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Study on

**Exploring the Factors Associated with Cerebral Palsy of Children**

**Prepared and Submitted By:**

**Sushama Kanan**

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## APPROVAL PAGE FOR GRADUATE THESIS

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BY SUSHAMA KANAN

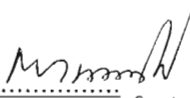
### Candidate

STUDENT ID NO: 2009-3-97-007  
DEGREE: MPRHGD  
DEPARTMENT: Social Relations, EWU  
PROMOTER: Dr. Rafiqul Huda Chaudhury

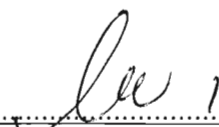
**Title: Exploring the Factors Associated with Cerebral Palsy of Children**

### Thesis Committee:

Dr. Rafiqul Huda Chaudhury  
Honorary Professor  
Adviser & Coordinator, MPRHGD Program, EWU

  
15/9/13  
Signature

Dr. Lutfun Nahar  
Chairperson and Assistant Professor  
Dept. of Social Relations  
EWU

  
15/9/13  
Signature

## DECLARATION -1

I declare that EXPLORING THE FACTORS ASSOCIATED WITH CHILDREN WITH CEREBRAL PALSY is my own work and that all sources that I have used or quoted have been indicated and acknowledged by means of complete references. Any mistakes or inaccuracies are my own.

SIGNATURE *Kanan*  
(SUSHAMA KANAN)

DATE *9/9/13*

## **DEDICATION**

**This thesis is dedicated to my parents, sister, teachers and friends.**

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All the praises and gratefulness are to the almighty Allah for giving me the passion to complete this study. I am extremely grateful to my supervisor Dr. Rafiqul Huda Chaudhury, Honorary Professor, Adviser & Coordinator, MPRHGD Program, East West University. Without his guidance and persistent help this dissertation would not have been possible. I gratefully acknowledge his contribution. I am also grateful to Dr. Lutfun Nahar, Assistant Professor, Dept. of Social Relations, East West University for her valuable advice and insightful thought. I would like to thank Department of Social Relations, East West University for providing me the opportunity to conduct the study. I am indebted to Ashley Willock who worked really hard to check and correct the English of my manuscript. I also want to thank Fatema Akhter Mitu to allow collecting data from the assessment form. Finally, I wish to thank all my family, friends and especially my beloved husband Md. Jahangir Alam Rony who inspired me to conduct the study.

## ABSTRACT

A cross sectional retrospective survey was conducted at the Center for Rehabilitation of the Paralyzed (CRP) to investigate risk factors in children with Cerebral Palsy (CP). Purposive sampling was used to select total 310 consecutive children with CP, who were rehabilitated in the pediatric in-patient clinic between March 2011 to September 2011.

Factors affecting CP were investigated by scanning case history section of participants' medical files. Information of each case history section was obtained through interviewing the families. Risk factors were recorded as consanguineous marriage, maternal complication during pregnancy, birth history (preterm birth/ term/ post term), birth injury, birth asphyxia, neonatal convulsion, postnatal illness and some socioeconomic factors (gender, geographical location, parents education and employment), which define difficulty to accessing health services and have consequences on disability.

There were more males (61%) than females (39%) among children with CP. Their age range was between 9 months to 11 years (the mean age was  $4.001 \pm 2.3025$  years). The most frequently encountered risk factors were, birth asphyxia (74%) and seizures after birth (58.1%). 37.4% of births were attended by a doctor, 21.6% attended by a nurse or midwife and 41% attended by traditional birth attendants. 133 (42.9%) children were brought to a health center for seeking treatment when they were between 2-4 years of age. In terms of seeking treatment for these children geographical location of them has influence. 42.6% children were from Dhaka which is the closest among all division because CRP is located in Dhaka city and the rest of the children were from other five divisions. Parents (mother and father) who had 10 years of education brought their children earlier to health center. 50% of total children with CP in this study were

first in their birth order. 7.10% of mother had hypertension, 9% of mothers had anemia and 31.60% of mothers had other complications such as amino fluid loss, fever and history of falling down etc. Labor period and gestational term were not found to be significant risk factors. Compared to other evidence consanguine marriage was not found as a prominent factor in this study. After birth participants of the study had some common complications like jaundice 25.5%, pneumonia 35.5 %, dehydration 7.7%, and other illnesses 18.1%. 9.4% of children had hearing difficulties and 17.7% had visual impairment associated with CP

This study identified birth asphyxia and seizure after birth as direct risk factors for CP, and socioeconomic factors as having indirect influence on the cause of CP

## **GLOSSARY OF TERMS**

|             |                                                       |
|-------------|-------------------------------------------------------|
| <b>CRP</b>  | <b>Center for the Rehabilitation of the Paralyzed</b> |
| <b>CP</b>   | <b>Cerebral Palsy</b>                                 |
| <b>CNS</b>  | <b>Central Nervous System</b>                         |
| <b>SPSS</b> | <b>Statistical Package for the Social Sciences</b>    |



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### 1.1 Background of the Study

Disability is a globally focused issue especially in developing countries at present. Rapid decrease in mortality and increase in morbidity rates are important issues in health sector in Bangladesh now a day. High morbidity rate increases disability and creates a huge burden on society.

The World Bank estimates that 20 percent of the world's poorest people have some kind of disability (World Facts and Statistics on Disabilities and Disability Issues, 2013). It is estimated that Bangladesh has about 5%-15% of total people have some kind of disability (Mahmud & Hossain, 2005) and 43% of those people with disability are physically challenged (JICA, 2002). In Bangladesh the prevalence rate of disability in both urban and rural population was estimated to be 70/1000 (Khan & Durkin, 1995).

Cerebral Palsy (CP) is the most common cause of severe physical disability in childhood. The worldwide prevalence of CP is approximately 2 to 2.5/ 1000 live births (Mohammed, 2006). During the past 20 years, there have been increases in incidence and prevalence of CP that may be related to improved documentation of cases by national registers, advances in neonatal care, or other factors (Koman et al., 2004). But no credible data is available for the rate of CP in Bangladesh.

The term 'cerebral palsy' describes a group of disorders of movements and posture due to a defect or lesion of the immature brain (Bax, 1964). Cerebral palsy is a complex disorder with various types and degrees of motor impairment. It affects the development of movement and posture that is believed to arise from non-progressive disturbances in the developing fetal or infant brain (Thoroggod, 2011). CP results from an injury in the developing central nervous system (CNS), which can occur in uterus, during delivery or during the first 2 years of life (Cans, 2000).

There are numerous factors that contribute to higher risks of CP. In many cases the causes of cerebral palsy remains unknown, although a wide range of causes including congenital, genetic, inflammatory, anoxic, traumatic, toxic and metabolic are identified (Nelson & Ellenberg, 1986).

Prenatal events are responsible for approximately 75%, perinatal are 10-15% and post natal causes 10% of all cases of CP (Reddihough, 2011). In 20% to 30% of cases, there is no apparent etiologic event (Cans, 2000).

For many decades the belief that birth complications caused most cases of CP was widespread among physicians, families and even medical researchers. Researchers are investigating the roles of mishaps early in brain development, including genetic defects, traumatic events in newborn babies' brains, such as bleeding, epileptic seizures, and breathing and circulation problems, which can cause the abnormal release of chemicals that, trigger the kind of damage that causes cerebral palsy. In the 1980's, scientists analyzed extensive data from more than 35,000 newborns and their mothers and discovered that complications during birth and labor accounted for only a fraction of the infants born with CP probably less than 10 percent. It stimulated researchers to search for other factors before, during and after birth that were associated with the disorder (Kumari & Yadav, 2012).

According to Reddihough and Collins (2003) over the past 20 years there have been radical changes in the understanding of etiological factors causing CP. One hundred years ago literatures identified abnormal birth as a possible factor, causing Cerebral Palsy. For over 100 years, most cases of CP were thought to be caused by asphyxia during either labor or the perinatal period (Blair and Stanley 1988, Paneth, 1986). Prevalence rate of CP were used as outcome measures of obstetric practice and neonatal care and it was expected that improvement in this areas would result in lower rates of CP (Blair and Stanley 2002, Torfs et al., 1990).

