmitted diseases may help to reduce the risk of subsequent preterm birth. In the present study of 343 cases of preterm births, the incidence of preterm births was found to be 6.05 %.

In our study, majority of patients were unbooked and belonging to low socio-economic class. Preterm births were more common in primigravida and women in the age group 21-25 years. The mean gestational age at delivery was 34.52 weeks.

The most common predisposing factor for preterm births was lack of essential antenatal check-ups. Others were low socio-economic class, extremes of age (≤ 20 years or ≥ 35 years), previous history of preterm births, previous history of abortions and family history of preterm births. The most common etiologic factor for preterm births was PPROM, followed by gestational hypertension, fetal distress, IUFD, multiple gestation, mal-presentation, maternal medical disorders, pre-eclampsia/ eclampsia, antepartum haemorrhage, chorioamnionitis, cervical incompetence, uterine factors (bicornuate uterus, fibroid uterus), fetal congenital anomalies.

In our study, 55.39 % patients with preterm labour were allowed delivery (vaginal or caesarean section) due to maternal or fetal indications. Rest 44.31 % patients were given tocolysis. In 17.76 % cases, pregnancy could be prolonged for > 21 days. Majority of patients delivered vaginally.

Majority of preterm babies were males. The mean Apgar score was 5.08 at 1 minute and 6.07 at 5 minutes. Maximum babies had birth weight in the range of 2.00-2.49 kg (mean birth weight 1.99 ± 0.39 kg).98.35 % of babies were low birth weight (i.e. < 2.5 kg).

Early neonatal mortality was greater in very preterm babies (45.61 %) as compared to that in moderately preterm babies (10.51 %). Prenatal mortality was greater in very preterm babies (61.40 %) as compared to that in moderately preterm babies (22.46 %). The prenatal mortality rate in our hospital is 291/1000 live births. In our study, the most common cause of neonatal morbidity was neonatal jaundice, followed by neonatal septicemia and feeding problems.78.38 % preterm babies had NICU admissions. The most common cause of neonatal mortality was respiratory distress syndrome, followed by neonatal septicemia and intraventricular haemorrhage. Hence, availability of neonatologist in all cases of preterm deliveries is mandatory. Majority of still births were associated with gestational hypertension, ante-partum haemorrhage and pre eclampsia/eclampsia. So, early detection, timely and prompt intervention is necessary to reduce maternal and fetal mortality and morbidity.

The most common cause of maternal morbidity was post-partum haemorrhage. So, required measures should be taken to prevent and treat post-partum haemorrhage to reduce maternal morbidity.Educational programmes to increase awareness of signs and symptoms of preterm labour should be encouraged, so that women seek early medical attention. Most of the maternal causes of preterm labour are modifiable and could be controlled by pre-conceptional counseling and efficient prenatal care. Tertiary prevention measures such as maternal transfer to a tertiary care centre for further management and administration of glucocorticoids and tocolytics in selected cases have shown benefit in the overall outcome of preterm births.

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