Faculty of Medicine

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Prevalence of Cardio-Respiratory Symptoms among the Child with Cerebral Palsy in Dhaka city

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Session: 2018-2019

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August 2024

DECLARATION

I declare that the work presented here is my own. All sources used have been cited appropriately. Any mistakes or inaccuracies are my own. I also declare that for any publication, presentation or dissemination of the study. I would be bound to take written consent from the Saic College of Medical Science and Technology (SCMST).

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Content

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List of Acronyms

BMI- body mass index

BPD- Bronchopulmonary dysplasia

CO2 - Carbon Dioxide

CP- cerebral palsy

CPX- The cardiopulmonary exercise test

CVD- cardiovascular disease

FRC - Functional residual capacity

GMFCS- Gross Motor Function Classification System

HRV- Heart rate variability

O2 - Oxygen

PaCO2 - Partial arterial carbon dioxide pressure

PEFR- peak expiratory flow rate (PEFR)

SpO2- Spot arterial Oxygen saturation

WHR- waist-to-hip ratio

FVC - forced vital capacity

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Abstract

Introduction: Cardio-respiratory symptoms are prevalent in children with cerebral palsy (CP) due to systemic complications and neuromuscular dysfunction, significantly impacting their quality of life. This study investigates the prevalence of cardio-respiratory symptoms among children with CP and explores associated demographic and clinical factors. **Methodology:** A cross-sectional study was conducted involving children diagnosed with CP. Participants were assessed for cardio-respiratory symptoms, including wheezing, coughing, and difficulty swallowing. Data collection tools included caregiver-reported surveys and clinical measures such as heart rate, respiratory rate, and nutritional status. Demographic data, including gender, family structure, and caregiver education levels, were also analyzed. Descriptive and inferential statistical methods were applied to evaluate the findings. **Results:** Total number of children with cerebral palsy was 85 among them 63.5% was boy and 36.5 was girls. The prevalence of Shortness of breath (16.5), wheezing (36.5%), coughing (31.8%), and difficulty swallowing (43.5%) highlights significant respiratory challenges. The mean respiratory rate was 31.29 breaths per minute, and the mean heart rate was 113.41 beats per minute, indicating elevated metabolic stress. Nutritional deficits were prevalent, with 50.6% of participants being underweight. Socio-economic factors, including caregiver education, influenced symptom management and healthcare access. **Conclusion:** This study highlights the need for monitoring and interventions to address cardio-respiratory symptoms in children with CP and improve outcomes.

Keywords: *Children*, *Cerebral Palsy*, *Cardio-respiratory Symptoms*

CHAPTER – I INTRODUCTION

1.1 Background:

The term cerebral palsy (CP) refers to a collection of long-term abnormalities of posture and movement development that limit an individual's activities and These abnormalities are thought to be caused by non-progressive disruptions in the growing fetal or infant brain (Boel et al. 2018, p. 646).

Cerebral palsy (CP) is a neurological disorder that mostly affects body mobility and muscle coordination. Cerebral palsy is caused by a non-progressive brain damage or abnormality that appears throughout a child's brain development. One of the most significant of these issues is cardio-respiratory symptoms. While the primary cause of impairments in children with cerebral palsy (CP) is movement impairments, respiratory issues and other secondary repercussions can also have a substantial impact on these children's health and wellbeing (Alqahtani et al. 2024, p. 181).

Heyn et al. (2019, p. 477) discussed that The phrase "cardiovascular disease" describes disorders affecting narrowed or blocked blood vessels, which can cause angina, heart attacks, hypertension, and chest pain. Body mass index (BMI), hyperglycemia, and waist-to-hip ratio (WHR) are risk factors for cardiovascular disease (CVD) that have been identified through studies on a number of people with cerebral palsy (CP) and other disabilities. Based on these findings, patients can now be categorized as having a high risk of developing CVD.

Malnutrition, dysphagia, gastric reflux, impaired respiratory performance, orthopedic problems, and cardiovascular problems are thought to be risk factors for the recurring respiratory problems that these people commonly suffer. However, the research now accessible provides information on the frequency of oral aspiration in the lungs as well as the proportionate contribution of these putative risk factors. There aren't many motor dysfunctions in CP, and risk factors could limit hospitalization rates early and prevent long-term lung damage and related respiratory problems (Cakar et al. 2021, p. 1626).

Among the symptoms that can raise the risk of pulmonary aspiration and produce respiratory exacerbations in people with cerebral palsy are ineffective coughing with airway mucus burden, trouble handling oropharyngeal secretions, swallowing

difficulties, and gastroesophageal reflux (Vianello et al. 2015, p. 1431). Lagos-Guimaraes et al. (2016, p. 132) found that One common symptom of cerebral palsy is dysphagia and The condition known as oropharyngeal dysphagia may manifest in the patient as an oral phase, pharyngeal phase, or both. Dysphagia affects 43% of kids with cerebral palsy. Poor cervical control, ineffective lip closure, inadequate preparation and bolus propulsion, delayed swallowing response, laryngeal penetration, and/or tracheal aspiration are the most frequent problem.

Ryan et al. (2019, p. 924) Mention that, Although it is conceivable that persons with CP have a higher chance of dying from cancer, respiratory illnesses, and cardiovascular diseases, just one study has examined the prevalence of these ailments' deaths in adults with CP relative to the general population.4 Since then, no research has looked at relationships between CP and mortality from these illnesses in populations outside of the United States.

The general pediatric population (less than 15 years old) in Aotearoa New Zealand (AoNZ) has the highest rates of respiratory hospitalization (only adults over 65 have higher rates), with hospital admissions for viral pneumonia, bronchiolitis, asthma, and wheeze rising to over 21,000 per year since 2000 (Sorhage et al. 2022, p. 6968). Recently, the impact of respiratory disease on people with cerebral palsy (CP) has been studied in Australia using data from the CP Registry and hospital admissions and Three non-modifiable predictive risk variables for future respiratory-related hospital admissions were found, then The effects of respiratory illnesses on children with cerebral palsy (CP) are not as well understood in Australia and New Zealand (AoNZ), and while hospital admissions have risen over the past 14 years, the causes of hospitalization are poorly recorded (Sorhage et al. 2022, p. 6968).

Hui-Yi (et al. 2012, p.1176) argued that Within the age range of 0-24 years, respiratory disease accounts for 11% of related diagnoses, with CP accounting for 42% of primary diagnoses in hospitalizations for this condition and Previous research has shown that a number of notable impairments in children with cerebral palsy (CP), such as motor control deficits, joint range restriction, and muscle spasticity, are just a few of the elements that affect their everyday functional activities.

One of the main causes of illness and death worldwide, including in The Netherlands, is cardiovascular disease (CVD). Several general population studies have shown that being overweight, having poor aerobic fitness, and not exercising are risk factors for cardiovascular disease and Individuals with long-term medical disorders, such cerebral palsy (CP), may be more susceptible to cardiovascular disease (CVD) due to their lower levels of aerobic fitness and regular physical exercise (Van der Slot et al. 2013, p . 866).

Most CP-related hospitalizations and deaths are caused by diseases of the respiratory system and Risk factors for early death include spasticity, epilepsy, severe intellectual disability, term birth, and severe motor impairment. Respiratory failure remains the leading cause of death for individuals with cerebral palsy (CP) and Numerous studies examining the causes of death in children with cerebral palsy (CP) have discovered that scoliosis is not the cause of death, but rather conditions such as pneumonia, seizures, GERD, and previous respiratory symptoms (Rawhaa et al. 2024, p. 41).

Cakar MD and Cine MD (2021, p. 1626) found that there is a dearth of information in the literature about the relative importance of these potential risk factors and the frequency of pulmonary aspiration brought on by oral motor dysfunctions in individuals with cerebral palsy.

Garcia et al. (2016, p. 124) reported that The current study evaluated the cardio-respiratory fitness, energy expenditure, anaerobic endurance, muscle strength, agility, stability, balance, and flexibility of children with cerebral palsy (CP) with that of healthy, age- and sex-matched children in order to fill this vacuum in the research literature. this study reports the cardiorespiratory, metabolic, and neuromuscular fitness abilities of children with CP begin of the study; and had cognitive abilities that were unaffected.

Research on the metabolic syndrome, cardiovascular disease risk factors, and physical function in people with impairments is scarce and The purpose of the Cerebral Palsy Adult Transition project was to investigate the association between a cohort of young adults with CP who are ambulatory and their risk of developing secondary health issues and their capacity to walk and their general health state (Heyn et al. 2019, p. 477).

Marpole et al. (2020, p. 333) mentioned that Respiratory problems are common and During or after meals, 46% of participants in a cross-sectional survey comprising 551 individuals aged 1–26 reported experiencing a gurgly voice, wheezing, coughing, sneezing, choking, vomiting, or regurgitating. There were higher symptoms in those with GMFCS IV and V classifications. More hospital admissions and lunchtime symptoms were observed in participants who took nil by mouth compared to those who ate it orally.

Heart rate variability (HRV) analysis is a commonly used noninvasive method to represent heart-brain interactions by measuring the cardiac ANS modulation. For the purpose of assembling the body of current information and organizing future research, it is imperative to evaluate whether the studies on HRV in children with CP adhered to the guidelines for calculating RR intervals and conducting HRV analysis (Gasior et al. 2020, p. 1141).

A pulmonary function test is used to track the health of people with chronic lung disorders and to determine the underlying cause of respiratory symptoms in children with or without cerebral palsy. It is a reliable and accurate way to describe clinical respiratory function either before or after surgery (Lee et al. 2014, p. 965). The cardiopulmonary exercise test (CPX), which is widely used to promote exercise, is the gold standard for evaluating an individual's capacity for exercise in both adults and children. We postulated that ambulatory children with CP could benefit from symptom-limited CPX utilizing the modified Naughton procedure (kim et al . 2021, p.2626).