As a result, there was increased use of intervention such as electronic fetal monitoring and caesarean section. However, the role of perinatal asphyxia in the etiology of CP was challenged when the stillbirth and neonatal death rates declined but the CP rate remained constant (Emond et al 1989, Stanley & Blair 1991, Stanley & Watson 1988). Moreover, antenatal causes of CP are now felt to be more important than peri-natal or neonatal causes by many experts in the field (Blair & Stanley, 1988) which supports the famous psychiatrist Sigmund Freud's argument in 1987 that children with CP often had other neurological problems such as intellectual disability, visual disturbance and seizures which might have roots earlier in life, during the brain's development in the womb. But prenatal risk factors are more non-specific and harder to identify.



The underlying causes of CP remain largely unknown (Nelson, 2009). Risk factors can be associated with the parents, as well as the child. One of the strongest predictors of CP is preterm (baby born at less than 37 weeks of gestation) birth (Moster, Lie & Markestad, 2008). There has been a consistent increase in the risk of cerebral palsy associated with preterm and very preterm babies (Hagberg et al., 1993, MacGillivray & Campbell, 1995, Murphy et al., 1995, Pharoah et al., 1989, Stanley & Watson, 1992). CP is more common in males than in females, but the reason for this disparity is uncertain. Males are born more prematurely than female and therefore it results white matter injury and intra-ventricular hemorrhage (Johnston & Hagberg, 2007).

The mother's health is the most common risk factor. The age of mother during the pregnancy could have a strong influence on whether a child would develop CP or not. In general, mothers who are above 35 years of age or below 18 years during the pregnancy are more likely to give birth to a baby who has CP as there can be many complications during birth which lead to CP (MyChild™, 2011).

Socio-economic factors also may influence the risk of CP (Sundrum, et al., 2005). Previous studies have indicated that maternal infection increases the risk of Spastic CP in term infants, whereas the association appears to be less evident in preterm infants. This could have serious effects on the baby like brain damage (Jacobsson, et al., 2002).

Maternal trauma during pregnancy has been implicated in the aetiology of CP in the surviving offspring (Anquist, et al., 1994). Early epidemiological studies have suggested that there is an association between maternal hypertension and CP (Hagberg & Olow, 1976).

## **1.2 Justification of the Study**

The knowledge on risk factors of CP has been evolving; however available data shows that perinatal asphyxia accounts for between 6% and 8% of CP (Blair & Stanley, 1988, Naeye et al., 1989, Yudkin et al., 1995). There may be other underlying causes making infants at risk for developing CP, for example perinatal asphyxia. Prenatal events are thought to be responsible for approximately 75% of all cases of CP, although it is usually impossible to determine the nature and the exact timing of the damaging event (Blair & Stanley, 1988, Naeye et al., 1989, Yudkin et al., 1995).

Prenatal event of CP covers majority of causes of CP and thus it involves comprehensive prenatal care during pregnancy. Rathavuth Hong and Martin Ruiz-Beltran (2006) conducted a study on 'impact of prenatal care on infant survival in Bangladesh', the results of which indicate that children of mothers who did not receive pre natal care during pregnancy were more than twice as likely to die during infancy as children whose mothers received prenatal care during pregnancy.

It is estimated that proportion of post-natal cases acquired CP during postnatal care range between 10% (Holm, 1982) and 18% (Pharaoah et al., 1989). So, to minimize the chance of CP among newly born babies there is a need to improve the coverage and quality of post-natal care.

CP can be a severe disability and a substantial burden for the affected individual's family and society (Moster, 2010). The prevalence of disability is believed to be high for reasons relating to overpopulation, extreme poverty, illiteracy, lack of awareness and above all lack of proper medical care and services. Although disability is a major social and economic phenomenon in Bangladesh, there is little reliable data available on this issue, especially in the absence of a comprehensive national survey on persons with disabilities (JICA, 2002).

According to the US census bureau the total numbers of people with cerebral palsy in Bangladesh were 141,340,476 in 2004 (Right Diagnosis from health grades, 2011). A hospital based prospective study in Bangladesh showed that during nine months period of the study patients attended that hospital, 1.72% patients were diagnosed as CP (Khan, Moyeenuzzaman and Islam, 2006).

The magnitude of this figure is relatively high and therefore it addresses the potential importance of explaining the risk factor of developing CP, which is the intention of this study. Moreover, many studies have been conducted to explore what would be the impact if the risk factors are identified.

Still in Bangladesh there are very few reliable data on this issue and so far not enough research findings are available to explore the factors related to CP of children. This study may help to reveal the information that has relation in occurrences of CP. Findings from this study can provide recommendations about preventive measure for health care providers. Moreover the

findings may help what information may be important during conducting survey to identify people with disability.

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### **1.3 Study Objectives**

#### **General objective:**

To explore the factors associated with cerebral palsy.

#### **Specific objectives:**

To identify the socio demographic characteristics associated with cerebral palsy.

To identify the maternal factors (during pregnancy) associated with cerebral palsy.

To identify the complications during birth associated with cerebral palsy.

To identify the factors after birth related with cerebral palsy.

To find out the interrelationship among various risk factors.

## CHAPTER-02

### DEFINATION OF CEREBRAL PALSY (CP) AND FACTORS AFFECTING CP

#### 2.1 Cerebral Palsy

Cerebral Palsy (CP) is a permanent physical condition that affects movement. Its effect can be as mild as just a weakness in one hand ranging to almost complete lack of movement.

Cerebral – Brain

Palsy – weakness, paralysis or lack of muscle control.

Cerebral Palsy is characterized by an inability to fully control motor skills. Depending on which part of the brain has been damaged and the degree of involvement of the Central Nervous System (CNS), any of the following may occur: spasms involuntary movements, abnormal sensation and perception; impairment of sight, hearing or speech.

Cerebral Palsy (CP) is a persistent, but not unchanging, disorder of movement and posture due to non-progressive disorder of the immature brain (Brett, 1983). CP is a static neurologic condition resulting from brain injury that occurs before cerebral development is complete, because brain development continues during the first two years of life. CP can result from brain injury occurring during the prenatal, perinatal or post natal periods up to two years of age.

Cerebral Palsy is classified by three things:

1. The type of movement or muscle tone: spastic, athetoid, ataxic and mixed forms (Hughes & Newton, 1992).
2. The body part or parts effected: Hemiplegia, Diplegia, Quadriplegia
3. The degree of severity (effects on muscle tone): Severe, Moderate, Mild

Cerebral Palsy can effect: Mobility and balance, posture and growth, communication & language, fine motor control and coordination, eating, drinking and swallowing, personal care – dressing, bathing, toileting, perceptual difficulties, concentration and attention.

Other associated conditions with CP are Intellectual disability = 50%, Epilepsy = 33%, Sensory - Sight = 40% - Hearing = 10% (Hughes & Newton, 1992)

CP is generally diagnosed by taking history during prenatal, perinatal and postnatal onset of symptoms and clinical evaluation of general health, developmental milestone and strength/tone of muscle.

Cerebral palsy cannot be cured, but due to medical research, many patients can enjoy near-normal lives if their neurological problems are properly managed.

## **2.2 Consanguine Marriage (first cousin marriage)**

Inherited factors are thought to contribute to approximately 2% of cases in European populations (Hughes and Newton, 1992; Mitchell & Bunday, 1997). A study of CP prevalence in Asian (almost exclusively from Northern Pakistan) and non-Asian population in Yorkshire, United Kingdom has reported a two fold increase in CP prevalence in the Asian population (6.42 cases per 1000) compared with non-Asian population. Since about 60% of the Asian families in this study had a known history of consanguineous marriages and about a third of the affected children in these families had a first or second degree relative with the same type of CP, recessive genes may have caused the increased incidence. An independent study from Saudi Arabia reported a 2.5 fold increase in the occurrence of CP in consanguineous families (Al-Rajeh et al., 1991), also strongly suggesting that the recessive forms of CP exist.

## **2.3 During Pregnancy**

Pre-eclampsia is associated with an increased risk of CP in term infants (Collins & Paneth, 1998) but this association does not seem to exist in preterm infants (Murphy et al., 1995, Spinillo, 1998). It has been suggested pre-eclampsia itself can be directly responsible for preterm births (Amiel-Tison & Pettigrew, 1991). Maternal hypertension in pregnancy, especially pre-eclampsia, is associated with increased perinatal mortality and morbidity and often retards intra-uterine growth (Gray et al., 1998). Early epidemiological studies have suggested that there is an association between maternal hypertension and CP. There are reported higher rate of neurodevelopment problems in infants of hypertensive mothers (Gray et al., 1998).

## **2.4 Birth Trauma**

Major events likely to cause perinatal asphyxia include prolapsed cord, massive intra-partum hemorrhage, prolonged or traumatic delivery due to cephalopelvic disproportion or abnormal presentation, a large baby with shoulder dystocia and maternal shock from a variety of causes (Stanley, Blair and Alberman, 2000). Other reported associations with CP include prolonged second stage of labour (Powell et al., 1988), emergency caesarean section (Powell et al., 1988), premature separation of the placenta (Torfs et al., 1990) and abnormal foetal position (Torfs et al., 1990). In considering these factors, it is important to remember that it may not be the event itself that is the causal factor, but rather that the event is simply associated with one or more true causal factors. Substantial evidence has recently emerged that intrauterine exposure to infection, particularly chorioamnionitis, in the latter stages of pregnancy and during labor, is a strong risk factor for CP, particularly in term infants (Murphy et al 1995, Nelson, 2009 and Walstab et al., 2002).

Other factors associated with CP include prolonged rupture of the membranes in infants of all gestation (Nelson and Ellenberg, 1985) and in preterm babies (Murphy et al., 1995), the presence of meconium stained fluid (Spinillo et al., 1998, Walstab et al., 2002) and tight nuchal cord (Nelson and Grether 1998).

## **2.5 Birth Asphyxia**

Birth asphyxia occurs when a baby doesn't receive enough oxygen before, during or just after birth (Birth Asphyxia, n.d.). Perinatal asphyxia or neonatal asphyxia is the medical condition resulting from deprivation of oxygen to a newborn infant that lasts long enough during the birth process to cause physical harm, usually to the brain. Birth asphyxia is an important cause of preventable cerebral injury in the neonatal period. It continues to be a major cause of neonatal mortality and morbidity in both developing and developed countries. In Rajshahi Medical College a total of 871 neonates were admitted to the pediatric department from September 2001 to November 2002. Out of which 21.92%, were diagnosed with birth asphyxia, 22.73% with acute respiratory infection, 12.97% with low birth weight, 9.64% with neonatal jaundice, 4.38% with septicaemia, 2.98% with meningitis, 2.75% with diarrhea, 2.75% with birth trauma and 0.45% with neonatal tetanus. Out of the total birth asphyxiated babies mild type was 18.32%,

moderate type was 20.94% and severe birth asphyxia was 60%. The recovery rate in mild birth asphyxia was 100%, in moderate case was 95% and in severe case the rate was 74.13% (Birth Asphyxia, n.d.).

## **2.6 Pneumonia**

The causes and risk factors of neonatal and post-neo natal mortality were analyzed by following a cohort of 1351 infants born between July 1976 and June 1977 over a one year period in the Teknaf Dysentery project in rural Bangladesh. Tetanus (31%), prematurity (22%) and congenital anomalies (12%) were the commonest cause of neonatal deaths, whereas pneumonia (33%), malnutrition (18%), diarrhoeal illness (10%) and fever (9%) were the most important causes during the post natal period. Complications of the mother and newborn during the delivery were found to be significant determinants of neonatal mortality (Islam et al., 1982).

Mortality rates during the neonatal and post neonatal period was highest in mothers below the age of 20 years and lowest between mothers aged 25-29 years. The size of the family was positively correlated with the neonatal and post neonatal mortality rates (Islam et al., 1982).

## **2.7 Febrile Convulsions**

Children below 6 years are prone to convulsions when they have high fever. These are known as febrile convulsions and are not epileptic. This phenomenon occurs all over the world. Parents are advised to reduce the fever as early as possible by: (1) tepid sponging whenever the temperature touches 100F and (2) immediately administering medicines to lower the temperature.

## **2.8 Socio-Economic Status**

Sundrum, et al., (2005) conducted a retrospective cohort study on cerebral palsy and socio economic status and found that there was a linear association between risk of cerebral palsy and socioeconomic status. The study demonstrated two major issues regarding causes of CP; they are social gradients in birth weight and gestational age. In their study, it was been found that overall 51% and 30% of cases of cerebral palsy were statistically attributable to inequality in socio economic status.

Edmond et al. in 1989 reported a case control study nested in two population cohort studies (the UK 1958 and 1970 birth cohorts). Children in the control group used to examine for socio

economic effects were matched for birth weight. As at least part of the relation between socio economic status and cerebral palsy is likely to be mediated through birth weight, this control group would inevitably underestimate any association.

## **2.9 Summary of Factors Associated with CP**

Literature review points out strong association of CP with following factors.

### **2.10 List of key Variables Affecting CP**

#### **1. Socio-economic and demographic factors**

- Children's age
- Consanguinity (first cousin marriage)
- Mother's educational level
- Mother's employment
- Father's educational level
- Father's employment
- Children's sibling and their history of disability

#### **2. Pregnancy related factors**

- Health complications experienced by mother during pregnancy
- Time of gestation (preterm/term/post term baby)
- Labor period

#### **3. Variables related during birth**

- Place of delivery
- Birth attendants



- Birth injury
- Birth asphyxia

#### 4. Post natal complications

- Pneumonia
- Jaundice
- Dehydration
- Seizure
- Any other illness
- Hearing and vision status of children at present

### 3.1 Study Design

The design of this study was cross sectional retrospective survey. In this study the investigator took data from a large number of populations with cerebral palsy. Having a large sample number is commonly used in survey studies which is a supportive way to collect data (Hicks, 2000).

### 3.2 Study Population

Study populations are children with CP who attended at the pediatric unit of Center for the Rehabilitation of the Paralyzed (CRP), Savar, Bangladesh. Initially parents of these children were interviewed by a therapist through a case history information taking form. This case history part formed the basis of the study population.

### 3.3 Study Place

Pediatric unit of the center for the rehabilitation of the paralyzed was chosen as the study site as it is the easiest place for the investigator to obtain data and because patients come here from all over the country. CRP keeps data for at least 10 years. CRP was founded in 1979 in response to the desperate need for services for people with spinal injuries. Since then, CRP has developed into an internationally respected organization that focuses on a holistic approach to rehabilitation. One of its objectives is to provide treatment, rehabilitation and support services focusing on physical, emotional, social, psychological and economic aspects. In Dhaka, CRP's headquarter Savar campus has a paediatric in-patient ward where 21 children with CP are admitted with their mothers for a 14 days intensive therapy service at a minimum cost.

### 3.4 Sample Size

Data was taken from assessment forms of in-patient children with CP. Mothers provided the information. 310 assessment forms, which were completed between March, 2011 to September, 2011, constituted the sample of this study.

### **3.5 Inclusion Criteria**

Each section of the assessment form was completed.

### **3.6 Exclusion Criteria**

Other neurological deficit with cerebral palsy (i.e. autism, down's syndrome etc.).

### **3.7 Sampling Procedure**

The investigator used purposive sampling to conduct the study. This procedure was used because it was easier for the investigator to get all the assessment forms from 2011, cheap and available (Bailey, 1997).

### **3.8 Data Collection Materials and Procedure**

The case history section of the assessment form used in the paediatric unit of CRP was used as the data collection tool. This tool was appropriate for this study as it had been used for several years by different health professionals and allowed the investigator to collect the appropriate information. Investigator took all the data from the case history section.

### **3.9 Data Analysis**

After completing data collection, the data was analyzed using descriptive statistics in the software SPSS version 13. Cross tabulation analysis was done to detect statistically significant association. These findings were presented using a combination of tables, pie charts, cross tables etc.

### **3.10 Ethical Consideration**

Before conducting this study, a detailed protocol was submitted to the CRP ethical review committee for approval. The investigator received permission from the concerned department and authority for collecting data. The investigator did not manipulate the data and maintained confidentiality of the information.

### 3.11 Limitation of the Study

- The sample was not scientifically selected. Moreover, the sample size is small, so the results cannot be generalized for the whole population with CP.
- There are numerous factors associated with CP. This research took into account only a few factors that cannot exhibit a proper linkage.
- Other literature showed maternal age at pregnancy, disease of pregnant mother, food intake, working pattern, antenatal care and any other difficulties related to pregnancy as variables which were also deliberately missed in this research.
- From this study it was not identified which factors were prominent for causing CP.
- The study was retrospective and the data were written by whoever interviewed the family at the time. The investigator did not take the case history. The quality of data was totally dependent upon the interviewer. So, in this case data quality could be disputed.
- This study only considered children with CP. There was no comparison group. The study findings could have been more robust if there was a comparison group of non-CP children. Such comparison could have been more meaningful to identify risk factors that make children more vulnerable to CP.