In summary , This research focuses on exploring the cardiorespiratory symptoms experienced by children with cerebral palsy (CP). Cerebral palsy is a neurological disorder that affects movement and coordination, but it can also have significant impacts on respiratory and cardiovascular function due to muscle weakness, abnormal postures, and reduced mobility. These factors can lead to a range of issues, including respiratory infections, airway obstructions, and diminished lung function, which may compromise overall health and quality of life. The motivation behind this research stems from the need for a deeper understanding of the specific cardiorespiratory challenges faced by children with CP, the cardiorespiratory symptoms are less studied, despite their importance in improving overall outcomes and care for these children. By investigating these symptoms, this research aims to highlight areas that may benefit from targeted therapeutic interventions, early diagnosis, and better management strategies, ultimately enhancing the well-being and longevity of children with CP.

1.2 Justification:

A collection of chronic mobility problems that first manifest in early childhood is known as cerebral palsy (CP). It is brought on by aberrant development or injury to the brain regions responsible for posture, balance, and movement. Children who have cerebral palsy frequently experience a wide range of impairments that affect their day-to-day functioning, such as issues with speech, motor skills, and movement. Cardio-respiratory symptoms are a major issue among these problems. Although movement impairments are the main cause of impairments in children with cerebral palsy (CP), respiratory problems and other secondary consequences can also significantly affect the health and well-being of these children. This article will examine the relationship between symptoms of cardio-respiratory disease and cerebral palsy. Talk about how common cardio-respiratory problems are in CP patients. Describe typical symptoms include anomalies in the cardiovascular system, greater respiratory effort, and decreased lung function. Analyze the neurological causes of cerebral palsy and its impact on cardiovascular and respiratory regulation. I believe this research is important because similar studies have not been conducted. before Talk about the effects on everyday living activities, engaging in physical activity, and general quality of life. Determine any knowledge gaps regarding the role of the cardio-respiratory system in CP and suggest future research directions. The quality of life and functional results for people with cerebral palsy (CP) can be enhanced by healthcare professionals through the identification of the mechanisms driving cardio-respiratory symptoms and the implementation of focused therapies. In order to improve clinical management techniques and broaden our understanding of this crucial field, further research is required.

1.3 Research Question:

- What is the prevalence of cardio-respiratory symptoms among the child with cerebral palsy?

1.4 Objectives:

1.4.1 General Objective:

- To determine the prevalence and clinical characteristics system of cardio-respiratory symptoms among children with cerebral palsy at Feroza Bari Disable Hospital in Dhaka city.

1.4.2 Specific Objective:

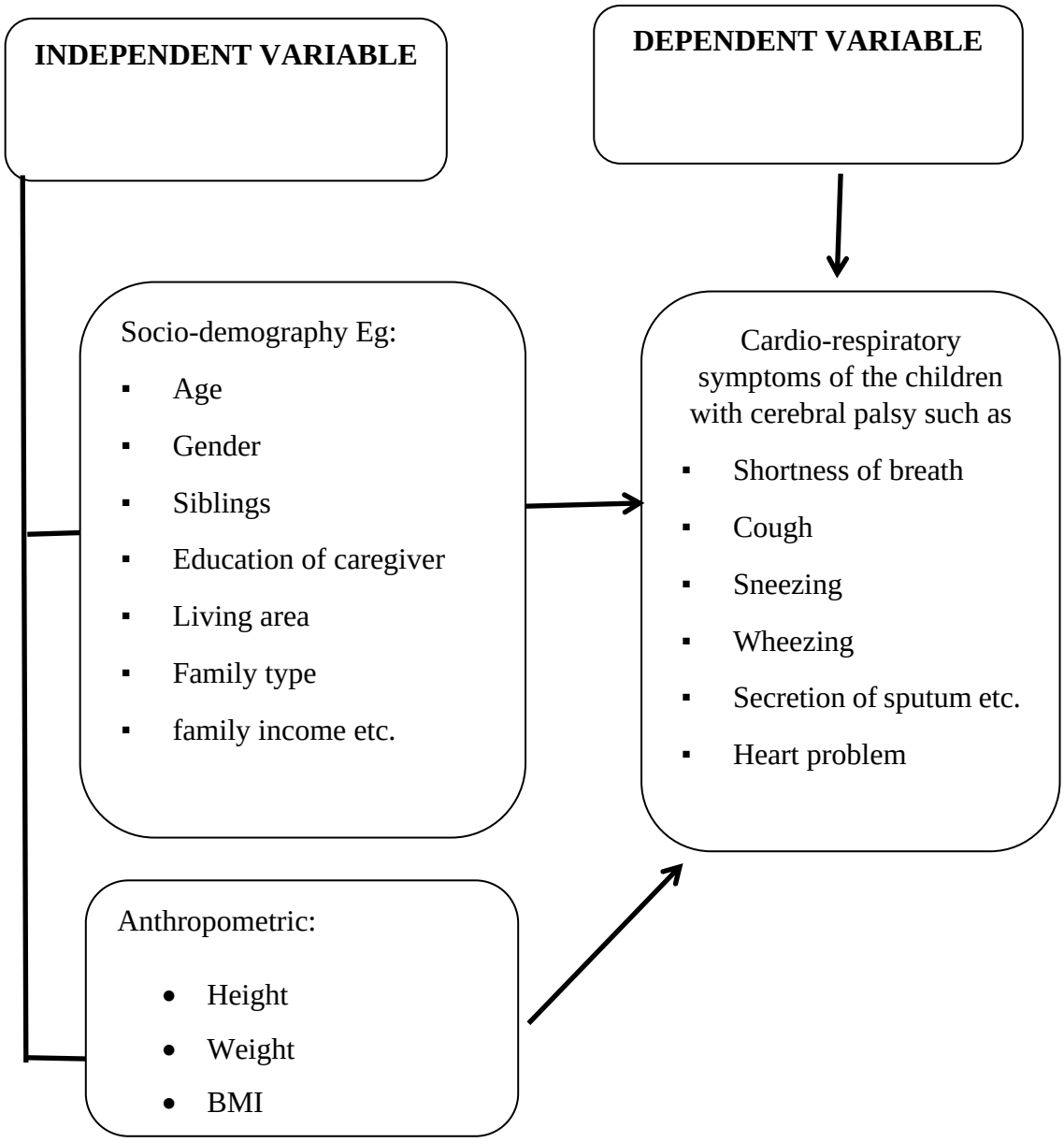
- To calculate the percentage of children with cerebral palsy experiencing specific cardio-respiratory symptoms such as shortness of breath, cough, sneezing, wheezing, secretion of sputum, difficulty in swallowing etc.

- To identify cardio-respiratory symptoms of the children with cerebral palsy attending at Feroza Bari Disable Hospital by asking question of the caregivers.

- To determine the socio-demographic characteristics of the children with cerebral palsy at Feroza Bari Disable Hospital.

- To explore potential correlations between the age, gender of the children with cerebral palsy and the incidence of cardio-respiratory symptoms.

1.5 Conceptual Framework:



1.6. Operational definition:

Cerebral palsy : Cerebral Palsy (CP) is defined as a group of permanent disorders of movement and posture , attributed to non-progressive disturbance in the developing fetal or infant brain, leading to activity limitations.

Cardio-respirstory Symptom: Cardio-respirstory Symptom are defined as any signs or complaintsrelated to the function of the heart and lungs, such as shortness of breath (dyspnea), coughing, wheezing, chest tightness, irregular heartbeat etc.

CHAPTER – II LITERATURE REVIEW

A neurological disorder that begins in early childhood and lasts the entirety of a person's life is cerebral palsy (Gasior et al., 2020). Motor impairments in CP patients that are ascribed to non-progressive abnormalities in the developing fetal or newborn brain sometimes coexist with a variety of other disorders, such as epilepsy, sensory, perceptual, cognitive, behavioral, and communication issues (Gasior et al. 2020, p. 1141).

With a prevalence of 1.4 to 2.1 instances per 1000 live births, cerebral palsy (CP) is the most prevalent physical disability among children in high-income nations. The leading cause of death, morbidity, and poor quality of life in people with cerebral palsy (CP) is respiratory-related illness [26% of the CP population is classed as combined Gross Motor Function Classification System (GMFCS) IV and V]. Children with CP have a complicated and multifaceted road to respiratory disease, which affects all levels of disability. Since 2000, the number of people with CP experiencing respiratory symptoms has climbed from 45% to over 21,000 every year (Sorhage et al. 2022, p. 6968).

According to Murthy et al.(2014, p.915) the estimated prevalence of cerebral palsy in Bangladesh was 3.7 per 1000 children. Out of 859 children with severe physical impairment, 48.5% had cerebral palsy (CP), and more than half of them (57%) had never received any rehabilitative support or services. Of those children, only 21.1% (182) were enrolled in regular school, and only 0.2% (2) were attending special schools, according to another pilot study (Khandaker et al. 2014, p. 363).

In addition, a strong association between walking distance and 2MWT was discovered in a number of neuromuscular conditions with different degrees of severity. This implies that when evaluating walking capacity in patients with neuromuscular disorders, the 2MWT is a reliable substitute for the 6MWT (Andersen et al., 2016). Additionally, a study revealed a strong correlation between 6MWT and 2MWT and 100m ($r = 0.827$ and $r = 0.827$, respectively, $p = 0.002$) (Alfano et al. 2014, p. 222).

Despite being present in all socioeconomic levels, the majority of cases of CP are linked to low birthweight and low socioeconomic status. The rate of CP, however, was 2.42 per 1000 live births for those in the lowest socioeconomic groups and 1.29 per 1000 for the most affluent groups, even within the normal birth weight ranges (Solaski et al. 2014, p. 1043 :Oskoui et al. 2016, p. 160).