The main objective of the study was to explore the factors associated with CP and find out the linkage between CP and biosocial, social and economic factors.

#### 4.1 Socio-economic and Demographic Factors

##### 4.1.1 Sex Ratio

Figure 1: Percentage distribution of children with CP by their sex

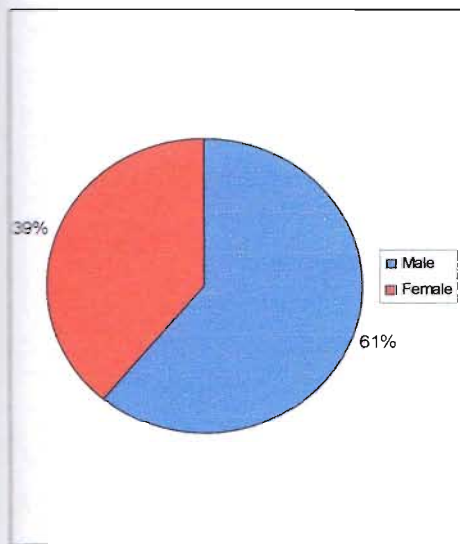


Figure 1 shows that 61% of the total children (310) were male and 39% of them were female.

### 4.1.2 Geographic Distribution of Children with CP

Figure 2: Percentage distribution of children with CP by geographic divisions

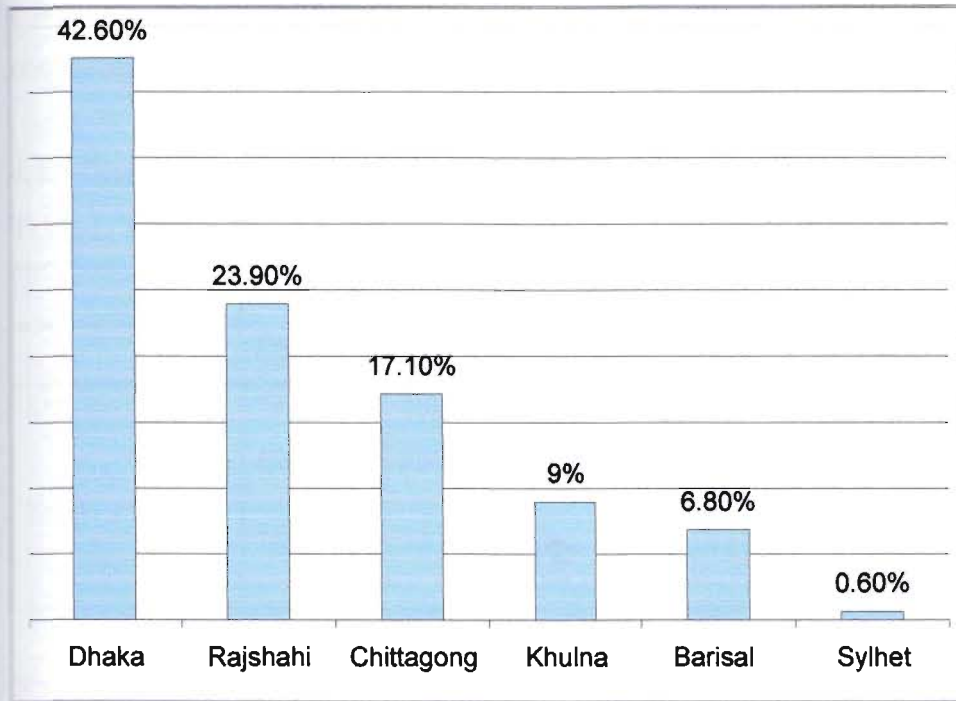


Figure 2 shows that the highest proportions (42.60%) of study children with CP were from Dhaka Division, followed by 23.90% from Rajshahi Division, 17.10% from Chittagong Division, 9% from Khulna Division, and 6.80% from Barisal Division. The lowest (0.6%) were from Sylhet Division. The findings of differential representation of children with CP at CRP from different divisions may partly be attributed to differential degree of physical proximity of geographic divisions and their most direct and convenient road/railway connectivity to CRP. The finding of highest proportion of in-patient children with CP from Dhaka Division is very much expected as CRP is located in Dhaka Division. Rajshahi has the most direct and convenient road connection to CRP, which may explain the finding of second highest in-patient children with CP from this division. In terms of distance, measured in terms of Kilometer from Divisional headquarters to Divisional headquarters, Chittagong Division is also relatively closer to CRP and has an excellent road and railway connection to Dhaka, the capital city from where CRP is easily connected. This may also partially explain the finding of third highest in-patient children with CP at CRP from this division. The distance of Khulna and Barisal Divisions from Dhaka is relatively

longer and road connectivity is not most direct and convenient. This may explain the finding of relatively lower representation of children with CP from these divisions at CRP. But easy connectivity hypothesis does not explain the finding of lowest number of in-patient children with CP from Sylhet at CRP as Sylhet has the shortest distance from Dhaka and the former is well connected to the latter by road and railways. This finding is contrary to expectation.

#### 4.1.3 Distribution of Children with CP by Division and Sex

Table 1: Numerical and percentage distribution of children with CP by division and sex

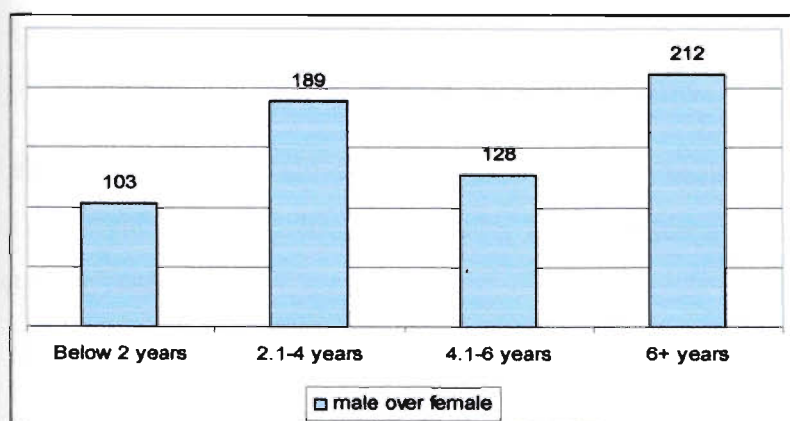
|       |        | Division  |           |        |          |          |            | Total        |
|-------|--------|-----------|-----------|--------|----------|----------|------------|--------------|
|       |        | Dhaka     | Rajshahi  | Sylhet | Khulna   | Barisal  | Chittagong |              |
| Sex   | male   | 73 (55.3) | 45(60.8)  | 1      | 21(75.0) | 12(57.1) | 37 (69.8)  | 189(61)      |
|       | female | 59 (44.7) | 29 (39.2) | 1      | 7 (25.0) | 9 (42.9) | 16 (30.2)  | 121(39)      |
| Total |        | 132(100)  | 74 (100)  | 2      | 28 (100) | 21(100)  | 53 (100)   | 310<br>(100) |

**Note: The figure in parenthesis refers to percentage.**

Data in table 1 shows that male children outnumber female children in almost all divisions. This is also seen across all age groups (see Figure 3).

#### 4.1.4 Sex Ratio by Age Group

Figure 3: Distribution of children with CP by sex ratio and age



Data in figure 3 show that among children with CP who came for treatment at CRP male children outweigh female children. This adverse sex-ratio in favour of male over female children holds in almost all age-groups but most prominently at ages 6 years and over, followed by age-groups 2.1-4.0 years and 4.1-6 years. There are about 212 boys for 100 girls at age 6 years and over, 189 boys for 100 girls at ages 2.1-4.0 years and 128 boys for 100 girls at ages 4.1-6 years. This pattern still holds for children below 2 years but with much lesser intensity. The sex ratio at this age was reported to be 103 boys for 100 girls.

#### 4.1.5 Child's Age at Time of Admission

Table 2: Percentage distribution of children with CP by age reported at the time of admission at CRP.

| Age group     | Frequency | Percent |
|---------------|-----------|---------|
| Below 2 years | 67        | 21.6    |
| 2-4 years     | 133       | 42.9    |
| 4-6 years     | 57        | 18.4    |
| 6+ years      | 53        | 17.1    |
| Total         | 310       | 100.0   |

Table 2 shows 42.9% children were brought to the health center when they were 2-4 years old, 21.6% children were below 2 years old, 18.4% children were 4-6 years old and 17.1% children were 6+ years old.



## 4.1.6 Distribution of Parents Education

### 4.1.6 (a) Mother's Education

Figure 4: Percentage distribution of children with CP by mother's education

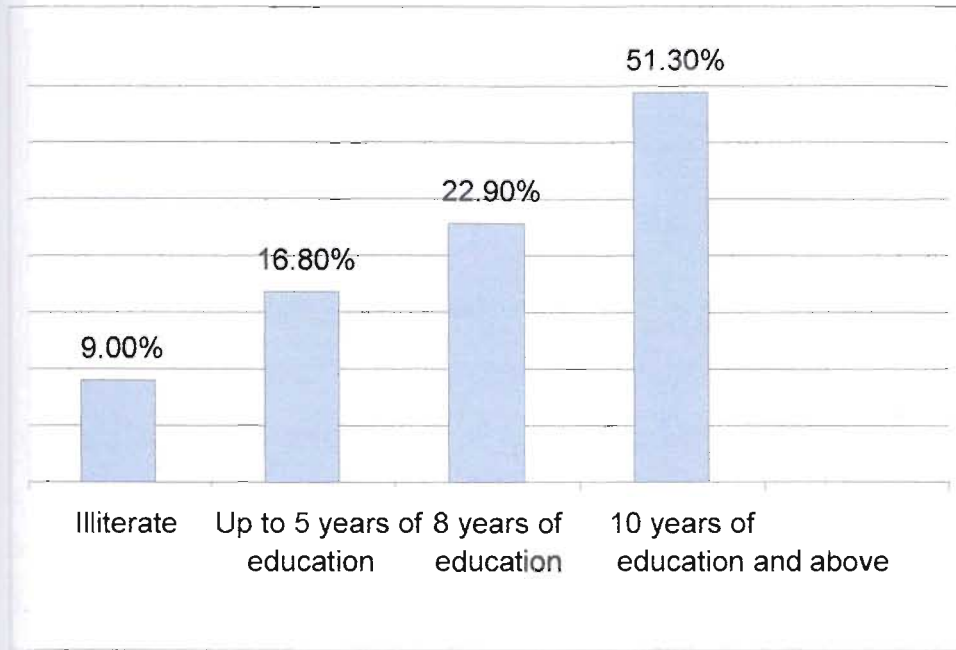


Figure 4 shows a positive relationship between admission of children with CP and their mother's education. Admission of children with CP increases with increasing education of mother, from lowest 9% among mothers with no formal education, to highest (51.3%) among mothers with education 10 years and above. This may be attributed to rising awareness of adverse consequences of CP on children with increasing level of education. Higher education leads to greater awareness of CP and its consequences on children.

#### 4.1.6 (b) Father's Education

Figure 5: Percentage distribution of children with CP by father's education

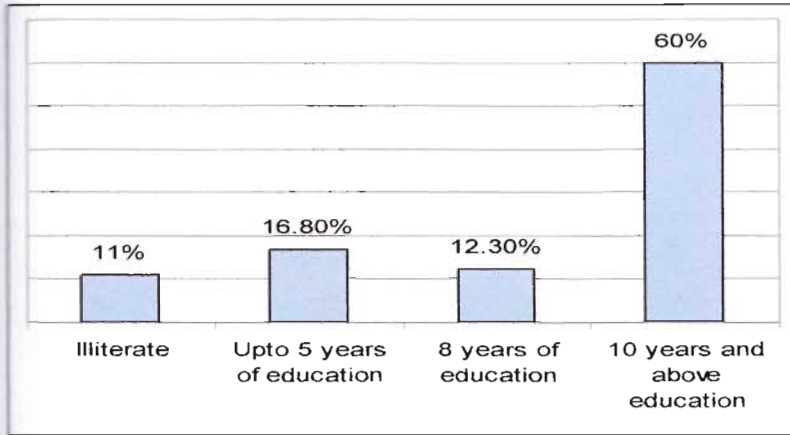


Figure 5 shows the same pattern of relationship between father's education and admission of children with CP as was found in case of mother's education with CP. Admission of children with CP in general rises with father's education, from lowest (11%) among children of illiterate fathers to 17% among fathers with primary level education. Then the admission of children with CP drops unexpectedly to 12% among fathers with 8 years of education. But admission rises to its highest (60%) among fathers with 10 years education and above. This once again vindicates that education makes a person enlightened including awareness on CP and its consequences.

#### 4.1.7 Percentage of Children with CP by parent's employment

##### 4.1.7 (a) Mother's Employment

Figure 6: Percentage distribution of children with CP by mother's employment

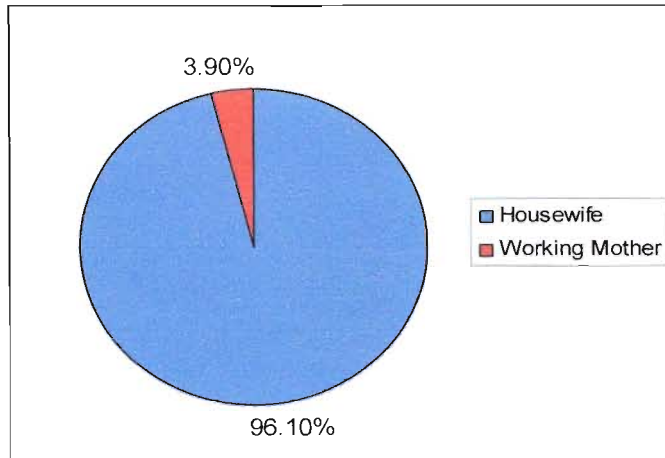


Figure 6 shows that mothers of children with CP were overwhelmingly (96%) housewives. Only a handful (4%) of them was working outside the home.

##### 4.1.7 (b) Father's Employment

Figure 7 Percentage distributions of children with CP by father's employment

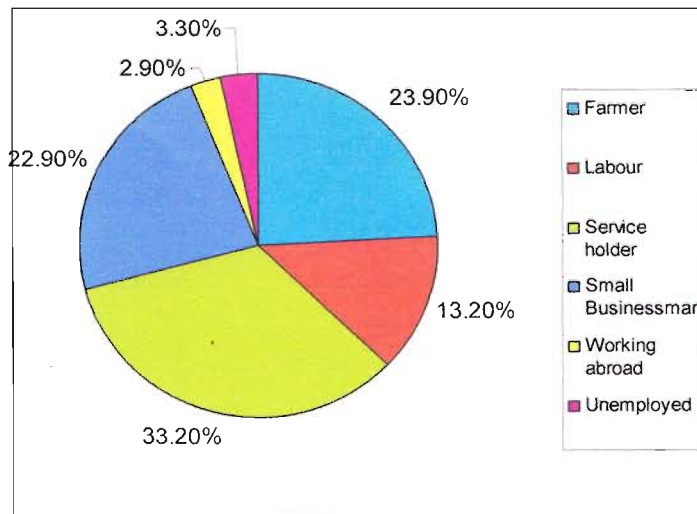
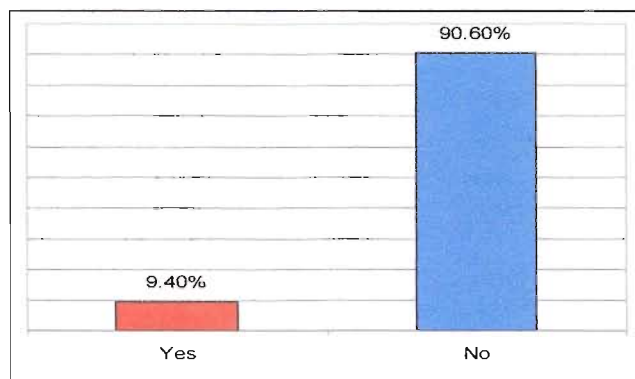


Figure 7 shows that fathers of children are predominantly (33.20%) service holders, followed by farmers (23.90%) and small businessmen (22.90%). 13.20% of them were laborers, 3.30% were unemployed and 2.90% were working abroad.

#### 4.1.8 Consanguineous Marriages

Figure 8: Percentage distribution of children with CP by first cousin marriage status of their parents.



Data in Figure 8 shows that over 9 out of 10 parents of children with CP have history of first cousin marriage. Only 9.40% had history of first cousin marriage. The finding of the present study is not in conformity with the findings reported by other studies on the subject mentioned in the literature review section.