Additionally, another study indicated that the 2-minute distance walked during the 6MWT was supported by the completion rate, values obtained, test-retest reliability, and relationship between the distances walked in 2 and 6 minutes. Additionally, research indicated that 2MWT was more well-tolerated than 6MWT in older adults and children undergoing geriatric therapy (Pin., 2014). Additionally, recent studies demonstrated that the 6MWD and 2MWD have very high test-retest reliability as determined by intra class correlation analysis (Vill et al. 2015, p. 640).

A study conducted on 50 active adults (23.2 ± 21.8 years) revealed a moderate link between HR Recovery and resting HR, despite the literature showing a strong relationship between HR Recovery and VO2 max (Bunn et al., 2017). Although some studies reported conflicting results, the American College of Sport Medicine (ACSM) assumes that a percentage of HR reserve provides the same intensity as the equivalent percentage of VO2 max. These factors include cardiovascular fitness, physical fitness, intensity of aerobic and anaerobic exercise, and ambient temperature (Mojtaba et al. 2010, p. 5412).

The study done by McCulloch., (2013) demonstrated that a submaximal graded exercise test may be used to estimate VO2 max when extrapolated to RPE and that, in healthy, able-bodied persons, there was a good connection between projected and actual VO2 max values. On a progressive maximal cycle ergometer, 21 CP children aged 6-14 had a mean VO2 max of 39.3 ml/kg/min. The VO2 max was thought to be the best measure of cardiorespiratory fitness. It can be used as an evaluation tool to identify improvements after therapies in this population and was found to be reliable in children with cerebral palsy (Brehm et al. 2014, p. 121).

In this category, circulatory and respiratory issues accounted for 66% of the causes of death, with respiratory failure accounting for 63% of these cases. Thus, respiratory failure characterized as "symptoms, signs, and abnormal clinical and laboratory findings, not elsewhere classified" accounted for 15% of the total number of deaths in our study's CP individuals. The second most

prevalent cause of death (19%) was "diseases of the respiratory system," compared to 6% for the French population as a whole. The leading causes of death in this group were influenza (2.4%), acute respiratory failure (21%), and pneumopathies (24.5%). In this category, the subjects' age at death was lower than that of the general population (Durufle –Tapin et al . 2014, p.24).

Lagos-Guimaraes et al. (2015, p. 132) reported that Of the 84 (81.5%) dysphagic children with cerebral palsy in this study, 24 (23.3%) had severe dysphagia, 8 (7.7%) had moderate dysphagia, and 52 (50.4%)had mild dysphagia. 100% of the sample in a study including 50 kids with cerebral palsy experienced dysphagia of some kind. According to a different epidemiological study carried out in Northern Ireland, 43% of the 1,357 children evaluated had dysphagia, irrespective of the kind of cerebral palsy. One These studies demonstrate that, regardless of motor or oral categorization, dysphagia is common in children with cerebral palsy, occurring in 43 to 100% of cases In line with this study, another study discovered that 70% of the children had an impaired pharyngeal phase, with choking being the most common symptom.

In young people with cerebral palsy, respiratory problems are highly prevalent. When 551 people between the ages of 1 and 26 participated in a cross-sectional survey, 46% of them reported having a gurgly voice, wheezing, coughing, sneezing, choking, vomiting, or regurgitating during or after meals. Over the course of five years, a prospective data-linkage study involving youth with cerebral palsy found characteristics that were strongly linked to subsequent respiratory hospitalizations. Oropharyngeal dysphagia, frequent respiratory symptoms (daily cough or weekly sounding chesty, phlegmy, or wheezy) (Marpole et al. 2020, p. 333).

45% of the participants in these study had a high exacerbation rate (two episodes/year), which is in line with other findings that respiratory issues seem to be the most prevalent comorbidity in young children with cerebral palsy (7,10). In addition, a significant percentage of the study participants (22/31, 71%) needed to be admitted to acute care hospitals for respiratory conditions in the year prior to the research. It is much more critical to find a high hospitalization rate among people whose pulmonary function indicators indicate a risk of respiratory exacerbations. Physicians can use this information to help them make prompt decisions on patient care and management (Vianello et al. 2015, p. 1431).

People with CP died from respiratory system diseases at higher rates between the ages of 20 and 29 and 30 and 39 (50% vs. 3% and 42% vs. 3%, respectively), but at similar rates between the ages of 40 and 49 and 50 and 59 (10% vs. 4% and 0% vs. 5%, respectively). According to a 2014 study conducted in France, CP patients had a lower percentage of deaths from neoplasms (7% vs. 29%) and a higher percentage of deaths from respiratory system disorders (19% vs. 6%) than the general population (Ryan et al. 2019, p. 924).

Medical records from 292 hospital stays for 83 CP patients were reviewed for this investigation. The patients (n = 83) in the study had a median age of 7.24 (minimum 0.62–maximum 18.45) years; 84% of them had quadriparetic conditions, and 55.4% of them were male. All of the children were Level 5 GMFCS, with only one being able to be classed as Level 2. The most prevalent factor in the genesis of CP is HIE. The follow-up period had a median duration of 4.42 (min–max: 0.05–12.28) years (Cakar et al. 2021, p. 1626).

Ryan et al. (2019, p. 924) Indicates That For 7693 person-years, 958 people with CP (52.5% males, 47.5% females; median age at follow-up initiation: 31 years [inter quartile range: 22–43 years]) were monitored. During the follow-up period, 142 patients (15%) passed away. Adults with CP were more likely to die from respiratory and cardiovascular conditions (SMR: 13.59, 95% CI 9.89–18.67 and 3.19, 95% CI 2.20–4.62) than from malignant neoplasms (SMR: 1.42, 95% CI 0.83–2.45).

Lagos-Guimaraes et al. (2015, p.132) Found That Techniques 103 children with cerebral palsy who had been referred for a video fluoroscopic and had returned for a follow-up medical examination a week later to look for pneumonia symptoms made up the group for this prospective cross-sectional study. Findings Between the ages of 0 and 14, 46 girls (44.66%) and 57 boys (55.34%) participated in the study. There were 84 (81.5%) people with dysphagia overall, with 24 (23.3%) having severe dysphagia, 8 (7.7%) having moderate dysphagia, and 52 (50.4%) having mild dysphagia.

There may be a correlation between the severity of (BPD) Bronchopulmonary dysplasia and the risk of CP. CP in children with the most severe BPD (using mechanical ventilation at 36 weeks

postmenstrual age) in the ELGAN research, which included over 1000 infants born before 28 weeks 50 (Cheong et al .,2018) . He also found that according to a study from the NICHD Neonatal Research Network of ELBW infants born between 2006 and 2007. The frequencies of all CP phenotypes, moderate to severe CP (defined as Gross Motor Function Classification System level 2 or higher) (7.0% vs. 2.1%), spastic diplegia (7.8% vs. 4.1%), and quadriplegia (3.9% vs. 0.9%) were higher in children with "physiological BPD" at 18 to 22 months than in children without BPD (Cheong et al. 2018, p. 1176).

These high-risk patients are diagnosed with "aspiration pneumonia" based on their medical history, physical examination, and radiological results. The most common symptoms of chronic aspiration, such as persistent coughing, wheezing, congestion, choking or gagging during feedings, wet vocal quality or wet breathing, failure to thrive, apnea, intermittent fever spikes, and recurrent chest infections, were asked of the parents in the history questionnaire even though we did not use a standard questionnaire to evaluate swallowing dysfunction (Cakar et al. 2021, p. 1626).

Vianello et al. (2015, p. 1431) Found that According to earlier research, thorough pulmonary rehabilitation programs can greatly enhance pulmonary function and sleeping patterns in CP patients, lowering exacerbations and the need for hospitalization. These programs include routine respiratory status assessments, chest physical therapy to help clear airways, and home non-invasive ventilation to manage sleep-disordered breathing. It may be possible to improve prompt treatment and rehabilitation for those who need it most by identifying patients who are more likely to benefit from pulmonary rehabilitation since they are more likely to have respiratory difficulties.

Following the initial evaluation, all patients had access to suction and home nebulizations.15.4% of the patients had a history of aspiration-related pneumonia, and 91% of the patients were hospitalized for pneumonia. Of the 292 hospitalizations, 64 patients (21.9%) had a tracheostomy. Of these hospitalizations, 40.8% required invasive ventilator therapy, 4.8% required noninvasive ventilator therapy, and 93.8% required O2 support (Cakar et al. 2021, p. 1626).

Notably, many severe CP patients may have cognitive difficulties that make it impossible to do traditional pulmonary function testing. Children with cerebral palsy also showed decreased vital

capacity, functional residual capacity, total lung capacity, and peak expiratory flow rate (PEFR). The finding that mobile children with cerebral palsy (CP) have better respiratory muscle strength and function further emphasizes the connection between movement problems and pulmonary function (Peneva et al .2023, p. 121).

García et al. (2016, p. 124) Reported that The following variables were measured: end-tidal partial pressure of oxygen (PETO2) and carbon dioxide (PETCO2), pulmonary ventilation (VE), ventilatory equivalent for oxygen (VE·VO2-1) and carbon dioxide (VE·CO2-1), and oxygen uptake (VO2). The maximum oxygen uptake, or VO2max, was defined as the maximum VO2 value attained during any continuous 1-minute test session. To achieve VO2max, at least two of the following requirements had to be met: (a) the achievement of a peak HR value above 95% of the age-predicted maximum; (b) a respiratory exchange ratio ≥1.15; or (c) a plateau in VO2 values despite increasing velocity.

Aerobic capacity, aerobic power, functional capacity, functional aerobic capacity, maximal functional capacity, cardiorespiratory endurance, cardiorespiratory fitness, cardiovascular fitness, maximal oxygen intake, maximum oxygen absorption, and other phrases are sometimes used interchangeably with it (Girling-Butler. 2012, p 124).
CRF varies from person to person and has been observed to be lower among those with disabilities such as cerebral palsy. Children with cerebral palsy suffer from physical restrictions brought on by motor incoordination and altered autonomic postural adjustment, which have a direct impact on heart rate and result in poor CRF, increased functional loss, and comorbidities (Teixeira et al. 2016, p.713).

The study has shown it as a determinant of CRF which is also required for different exercises like aerobic training. It is beneficial for CP patient in achieving the functional ability through a conditioning program with less energy expenditure, reduce cardiovascular risk, controlling blood pressure and improve VO2 max (Batista et al. 2010, p. 201).

To assess the variations in aerobic capabilities between children with GMFCS levels I and II, values acquired from CPX were examined. Compared to children with GMFCS level I (13.48±2.77 minutes; P<.001), children with GMFCS level II had a considerably shorter exercise duration

(9.69±2.31 minutes). There were no statistically significant differences between the two groups in the other metrics. Children with GMFCS level I demonstrated considerably greater motor capability than children with GMFCS level II in all field tests, including GMMF-66, GMFM88, 6MWT, PBS, and TUG (P<.05) (Kim et al .2021, p. 26269).

Vianello et al. (2015, p.1431) Reported That 21 out of 37 (56.8%) youngsters selected premature termination based on the RER. RER is the ratio of the amount of oxygen (O2) consumed during metabolism to the amount of carbon dioxide (CO2) produced. Carbohydrates are the main fuel source when the RER level is ≥1. The association between GMFCS level and RER during CPX was investigated using a chi-square test of independence; the results showed no significant link (P >.05) Of the 37 children who had successful CPX, (48.6%) ceased exercising because of leg weariness, and (51.4%) discontinued because of dyspnea.

Respiratory failure could result from weak respiratory muscles inability to handle this rise in ventilatory demand. It has been demonstrated that spirometry, and specifically an inspiratory VC (IVC) below 1.1 L and/or a CPF below 160 L/min, are accurate methods for identifying neuromuscular children who are at high risk for developing serious chest infections. Furthermore, even upper respiratory tract infections have been shown to impair respiratory muscle function in neuromuscular disease patients. Therefore, in order to prevent respiratory failure, cough-assisted procedures should be used as soon as an expiratory muscle weakening is noted (Fauroux et al. 2014, p.782).

In certain pediatric illness processes, malnutrition has a negative impact on respiratory muscle power. Given the risk of respiratory complications or the fact that inadequate nutrition may affect other perioperative factors like wound healing, it is plausible to conclude that a cachectic patient with neuromuscular illness is not a suitable candidate for surgery. According to one study, bronchiectasis was seen in 66% of individuals with chronic pulmonary aspiration. Bronchiectasis with poor clearance should always be taken into consideration in patients with neuromuscular illness and chronic aspiration (Blatter and Finder et al . 2013, p. 770).

45% of the participants in our study had a high exacerbation rate (two episodes/year), which is in line with other findings that respiratory issues seem to be the most prevalent comorbidity in young children with cerebral palsy (7,10). In addition, a significant percentage of the study participants (22/31, 71%) needed to be admitted to acute care hospitals for respiratory conditions in the year prior to the research. It is much more critical to find a high hospitalization rate among people whose pulmonary function indicators indicate a risk of respiratory exacerbations. Physicians can use this information to help them make prompt decisions on patient management and treatment (Vianello et al .2015, p.1431)

Additionally, sleep is a "at risk" position because it is linked to physiological changes in respiratory mechanics, including a decrease in functional residual capacity (FRC), an increase in ventilation/perfusion mismatch, and an increase in airflow resistance.11, 12 The diaphragm's activity remains unchanged, whereas the intercostal and upper airway muscles' activity drastically declines. Lastly, chemoreceptor sensitivity and central respiratory drive are less effective while we sleep than when we are awake. All of these alterations account for the physiological rise in partial arterial carbon dioxide pressure ($PaCO_2$) of around 3–5 mm Hg and the normal drop in spot arterial oxygen saturation (SpO_2) as determined by pulse oximetry of about 2-3% as you sleep (Fauroux et al. 2014, p.782).

Intravascular fluid changes and poor tissue oxygen delivery can result in cardiovascular adverse effects after surgery. Preoperative cardiac examinations are advised for patients with DMD by an expert panel of the American Academy of Pediatrics, and this approach makes sense for all patients with severe neuromuscular disease. A comprehensive evaluation that includes a full cardiologic evaluation and takes into account specialized studies like stress echocardiography can be helpful for neuromuscular patients who have normal preoperative electrocardiogram and echocardiogram findings but are still at risk for postoperative cardiac complications (Blatter and Finder et al . 2013, p. 770).

This study's primary goal was to show that feedback respiratory training is a successful strategy for improving cerebral palsy children's pulmonary function. Our findings indicate that the experimental group experienced greater and more advantageous impacts on lung function than the

control group. This finding backs up the study's main hypothesis, which was that children with cerebral palsy would benefit from feedback respiratory training in terms of their pulmonary function. When compared to gains in the control group, the experimental group's forced vital capacity and forced expiratory volume at one second exhibited substantial improvements, suggesting that feedback respiratory training had a greater therapeutic effect. The results of earlier research provide support for our current findings (Lee et al . 2014, p .965).

However, unlike the children in the control group, the children in the CP group had MIP and MEP that were connected with their heart and respiratory rates rather than their body height and weight. As far as we are aware, no such association has been documented in the literature. It is well recognized that two crucial aspects of an individual's health and fitness are their heart rate and respiration rate.Therefore, our discovery of a strong correlation between respiratory muscle strength and measures of health fitness in kids with CP deserves more research (Wang et al . 2012, p.1176).

The respiratory function of children with cerebral palsy was measured by using Spirometer Pony FX after having confirmed that the health states of the children are fair. In addition, repetitive education on children with cerebral palsy was performed in advance in order for them to properly understand the measurement devices and methods, and to accurately perform the measurement procedures. Respiratory functions were measured after having instructed the children with cerebral palsy to sit on chair with back support while wearing clothes that allowed comfortable movement of their body. Children with cerebral palsy were then instructed to take 3–4 natural breathe as they would in their daily life activities before taking deepest and quickest inspiration and expiration possible in order to measure forced vital capacity (FVC) (kwon et al. 2018, p. 998).

The most common pulmonary issues in children with cerebral palsy (CP) or when CP is a component of another syndrome are examined and summarized in this mini-review, along with the most prevalent risk factors that predispose them to these issues. In addition to not going into great length on gastric reflux, which is widespread in children and one of the most common risk factors for pneumonia, this review does not address sleep difficulties in CP (Peneva et al. 2023, p. 121).

CHAPTER – III METHODOLOGY

3.1 Study design: The design was descriptive type of cross sectional study carried out with the objective of determinig to the prevalence and cardiorespiratory symptoms among the child with cerebral palsy.

3.2 Study area: Data were collected from Firoza Bari Disabled Hospital, Topkhana Road, Dhaka, which specializes in the care and rehabilitation of children with disabilities. These hospitals were chosen due to their accessibility, diverse patient population, and reputation for providing specialized pediatric services.

3.3 Study place: The present study carried out at Saic College Of Medical Science And Technology (SCMST).

3.4 Study Period:

The period of the study was one year extending from september 2023 to august 2024.

3.5 Study Population:

For this study, the study population were children with cerebral palsy, but data were taken from their caregivers. This population was selected for getting accurate information about children's Cardio Respiratory symptom.

3.6 Sample Size :

The sample size of the study was calculated by the following statistical formula.

We know that –

$$n = \frac{Z^2 pq}{d^2}$$

Here,

n = required sample size

Z= confidence level at 95% (standard value of 1.96)

P = *P* is the prevalence taken as 15.4% or 0.154 (Cakar MD and Cine MD. 2021, p. 1626)

q = complement of p, calculated as (1 - p)

d = margin of error at 5% (standard value of 0.05)

Substituting the values:

$n = (1.96)^2 \times 0.154 \times (1 - 0.154) / (0.05)^2$

n = 200

Thus, the calculated sample size for the study was 200.

Due to time and funding limitation I can not took all the sample that's why i included 85 sample.

3.7 Eligibility Criteria:

Inclusion criteria:

1. children with cerebral palsy age 1 to 17 years (Ryan et al. 2019, p. 944).
2. The study will include child who are diagnosed with cerebral palsy (Kim et al. 2021, p. 26269).
3. The study included both boys and girls participants with cerebral palsy and a history of respiratory issues such as apnea, aspiration, recurrent pneumonia, hyperventilation, or cyanosis.
4. Child's guardian who will be willing to participate.
5. Child's who are active and regular with the physiotherapy program.

Exclusion criteria:

1. Child's guardian who will not be willing to participate (Heyn et al. 2019, p. 477).
2. Undiagnosed patient (Kim et al. 2021, p. 26269).
3. A severe intellectual disability or having undergone surgery in the previous six months.
4. Uncontrolled seizures.
5. This criterion excluded persons who could not understand study instructions .

3.8 Sampling Technique:

Convenience sampling method was adopted to select the children with cerebral palsy from Firoza Bari Disabled Hospital.

3.9 Method of Data collection

3.9.1 Techniques of data collection

The technique of data collection was face to face formal interview with the participants.

3.9.2 Instrument of data collection

A Pretested structured questionnaire was used to collect Socio-demographic information, Cardio-respiratory Symptom related information.