#### 4.1.9 Sibling with Disabilities

Figure 9: Percentage distribution of children with CP by disability status of their siblings.

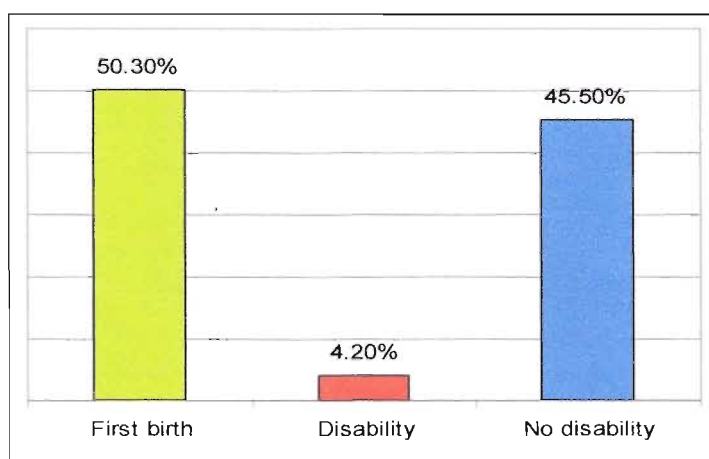


Figure 9 shows that 50.30% of the children with CP had no sibling, which means the first child is affected with CP, and other 49.70% children had siblings, out of which only 4.20% had any kind of disability and 45.50% had no disability.

**4.1.10 Birth History of Children**

Figure 10: Percentage distribution of the children with CP by timing of their birth

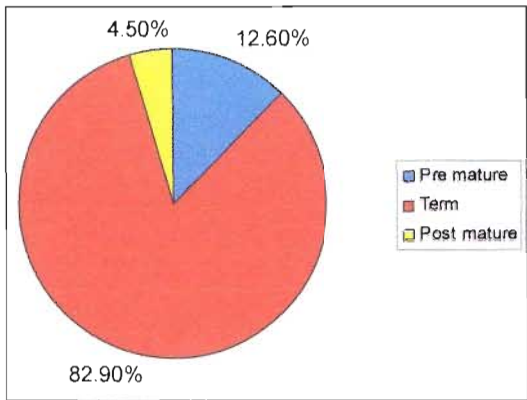
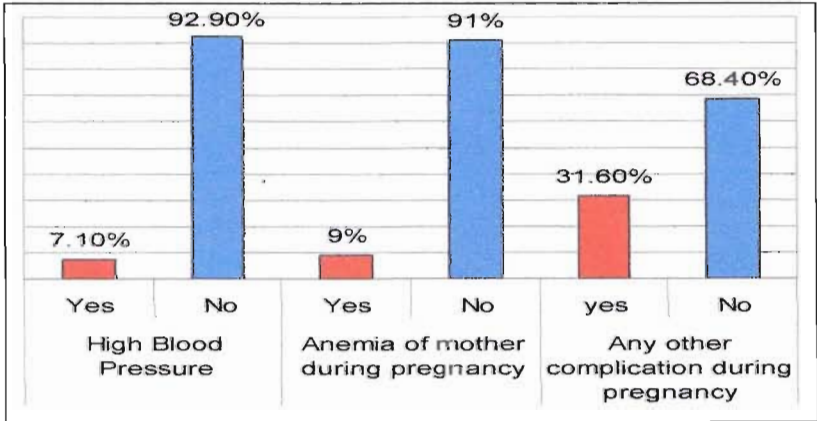


Figure 10 shows that 83% of the children with CP were born as a full term baby, 13% were born as a preterm baby and only 4% were born as a post term baby.

**4.2 Pregnancy Related Factors Affecting CP**

**4.2.1 Complications during Pregnancy**

Figure 11: Percentage distribution of children with CP by status of their mothers' complications during pregnancy.



Data in the figure 11 show that most mothers (68%) of the children with CP had no complications during their respective pregnancies; only one third of the mothers had some kind of complication other than high blood pressure and anemia.

#### 4.2.2 Labor Period

Table 3: Percentage distributions of children with CP by labor period their mothers undergone during delivery.

| Type of labor period | Frequency | Percentage |
|----------------------|-----------|------------|
| Prolonged labor      | 122       | 39.4       |
| Short labor          | 161       | 51.9       |
| Sudden birth         | 27        | 8.7        |
| Total                | 310       | 100.0      |

Table 3 shows that 39.4% of mothers had prolonged labor, 51.9% of mothers had short labor and 8.7% of mothers had sudden birth.

#### 4.3 Variables Related During Birth

##### 4.3.1 Birth Attendant

Table 4: Percentage distribution of children with CP by their birth attendants

| Types of birth attendant    | Frequency | Percent |
|-----------------------------|-----------|---------|
| Traditional birth attendant | 127       | 41.0    |
| Doctor                      | 116       | 37.4    |
| Nurse or midwife            | 67        | 21.6    |
| Total                       | 310       | 100.0   |

Table 4 shows that 37.4% births were attendant by doctor, 21.6% by nurse or midwife and 41% were by traditional birth attendant. The birth attendance pattern observed in this study is not in tune with the national pattern. Nationally, more births are attended by traditional birth attendants than skilled birth attendants.

### 4.3.2 Place of Delivery

Table 5: Percentage distribution of children with CP by their place of delivery

| Place of delivery | Frequency | Percent |
|-------------------|-----------|---------|
| Home              | 154       | 49.7    |
| Hospital          | 110       | 35.5    |
| Clinic            | 46        | 14.8    |
| Total             | 310       | 100.0   |

Table 5 shows that 49.7% of children born at home, 35.5% of children born in hospital and 14.8% of children born in clinic. This finding indicates that children with CP are more likely to be born at home.

### 4.3.3 Birth Injury during Birth

Figure 12: Percentage distribution of children with CP by birth injury

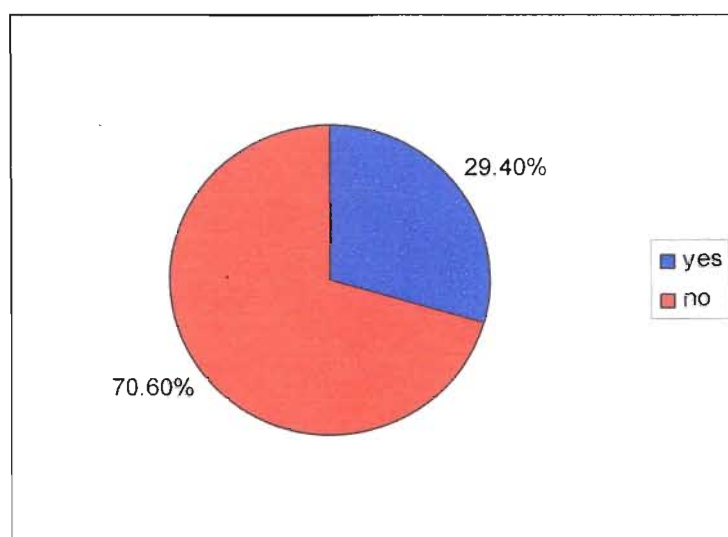


Figure 12 shows that 29% of children had birth injury and 71% of children had no injury at birth.

#### 4.3.4 Birth Asphyxia during Birth

Figure 13: Percentage distribution of children with CP by birth asphyxia

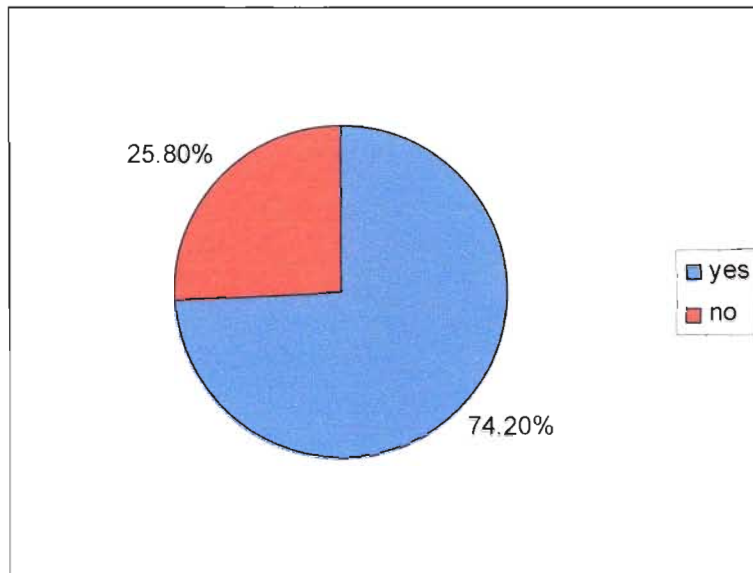


Figure 13 shows that 74% of total children had birth asphyxia and 26% of children had no birth asphyxia.