3.10 Procedure of data collection : The researcher obtained permission from the Ethical Review Board of SAIC College of Medical Science and Technology to carry out the study. A written permission was also taken from the concerned authority of firozabari disable hospital in Dhaka for data collection. After that the researcher approached the cardio-respiratory symptom and the aim and objectives of the study was explained in details to them. Interested caregivers were included in the study. Participants were asked to fill up written consent form with their signature to ensure volunteer participation. They were informed about the privacy and confidentiality of the information. Then the researcher started interview with the participants by using the pretested questionnaire. The interview was in a cordial environment. At the end of the interview, the researcher thanked the participants.

3.11 Tools of Data Collection

1. Stethoscope
2. Blood pressure Machine
3. Weight Machine
4. Height Measurement Tape

3.12 Data management:

3.12.1 Editing of data:

The questionnaires were reviewed after data collection to identify any mistakes or inconsistencies. Necessary corrections were done as required. All responses were adequately coded for analysis.

3.12.2 Entry of data:

The coded data were entered into a computer based on the variables of the study.

3.12.3 Analysis of data

The data were analyzed using the Statistical Package for the Social Sciences (SPSS) program. Descriptive statistics, such as frequency, distribution, range, mean, and percentage were performed. For inferential statistics the relationship between independent and dependent variables were analyzed accordingly.

3.13 Questionnaire: The questionnaire was developed under the advice and permission of the supervisor following certain guidelines semi-structured questionnaires (Both open-ended and close-ended questionnaires) are used for data collection.

3.14 Ethical consideration: Strict adherence to ethical guidelines is paramount in this study. A formal project proposal has been submitted to the Department of Physiotherapy at Saic College of Medical Science and Technology (SCMST), and approval has been obtained from the Institutional Review Board (IRB) of SCMST to conduct the study. This study follows the guidelines set forth by the World Health Organization (WHO) and Bangladesh Medical Research Council (BMRC), ensuring confidentiality of participant information at all times. Permission to collect data has been obtained from the study area authorities. Participants will be fully informed about the aims and objectives of the study before consenting to participate. Written consent will be obtained from each participant, and the process will be explained verbally as well. Participants will be assured of the confidentiality of their information, which will only be shared with the research supervisor. Participants will be informed of their rights, including the option to withdraw from the study at any time without consequences. To protect anonymity, participant names and addresses will not be used; instead, participation numbers will be assigned in all notes and transcripts. It will be made clear that information gathered may be presented in presentations, seminars, or written papers, but in a way that ensures no identification of individuals and poses no harm to them. Participants will be assured of their right to discuss any concerns related to the study with senior authorities. The ethical standards upheld in this study aim to protect participant welfare while maintaining the integrity and confidentiality of the research process.

CHAPTER IV RESULTS

The objective of the present study was to determine the prevalence and clinical characteristics of cardio-respiratory systems among the children with cerebral palsy at Feroza Bari Disable Hospital. Data were collected from the caregivers of the children with cerebral palsy by interview using a pretested questionnaire. Data were analyzed by SPPS program. The findings of the study have been presented in the following section with tables, charts and description.

4.1 Socio-Demographic Information

Table-I: Frequency distribution of respondent according to socio-demographic variables

Variable	Catagory	Frequency (n)	Percentage (%)
Age overall (Mean ± SD)= 3.88 ±2.155			
Age of The Patient	1-5	70	82.4
	6-10	15	17.6
Gender	Boy	54	63.5
	Girl	31	36.5
Siblings	0	47	55.3
	1	31	36.5
	2	7	8.2
Gurdian Age	15-24	73	85.9
	25-34	10	11.8
	35-44	10	11.8
	45-54	2	2.4
Education Of The Care Guardian	Illiterate	4	4.7
	Primary	9	10.6
	SSC	39	45.9
	HSC	20	23.5
	Graduation	13	15.3
	Muslim	83	97.6

Religion	Hindu	2	2.4
Living Area	Rural	39	45.9
	Urban	46	54.1
Family Type	Nuclear	53	62.4
	Extended	32	37.6
Monthly expenditure overall (Mean ± SD)= 1.33± 0.497			
Monthly expenditure	15000-20000	58	68.2
	21000-25000	26	30.6
	26000-30000	1	1.2

• Socio-demographic Status:

Among the participants, boys were more common, with 63.5% (54 participants), while girls comprised 36.5% (31 participants) Over half of the patients, 55.3% (47 participants), had no siblings. About 36.5% (31 participants) had one sibling, and only 8.2% (7 participants) had two siblings. Care guardians varied in educational attainment, with 45.9% (39 participants) having completed secondary education (SSC) and 23.5% (20 participants) having completed higher secondary education (HSC). Additionally, 15.3% (13 participants) had a graduation degree, while 10.6% (9 participants) had primary education. A smaller percentage, 4.7% (4 participants), were illiterate. The vast majority, 97.6% (83 participants), were Muslim, with 2.4% (2 participants) identifying as Hindu. A slightly higher proportion of patients lived in urban areas (54.1%, 46 participants), compared to rural areas (45.9%, 39 participants). Nuclear families were more common, with 62.4% (53 participants), while 37.6% (32 participants) lived in extended family settings. Half of the participants (50.6%, 43 participants) were underweight, while 38.8% (33 participants) had a normal weight. Overweight individuals made up 8.2% (7 participants), and obesity was reported in 2.4% (2 participants).

4.2: Health Related Information:

BMI of The Participants:

Table-II: Frequency distribution of respondent according to BMI of the participants:

Variables	Category	Frequency (n)	Percentage (%)
BMI of the respondents	Underweight	43	50.6
	Normal Weight	33	38.8
	Overweight	7	8.2
	Obesity	2	2.4

BMI Of The Participant:

The nutritional status of participants indicates that the largest group falls under the 'Underweight' category, comprising 43 individuals, or 50.6% of the sample. This is followed by the 'Normal Weight' category, with 33 participants representing 38.8%. A smaller proportion of individuals are classified as 'Overweight,' totaling 7 participants (8.2%), while only 2 participants (2.4%) fall into the 'Obesity' category. This distribution suggests a prevalence of underweight individuals within the sample, with fewer participants in the overweight and obese categories."

Table-III : Frequency distribution of respondent according to cardio-respiratory symptom

Serial No	Variable	Cardio-respiratory symptom	Frequency (n)	Percentage (%)
1	Shortness Of Breath	Yes	14	16.5
		No	71	83.5
2	Cough	Yes	27	31.8
		No	58	68.2
3	Secretion Of Sputum	Yes	16	18.8
		No	69	81.2
4	Sneezing	Yes	32	37.6
		No	53	62.4
5	Wheezing	Yes	31	36.5
		No	54	63.5
6	Difficulty Swallowing	Yes	37	43.5
		No	48	56.5
7	Pneumonia	Yes	9	10.6
		No	76	89.4
8	Asthma	Yes	5	5.9
		No	80	94.1

Cardio-Respiratory Symptom of the participant:

Of the participants, 71 individuals (83.5%) make up the majority of the sample, while 14 participants (16.5%) represent a smaller segment. This significant difference indicates a predominant characteristic or grouping within the larger category, with a relatively small proportion in the other.The distribution shows that 58 participants, representing 68.2% of the sample, fall into the larger group, while 27 participants (31.8%) make up the smaller group. This suggests that the majority of the sample is concentrated within the larger category, with about one-third of the participants in the smaller category.The data indicates that 69 participants, constituting 81.2% of the sample, belong to the larger category, while 16 participants (18.8%) are in the smaller category. This distribution highlights a clear majority within the larger category, with a smaller, yet notable, proportion in the other.The data reveals that 53 participants, representing 62.4% of the sample, fall within the larger category, while 32 participants (37.6%) belong to the smaller category. This distribution indicates a majority in the larger group, with a substantial portion still represented in the smaller category.Out of the total sample, 31 participants (36.5%) represented the first group, while the remaining 54 participants (63.5%) constituted the second group. This distribution indicates that a majority of the participants belong to the second group, highlighting a notable difference in group sizesOut of the total sample, 31 participants (36.5%) represented the first group, while the remaining 54 participants (63.5%) constituted the second group. This distribution indicates that a majority of the participants belong to the second group, highlighting a notable difference in group sizes..In this distribution, 37 participants (43.5%) fall into the first category, while 48 participants (56.5%) make up the second category. This indicates a relatively balanced division, though the second category holds a slightly larger proportion of the sample.In this distribution, 9 participants (10.6%) are in the first category, whereas a substantial majority of 76 participants (89.4%) are in the second category. This disparity shows that the second category overwhelmingly represents most of the sample. Of the participants, 5 (5.9%) are in the first category, while a vast majority of 80 (94.1%) are in the second category. This indicates a strong concentration of participants in the second category, with only a small minority represented in the first.

4.3 Sleep Disturbance Of The Participant:

"In this distribution, 15 participants (17.6%) are in the first category, while the majority of 70 participants (82.4%) belong to the second category. This shows a significant skew toward the second category, which comprises the bulk of the sample."

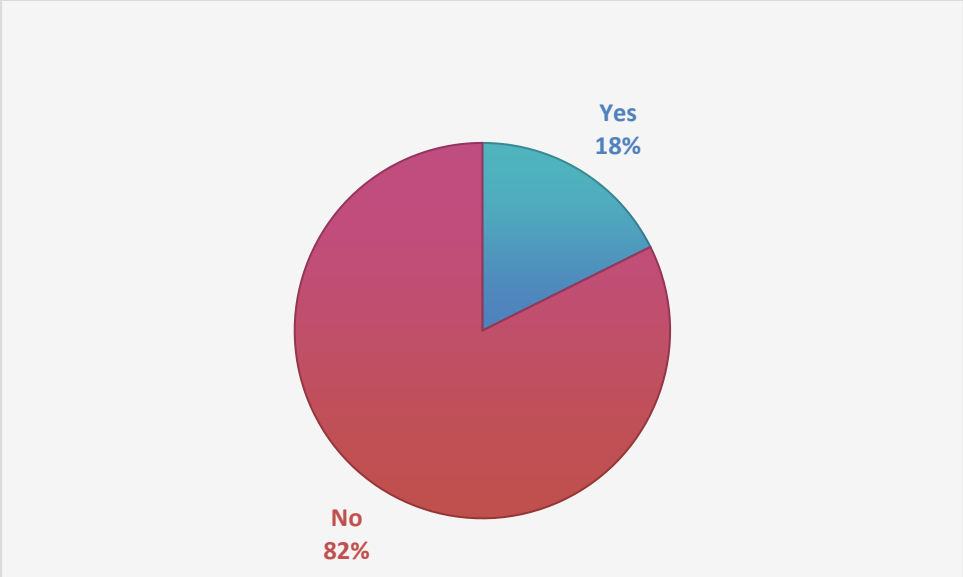


Figure: Sleep Disturbance of The Participant

4.4 Fainting Of The Participant:

"The entire sample consists of 85 participants, representing 100% of the total, with no division across categories. This indicates a fully unified sample group."

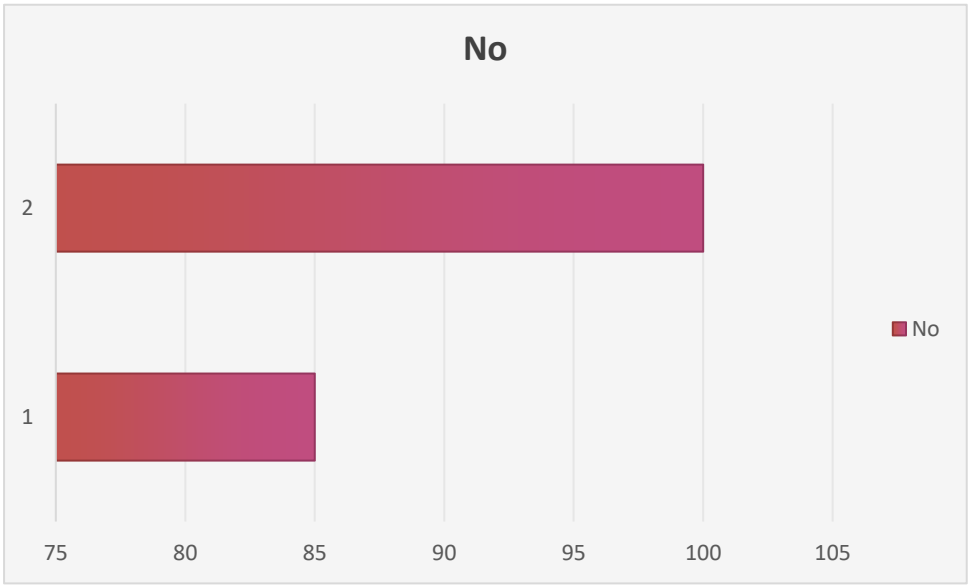


Figure: Fainting of The Participant

4.5 Heart Problem Of The Participant:

"Out of the total sample, 2 participants (2.4%) are in the first category, while the overwhelming majority of 83 participants (97.6%) are in the second category. This shows a significant concentration of participants in the second category."

Figure : Heart Problem 0f The Participant

4.6 Abnormal Shape Of The Chest of Participant:

"Among the participants, 8 (9.4%) belong to the first category, while 77 (90.6%) are in the second category. This indicates a clear majority in the second category, with the first category representing a smaller proportion of the sample."

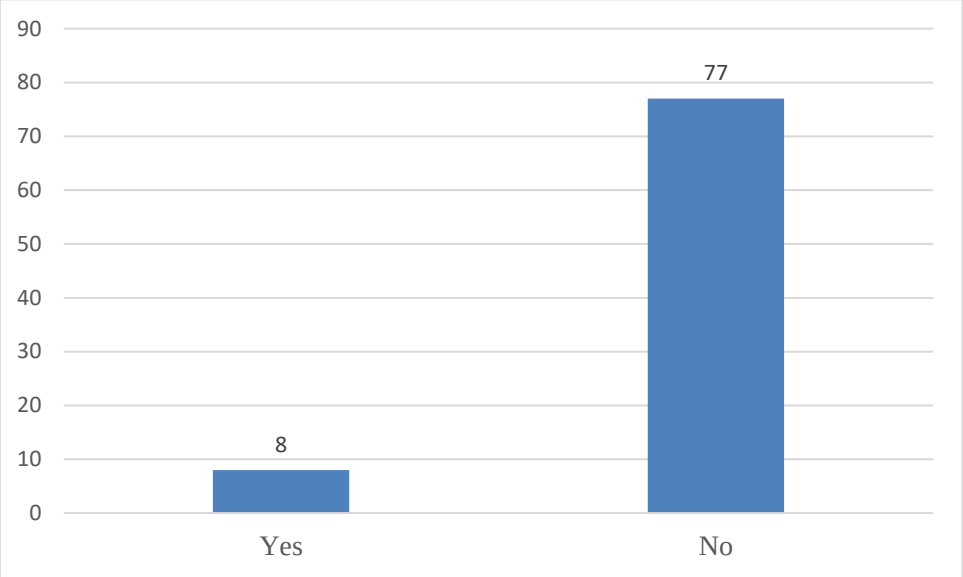


Figure : Abnormal Shape of The Chest of Participant

Table-IV: Frequency distribution of respondent according to Respiratory Rate and Heart Rate information

	N	Minimum	Maximum	Mean	Std. Deviation
Respiratory Rate Of The Patient	85	22	40	31.29	5.857
Heart Rate Of The Patient	85	90	130	113.41	11.079

- **Respiratory Rate of Patients**:

The respiratory rate among participants ranged from a minimum of 22 breaths per minute to a maximum of 40 breaths per minute. The average respiratory rate was 31.29 breaths per minute, with a standard deviation of 5.857, indicating moderate variability among participants.

- **Heart Rate of Patients**:

Heart rates for the participants varied between 90 and 130 beats per minute. The mean heart rate was 113.41 beats per minute, with a standard deviation of 11.079, showing some spread in heart rate values across the sample.

4.7 Association between Cardio-respiratory Symptom and Age and Gender

Table-V: Association between Cardio-respiratory Symptom and Age and Gender

Serial No	Cardio-respiratory Symptom	Chi- Square Test			
		Age		Gender	
		(X2)	P value	(X2)	P value
1	Shortness Of Breath	0.165	0.685	0.004	0.949
2	Cough	0.021	0.886	0.005	0.941
3	Secretion Of Sputum	5.345	0.021*	0.009	0.924
4	Sneezing	0.043	0.836	0.097	0.755
5	Wheezing	0.098	0,754	0.106	0.745
6	Difficulty Swallowing	0.092	0.761	0.050	0.822
7	Pneumonia	1.704	0.192	0.043	0.836
8	Asthma	1.826	0.177	0.029	0.866
9	Sleep Disturbance	3.084	0.079	0.756	0.385
10	Heart Problem	0.439	0.508	1.176	0.278
11	Abnormal Shape Of The Chest	0.161	0.688	0.502	0.479

Cardio-respiratory Symptom and Age and Gender :

Based on the statistical results presented in Table V, the association between cardio-respiratory symptoms and age and gender among children with cerebral palsy was analyzed using the Chi-square test. The findings indicate that most symptoms did not show significant associations with either age or gender, suggesting that these factors may not play a dominant role in the prevalence of these conditions.

Among the symptoms analyzed, secretion of sputum was the only symptom that showed a statistically significant association with age ($\chi^2 = 5.345$, $p = 0.021$). This suggests that the occurrence of sputum secretion is influenced by the child's age, potentially indicating age-related variations in respiratory function or disease severity. However, secretion of sputum did not exhibit a significant association with gender ($\chi^2 = 0.009$, $p = 0.924$), implying that both male and female children are equally affected.

Other symptoms such as shortness of breath, cough, sneezing, wheezing, difficulty swallowing, pneumonia, asthma, sleep disturbance, heart problems, and abnormal chest shape did not show significant associations with age or gender. The p-values for these symptoms were all above the standard threshold of 0.05, indicating no strong evidence to support age- or gender-related differences in their occurrence.

The lack of significant associations in most symptoms suggests that cardio-respiratory issues in children with cerebral palsy are likely influenced by other factors such as neuromuscular dysfunction, nutritional status, environmental exposure, or overall disease severity, rather than by age or gender alone. This highlights the need for a comprehensive and individualized approach in managing these symptoms rather than relying solely on demographic factors for risk assessment.

Cardio-respiratory symptoms in children with cerebral palsy (CP) are a serious issue because of the combined consequences of systemic problems, limited physical activity, and motor limitations. The findings of this study highlight the necessity of a multidisciplinary approach to managing

these symptoms by offering a thorough understanding of their prevalence and features. This conversation examines the results in light of other studies, emphasizing the difficulties with the heart and lungs, the impact of demographics, and the consequences for therapeutic measures.

Participants reported respiratory problems often, with coughing (31.8%) and wheezing (36.5%) being the most prevalent. These results are in line with Naqvi et al. (2020, p.121), who noted that children with cerebral palsy frequently experience recurrent wheezing episodes as a result of impaired airway clearance and heightened vulnerability to infections. Further corroborated by Minciu (2012, p. 333), who highlighted the major contribution of dysphagia and poor cough efficiency to chronic pulmonary symptoms, this study found that 43.5% of people had swallowing difficulties. The risk of aspiration pneumonia is increased by such symptoms, which are frequently caused by poor oropharyngeal coordination.