#### 4.4 Variables related to Post-natal Complications

##### 4.4.1 Jaundice after Birth

Table 6: Percentage distribution of children with CP who had jaundice after birth

| Jaundice after birth | Frequency | Percent |
|----------------------|-----------|---------|
| Yes                  | 79        | 25.5    |
| No                   | 231       | 74.5    |
| Total                | 310       | 100.0   |



Table 6 shows that 25.5% of children with CP had jaundice after their birth and 74.5% of children had no jaundice after birth.

**4.4.2 Pneumonia after birth**

Table 7: Percentage distribution of children with CP who had pneumonia after birth

| Pneumonia after birth | Percent | Frequency |
|-----------------------|---------|-----------|
| Yes                   | 35.5    | 110       |
| No                    | 64.5    | 200       |
| Total                 | 100.0   | 310       |

Table 7 shows that 35.5% of total children with CP had pneumonia after their birth and 64.5% had no pneumonia after birth.

**4.4.3 Dehydration after birth**

Table 8: Percentage distribution of children with CP having dehydration after birth

| Dehydration after birth | Frequency | Percent |
|-------------------------|-----------|---------|
| Yes                     | 24        | 7.7     |
| No                      | 286       | 92.3    |
| Total                   | 310       | 100.0   |

Table 8 shows that 7.7% of children had dehydration after birth and 92.3% did not have dehydration.

#### 4.4.4 Seizures after birth

Table 9: Percentage distribution of children with CP by history of seizure after birth

| History of seizure after birth | Frequency | Percent |
|--------------------------------|-----------|---------|
| Yes                            | 180       | 58.1    |
| No                             | 130       | 41.9    |
| Total                          | 310       | 100.0   |

Table 9 shows that 58.1% of children with CP had history of seizure after birth and 41.9% had no seizure after birth.

#### 4.4.5 Oxygen needed after birth

Table 10: Percentage distribution of children with CP who needed oxygen after birth

| Oxygen needed after birth | Frequency | Percent |
|---------------------------|-----------|---------|
| Yes                       | 79        | 25.5    |
| No                        | 231       | 74.5    |
| Total                     | 310       | 100.0   |

Table 10 shows that only little over one-quarter of children with CP needed oxygen after birth but an overwhelming proportion (74.5%) of them did not need oxygen after their birth.

#### 4.4.6 Presence of Epilepsy

7

Table 11: Percentage distribution of children with CP by history of epilepsy/seizure

| Epilepsy         | Frequency | Percent |
|------------------|-----------|---------|
| Yes              | 105       | 33.9    |
| No               | 192       | 61.9    |
| Only one seizure | 13        | 4.2     |
| Total            | 310       | 100.0   |

Table 11 shows that 33.9% of children had diagnosed epilepsy, 4.2% had only one seizure after birth and 61.9% of children had no history of epilepsy or seizure in their life.

#### 4.4.7 Hearing Status of Children

Table 12: Percentage distribution of children with CP by their hearing status

| Hearing status | Frequency | Percent |
|----------------|-----------|---------|
| Normal         | 281       | 90.6    |
| Impaired       | 29        | 9.4     |
| Total          | 310       | 100.0   |

Table 12 shows that 90.6% of children with CP have normal hearing and 9.4% of children had hearing impairment.

**4.4.8 Vision Status of Children**

5

Table 13: Percentage distribution of children with CP by their vision status

| Vision status | Frequency | Percent |
|---------------|-----------|---------|
| Normal        | 255       | 82.3    |
| Impaired      | 55        | 17.7    |
| Total         | 310       | 100.0   |

Table 13 shows that 82.3% of children with CP have normal vision and 17.7% of children had impaired vision.

The findings and its explanations are discussed in details below under the following headings:

### 5.1 Sex Ratio

Figure 1 shows that among the total number of children, males have a higher rate to female children. There could be two reasons for that- one could be male children may have higher chance of having CP than female children and another could be parents have more preference for male children for seeking health care facilities.

Evidence also suggests that males have a higher incidence than females of several brain-based developmental disabilities including mental retardation, autism, attention deficit hyperactivity disorder and cerebral palsy. Johnston & Hagberg (2007) showed in their report in 2007 that the incidence of CP was 30% higher in males than females based on analysis of a European database of 4500 children. Also in extremely preterm birth, males had significantly higher incidence of severe disability, cerebral palsy, and low scores of cognitive function at 6 years of age compared with females. A hospital based study in Bangladesh also found more male patients (66.7%) with CP than female patients (33.3%) (Khan, Moyeenuzzaman and Islam, 2006).

In 1987 Pharoah, Cooke, Rosenbloom and Cooke showed in their study, 685 cases of children with CP were found from different data sources for the period of 1966-77 to a specific regional health centers where those children were taken with a male: female ratio of 1.4:1. In this study also male and female ratio is 1.56:1 which is similar to studies found in literature.

### 5.2 Gender Ratio According to Division

The findings of differential representation of children with CP at CRP from different divisions may partly be attributed to differential degree of physical proximity of geographic divisions and their most direct and convenient road/railway connectivity to CRP

From figure 2 it was seen that maximum number of children came from Dhaka division and the next highest number were from Rajshahi and then from Chittagong. The rest of the divisions have lower numbers of participants. Sylhet has only two participants which is the lowest number.

Dhaka, Chittagong, Rajshahi and Khulna are metropolitan cities which is reflected in the data from this study which shows a higher percentage of participation from those divisions.

Health seeking behavior can also be a determinant here because health seeking behavior depends on various socio-economic factors such as geographical distance of the health care service, people's awareness about health care providers and economic status of people and so on (Ahmed, 2005)

As CRP is located in the Dhaka division, so it becomes close distance comparing to other divisions. Then it also can be assumed people from metropolitan area may have exposure to knowledge of health care system and which influences the health seeking behavior of people within the Dhaka division when compared to people in other divisions.

It is found in the study that highest number of children admitted to the CRP paediatric program (42.5%) were between 2-4 years of age (see table 2). This finding corresponds to another study by Pandey, Jha, Dhungana, Lamsal in 2009 that found younger children were brought to the hospital sooner; children less than five years were brought earlier, particularly infants.

This study also shows that parents brought their children to CRP irrespective of their gender at below 2 years of age (male=34, female=33) whereas it becomes significantly disproportionate for the 2-4 years age group (male=87, female=46) (see figure 3). Different studies show that medical care is positively predicted by male gender, geographic location, greater socioeconomic status, and serious illness of long duration.

### **5.3 Parent's Education and Employment**

According to Tipping and Segall (1995) socioeconomic factors include mother's educational level and her husband's occupation and educational level influences parent's health seeking attitude.

In this study 38.50% of mothers have 10 years of education (see figure 4) where as 30% have 10 years and another 30% of fathers have 12 years or above education (see figure 5). Only 4% of mothers were working women where as 96% of mothers were housewives (see figure 6).

Rahman, Islam, Islam, Sadhya and Latif (2011) found in their study that only 68.6% of the household heads were literate, which correspondent to the adult literacy rate of Bangladesh. Other studies show that parent's education, age and the relative decision making power of women has impact upon whether they will attend health service or not (Amin, Shah and Becker, 2000). So, from the investigator's point of view having at least 10 years of education for both parents may have positive relation to seeking health services.

The main occupation of people of rural Bangladesh is agriculture (Rahman, Islam, Islam, Sadhya and Latif, 2011). This study found the second highest percentage (23.90%) of fathers were agricultural workers (see figure 7). Prevalence of CP was higher in lower income families than middle and upper income families (Sundrum et al, 2005). Agricultural worker and small business holders can be counted as lower to middle income families in Bangladesh, this study found this group has a high number of children CP. According to Amin, Shah and Becker (2010), wealth status of a family is a major determinant in health-seeking behavior. Results from this study also found that the highest percentage (33.20%) of parents to bring their child to a health service, fell within the service holder group. People who are service holders are considered middle- upper income in Bangladesh.