According to research like that conducted by Hill et al. (2019, p. 231), one of the main reasons why children with cerebral palsy suffer from morbidity is respiratory difficulties. A chronic inflammation of the upper airway, perhaps made worse by recurrent infections or allergies, may also be the cause of the high prevalence of sneezing (37.6%) found in this study.

Many participants appear to be in a hypermetabolic condition, as shown by the mean heart rate of 113.41 beats per minute and respiration rate of 31.29 breaths per minute. Similarly, Nsenga and Shephard (2013, p. 431) reported elevated baseline metabolic rates in children with cerebral palsy (CP) as a result of the effort needed to compensate for movement abnormalities. A typical characteristic of CP is autonomic dysfunction, which affects cardiac control and is frequently linked to elevated heart rates (Amichai & Katz-Leurer. 2014, p. 431). Children with spastic CP subtypes are more at risk for tachycardia and other arrhythmias due to this dysregulation.

Kholod et al. (2013, p. 400) found the heart rate patterns of children with cerebral palsy to be significantly variable, which further supports the presence of autonomic dysfunction. The significance of regular cardio-respiratory monitoring in identifying and treating early dysfunctional symptoms is highlighted by these findings.

This study shows that guys made up a significant portion of the participants (63.5%). Molin and Alricsson (2020) propose that although the gender distribution of CP is generally balanced, this skewed ratio may be a reflection of socioeconomic and cultural factors that influence healthcare-

seeking behavior. Furthermore, studies showing greater availability to diagnostic and therapeutic services in urban regions as opposed to rural ones is consistent with the larger participation of urban participants (54.1%) (Badawi et al. 2021, p. 211).

Merely 15.3% of caregivers had earned a degree, making caregiver education an important variable. Walsh et al. (2020, p. 490) discovered that caregiver literacy levels affect the capacity to treat CP-related difficulties, which is in line with this low level of education. Low levels of education are frequently associated with a diminished understanding of the significance of early intervention, which may increase the frequency of symptoms.

The discovery that 50.6% of participants were underweight is consistent with the fact that malnutrition in children with cerebral palsy is a global problem. According to Diwan et al. (2014), poor nutritional outcomes are caused by gastrointestinal problems, feeding difficulties, and increased energy expenditure brought on by spasticity. On the other hand, just 2.4% of individuals were categorized as obese, which is indicative of the nutritional imbalances and decreased mobility that are frequently observed in CP.

Malnutrition has a direct influence on respiratory health because it weakens the muscles used for expiration and inspiration, which makes it harder to adequately remove secretions. In children with cerebral palsy, research like that conducted by Hill et al. (2009, p. 543) highlights the crucial relationship between respiratory function and nutritional condition.

The results of this investigation underscore the pressing necessity for focused therapies to alleviate cardio-respiratory problems. Children with cerebral palsy can benefit from aerobic exercise programs that increase VO2 max and lower respiratory rates, as shown by Nsenga and Shephard (2013, p. 789). Reychler et al. (2018, p. 321) also found that respiratory infections are less common and respiratory muscle strength is greatly increased by inspiratory muscle exercise.

According to these results, incorporating structured exercise regimens into rehabilitation plans may help to alleviate a number of the symptoms this study found. Additionally, as Naqvi et al. (2020, p. 221) support, the high prevalence of swallowing issues may be addressed by customized physiotherapy treatments that emphasize oropharyngeal strengthening.

Nuclear families accounted for 62.4% of the participants, making family structure another important consideration. According to research by Kalogerova and Gryshun (2013, p.121), nuclear

family environments frequently restrict access to prolonged caregiving assistance, which puts an increased strain on parents. Further complicating symptom management, this burden may have an impact on the regularity and caliber of treatment given to children with cerebral palsy.

Additionally, environmental variables, such as exposure to pollutants and allergens, may be responsible for the high frequency of respiratory symptoms. According to Minciu (2012), environmental stimuli can exacerbate wheeze and coughing bouts in children with cerebral palsy.

The study's conclusions highlight the value of a multidisciplinary strategy in the treatment of cardio-respiratory symptoms in people with cerebral palsy. Regular evaluations with instruments like spirometry and pulse oximetry could aid in the early identification of children who are at risk, as suggested by Walsh et al. (2020, p. 231). Malnutrition and poor respiratory health are two issues that may be resolved by combining nutritional support with respiratory therapy.

Functional electrical stimulation for respiratory muscles is one example of a tailored intervention that may improve results. A study by Diwan et al. (2014, p. 25), for example, shows how novel treatments can lower the prevalence of symptoms and enhance quality of life.

Although this study offers insightful information, there are a number of limitations that should be noted. The cross-sectional design makes it impossible to analyze how symptoms change over time, and depending solely on data provided by caregivers may lead to reporting bias. It is recommended that future studies use longitudinal designs to investigate the long-term effects of cardio-respiratory symptoms on quality of life and functional outcomes.

Furthermore, to develop evidence-based recommendations for treating these symptoms, randomized controlled studies assessing the efficacy of specific interventions-like aerobic exercise regimens and inspiratory muscle training- are crucial.

5.1 Limitations:

▪ The cross-sectional design of the study limits the capacity to ascertain causality or monitor the evolution of symptoms over time.

▪ With only 85 participants, the sample size might not accurately reflect the wide range of children in Dhaka who have cerebral palsy (CP).

▪ Convenience sampling may limit generalizability and induce selection bias.

▪ A lot of the data was gathered via caregiver reports, which could lead to reporting bias.

▪ The study excluded insights from rural or other urban areas and only examined Dhaka city.

▪ It's possible that important information concerning more severe cases was overlooked by excluding patients with severe intellectual deficits or those who had recent surgery.

▪ The study may have missed other important health risks because it only examined a small number of nutritional status markers.

▪ The study's one-year duration may have been insufficient to capture seasonal variations in respiratory symptoms.

▪ The lack of sophisticated diagnostic tools limited the study to basic cardio-respiratory assessments.

▪ Variability in cultural practices and socioeconomic conditions were not thoroughly analyzed in relation to healthcare-seeking behavior.

CHAPTER VI CONCLUSION & RECOMMENDATION

The study found that cardio-respiratory symptoms, including coughing (31.8%), wheezing (36.5%), and trouble swallowing (43.5%), were highly prevalent. According to the established pathophysiology of cerebral palsy, children who have neuromuscular dysfunction, poor oropharyngeal control, and less physical activity are more likely to experience long-term respiratory issues. The average heart rate of 113.41 beats per minute and respiratory rate of 31.29 breaths per minute also show elevated baseline metabolic demands, which are indicative of systemic stress. The need for early and regular cardio-respiratory evaluations to identify children who are at risk and avoid long-term consequences is highlighted by these physiological signs.

50.6% of subjects were underweight, indicating a significant nutritional deficit. Among the contributing variables were feeding issues, elevated energy expenditure, and gastrointestinal dysfunction, which exacerbated respiratory muscle weakness and decreased overall resistance to infections. Furthermore, socioeconomic and cultural factors that may affect healthcare access and utilization are reflected in the demographic effects findings, which include the larger percentage of urban inhabitants (54.1%) and the preponderance of male participants (63.5%).

The results have important clinical practice implications, highlighting the necessity of a multidisciplinary approach to the management of cardio-respiratory symptoms in children with cerebral palsy. Early identification, regular monitoring, and focused interventions are all necessary to address these symptoms. It is possible to identify respiratory dysfunction early and take prompt action by doing routine evaluations with instruments like spirometry and pulse oximetry. Programs for physical therapy that emphasize the strength of the inspiratory and expiratory muscles are also essential for enhancing respiratory function and lowering the risk of infection.

In the overall care of cerebral palsy, nutritional therapies are essential. Clinicians can improve respiratory muscle performance and overall health outcomes by treating malnutrition with dietary changes, nutritional supplements, and specialized feeding procedures. Personalized physical therapy regimens that include functional electrical stimulation (FES) and aerobic training have also been shown to significantly enhance cardio-respiratory fitness and ought to be incorporated into routine treatment procedures.

The systemic character of CP and the interaction of many physiological areas are clarified by this work. The results highlight the significance of identifying and treating CP's systemic manifestations, even though it is frequently classified as a motor condition. Children with CP have increased rates of morbidity and mortality due to cardio-respiratory symptoms, which have a substantial negative influence on quality of life. Healthcare professionals can help children with cerebral palsy reach their full potential by addressing these symptoms, which will also increase functional outcomes and survival rates.

The results also demonstrate how socioeconomic factors influence health outcomes. The prevalence of nuclear families and the lack of caregiver education point to the need for community-based education and support initiatives to help families deal with the challenges associated with cerebral palsy. Caregivers can identify early indicators of cardio-respiratory distress and seek prompt medical attention with the support of awareness campaigns and training initiatives.

Recommendations:

- In order to increase representativeness and generalizability, future research should involve larger and more varied populations.
- Use longitudinal designs to evaluate how cardio-respiratory symptoms change over time.
- Use random sampling techniques to increase the validity of results and lessen bias.
- For thorough cardio-respiratory evaluations, use cutting-edge diagnostic instruments such as spirometry and imaging methods.
- In order to comprehend regional differences in healthcare outcomes and access, include people from rural areas.
- Extend the inclusion criteria to include youngsters who have recently undergone surgery or have severe intellectual difficulties in order to gain a more thorough understanding.
- Examine how specific dietary changes affect children with cerebral palsy's respiratory health.
- Examine how cultural traditions and beliefs influence symptom management and healthcare-seeking behaviors.
- Teach caregivers how to identify and treat cardio-respiratory problems through focused community initiatives.
- Encourage cooperation between pulmonologists, physiotherapists, and dietitians to develop comprehensive treatment plans for kids with cerebral palsy.

CHAPTER VII REFERENCE

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Appendix-A

Informed consent Form
Please Read It Carefully

Assalamualaikum,

I am Hira Moni Das, a student of B.Sc. in physiotherapy, 4th year 2018-19 session, at Saic College of Medical Science & Technology, affiliated with the University of Dhaka under the faculty of Medicine. I am conducting a research program entitled **"prevalence of cardio-respiratory symptoms and complications among children with cerebral palsy**". In this study, I would like to find out the certain co-morbidities are associated with an increased risk of respiratory problems, which in turn increases the risk of morbidity and death in CP patients..

I would like to request some information regarding your sociodemographic, functional independence, and medical information-related questions. Please note that this academic research project will take approximately 20-30 minutes to complete. Participating in this study will not affect your current or future treatment in any way. It is important to mention that the information collected will only be used for academic research purposes, and all your provided data will be kept confidential. In the case of any report or publication, we will ensure that your identity remains anonymous.

If you have any questions regarding the study or your rights as a participant, please feel free to contact the investigator Hira Moni Das or the research supervisor of Md Shahidul Islam, Asst.Professor, SCMST, SCMST, Mirpur, Dhaka.

Do you have any questions before I start?

So, may I have your consent to proceed with the interview?

Yes	No

Participant Signature……..Date…….

Supervisor Signature……..Date…….

Contact No……

Research Questionnaire

"Prevalence of cardio-respiratory symptoms/complications among the child with cerebral palsy"

Patients Information

Date of interview: Mobile No: ……

Patients ID:

Name of participant:

Patients address: Village: Post Office:

P. S: District:

Part-1: Socio-demographic Information

QN	Question	Response
1.1	Patients Age	…….
1.2	Patients Gender	1 = Boy 2 = Girl
1.3	Siblings	
1.4	Age of the care guardian	……..
1.5	Education of the care guardian	1= Illiterate 2= Primary 3= SSC 4= HSC 5= Graduation
1.6	religion	1= Muslim 2= Hindu 3= Others
1.7	Living area	1 = Rural

		2 = Urban
1.8	Family type	1 = Nuclear 2 = Extended
1.9	Family income (in BDT)	…….

Part-2: Topic Related Information

QN	Question	Response
2.1	Height	…….cm
2.2	Weight	……Kg
2.3	BMI	1= Underweight 2=Normal weight 3= Over weight 4= Obesity
2.4	Shortness of breath	1= Yes 2= No
2.5	Cough	1= Yes 2= No
2.6	Secretions and sputum	1= Yes 2= No
2.7	Sneezing	1= Yes 2= No
2.8	wheezing	1= Yes 2= No
2.9	Difficulty Swallowing	1= Yes

		2= N0
2.10	Pneumonia	1= Yes 2= No
2.11	Asthma	1= Yes 2= No
2.12	Sleep disturbance	1= Yes 2= No
2.13	Fainting	1= Yes 2= No
2.14	Heart problem	1= Yes 2= No
2.15	Abnormality of the shape of the chest	1= Yes 2=No
2.16	Respiratory rate	…….
2.17	Heart rate	…….

প্রশ্নপত্র (বাংলা)

“Prevalence of cardiorespiratory symptoms/complications among the child with cerebral palsy”

রোগীর তথ্য সমূহ:

সাক্ষাৎকারের তারিখ : মোবাইল:.....

রোগীর আইডি নাম্বার :

অভিভাবকের নাম :

রোগীর ঠিকানা : গ্রাম : ডাকঘর :

থানা : জেলা:

পর্ব:১. সামাজিক জনসংখ্যা সংক্রান্ত তথ্য।

প্রশ্ন নাম্বার	প্রশ্ন	উত্তর
১.১	বাচ্চার বয়স কত	…… মাস …….বছর
১.২	লিঙ্গ	ছেলে=১ মেয়ে =.২
১.৩	ভাই বোন কতজন আছে	.....জন
১.৪	যে বাচ্চাকে দেখাশোনা করে তার বয়স কত	..... বছর
১.৫	যে বাচ্চাকে দেখাশোনা করে তার শিক্ষকতা যোগ্যতা কি	অশিক্ষিত=১ প্রাথমিক=২ মাধ্যমিক= উচ্চমাধ্যমিক =৪ স্নাতক=৫
১.৬	ধর্ম	মুসলিম=১ হিন্দু=২ অন্যান্য=৩
১.৭	বসবাসের স্থান	গ্রাম =১ শহর=২
১.৮	পরিবারের ধরন	একক =১ যৌথ=২
১.৯	পরিবারের আয় কত	..... টাকা

পর্ব : ২. বিষয়সম্পর্কিত প্রশ্ন (চিকিৎসা সংক্রান্ত তথ্য)

প্রশ্ন নাম্বার	প্রশ্ন	উত্তর
২.১	বাচ্চার উচ্চতা	.....ফিট ……ইঞ্চি
২.২	বাচ্চার ওজন	.....কেজি
২.৩	বি এম আই	
২.৪	বাচ্চার কি শ্বাসকষ্ট আছে	হ্যাঁ=১ না =২
২.৫	বাচ্চার কি কাশি আছে	হ্যাঁ=১ না =২
২.৬	কাশির সাথে কি থুতু বের হয়	হ্যাঁ=১ না =২
২.৭	বাচ্চার হাঁচি আছে	হ্যাঁ=১ না =২
২.৮	নিঃশ্বাসের সাথে বাঁশির মতো শব্দ হয়	হ্যাঁ=১ না =২
২.৯	বাচ্চা কে কি খাওয়াইতে সমস্যা হয়	হ্যাঁ=১ না =২
২.১০	বাচ্চার কি নিউমোনিয়া আছে	হ্যাঁ=১ না =২
২.১১	বাচ্চার কি অ্যাজমা আছে	হ্যাঁ=১ না =২
২.১২	বাচ্চার কি ঘুমের কোন সমস্যা হয়	হ্যাঁ=১ না =২
২.১৩	সে কি মাঝে মাঝে অজ্ঞান হয়	হ্যাঁ=১ না =২
২.১৪	বাচ্চার কি হার্টয়ের সমস্যা আছে	হ্যাঁ=১ না =২

২.১৫	বাচ্চার বুকের আকৃতিতে অস্বাভাবিকতা	হ্যাঁ=১ না =২
২.১৬	শ্বাস-প্রশ্বাসের হার	
২.১৭	হার্টয়ের হার	

Appendix-C

BANGLADESH COUNCIL FOR CHILD WELFARE-BCCW
বাংলাদেশ শিশু কল্যাণ পরিষদ-বাশিকপ
Registered with Department of Social Services, # 201(1962)/ Foreign Donation Registration # 499
22/1 Topkhana Road, Dhaka-1000, Phone : 02223384257, 02223389760
E-mail: shishukallyanparishad@gmail.com, Website : www.bccw-bd.org

ফা-ভি-০৮/বাশিকপ২০০৬(প্রশাসন)-অংশ-২-প-৩০৪ তারিখ : ১০-০৬-২০২৪

বরাবর
অধ্যক্ষ
সাইক কলেজ অব মেডিকেল সায়েন্স এন্ড টেকনোলজি
সাইক টাওয়ার, এম-১/৬, মিরপুর # ১৪
ঢাকা-১২১৬।

বিষয় : ডাটা কালেকশনের অনুমতি প্রসঙ্গে।
সূত্র : 1st June 2024.

উপর্যুক্ত বিষয়ে সূত্রোল্লিখিত পত্রের বর্ণনা মতে আপনার প্রতিষ্ঠানের শিক্ষার্থী হীরা মণি দাসকে বাংলাদেশ শিশু কল্যাণ পরিষদ পরিচালিত ফিরোজা বারি প্রতিবন্ধী শিশু হাসপাতালে **"Prevalence of cardiorepiratory symptom among the child with cerebral palsy"** উপর ডাটা কালেকশনের জন্য সম্মতি জ্ঞাপন করা হলো। এক্ষেত্রে প্রতিষ্ঠানের পক্ষ থেকে কোনরূপ ভাতা বা সম্মানী প্রদান করা হবে না এবং প্রতিষ্ঠান কর্তৃক নির্ধারিত সময় ও নিয়ম নীতি অবশ্যই মেনে চলতে হবে। এতদসংশ্লিষ্ট যাবতীয় বিষয়ে পরবর্তী ব্যবস্থাদি সম্পাদনের জন্য মিসেস ইয়াসমিন আরা ডলি, পরিচালক, বাশিকপ-এর সাথে (**02223384257**-Ex-107) যোগাযোগ করার অনুরোধ জানানো হলো।

ধন্যবাদান্তে

মোহাম্মদ মনিরুল আলম
সাধারণ সম্পাদক, বাশিকপ

অনুলিপি
১. মিসেস ইয়াসমিন আরা ডলি, পরিচালক, বাশিকপ এবং চিফ ফিজিওথেরাপিস্ট ও ট্রেনিং কো-অর্ডিনেটর, ফিরোজা বারি প্রতিবন্ধী শিশু হাসপাতাল
২. অফিস কপি

Helsinki, 1964 - 2013 and other applicable regulation.

Best regards,
04. 06. 24.

Dr. Abul Kasem Mohammad Enamul Haque
Principal, SCMST &Chairman, Institutional Review Board (IRB)
SAIC College of Medical Science & Technology (SCMST)
Mirpur-14, Dhaka-1216, Bangladesh

Gant Chart

Activities/ Months	Sep 23	Oct 23	Nov 23	Dec 23	Jan 24	Feb 24	Mar 24	Apr 24	May 24	June 24	July 24	Aug 24
Proposal presentation												
Introduction												
Literature Review												
Methodology												
Data collection												
Data Analysis												
Result												
1st progress presentation												
Discussion												
Conclusion And Recommendation												
2nd progress presentation												
Communication with supervisor												
Final submission												