#### **5.4 Consanguine (First cousin marriage)**

In this study it was found that 9.40% of the participants' parents had history of first cousin marriage (see figure 8). Sinha, Corry, Subesinghe, Wild, Levene (1997) studied on 39 Asian families who have a child with CP. They found 15 of the families had first cousin marriages and nine of these families had another first or second degree family member with a similar type of CP to the index child.

Gulten et al, (2008) reported that the most frequently encountered risk factors of CP were low birth weight (45.1%), preterm birth (40.5%), birth asphyxia (34.6%) and consanguineous marriage (23.8%). Low birth weight, preterm birth, birth asphyxia and consanguineous marriage were top-ranked risk factors that were determined in Turkish children with CP. Compared with other countries; consanguineous marriage is still an important problem in Turkey.

But in this study consanguineous marriage is not exhibited as a prominent factor whereas evidence strongly suggests a positive relation with CP.

### **5.5 Siblings with Disability**

In this study 50.30% of the children had no sibling which means the first child is affected with CP and other 49.70% had siblings from which 4.20% had any kind of disability and 45.50% had no disability (see figure 9). It has been observed that babies who are first born could have greater chances of having CP (My Child™, 2011) which is also seen in this study because half of the children of this study affected with CP are first born.

### **5.6 Birth History**

This study found 83% of the children were born as a full term baby, 13% born as a preterm baby and only 4% were born as a post term baby (see figure 10) which is similar to Gynecol, Thorngren-Jerneck and Herbst's study. Gynecol, et al. (2006) reported that infants born preterm had a highly increased risk for CP, and constituted 35% of all cases. Preterm birth entails a high risk for CP, but 65% of their study participants born at term. They found several obstetric factors and low Apgar scores were associated with CP. So, they concluded that term babies also had a greater chance of having CP depending on other associated factors.

### **5.7 Complication of Mother during Pregnancy**

This study found that 7.10% of mothers had high blood pressure, 9% of mother had anemia, 31.60% of mothers had other complications (for example amino fluid loss, fever, history of fall down etc.) and 68.40% of mothers had no complication (see figure 11). Early epidemiological studies have suggested that there is an association between maternal hypertension and CP. Maternal disorders like hypertension during pregnancy was detected as one of the strong risk factors for causing CP (Gulten et al, 2008). The role of maternal anemia in the pathogenesis of preterm birth has been controversial. Anemia is not a strong risk factor for pre-term birth when an appropriate comparison group was used (Gulten et al, 2008). So, further research is required into the effects of other complications during birth that lead to CP.



## **5.8 Labor Period**

This study found that 39.4% of mothers had prolonged labor, 51.9% of mother had short labor and 8.7% of mother had sudden birth (see table 3). According to Karin, Nelson, Jonas and Ellenberg, (1985) duration of labor, whether precipitated or prolonged, is not a risk factor for CP. But Arrowsmith, Hamlin, Catherine, and Lewis (1996) stated that labor period has an association with birth injuries and it leads to CP. So, it can be summarized that though there is no direct association between labor and CP, it does have an indirect influence on CP.

## **5.9 Birth Attendant and Place of Delivery**

This study found 37.4% of births were attendant by doctor, 21.6% by nurse or midwife and 41% were by traditional birth attendant (see table 4). Moreover, 35.5% of children were born in hospital, 14.8% were born in a clinic and 49.7% of children were born at home (see table 5). Blum, Sharmin and Ronsmans (2006) reported that findings of their study illuminate major constraints encountered during home deliveries, including poor transportation, inappropriate environment for delivery, insufficient supplies and equipment, lack of security, and inadequate training and medical supervision, which may prevent the provision of skilled care.

Islam, Islam and Banowary (2009) mentioned in their study that according to the Bangladesh Demographic and Health Survey 2007, almost two in three births were assisted by dais (untrained traditional birth attendants) and one in seventeen was assisted by relatives or friends whereas only 15 percent of births in Bangladesh had been in a health facility, it was very low (4%) in 1993-94 BDHS and has increased by over 10 percentage points in the last 13 years.

This study also revealed there is little difference in risk factor of CP between the percentage of getting traditional birth attendants and skilled health care providers (doctors).

## **5.10 Birth Injury during Birth**

29% of children had birth injury and 71% of children had no injury at birth (see figure 12). Birth injury encounter head trauma during delivery. Blair and Stanley (1992) reported in their study that during nonmetropolitan delivery head trauma is common cause of sustained permanent brain damage and it may lead to CP.

74% of total children had birth asphyxia and 26% of children had no birth asphyxia (see figure 13). Gulten et al. (2008) found birth asphyxia is one of the major risk factors for CP (Suvanand et al. 1997). In their study 34.6% children had history of CP due to birth asphyxia. So, this study and the literature both support that birth asphyxia is a prominent cause of CP.

### **5.11 Post-natal Illness**

In this study the investigator identified that jaundice (25.5%), pneumonia (35.5%), and neonatal seizures (58.1) were the leading risk factors for CP (see table 6, table 7 and table 9). These findings are similar to Gulten et al (2008) who also found neonatal convulsion was one of the prominent risk factor of causing CP. In 33.9% of children this neonatal seizure remained and led to epilepsy.

Dimitrios, et al. (1999) stated that the overall prevalence of epilepsy was 36.1%. Patients with atonic-diplegic, dystonic, tetraplegic, and hemiplegic cerebral palsy had a higher incidence of epilepsy (87.5%, 87.1%, 56.5%, and 42%, respectively). Ahmed, Sobhan, Islam (1998) found in their study, 48 percent of the neonates were reported to have suffered from some kind of morbidity. Fever (20%) was the most commonly reported morbidity in the study population, followed by breathing difficulty (11%). Birth order, mother's education, complications during pregnancy and/or delivery, and death of a sibling were found to be significantly associated with reporting of neonatal morbidity. So, neonatal illness increases the possibility of having CP.

### **5.12 Hearing and Vision Status**

Among all the children in this study 9.4% had a hearing impairment (see table 13) and 17.7% had impaired vision (see table 14). According to Workinger (2005) CP is defined as a group of disorders of movement of limbs and muscle associated with hearing and vision problem. Pharoah, Cooke, Johnson, King and Mutch (1998) showed in their study, among 1649 cases of CP children 146 (8.9%) had severe visual disability and 12 had severe hearing disability which can help to make conclusion that in CP visual disability is more common than hearing disability. In Bangladesh a study by Khan, Moyeenuzzaman and Islam in 2006 also found hearing impairment (13.9%), visual problem (8.6%) and squint (26.8%) among 93 patients with CP. So, visual disability and hearing disability is common in CP.

CP is one of the major common childhood disabilities that affect children's overall development. Children with CP can be characterized with movement disorder, speech and language difficulties, hearing and vision difficulties. When taking a case history from parents about their children, predetermined questions are asked to determine prognosis and counseling to the parent. This study considered this information to explore a broader picture of the factors related to CP. This multifactorial information was categorized into socioeconomic factors (gender, geographical location, parent's education, employment, and consanguinity marriage), maternal factors (complication during pregnancy, labor period, accessing birth attendants), neonatal factors (birth injury, birth asphyxia, neonatal illness, seizure), and associated problems with CP (hearing and vision status of children).

The proportion of cases experiencing identified factors and the distribution of those factors between data also varied with health seeking pattern of parents. Determining the causal pathway of a problem can aid to find out the prevention. It can be concluded that there were many pathways to have cerebral palsy, many of which could not be identified. Each contributed only a small proportion and many may have been multifactorial.

This study shows that there is significant rate of birth asphyxia (lack of oxygen just after birth) and seizure among the children with CP. Birth asphyxia is present irrespective of whether the birth was attended by either doctor or traditional birth attendants. Children were brought to health center at early stage whose parents had 10 years of education and male children were higher number in this case. Bio-medical background and socio demographic characteristics of children with CP are found important in this study.

The study findings demand an awareness of health care service providers and health policy makers to have the appropriate facilities in the labor room to prevent birth asphyxia and give emphasis on the treatment of seizure. Moreover maternal factors need to be taken into as a prevention measure of childhood disability during antenatal visit of the mothers. Antenatal care of mothers needs to be provided equitably for all mothers in metro and rural areas and the government should strengthen programs on antenatal care. An appropriate health services for children with CP need to be accessible at least in district areas to reduce difficulties due to physical distance.

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